Submersible Motor Pump

Amarex KRT

Sizes DN 40 to DN 300, 50 Hz, CE
Motor sizes
2 Poles: 3 2.E to 75 2.E
4 Poles: 2 4.E to 75 4.E
6 Poles: 7 6.E to 55 6.E
8 Poles: 11 8.E to 45 8.E

Installation/Operating Manual

KSB

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Installation/Operating Manual Amarex KRT

Original operating manual

Subject to technical modification without prior notice.

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Glossary

Back pull-out unit

Pump without pump casing; partly completed machinery

Certificate of decontamination

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

Close-coupled design

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

Discharge line

The pipeline which is connected to the discharge nozzle

Flamepath

The surface of motor housing components which form flameproof joints when an explosion-proof motor is installed.

Hydraulic system

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

Pump set

Complete pump set consisting of pump, drive, additional components and accessories

Suction lift line/suction head line

The pipeline which is connected to the suction nozzle

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1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover (for details, refer to the table below)

Table 1: Variants covered by this operating manual

Size	Impeller type	Material variant						
		Grey cast iron				Industrial materials		
		G	G1	G2	GH	H	C1	C2
40-252	F, K, S	F, K, S	F, K	F, K	F, K	F, K	F, K	F, K
50-215	F	F	F	F	F	F	F	F
50-216	F	F	F	F	F	F	F	F
50-216	S	S	-	-	-	-	-	-
65-215	F	F	F	F	F	F	F	F
65-216	E	E	-	-	-	-	-	-
65-217	F	F	F	F	F	-	-	-
65-253	K	K	-	-	-	-	-	-
80-215	F	F	F	F	F	-	-	-
80-216	E	E	-	-	-	-	-	-
80-216	F	F	F	F	F	F	F	F
80-252	F	F	F	F	F	F	F	F
80-253	E, F, K	E, F, K	F, K	F, K	F, K	F, K	F, K	F, K
80-315	D	D	D	-	-	-	-	-
80-315	K	K	K	K	K	-	-	-
80-317	D	D	D	-	-	-	-	-
80-317	F	F	F	F	F	-	-	-
100-215	F	F	F	F	F	-	-	-
100-253	D	D	D	-	-	-	-	-
100-253	E, K	E, K	K	K	K	K	K	K
100-254	F, K	F, K	F, K	F, K	F, K	F, K	F, K	F, K
100-315	D	D	D	-	-	-	-	-
100-315	E	E	-	-	-	-	-	-
100-315	F, K	F, K	F, K	F, K	F, K	F, K	F, K	F, K
100-316	D	D	D	-	-	-	-	-
100-316	F, K	F, K	F, K	F, K	F, K	F, K	F, K	F, K
100-317	E	E	-	-	-	-	-	-
100-400	K	K	K	-	K	-	K	K
100-401	E, F, K	E, F, K	F, K	-	F, K	F, K	F, K	F, K
150-253	D	D	D	-	-	-	-	-
150-315	D	D	D	-	-	-	-	-
150-315	F	F	F	F	F	F	F	F
150-317	E, K	E, K	K	K	K	K	K	K
150-400	D	D	D	-	-	-	-	-
150-400	K	K	K	K	K	K	K	K
150-401	D	D	D	-	-	-	-	-
150-401	E, F	E, F	F	-	F	F	F	F
150-403	K	K	K	K	K	K	K	K
151-403	K	K	K	K	K	K	K	K
200-315	D	D	D	-	-	-	-	-
200-315	K	K	K	K	K	K	K	K

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Size	Impeller type	Material variant						
		Grey cast iron				Industrial materials		
		G	G1	G2	GH	H	C1	C2
200-316	K	K	K	K	K	K	K	K
200-317	K	K	K	K	K	-	-	-
200-318	K	K	K	K	K	-	-	-
200-400	D	D	D	-	-	-	-	-
200-401	E	E	-	-	-	-	-	-
200-402	K	K	K	K	K	K	K	K
200-403	K	K	K	K	K	K	K	K
250-400	D	D	D	-	-	-	-	-
250-401	K	K	K	K	K	K	K	K
250-403	K	K	K	K	K	K	K	K
300-400	D	D	D	-	-	-	-	-
300-400	K	K	K	K	K	K	K	K
300-401	K	K	K	K	K	K	K	K
300-403	K	K	K	K	K	K	K	K

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

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

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

1.2 Installation of partly completed machinery

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

1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇨ Section 2.3, Page 12)

1.4 Other applicable documents

Table 2: Overview of other applicable documents

Document	Content
Data sheet	Technical data of the pump set
General arrangement drawing/ outline drawing	Mating dimensions, installation dimensions and weights of the pump set
Hydraulic characteristic curve	Characteristic curves showing head, flow rate, efficiency and power input
General assembly drawing[1)]	Sectional drawing of the pump set with part numbers
Sub-supplier product literature[1)]	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists[1)]	Description of spare parts
Supplementary operating manual[1)]	E.g. for special accessories

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

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

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

1.6 Key to safety symbols/markings

Table 4: Definition of safety symbols/markings

Symbol	Description
⚠ DANGER	**DANGER** This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
⚠ WARNING	**WARNING** This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**Explosion protection** This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (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.

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2 Safety

DANGER

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

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

2.1 General

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

2.2 Intended use

The pump set must only be operated within the operating limits described in the other applicable documents.

- Only operate pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.
- Only use the pump (set) 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 duty specified in the data sheet or product literature (Q_{min} and Q_{max}) (to prevent damage such as shaft fracture, bearing failure, mechanical seal damage, etc).
- When untreated waste water is handled, the duty points in continuous operation lie within 0.7 to 1.2 × Q_{BEP} to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates (< 0.7 × Q_{BEP}).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc.).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

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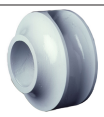
	Impeller with cutter (impeller type S/S-max)	**Suitable for the following fluids:** fluids containing coarse substances and/or long fibres
	Free-flow impeller (impeller type F/F-max)	**Suitable for the following fluids:** fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas
	Closed single-channel impeller (impeller type E/E-max)	**Suitable for the following fluids:** fluids containing solids and stringy material
	Closed multi-channel impeller (impeller type K/K-max)	**Suitable for the following fluids:** contaminated, solids-laden, non-gaseous fluids without stringy material
	Open, diagonal single-channel impeller (impeller type)	**Suitable for the following fluids:** fluids containing solid substances and long fibres

- Use in the Amajet system
  See Amajet installation/operating manual for installation types.
  The following sizes are approved for use in the Amajet system:
  - D 100-253
  - F 100-254
  - D 100-316
  - F 100-316
  - D 150-253
  - F 150-315

Prevention of foreseeable misuse

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

2.3 Personnel qualification and training

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

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

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

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

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

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:

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- Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
- Failure of important product functions
- Failure of prescribed maintenance and servicing practices
- Hazard to the environment due to leakage of hazardous substances

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇨ Section 6.3, Page 56)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇨ Section 6.1, Page 50)

2.8 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.

2.9 Explosion protection

DANGER

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

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

Special conditions apply to the operation of an explosion-proof pump set to EU Directive 2014/34/EU (ATEX).
Especially adhere to the sections in this manual marked with the symbol opposite.
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.

2.9.1 Repair

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

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3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

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

3.2 Transport

DANGER

Improper transport

Danger to life from falling parts!

Damage to the pump set!

- Use the attachment point provided for attaching the lifting accessory.
- Never suspend the pump set by its power cable.
- Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump.
- Securely attach the lifting chain/rope to the pump and crane.
- Use tested, marked and approved lifting accessories only.
- Observe the regional transport regulations.
- Observe the product literature supplied by the lifting accessory manufacturer.
- The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.

WARNING

Incorrect handling of the power cable

Personal injury and damage to property!

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

To transport the pump set suspend it from the lifting tackle as shown.

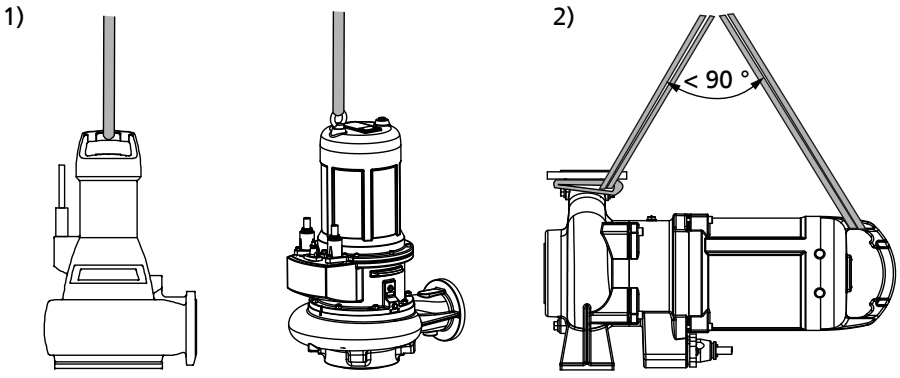

Fig. 1: Transporting the pump set 1) vertical installation 2) horizontal installation

3.2.1 Placing the pump set down

⚠ WARNING

Incorrect positioning/placing down

Personal injury and damage to property!

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

⚠ WARNING

Improper placing of pump sets in a vertical/horizontal position

Personal injury and damage to property!

- Use appropriate means to secure the pump set against tilting or tipping over.
- If possible, use two pieces of lifting equipment when handling large pump sets (using the attachment point provided on the motor and the discharge nozzle).
- Secure the power cables against falling down.
- Use additional supports for the transport holder to secure it against tilting.
- Maintain adequate safety distance during lifting operations.

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Placing the pump set on unsecured and uneven surfaces

Personal injury and damage to property!

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

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

3.2.2 Pulling the pump set upright

To change the pump from a horizontal to a vertical position, attach lifting equipment to the attachment point provided.
When the pump is pulled upright, the pump casing will act as a pivot. Place wooden supports under the pivot points.

Pumps of installation types S and K with a nominal discharge nozzle diameter of DN150 and above have a threaded hole in the claw. If two cranes are available, a swivel eyebolt can be screwed into the claw to pull the pump set upright. The direction of pull of the swivel eyebolt at an angle of 90° to the bolt axis should be approved for the entire pump set weight.

3.3 Storage/preservation

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

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CAUTION

Improper storage

Damage to the power cables!

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

CAUTION

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of the pump (set)!

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

CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

Table 5: Ambient conditions for storage

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

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

1. 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).

NOTE

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

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇨ Section 7.3, Page 69)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
   Indicate any safety measures and decontamination measures taken.
   (⇨ Section 11, Page 124)

NOTE

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

3.5 Disposal

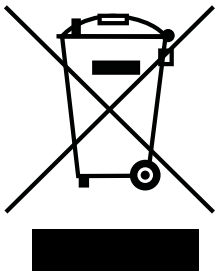
⚠ WARNING

Fluids, consumables and supplies posing a health hazard

Hazard to persons and the environment!

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

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



Electrical or electronic equipment marked with the adjacent symbol must not be disposed of in household waste at the end of its service life.

Contact your local waste disposal partner for returns.

If the used electrical or electronic equipment contains personal data, the operator is responsible for deleting it before the equipment is returned.

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4 Description of the Pump (Set)

4.1 General description

Horizontal or vertical single-stage submersible motor pump in close-coupled design, with various next-generation impeller types, for wet or dry installation, stationary or transportable version, with energy-saving motor and models for use in potentially explosive atmospheres.

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

4.2 Designation

Example: Amarex KRT F 50 - 215 / 32ZEG - S IE3

Table 6: Designation key

Code	Description	
Amarex KRT	Type series	
F	Impeller type (⇨ Section 2.2, Page 11)	
50	Nominal discharge nozzle diameter [mm]	
215	Maximum nominal impeller diameter [mm]	
3	Motor size	
2	Number of motor poles	
ZE	Motor version	
	UE	Non-explosion-proof, for fluid temperatures of up to 40 °C[2)]
	SU	Non-explosion-proof, for fluid temperatures of up to 60 °C[2)]
	XE	Explosion protection Ⓔx II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 40 °C[2)]
	YE	Explosion protection Ⓔx II 2G Ex db h IIB T4 Gb, for fluid temperatures of up to 40 °C[2)]
	ZE	Explosion protection Ⓔx II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 60 °C[2)]
G	Material variant	
	G	Standard variant, grey cast iron
	G1	Like G, with impeller made of duplex stainless steel
	G2	Like G, with impeller made of white cast iron
	GH	Like G, with impeller and discharge cover made of white cast iron
	H	Like G, with impeller, discharge cover and pump casing made of white cast iron
	C1	Wetted parts made of duplex stainless steel, mechanical seal with elastomer bellows, bolts/screws made of A4
	C2	Wetted parts made of duplex stainless steel, mechanical seal with covered spring, bolts/screws made of 1.4462
S	Installation type (⇨ Section 4.6, Page 21)	
IE3	Motor efficiency classification	
	[3)]	No efficiency classification
	IE3	Efficiency classification[4)]

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2) Maximum fluid temperature and ambient temperature
3) Blank
4) IEC 60034-30 standard not binding for submersible motor pumps. Efficiencies calculated/determined according to the measurement method specified in IEC 60034-2. The marking is used for submersible motors that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.

4.3 Product information

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

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see http://www.ksb.com/reach.

4.4 Name plate

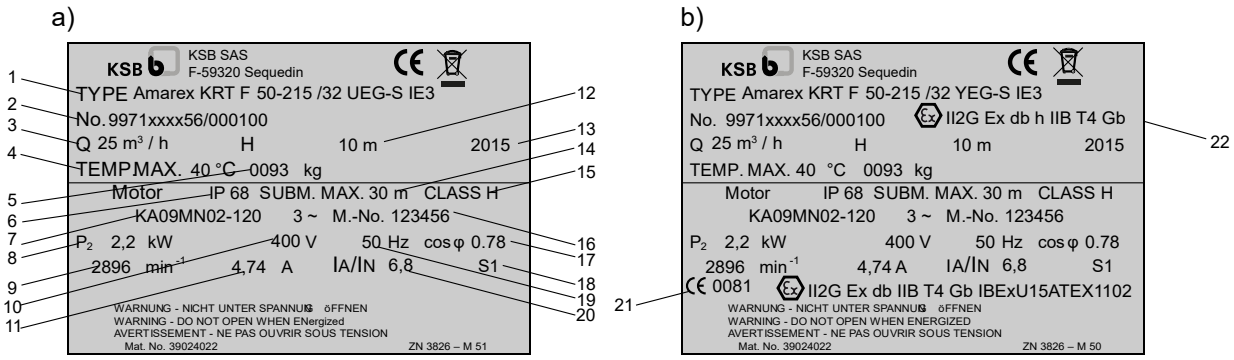

Fig. 2: Name plate (example) a) for non-explosionproof model, b) for explosion-proof model

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

4.5 Design details

Design

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

Impeller type

- Various application-oriented impeller types (⇨ Section 2.2, Page 11)

Shaft seal

Standard bearings:

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

Reinforced bearings: (⇨ Section 9.2.7, Page 101)

- Two bi-directional mechanical seals in tandem arrangement, with leakage chamber

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Bearings

Standard bearings:

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

Reinforced bearings: (⇨ Section 9.2.7, Page 101)

Drive end:

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

Pump-end:

- Grease-lubricated bearings
- Can be re-lubricated

Drive

- Three-phase asynchronous squirrel-cage motor
- Type of protection Ex db IIB (applies to explosion-proof pump sets only)

4.6 Installation types

Fig. 3: Installation types

1	Installation type D: stationary dry installation, vertical (S1 duty)
2	Installation type H: stationary dry installation, horizontal (S1 duty)
3	Installation type K: stationary wet installation (S1 duty with motor outside of the fluid possible) with guide rail arrangement Installation type S: stationary wet installation (S1 duty with submerged motor) with guide rail arrangement
4	Installation type K: stationary wet installation (S1 duty with motor outside of the fluid possible) with guide wire arrangement Installation type S: stationary wet installation (S1 duty with submerged motor) with guide wire arrangement
5	Installation type P: wet installation of transportable model (S1 duty with submerged motor)

Pump sets of installation types D, H and K
are suitable for continuous duty with the motor outside the fluid. Cooling is effected by means of air convection.
Versions with a cooling jacket have an additional internal cooling circuit.

Pump sets of installation types P and S
are designed for continuously submerged operation. 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.

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4.7 Configuration and function

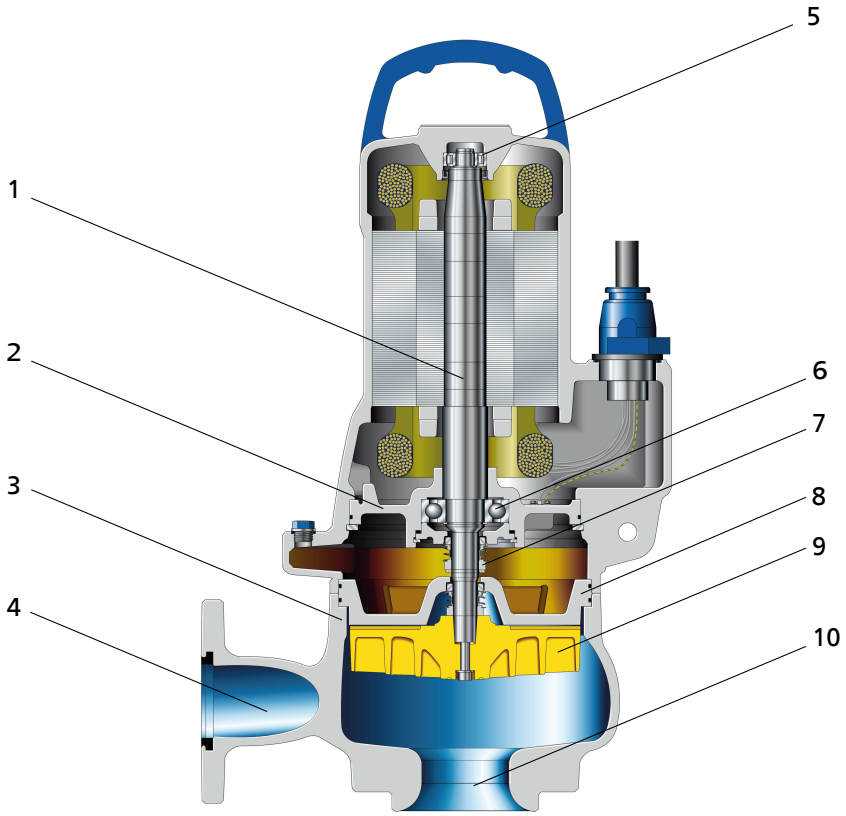

Fig. 4: Sectional drawing

1	Shaft	2	Bearing housing
3	Pump casing	4	Discharge nozzle
5	Bearing, motor end	6	Bearing, pump end
7	Shaft seal	8	Discharge cover
9	Impeller	10	Suction nozzle

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

Function The fluid enters the pump axially via the suction nozzle (10) and is accelerated outward in a cylindrical flow by the rotating impeller (9). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (4), where it leaves the pump. At the rear side of the impeller, the shaft (1) enters the hydraulic system via the discharge cover. The shaft passage through the discharge cover is sealed with a shaft seal (7). The shaft runs in rolling element bearings (5 and 6), which are supported by a bearing housing (2).

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

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4.8 Noise characteristics

Table 7: Surface sound pressure level (L_{pA} [5] [6]) depending on speed (n) and rated power (P_2)

P_2	L_{pA}		
	n = 2900 rpm	n = 1450 rpm	n = 960 rpm
[kW]	[dB]	[dB]	[dB]
2,2	65,0	58,5	57,5
3,0	67,0	60,5	59,0
4,0	68,5	62,0	60,5
5,5	70,0	63,5	63,0
7,5	71,0	65,0	63,5
11,0	72,5	67,0	65,5
15,0	73,5	68,0	66,5
18,5	74,0	68,5	67,5
22,0	74,5	69,0	68,0
30,0	75,0	70,5	69,0
37,0	76,0	71,0	69,5
45,0	77,0	71,5	70,5
55,0	77,5	72,5	71,0
75,0	78,0	73,5	72,0

4.9 Scope of supply

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

Stationary wet-installed model (installation types S and K)

- Pump set complete with power cables
- Claw with sealing elements and fasteners
- Lifting rope/lifting chain
- Mounting bracket with fasteners
- Duckfoot bend with fasteners
- Guide wire / guide rail
  (guide rails are not included in KSB's scope of supply)

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

Wet-installed transportable model (installation type P)

- Pump set complete with power cables
- Foot plate or pump stool with fasteners
- Lifting rope/lifting chain

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

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5) Measured at a distance of 1 m from the pump outline (as per DIN 45635 Parts 1 and 24)
6) For installation types D and H only

Stationary dry-installed model (installation types D and H)

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

- Pump set complete with power cables
- Foundation rails (for horizontal installation)
- Suction-side flanged spacer with inspection hole[7)] (optional)
- Suction elbow (for vertical installation)

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

4.10 Dimensions and weights

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

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7) For nominal discharge nozzle diameter ≥ DN 100

5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the pump set!

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

DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

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

DANGER

Persons in the tank during pump operation

Electric shock!

Risk of injury!

Danger of death from drowning!

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

WARNING

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

Risk of injury! Damage to the submersible motor pump!

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

WARNING

Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up

Personal injury and damage to property!

- Check the pump sump/inlet tank for impermissible solid objects before flooding, and remove, if necessary.

5.2 Checks to be carried out prior to installation

5.2.1 Checking the operating data

Before installing the pump set, verify that the name plate data matches the data given in the purchase order and the site system data.

5.2.2 Preparing the place of installation

Place of installation for stationary models

⚠ WARNING

Installation on mounting surfaces which are unsecured and cannot support the load

Personal injury and damage to property!

- ▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class XC1 to EN 206-1.
- ▷ The mounting surface must have set and must be completely horizontal and even.
- ▷ Observe the weights indicated.

Resonances

Any resonances at the usual excitation frequencies (1 x and 2 x rotational frequency, vane passing frequency) 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

⚠ WARNING

Incorrect positioning/placing down

Personal injury and damage to property!

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

Resonances

Any resonances at the usual excitation frequencies (1 x and 2 x rotational frequency, vane passing frequency) 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.

5.2.3 Checking the lubricant level

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

Visual inspection for signs of oil leakage

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

Filling in the lubricant

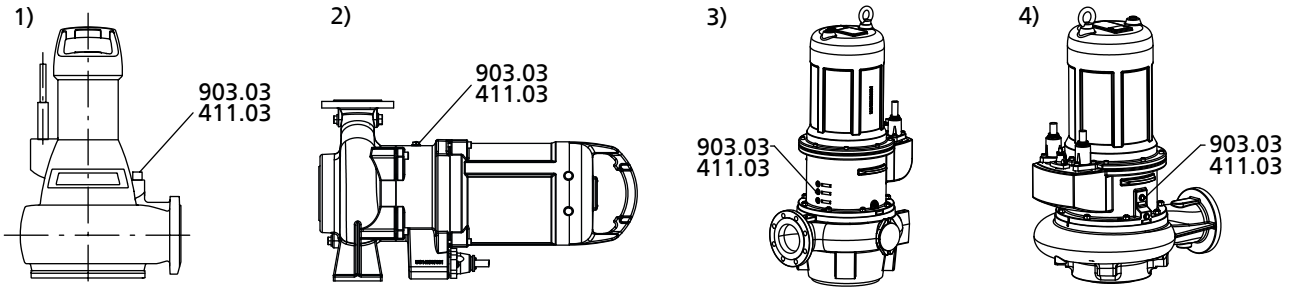

Fig. 5: Filling in the lubricant

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Table 8: Filling in the lubricant

Motor	Impeller type	Illustration No.			
		1	2	3	4
3 2.E - 7 2.E	E, F, K, S	✗	-	-	-
11 2.E - 26 2.E	E, F, K, S	-	✗	-	-
55 2.E - 75 2.E	D	-	-	✗	-
2 4.E - 5 4.E	E, F, K, S	✗	-	-	-
7 4.E - 37 4.E	D, E, F, K, S	-	✗	-	-
45 4.E - 75 4.E	D	-	-	✗	-
45 4.E - 75 4.E	E, F, K	-	-	-	✗
7 6.E - 30 6.E	D, E, F, K, S	-	✗	-	-
31 6.E - 55 6.E	D	-	-	✗	-
31 6.E - 55 6.E	E, F, K	-	-	-	✗
11 8.E - 22 8.E	D, E, F, K	-	✗	-	-
30 8.E - 45 8.E	D	-	-	✗	-
30 8.E - 45 8.E	E, F, K	-	-	-	✗

1. Position the pump set as shown.
2. Unscrew and remove screw plug 903.03 with joint ring 411.03.
3. Fill lubricant through the lubricant filler opening until the lubricant level reaches the opening.
4. Fit screw plug 903.03 together with a new joint ring 411.03.

5.2.4 Checking the direction of rotation

⚠ DANGER

Pump set running dry

Explosion hazard!

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

⚠ WARNING

Hands or foreign objects in the pump casing

Risk of injuries, damage to the pump!

- ▷ Never insert your hands or any other objects into the pump.
- ▷ Check that the inside of the pump is free from any foreign objects.
- ▷ Take suitable precautions (e.g. wear safety goggles).

⚠ WARNING

Improper positioning of pump set when checking the direction of rotation

Personal injury and damage to property!

- ▷ Use appropriate means to secure the pump set against tilting or tipping over.

	**CAUTION** **Pump set running dry** Increased vibrations! Damage to mechanical seals and bearings! ▷ Never operate the pump set for more than 60 seconds without the fluid handled.

✓ The pump set is connected to the power supply. (⇨ Section 5.4.2, Page 47)

1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
2. Check the direction of rotation.
   Impeller rotation must be anti-clockwise (seen from the pump mouth end). On some pump casings, the direction of rotation is marked by an arrow.

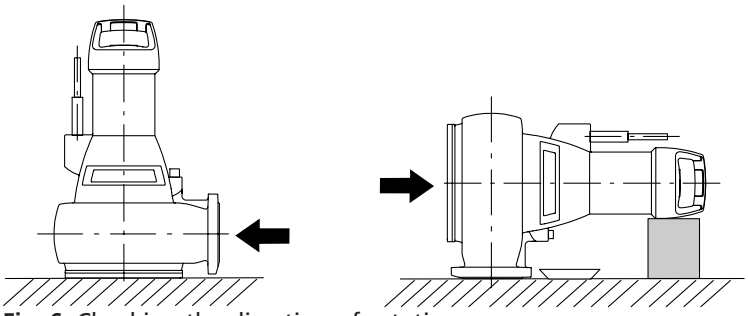

Fig. 6: Checking the direction of rotation

3. If the impeller 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 and make sure it cannot be started unintentionally.

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

Fastening the duckfoot bend with chemical anchors

Depending on the pump size, the duckfoot bend is fastened with chemical anchors.

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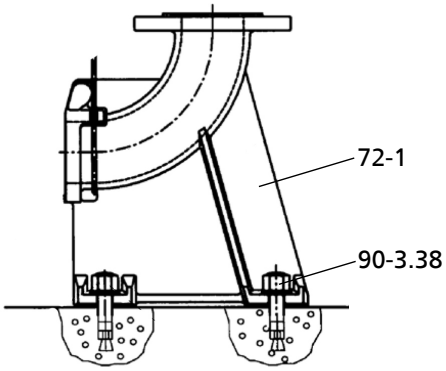

Fig. 7: Fastening the duckfoot bend

1. Position duckfoot bend 72-1 on the floor of the tank/sump.
2. Insert chemical anchors 90-3.38.
3. Bolt duckfoot bend 72-1 to the floor with chemical anchors 90-3.38.

Chemical anchor dimensions

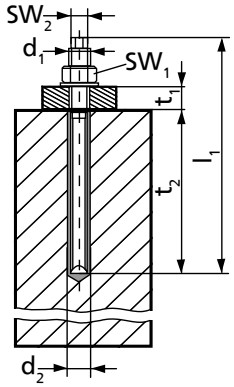

Fig. 8: Dimensions

Table 9: Chemical anchor dimensions

Size	d_2	t_1	t_2	SW_1 [8]	SW_2 [8]	M_{d1}
(d_1 × l_1)	[mm]					[Nm]
M10 × 130	12	22	90	17	6	20
M12 × 160	14	25	110	19	8	40
M16 × 190	18	35	125	24	12	60
M20 × 260	25	65	170	30	14	120
M24 × 300 [9]	28	65	210	36	17	180
M30 × 380 [9]	35	65	280	46	-	400

Table 10: Curing times of mortar cartridge

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

8) SW = Width across flats
9) Mounting accessories of the respective manufacturer are required.

5.3.1.2 Connecting the piping

DANGER

Impermissible loads acting on the flange of the duckfoot bend

Danger to life from escaping hot, toxic, corrosive or flammable fluids!

- Do not use the pump as an anchorage point for the piping.
- Anchor the pipes 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 for thermal expansion of the piping.

NOTE

When the pump set is used for draining low-level building areas, install a swing check valve in the discharge line to avoid backflow from the sewer system.

CAUTION

Critical speed

Increased vibrations!

Damage to mechanical seals and bearings!

- 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.

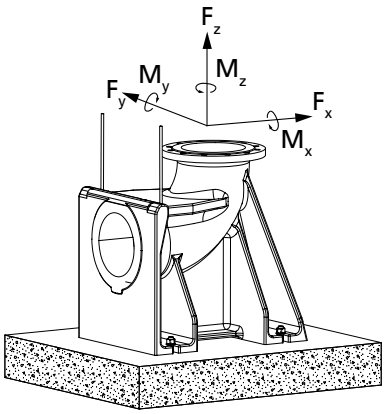

Fig. 9: Permissible flange loads

Table 11: Permissible flange loads

Nominal flange diameter	Forces [N]				Moments [Nm]			
	F_y	F_z	F_x	$\sum F$	M_y	M_z	M_x	$\sum M$
50	1350	1650	1500	2600	1000	1150	1400	2050
65	1700	2100	1850	3300	1100	1200	1500	2200
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600
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

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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

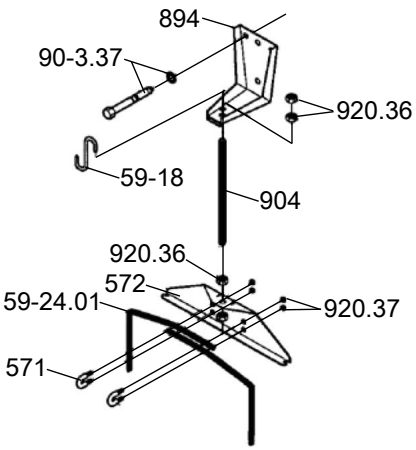

Fig. 10: Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm.
2. Insert clamping pieces 571 through the holes of suspension bracket 572 and fasten with nuts 920.37.
3. Fasten fully threaded stud 904 with the pre-assembled clamping arrangement to the mounting bracket with nut 920.36.
   Tighten nut 920.36 allowing sufficient play for subsequently tensioning the guide wire.

Inserting the guide wire

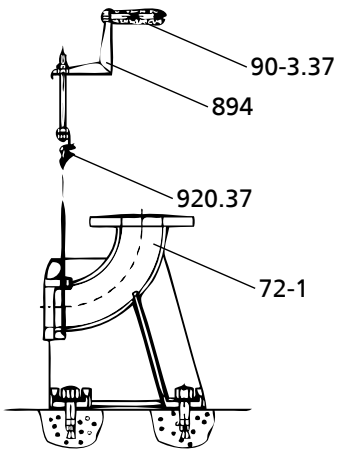

Fig. 11: Inserting the guide wire

1. Lift clamping piece 571 and insert one end of the guide wire.
2. Run wire 59-24.01 around duckfoot bend 72-1 and back again to suspension bracket 572 and insert it into clamping piece 571.
3. Manually tension wire 59-24.01 and secure it by means of hexagon nuts 920.37.

4. Pull the wire taut by tightening hexagon nuts 920.36 on the upper side of the mounting bracket to a torque of M_A = 14 Nm and a wire tension force P = 6000 N.
5. Secure the nuts with a second hexagon nut.
6. The loose wire ends at 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 / lifting rope at a later stage.

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 which are suitable for the fluid handled or as specified by the operator.

Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

Hydraulic system size	Outside diameter	Wall thickness[10)]	
		min.	max.
	[mm]	[mm]	[mm]
DN 40 to DN 150	60	2	5
DN 200 to DN 300	89	3	6

Fitting the mounting bracket

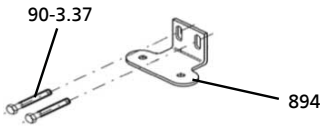

Fig. 12: Fitting the mounting bracket

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. (⇨ Section 1.4, Page 9)

Fitting the guide rails

CAUTION

Improper installation of guide rails

Damage to the guide rail arrangement!

▷ Always adjust the guide rails so that they are in a perfectly vertical position.

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

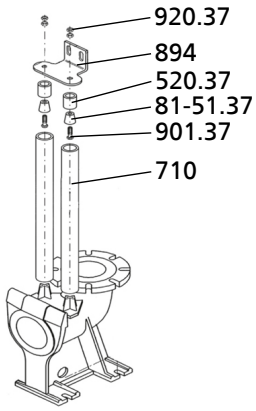

Fig. 13: Fitting the guide rails

1. Place rails 710 onto the conical bosses provided on duckfoot bend 72-1 and position them vertically.
2. Mark the length of rails 710 (up to the lower edge of the mounting bracket), 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. Debur the rails 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. Lock nuts 920.37 with a second nut each and secure them with Loctite 243.

NOTE

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.

Fitting the middle support

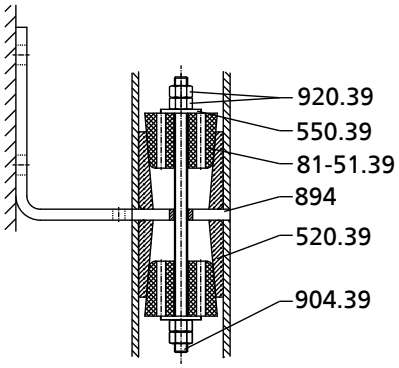

Fig. 14: Fitting the middle support

1. Measure the inside diameter of the guide rails.
2. Expand elastic sleeves 520.39 with clamping sleeves 81-51.39 to the inside diameter of the guide rails by tightening nuts 920.39.
3. Slip the guide rails onto the sleeves and verify that there is a tight fit between the guide rails and the sleeves.
4. Secure the fasteners with locknuts.

5.3.1.5 Preparing the pump set

Fitting the claw

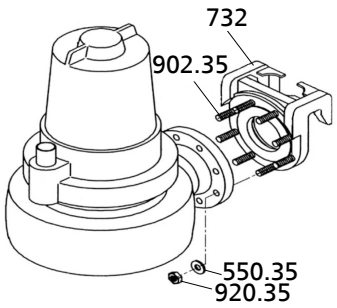

Fig. 15: Fitting the claw

1. Fasten claw 732 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35.
   Observe the tightening torques. (⇨ Section 7.6, Page 89)
2. Fit profile seal 410 in the groove of the claw.
   This will seal the duckfoot bend/pump connection.

Attaching the lifting chain/rope

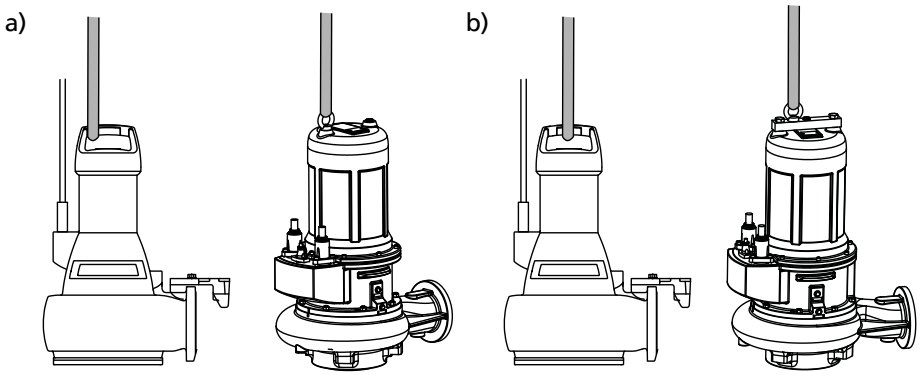

Fig. 16: Attaching the chain / lifting rope for stationary wet installation a) with guide wire arrangement b) with guide rail arrangement

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

5.3.1.6 Installing the pump set

	**NOTE** Make sure the pump set with the pre-assembled claw can easily be guided 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.

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5.3.2 Transportable wet-installed model

Attaching the lifting chain / lifting rope

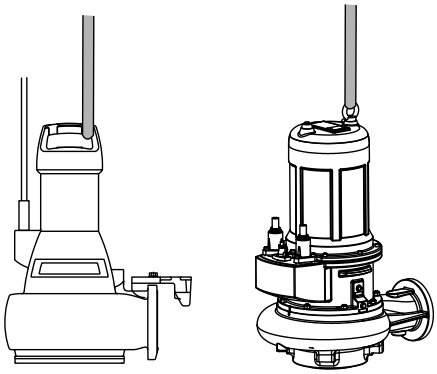

Fig. 17: Attaching the lifting chain / lifting rope (transportable wet-installed model)

1. Attach the lifting chain or lifting rope to the pump set on the discharge nozzle side as illustrated.

Fitting the foot plate or pump stool

Fit the foot plate or pump stool before installing the pump.
Tighten the bolts/screws as specified and observe the tightening torques.

Connecting the piping

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

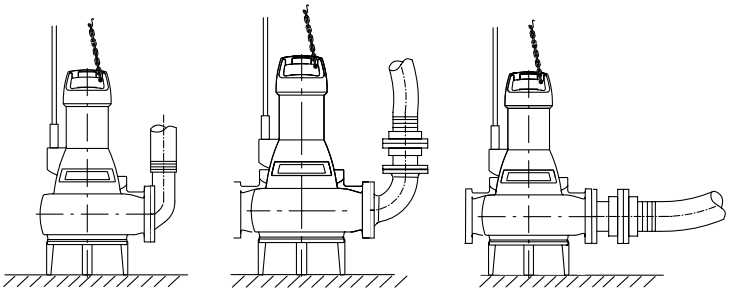

Fig. 18: Connection options

5.3.3 Stationary dry installation

5.3.3.1 Preparing the foundation

Fastening

- Fasten the pump feet, foundation rails or suction duckfoot bend to a concrete foundation with chemical anchors.

✓ The foundation has the required strength and characteristics.

✓ The foundation has been prepared in accordance with the dimensions given in the outline drawing/general arrangement drawing.

1. Position the pump set on the foundation and level it with the help of a spirit level placed on the shaft and discharge nozzle.
   Permissible deviation: 0.2 mm/m
2. Use shims for height compensation if necessary.
   Always fit shims immediately to the left and right of the chemical anchors between the foundation rails and the foundation.
   For a bolt-to-bolt distance (L) ≥ 800 mm fit additional shims halfway between the adjoining holes.
   All shims must lie perfectly flush.

3. Drill the holes as specified in the "Chemical anchor dimensions" table. Then clean the holes.

⚠ WARNING

Improper handling of mortar cartridge

Skin sensitisation and/or irritation!

▷ Wear suitable protective clothing.

4. Insert the mortar cartridges into the drilled holes.
   Observe the curing times of the mortar cartridges!
5. Insert threaded bolts into the corresponding drilled holes with an electric tool (e.g. impact drill, hammer drill).
6. After the curing time (see table), tighten the chemical anchors evenly and tightly.
7. Grout the foundation rails using low-shrinkage concrete.

Chemical anchor dimensions

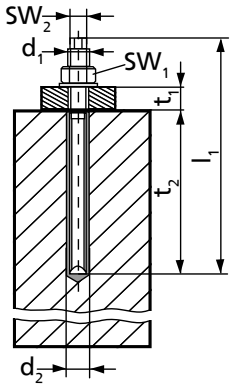

Fig. 19: Dimensions

Table 13: Chemical anchor dimensions

Size	d_2	t_1	t_2	SW_1 [11)]	SW_2 [11)]	M_{d1}
(d_1 × l_1)	[mm]					[Nm]
M10 × 130	12	22	90	17	6	20
M12 × 160	14	25	110	19	8	40
M16 × 190	18	35	125	24	12	60
M20 × 260	25	65	170	30	14	120
M24 × 300[12)]	28	65	210	36	17	180
M30 × 380[12)]	35	65	280	46	-	400

Table 14: Curing times of mortar cartridge

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

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11) SW = Width across flats
12) Mounting accessories of the respective manufacturer are required.

5.3.3.2 Piping

5.3.3.2.1 Connecting the piping

DANGER

Impermissible loads acting on the pump nozzles

Danger to life from escaping hot, toxic, corrosive or flammable fluids!

- ▹ Do not use the pump as an anchorage point for the piping.
- ▹ Anchor the pipes in close proximity to the pump and connect them properly without transmitting any stresses or strains.
- ▹ Observe the permissible forces and moments at the pump nozzles.
- ▹ Take appropriate measures to compensate for thermal expansion of the piping.

CAUTION

Incorrect earthing during welding work at the piping

Destruction of rolling element bearings (pitting effect)!

- ▹ Never earth the electric welding equipment on the pump or baseplate.
- ▹ Prevent current flowing through the rolling element bearings.

NOTE

Installing check and shut-off elements in the system is recommended, depending on the type of plant and pump. However, such elements must not obstruct proper drainage or hinder disassembly of the pump.

- ✓ Suction lift lines have been laid with a rising slope, suction head lines with a downward slope towards the pump.
- ✓ A flow stabilisation section having a length equivalent to at least twice the diameter of the suction flange has been provided upstream of the suction flange.
- ✓ The nominal pipe diameters are at least equal to or larger than the nominal pump nozzle diameters.
- ✓ Adapters to larger nominal diameters are designed with a diffuser angle of approx. 8° to avoid excessive pressure losses.
- ✓ The pipes 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, pipes and connections (especially of 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 to the piping.

5.3.3.2.2 Permissible forces and moments at the pump nozzles

Installation on pump feet (horizontal)

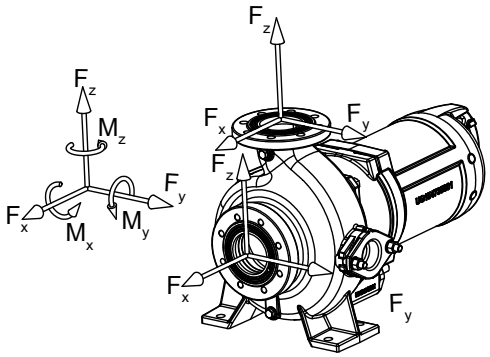

Fig. 20: Forces and moments at the pump nozzles for installation on pump feet

The data on forces and moments apply to static piping loads only. If the limits are exceeded, they must be checked and verified.
If a computerised strength analysis is required, values are available on request only. The values are only applicable if the pump is installed on a completely grouted baseplate and bolted to a rigid and level foundation.

The values correspond with those specified in EN ISO 5199 for horizontal installation of pump family 1A for cast iron at 20 °C.

Table 15: Forces and moments at the pump nozzles

Size	Impeller type	Forces [N]								Moments [Nm]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F_x	F_y	F_z	ΣF	F_x	F_y	F_z	ΣF	M_x	M_y	M_z	ΣM	M_x	M_y	M_z	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
50-215	F	750	650	600	1150	550	500	600	900	550	400	400	750	500	350	400	700
50-216	F	750	650	600	1150	550	500	600	900	550	400	400	750	500	350	400	700
65-215	F	900	800	700	1400	650	600	750	1150	600	400	450	800	550	400	400	750
65-216	E	900	800	700	1400	650	600	750	1150	600	400	450	800	550	400	400	750
65-217	F	900	800	700	1400	650	600	750	1150	600	400	450	800	550	400	400	750
80-215	F	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-216	E, F	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-217	F	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-252	F	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-253	E, F	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-315	D	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
80-316	D	1400	1250	1100	2150	800	700	900	1400	750	550	650	1050	600	400	450	800
80-317	D	1200	1050	950	1850	800	700	900	1400	600	450	500	900	600	400	450	800
100-215	F	1200	1050	950	1850	1050	950	1200	1850	600	450	500	900	600	450	500	900
100-253	E, K	1200	1050	950	1850	1050	950	1200	1850	600	450	500	900	600	450	500	900
100-253	D	1750	1600	1400	2750	1050	950	1200	1850	900	600	700	1300	600	450	500	900
100-254	F, K	1200	1050	950	1850	1050	950	1200	1850	600	450	500	900	600	450	500	900
100-315	D	1400	1250	1100	2150	1050	950	1200	1850	750	550	650	1050	600	450	500	900
100-316	D	1750	1600	1400	2750	1050	950	1200	1850	900	600	700	1300	600	450	500	900
100-317	E	1400	1250	1100	2150	1050	950	1200	1850	750	550	650	1050	600	450	500	900
150-253	D	1750	1600	1400	2750	1600	1400	1750	2750	900	600	700	1300	900	600	700	1300
150-315	F, D	1750	1600	1400	2750	1600	1400	1750	2750	900	600	700	1300	900	600	700	1300
150-317	E, K	1750	1600	1400	2750	1600	1400	1750	2750	900	600	700	1300	900	600	700	1300
200-315	K, D	2350	2100	1900	3650	2100	1900	2350	3650	1150	800	950	1700	1150	800	950	1700
200-316	K	2350	2100	1900	3650	2100	1900	2350	3650	1150	800	950	1700	1150	800	950	1700

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Size	Impeller type	Forces [N]								Moments [Nm]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F_x	F_y	F_z	ΣF	F_x	F_y	F_z	ΣF	M_x	M_y	M_z	ΣM	M_x	M_y	M_z	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
200-317	K	2350	2100	1900	3650	2100	1900	2350	3650	1150	800	950	1700	1150	800	950	1700
200-318	K	2350	2100	1900	3650	2100	1900	2350	3650	1150	800	950	1700	1150	800	950	1700

Installation on a suction elbow (vertical)

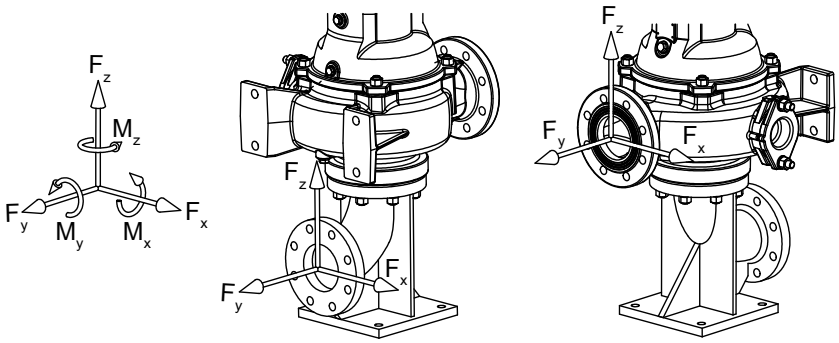

Fig. 21: Forces and moments at the pump nozzles for installation on a suction elbow

Table 16: Forces and moments at the pump nozzles

Size	Impeller type	Forces [N]								Moments [Nm]							
		Suction nozzle				Discharge nozzle				Suction nozzle				Discharge nozzle			
		F_x	F_y	F_z	ΣF	F_x	F_y	F_z	ΣF	M_x	M_y	M_z	ΣM	M_x	M_y	M_z	ΣM
		(+/-)				(+/-)				(+/-)				(+/-)			
50-215	F	1850	1700	2100	3300	550	600	500	900	1500	1100	1200	2200	500	350	400	700
50-216	F	1850	1700	2100	3300	550	600	500	900	1500	1100	1200	2200	500	350	400	700
65-215	F	2250	2050	2500	3950	650	750	600	1150	1600	1150	1300	2350	550	400	400	750
65-216	E	2250	2050	2500	3950	650	750	600	1150	1600	1150	1300	2350	550	400	400	750
65-217	F	2250	2050	2500	3950	650	750	600	1150	1600	1150	1300	2350	550	400	400	750
80-215	F	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-216	F, E	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-217	F	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-252	F	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-253	F, E	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-315	D	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
80-316	D	3550	3200	3950	6200	800	900	700	1400	2100	1500	1900	3050	600	400	450	800
80-317	D	3000	2700	3350	5250	800	900	700	1400	1750	1250	1450	2600	600	400	450	800
100-215	F	3000	2700	3350	5250	1050	1200	950	1850	1750	1250	1450	2600	600	450	500	900
100-253	E, K	3000	2700	3350	5250	1050	1200	950	1850	1750	1250	1450	2600	600	450	500	900
100-253	D	4500	4050	5000	7850	1050	1200	950	1850	2500	1750	2050	3650	600	450	500	900
100-254	F, K	3000	2700	3350	5250	1050	1200	950	1850	1750	1250	1450	2600	600	450	500	900
100-315	D	3550	3200	3950	6200	1050	1200	950	1850	2100	1500	1900	3050	600	450	500	900
100-316	D	4500	4050	5000	7850	1050	1200	950	1850	2500	1750	2050	3650	600	450	500	900
100-317	E	3550	3200	3950	6200	1050	1200	950	1850	2100	1500	1900	3050	600	450	500	900
150-253	D	4500	4050	5000	7850	1600	1750	1400	2750	2500	1750	2050	3650	900	600	700	1300
150-315	F, D	4500	4050	5000	7850	1600	1750	1400	2750	2500	1750	2050	3650	900	600	700	1300
150-317	E, K	4500	4050	5000	7850	1600	1750	1400	2750	2500	1750	2050	3650	900	600	700	1300
200-315	K, D	6000	5400	6700	10450	2100	2350	1900	3650	3250	2300	2650	4800	1150	800	950	1700
200-316	K	6000	5400	6700	10450	2100	2350	1900	3650	3250	2300	2650	4800	1150	800	950	1700
200-317	K	6000	5400	6700	10450	2100	2350	1900	3650	3250	2300	2650	4800	1150	800	950	1700
200-318	K	6000	5400	6700	10450	2100	2350	1900	3650	3250	2300	2650	4800	1150	800	950	1700

5.3.3.2.3 Vacuum balance line

NOTE

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

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.

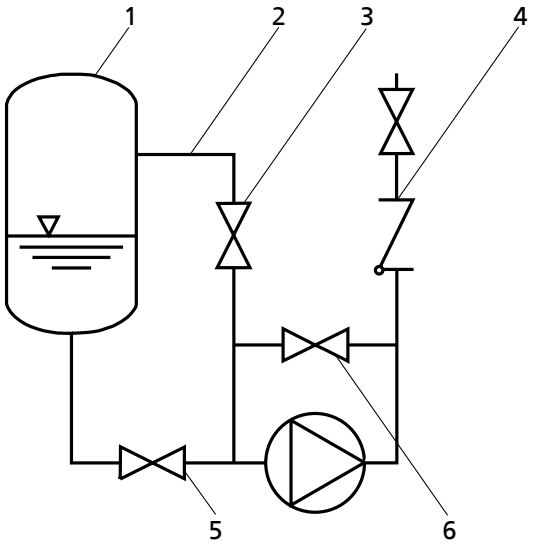

Fig. 22: Vacuum balance system

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

NOTE

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

5.3.3.3 Auxiliary connections

⚠ WARNING

Screw plugs subjected to pressure

Risk of injuries by parts flying off and escaping fluid!

- ▷ Never use screw plugs for releasing pressure from the pump casing.
- ▷ Always use suitable venting devices (e.g. vent valve).

The following auxiliary connections are available:

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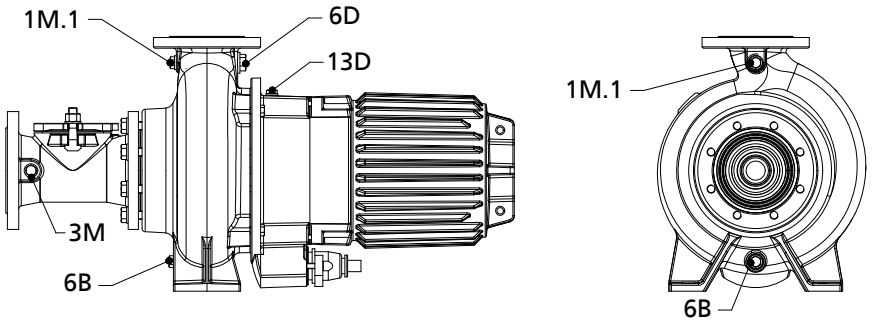

Fig. 23: Auxiliary connections

Table 17: Size of auxiliary connections

Size	Impeller type	Connection				
		Pressure gauge	Vent	Pressure/ vacuum gauge	Casing drain	Oil filling
		1 M.1	6 D	3 M	6 B	13 D
40-252	F, K, S	-	-	-	-	-
50-215	F	G 1/2	G 1/2	G 1/2	G 1/2	G 1/2
50-216	F, S	G 1/2	G 1/2	G 1/2	G 1/2	G 1/2
65-215	F	G 1/2	G 3/4	G 1/2	G 1/2	G 1/2
65-216	E	G 1/2	G 3/4	G 1/2	G 1/2	G 1/2
65-217	F	G 1/2	G 3/4	G 1/2	G 1/2	G 1/2
65-253	K	G 1/2	G 3/4	G 1/2	G 1/2	G 1/2
80-215	F	G 1/2	G 1	G 1/2	G 1/2	G 1/2
80-216	E, F	G 1/2	G 1	G 1/2	G 1/2	G 1/2
80-252	F	G 1/2	G 1	G 1/2	G 1/2	G 1/2
80-253	E, F, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
80-315	D, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
80-317	D, F	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-215	F	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-253	D, E, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-254	F, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-315	D, E, F, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-316	D, F, K	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-317	E	G 1/2	G 1	G 1/2	G 1/2	G 1/2
100-400	K	G 1/2	G 1	G 1/2	G 1	G 1/2
100-401	E, F, K	G 1/2	G 1	G 1/2	G 1	G 1/2
150-253	D	G 1/2	G 1	G 1/2	G 1/2	G 1/2
150-315	D, F	G 1/2	G 1	G 1/2	G 1	G 1/2
150-317	E, K	G 1/2	G 1	G 1/2	G 1	G 1/2
150-400	D, K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
150-401	D, E, F	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
150-403	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
151-403	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
200-315	D, K	G 1/2	G 1	G 1/2	G 1	G 1/2
200-316	K	G 1/2	G 1	G 1/2	G 1	G 1/2
200-317	K	G 1/2	G 1	G 1/2	G 1	G 1/2
200-318	K	G 1/2	G 1	G 1/2	G 1	G 1/2
200-400	D	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2

Size	Impeller type	Connection				
		Pressure gauge	Vent	Pressure/ vacuum gauge	Casing drain	Oil filling
		1 M.1	6 D	3 M	6 B	13 D
200-401	E, K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
200-402	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
200-403	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
250-400	D	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
250-401	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
250-403	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
300-400	D, K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
300-401	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2
300-403	K	G 1/2	G 1 1/4	G 1/2	G 1	G 1/2

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the pump set observe the wiring diagrams.
(⇨ Section 9.3, Page 108)

NOTE

When laying a cable between the control system and the pump set's connection point, verify that the number of cores is sufficient for the sensors. A minimum cross-section of 1.5 mm² is required.

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.
(⇨ Section 6.2.2, Page 53)

5.4.1.1 Starting method

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

- Pump sets with one power cable 8G1.5 (⇨ Section 9.3.2.1, Page 109)
- Pump sets with two power cables 4G16 and 8G1.5 (⇨ Section 9.3.2.5, Page 113)

For reducing the starting current autotransformers or soft starters can be used. For selecting suitable devices observe the rated current of the motor.
(⇨ Section 4.4, Page 20)
At least three times the rated current is required for reliable start-up. The run-up time must not exceed 4 seconds.

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

5.4.1.2 Setting the overload protection device

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

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5.4.1.3 Level control

DANGER

Pump set running dry

Explosion hazard!

▷ Never allow an explosion-proof pump set to run dry!

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

▷ Never allow the fluid level to drop below the specified minimum.

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

5.4.1.4 Operation on a frequency inverter

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

DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

DANGER

Incorrect selection and setting of the frequency inverter

Explosion hazard!

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

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

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

Setting Observe the following instructions for setting a frequency inverter:

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

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

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

Operation Observe the following limits during operation on a frequency inverter:

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

Electromagnetic compatibility Operation on a frequency inverter produces interference emissions whose level varies depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a motor and a frequency inverter, from exceeding any

given limits always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a pump set with shielded power cable.

Interference immunity

The pump set generally meets the interference immunity requirements to IEC 61000-6-1. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the cables in the plant. No modifications are required on the power/control cable of the pump set. Suitable analysing devices must be selected. To monitor the leakage sensor inside the motor using a special relay available from KSB is recommended.

5.4.1.5 Sensors

DANGER

Operating an incompletely connected pump set

Explosion hazard!

Damage to the pump set!

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

CAUTION

Incorrect wiring

Damage to the sensors!

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

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

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

NOTE

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

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

5.4.1.5.1 Motor temperature

Pump sets of installation types P or S with 8-core power cable

DANGER

Insufficient cooling

Explosion hazard!

Winding damage!

- Never operate an explosion-proof pump set without operational temperature monitoring.

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The pump set features double monitoring of the winding temperature. The temperature switches for motor temperature 1 (terminals 20 and 21, max. 250 V~/2 A) serve as temperature control devices which open when the winding temperature is too high. Tripping must result in the pump set cutting out. Automatic re-starting is permitted.

If the temperature switches at terminals 21 and 22 are not used, the conductor for terminal 22 must be insulated or connected to a dummy terminal.

⚠ WARNING

Incorrect electrical installation

Electric shock!

- ▹ Adequately insulate conductor 22.

For an explosion-proof pump set (motor version XE, YE or ZE) use the temperature switches for motor temperature 2 (terminals 21 and 22, maximum 250 V~/2 A) in addition to the above. Tripping must result in the pump set cutting out. After the pump set has been tripped by these temperature switches, it must not re-start automatically.

Pump sets of installation types P or S with 12-core power cable or several power cables

⚠ DANGER

Insufficient cooling

Explosion hazard!

Winding damage!

- ▹ Never operate a pump set without operational temperature monitoring equipment.
- ▹ For explosion-proof pump sets use a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex db type of protection.

CAUTION

Incorrect wiring

Winding damage!

- ▹ Never rely on the PTC thermistors alone for temperature monitoring.

The pump set features double monitoring of the winding temperature. 2 temperature switches (terminals 21 and 22, max. 250 V~/2 A) serve as temperature control devices which open when the winding temperature is too high. Tripping must result in the pump set cutting out. Automatic re-starting is permitted.

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

Pump sets of installation type D, H or K

DANGER

Insufficient cooling

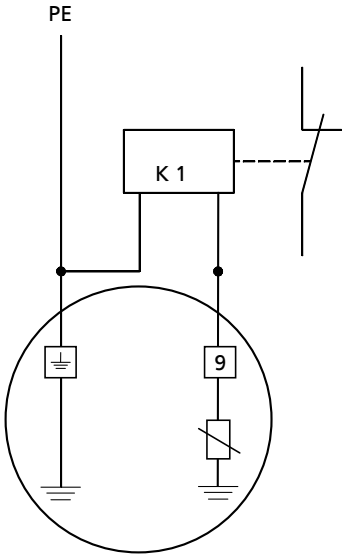
Explosion hazard!

Winding damage!

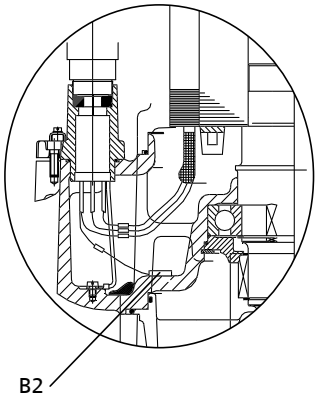
- Never operate a pump set without operational temperature monitoring equipment.
- For explosion-proof pump sets use a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex db type of protection.

The motor is monitored by three series-connected PTC thermistors with terminals 10 and 11. Tripping must result in the pump set cutting out. Automatic re-starting is not permitted.
On explosion-proof pump sets, 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 db type of protection.

5.4.1.5.2 Leakage inside the motor



Wiring of the electrode relay



Position of the electrode in the motor housing

An electrode fitted inside the motor monitors the winding space (B2) for leakage. The electrode is intended for connection to an electrode relay (core marking 9). Tripping of the electrode relay must result in the pump set cutting out.

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

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

5.4.1.5.3 Bearing temperature

As an option, the pump set can be supplied with temperature monitoring in the area of the pump-end bearings.
Check in the data sheet whether the pump set is equipped with bearing temperature monitoring.

The bearing temperature sensor is a Pt100 resistance thermometer. It must be connected to a temperature control device with a Pt100 input and two separate outputs for two different switching points (sensor circuit maximum 6 V/2 mA).

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Set the following limits:

- Alert at 110 °C
- Cut-out of the pump set at 130 °C

5.4.2 Connection to power supply

DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

- ▷ Always have the electrical connections installed by a trained and qualified electrician.
- ▷ Observe regulations IEC 60364 and, for explosion-proof models, .

WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

CAUTION

Improper routing of power cable

Damage to the power cables!

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

CAUTION

Motor overload

Damage to the motor!

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

For electrical connection observe the wiring diagrams and the information for planning the control system. (⇨ Section 9.3, Page 108) (⇨ Section 5.4.1, Page 42)

The pump set is supplied with power cables. Always connect all marked cores.

DANGER

Incorrect wiring

Explosion hazard!

- ▷ The connection point of the cable ends must be located outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.

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DANGER

Operating an incompletely connected pump set

Explosion hazard!

Damage to the pump set!

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

DANGER

Connection of damaged power cables

Danger of death from electric shock!

- ▷ Check the power cables for damage before connecting them.
- ▷ Never connect damaged power cables.
- ▷ Replace damaged power cables.

CAUTION

Flow-induced motion

Damage to the power cable!

- ▷ Run the power cable upwards without slack.

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

5.4.2.1 Potential equalisation

Wet installation (installation types K, P, S)

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

DANGER

Incorrect wiring

Explosion hazard!

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

DANGER

Touching the pump set during operation

Electric shock!

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

Dry installation (installation types D and H)

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

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Connecting the potential equalisation conductor

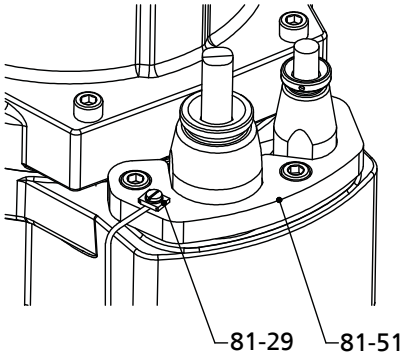

Fig. 24: Connecting the potential equalisation conductor

81-29	Connection terminal
81-51	Clamping element

1. Connect the potential equalisation conductor to terminal 81-29 provided on clamping element 81-51.

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 power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled. The pump has been vented.
- 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 activities required for returning the equipment to service have been carried out. (⇨ Section 6.4, Page 57)

DANGER

Persons in the tank during pump operation

Electric shock!

Risk of injury!

Danger of death from drowning!

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

DANGER

Exceeding the operating limits

Pump casing could burst/leak!

Pressurised hot or toxic fluid could escape!

Flying parts!

▷ Maintain an adequate safety distance from pump sets which are in operation.

6.1.2 Priming and venting the pump set (dry installation only - installation types D and H)

DANGER

Shaft seal failure caused by insufficient lubrication

Hot or toxic fluid could escape!

Damage to the pump!

▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.

1. Vent the pump and suction line and prime 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).

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6.1.3 Start-up

Wet installation (installation types K, P, S)

CAUTION

Re-starting while motor is still running down

Damage to the pump set!

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

✓ The fluid level is sufficiently high.

CAUTION

Start-up against a closed shut-off element

Increased vibrations!

Damage to mechanical seals and bearings!

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

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

Dry installation (installation types D and H)

⚠ DANGER

Non-compliance with the permissible pressure limits and temperature limits if the pump is operated with the suction line and discharge line closed

Explosion hazard!

Hot or toxic fluids escaping!

- ▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.
- ▷ Only start up the pump set against a slightly open discharge-side shut-off element.

⚠ DANGER

Excessive temperatures due to dry running or excessive gas content in the fluid handled

Explosion hazard!

Damage to the pump set!

- ▷ Never operate the pump set without liquid fill.
- ▷ Prime the pump as per operating instructions.
- ▷ Always operate the pump within the permissible operating range.

⚠ WARNING

Hot surface

Risk of burns

- ▷ Never touch a pump set which is in operation.

⚠ WARNING

Very high noise emission during operation

Personal injury!

- ▷ Minimise exposure in the vicinity of the pump set.
- ▷ For required work near running pump sets use appropriate ear protection.

⚠ WARNING

Abnormal noises, vibrations, temperatures or leakage

Damage to the pump!

Risk of personal injury!

- ▷ Switch off the pump (set) immediately.
- ▷ Eliminate the causes before returning the pump set to service.

- ✓ Pump, suction line and inlet tank (if fitted) have been vented and primed with the fluid to be handled.
- ✓ The priming lines and venting lines have been closed.

CAUTION

Start-up against open discharge line

Motor overload!

- ▷ Make sure the motor has sufficient power reserves.
- ▷ Use a soft starter.
- ▷ Use speed control.

1. Fully open the shut-off element in the suction head/suction lift line.
2. 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 comply with the duty point.

6.1.4 Shutdown (dry installation only - installation types D and H)

- ✓ The shut-off element in the suction line is and remains open.

1. Switch off the motor.
2. Immediately after having switched off the motor, close the shut-off element in the discharge line.

NOTE

If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open provided that the system conditions and system regulations are considered and observed.

For prolonged shutdown periods:

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

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CAUTION

Danger of freezing!

Damage to the pump set!

- Drain the pump set or protect it against freezing.

6.2 Operating limits

DANGER

Non-compliance with operating limits

Damage to the pump set!

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

6.2.1 Frequency of starts

CAUTION

Excessive frequency of starts

Risk of damage to the motor!

- Never exceed the specified frequency of starts.

To prevent high temperature increases in the motor and excessive loads on the motor, sealing elements and bearings, do not exceed the following number of starts per hour.

Table 18: Frequency of starts

Motor rating	Maximum frequency of starts
[kW]	[Starts/hours]
≤ 7,5	30
> 7,5	10

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

6.2.2 Operation on the power supply mains

DANGER

Permissible tolerances for operation on mains power exceeded

Explosion hazard!

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

The mains voltage and mains frequency may fluctuate around the rated values as defined for zone B to IEC 60034-1. The voltage difference between the individual phases must not exceed 1 %.

6.2.3 Operation on a frequency inverter

DANGER

Operation outside the permitted frequency range

Explosion hazard!

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

CAUTION

Pumping solids-laden fluids at reduced speed

Increased wear and clogging!

- Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.

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

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

CAUTION

Danger of freezing!

Damage to the pump set!

- Drain the pump set or protect it against freezing.

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

6.2.4.2 Minimum level of fluid handled (for installation types K, P and S only)

DANGER

Pump set running dry

Explosion hazard!

- Never allow an explosion-proof pump set to run dry!

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

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

Installation types P and S

The pump set is 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.

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.
(⇨ Section 1.4, Page 9)

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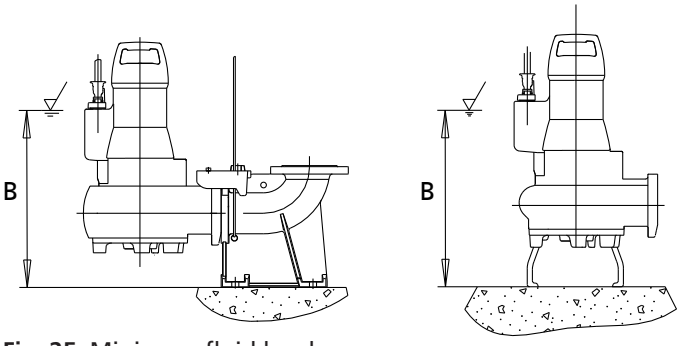

Fig. 25: Minimum fluid level

	NOTE
	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).

Installation type K

Pump sets of installation type K 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.

Use in the Amajet system

Slurp mode

Slurp mode (partly involving air intake) is permissible for a period of up to 60 seconds.
For pumps with D impeller, slurp mode is impermissible. Make sure that the pump set stops in time.

6.2.4.3 Density of the fluid handled

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

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

6.2.4.4 Abrasive fluids

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

The pump set remains installed

⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

⚠ WARNING

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

Risk of injury!

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

CAUTION

Danger of frost/freezing

Damage to the pump set!

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

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

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

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

✓ The pump has been properly drained.

✓ The safety instructions for dismantling the pump have been observed.
(⇨ Section 7.1, Page 58)

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 nozzle and discharge nozzle.
   It is advisable to then close the pump nozzles (e.g. with plastic caps).
3. Oil or grease all exposed machined parts and surfaces of the pump (with silicone-free oil or grease, food-approved if required) to protect them against corrosion.
   Observe the additional instructions on preservation. (⇨ Section 3.3, Page 16)

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6.4 Returning to service

For returning the pump set to service, observe the items on commissioning/start-up. (⇨ Section 6.1, Page 50)

Refer to and comply with the operating limits. (⇨ Section 6.2, Page 53)

For returning the pump set to service after storage also follow the instructions for maintenance/inspection. (⇨ Section 7.2, Page 60)

⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

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

NOTE

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

7 Servicing/Maintenance

7.1 Safety regulations

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

DANGER

Sparks produced during servicing work

Explosion hazard!

- Observe the safety regulations in force at the place of installation!
- Never open an energised pump set.
- Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.

DANGER

Improperly serviced pump set

Explosion hazard!

Damage to the pump set!

- Service the pump set regularly.
- Prepare a maintenance schedule with special emphasis on lubricants, power cable, bearing assembly and shaft seal.

DANGER

Electrical connection work by unqualified personnel

Danger of death from electric shock!

- Always have any work on the connection to the power supply performed by a trained electrician.
- Observe regulation .

DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

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

WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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

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⚠ WARNING

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

Risk of injury! Damage to the submersible motor pump!

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

⚠ WARNING

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

Risk of injury!

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

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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

NOTE

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

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

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the pump set.

7.2 Servicing/inspection

recommends the following regular servicing schedule:

Table 19: Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours[13)]	Insulation resistance measurement	(⇨ Section 7.2.2.4, Page 61)
	Checking the power cables	(⇨ Section 7.2.2.3, Page 61)
	Visual inspection of the lifting chain / lifting rope	(⇨ Section 7.2.2.1, Page 61)
	Visual inspection of lifting accessories	(⇨ Section 7.2.2.2, Page 61)
Every 10,000 operating hours[14)]	Checking the sensors	(⇨ Section 7.2.2.5, Page 62)
	Changing the lubricant	(⇨ Section 7.2.3.1.4, Page 66)
Every 5 years	General overhaul	-

NOTE

In demanding conditions (e.g. high mechanical and hydraulic loads) reduce the maintenance interval accordingly.

For a consultation or any queries please contact Service.

7.2.1 Supervision of operation (for installation types D and H only)

DANGER

Risk of potentially explosive atmosphere inside the pump

Explosion hazard!

- The pump internals in contact with the fluid to be handled, including the seal chamber and auxiliary systems, must be filled with the fluid to be handled at all times.
- Provide sufficient inlet pressure.
- Provide an appropriate monitoring system.

CAUTION

Increased wear due to dry running

Damage to the pump set!

- Never operate the pump set without liquid fill.
- Never close the shut-off element in the suction line and/or supply line during pump operation.

CAUTION

Impermissibly high temperature of fluid handled

Damage to the pump!

- Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).
- Observe the temperature limits in the data sheet and in the section on operating limits.

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13) At least once a year
14) At least every three years

While the system is in operation, observe or check the following:

- The pump set must run quietly and free from vibrations at all times.
- Monitor the correct functioning of any auxiliary connections.
- Monitor the stand-by pump.
  To make sure that stand-by pumps are ready for operation, start them up once a week.

7.2.2 Inspection work

7.2.2.1 Checking the lifting chain/rope (for installation types K, P and S only)

✓ The pump set has been lifted out of the pump sump and cleaned. (Applies to installation type K only.)

1. Inspect the lifting chain/rope as well as their fasteners for any visible damage.
2. Replace any damaged components by original spare parts.

7.2.2.2 Checking the lifting accessories

✓ The pump set has been lifted out of the pump sump and cleaned. (For installation types K, P and S only)

1. Check the bail or eyebolt including fasteners (screws/bolts) for any visible damage.
2. Replace any damaged components by original spare parts.

7.2.2.3 Checking the power cables

Visual inspection

✓ The pump set has been lifted out of the pump sump and cleaned.

1. Inspect the power cables for visible damage.
2. Replace any damaged components by original spare parts.

Checking the earth conductor

✓ The pump set has been lifted out of the pump sump and cleaned.

1. Measure the resistance between the earth conductor and chassis ground.
   The electrical resistance must be lower 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.

7.2.2.4 Measuring the insulation resistance

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

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

✓ Use an insulation resistance measuring device.

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

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

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

NOTE

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

NOTE

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

7.2.2.5 Checking the sensors

CAUTION

Excessive test voltage

Damage to the sensors!

▹ Use a commercially available ohmmeter to measure the resistance.

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

Temperature sensors in the motor winding

Table 20: Resistance measurement

Measurement between terminals ...	Resistance [Ω]
20 and 21[15)]	< 1
21 and 22	< 1
10 and 11[15)]	100-1000

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.

Leakage sensor in the motor

Table 21: Resistance measurement of the leakage sensor in the motor

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

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

Bearing temperature sensor

Table 22: Resistance measurement of the bearing temperature sensor

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

7.2.2.6 Visual inspection through the inspection hole (for inspection types D and H only and for pump sets with nominal diameters ≥100)

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

15) If any

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

	**⚠ WARNING** **Hands or foreign objects in the pump casing** Risk of injuries, damage to the pump! ▹ Check that the inside of the pump is free from any foreign objects. Remove any foreign objects. ▹ Never insert your hands or any other objects into the pump, if the pump set has not been disconnected from the power supply and secured against unintentional start-up.

If a problem has occurred which requires visual inspection, observe the following instructions:

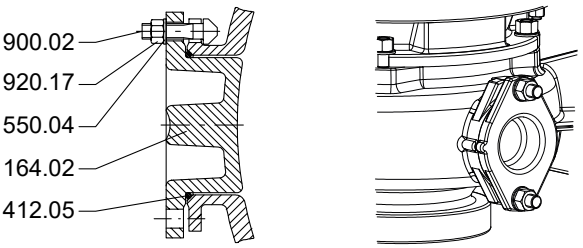

Fig. 26: Inspection hole in the casing

Opening the inspection hole

- Close the shut-off element on the suction side.
- Switch off the drive and make sure it cannot be re-started unintentionally.
- Close the shut-off element on the discharge side.
- Open the drain plug (auxiliary connection 6B).
- Collect and dispose of any liquid residues.
- Loosen nuts 920.17 at the inspection hole. Remove inspection cover 164.02.
- Perform a visual inspection with a lamp 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.

7.2.3 Lubrication and lubricant change

7.2.3.1 Lubricating the mechanical seal

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

7.2.3.1.1 Intervals

Replace the lubricant every 10,000 operating hours but at least every 3 years.

7.2.3.1.2 Lubricant quality

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

Table 23: Oil quality

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

Recommended oil types for mechanical seals:

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

⚠ WARNING

Lubricant contaminating fluid handled

Hazard to persons and the environment!

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

7.2.3.1.3 Lubricant quantity

Table 24: Lubricant quantity [l] depending on the motor

Size	Impeller type	Lubricant quantity depending on the motor					
		3 2.E 2 4.E 3 4.E	4 2.E 5 2.E 7 2.E 4 4.E 5 4.E	11 2.E 15 2.E 18 2.E 22 2.E 26 2.E	7 4.E 11 4.E 15 4.E 18 4.E 22 4.E 7 6.E 11 6.E 15 6.E 18 6.E	30 4.E 37 4.E 22 6.E 30 6.E 11 8.E 15 8.E 18 8.E 22 8.E	55 2.E 65 2.E 75 2.E 45 4.E 55 4.E 65 4.E 75 4.E 31 6.E 37 6.E 45 6.E 55 6.E 30 8.E 37 8.E 45 8.E
		[l]	[l]	[l]	[l]	[l]	[l]
40-252	F, K, S	-	2,7	2,6	2,6	-	-
50-215	F	1,9	1,9	2,0	2,0	-	-
50-216	F	1,9	1,9	2,0	2,0	-	-
50-216	S	1,9	1,9	2,0	2,0	-	-
65-215	F	1,9	1,9	2,0	2,0	-	-
65-216	E	3,1	3,1	3,1	3,1	-	-
65-217	F	1,9	1,9	2,0	2,0	-	-
65-253	K	-	2,4	2,5	2,5	-	-
80-215	F	1,9	1,9	2,0	2,0	-	-
80-216	E	3,1	3,1	3,1	3,1	-	-
80-216	F	1,9	1,9	2,0	2,0	-	-
80-252	F	-	2,7	2,6	2,6	-	-

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Size	Impeller type	Lubricant quantity depending on the motor					
		3 2.E 2 4.E 3 4.E	4 2.E 5 2.E 7 2.E 4 4.E 5 4.E	11 2.E 15 2.E 18 2.E 22 2.E 26 2.E	7 4.E 11 4.E 15 4.E 18 4.E 22 4.E 7 6.E 11 6.E 15 6.E 18 6.E	30 4.E 37 4.E 22 6.E 30 6.E 11 8.E 15 8.E 18 8.E 22 8.E	55 2.E 65 2.E 75 2.E 45 4.E 55 4.E 65 4.E 75 4.E 31 6.E 37 6.E 45 6.E 55 6.E 30 8.E 37 8.E 45 8.E
		[l]	[l]	[l]	[l]	[l]	[l]
80-253	E, F, K	-	2,4	2,5	2,5	-	-
80-315	D	-	-	-	4,5	-	1,4
80-315	K	-	-	-	4,1	-	-
80-317	D	-	-	-	4,1	-	-
80-317	F	-	-	-	4,1	-	-
100-215	F	1,9	1,9	2,0	2,0	-	-
100-253	D	-	-	-	2,5	-	-
100-253	E, K	-	2,4	2,5	2,5	-	-
100-254	F, K	-	2,7	2,6	2,6	-	-
100-315	D	-	-	-	4,5	4,9	1,4
100-315	E	-	-	-	4,5	4,9	-
100-315	F, K	-	-	-	4,1	4,9	-
100-316	D	-	-	-	4,5	4,9	-
100-316	F, K	-	-	-	4,1	4,9	-
100-317	E	-	-	-	4,5	4,9	-
100-400	K	-	-	-	-	6,5	6,6
100-401	E, F, K	-	-	-	-	6,5	6,6
150-253	D	-	-	-	2,5	-	-
150-315	D	-	-	-	4,1	4,9	-
150-315	F	-	-	-	4,5	4,9	-
150-317	E, K	-	-	-	4,5	4,9	-
150-400	D	-	-	-	-	-	1,4
150-400	K	-	-	-	-	6,5	6,6
150-401	D	-	-	-	-	-	1,4
150-401	E, F	-	-	-	-	6,5	6,6
150-403	K	-	-	-	-	6,5	6,6
151-403	K	-	-	-	-	6,5	6,6
200-315	D	-	-	-	4,1	4,9	-
200-315	K	-	-	-	4,5	4,9	-
200-316	K	-	-	-	4,1	4,9	-
200-317	K	-	-	-	4,5	4,9	-
200-318	K	-	-	-	4,1	4,9	-
200-400	D	-	-	-	-	6,5	6,6
200-401	E, K	-	-	-	-	6,5	6,6
200-402	K	-	-	-	-	6,5	6,6
200-403	K	-	-	-	-	6,5	6,6

Size	Impeller type	Lubricant quantity depending on the motor					
		3 2.E 2 4.E 3 4.E	4 2.E 5 2.E 7 2.E 4 4.E 5 4.E	11 2.E 15 2.E 18 2.E 22 2.E 26 2.E	7 4.E 11 4.E 15 4.E 18 4.E 22 4.E 7 6.E 11 6.E 15 6.E 18 6.E	30 4.E 37 4.E 22 6.E 30 6.E 11 8.E 15 8.E 18 8.E 22 8.E	55 2.E 65 2.E 75 2.E 45 4.E 55 4.E 65 4.E 75 4.E 31 6.E 37 6.E 45 6.E 55 6.E 30 8.E 37 8.E 45 8.E
		[l]	[l]	[l]	[l]	[l]	[l]
250-400	D	-	-	-	-	-	1,4
250-401	K	-	-	-	-	6,5	6,6
250-403	K	-	-	-	-	6,5	6,6
300-400	D	-	-	-	-	-	1,4
300-400	K	-	-	-	-	6,5	6,6
300-401	K	-	-	-	-	6,5	6,6
300-403	K	-	-	-	-	6,5	6,6

7.2.3.1.4 Changing the lubricant

⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

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

⚠ WARNING

Excess pressure in the lubricant reservoir

Liquid spurting out when the lubricant reservoir is opened at operating temperature!

- ▷ Open the screw plug of the lubricant reservoir very carefully.

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Draining the lubricant

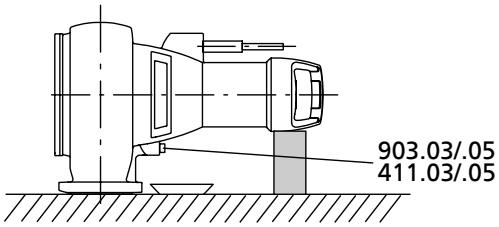

Fig. 27: Draining the lubricant

1. Position the pump set as shown.
2. Place a suitable container under the screw plug.
3. Undo screw plug 903.03/.05 with joint ring 411.03/.05 and drain off the lubricant.

Filling in the lubricant

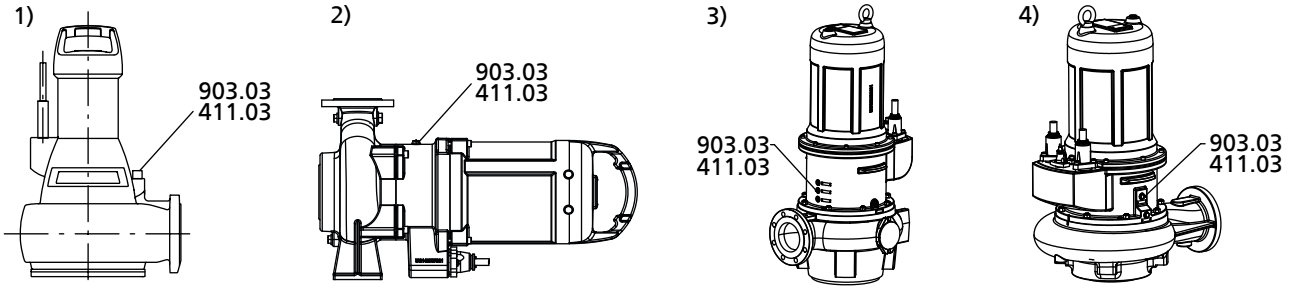

Fig. 28: Filling in the lubricant

Table 25: Filling in the lubricant

Motor	Impeller type	Illustration No.			
		1	2	3	4
3 2.E - 7 2.E	E, F, K, S	✘	-	-	-
11 2.E - 26 2.E	E, F, K, S	-	✘	-	-
55 2.E - 75 2.E	D	-	-	✘	-
2 4.E - 5 4.E	E, F, K, S	✘	-	-	-
7 4.E - 37 4.E	D, E, F, K, S	-	✘	-	-
45 4.E - 75 4.E	D	-	-	✘	-
45 4.E - 75 4.E	E, F, K	-	-	-	✘
7 6.E - 30 6.E	D, E, F, K, S	-	✘	-	-
31 6.E - 55 6.E	D	-	-	✘	-
31 6.E - 55 6.E	E, F, K	-	-	-	✘
11 8.E - 22 8.E	D, E, F, K	-	✘	-	-
30 8.E - 45 8.E	D	-	-	✘	-
30 8.E - 45 8.E	E, F, K	-	-	-	✘

1. Position the pump set as shown.
2. Unscrew and remove screw plug 903.03 with joint ring 411.03.
3. Fill lubricant through the lubricant filler opening until the lubricant level reaches the opening.
4. Fit screw plug 903.03 together with a new joint ring 411.03.

7.2.3.2 Lubricating the rolling element bearings

The rolling element bearings of the pump set are packed with maintenance-free grease, with the exceptions noted below.

On pump sets with reinforced bearings the pump-end rolling element bearings can be re-lubricated; they need to be relubricated as part of the maintenance work.

7.2.3.2.1 Grease quality

CAUTION

Mix of different grease types

Damage to the pump set!

- ▷ Make sure to use the right type of grease.
- ▷ Never mix different types of grease.

The following greases can be used to lubricate the rolling element bearings:

Grease quality

- Lithium soap grease suitable for high temperatures

Recommended commercially available brands

- ESSO UNIREX N3
- TEXACO HYTEX EP3/DEA Pragon

Table 26: Lubricant characteristics

Type	Base oil	Thickener	NLGI class (DIN 51518)	Worked penetration at 25 °C, 0.1 mm (DIN 51818)	Drop point (ISO 2176)	Application temperature range [°C]	Viscosity at 40 °C (DIN 51562)
A	Mineral oil	Lithium complex soap	2 or 3	220 to 295	>275 °C	-20 to +160	≤120

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

- Type A
  - Multis Complex EP2, Fa. TOTAL
  - ESSO UNIREX N3
  - TEXACO HYTEX EP3/DEA Pragon

7.2.3.2.2 Grease quantity

Use 60g grease to lubricate the rolling element bearings.

7.2.3.2.3 Re-lubrication

Pump sets with reinforced bearings

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

DANGER

Dry running

Explosion hazard!

- ▷ Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.

WARNING

Hands inside the pump casing

Risk of injuries, damage to the pump!

- ▷ Always disconnect the pump set from the power supply and secure it against unintentional start-up before inserting your hands or other objects into the pump.

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	**CAUTION** **Incomplete re-lubrication** Bearing damage! ▷ Always re-lubricate the bearings with the pump set in operation.

✓ The pump set has been positioned on a level surface.

✓ The pump set is secured against tipping over.

1. Remove screw plug 903.46 and joint ring 411.46.
2. Connect the pump set to the power supply. (⇨ Section 5.4.2, Page 47)

	**CAUTION** **Pump set running dry** Increased vibrations! Damage to mechanical seals and bearings! ▷ Never operate the pump set for more than 60 seconds without the fluid handled.

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

7.3 Drainage/cleaning

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set. (⇨ Section 11, Page 124)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

	**⚠ WARNING** **Unqualified personnel performing work on the pump (set)** Risk of injury! ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.

⚠ WARNING

Hot surface

Risk of injury!

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

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

Observe the safety instructions and information.

For dismantling and reassembly observe the general assembly drawing.

In the event of damage you can always contact Service.

⚠ DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

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

⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

7.4.2 Preparing the pump set

7.4.2.1 Preparing the pump set (for installation types K, P and S only)

✓ The pump set has been removed from the pump sump.

✓ The pump set has been cleaned. (⇨ Section 7.3, Page 69)

✓ The lubricant has been drained.

1. De-energise the pump set and secure it against unintentional start-up.
2. For models with reinforced bearings, drain the leakage chamber and leave it open for the duration of the disassembly.

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7.4.2.2 Preparing the pump set (for installation types D and H only)

7.4.2.2.1 Separating the pump from the piping

✓ The pump set has been switched off properly.

✓ The shut-off elements in the suction line and discharge line have been closed.

✓ Any auxiliary connections have been closed.

✓ The pump has been drained and the pump pressure has been released.

1. Disconnect any auxiliary feed lines.
2. Remove the discharge nozzle and suction nozzle from the piping.

NOTE

After the pump set has been dismantled, the suction casing should be cleaned with water. Suitable protective clothing is recommended.

7.4.2.2.2 Removing the pump set

⚠ WARNING

Pump set tilting

Risk of squashing hands and feet!

▹ Suspend or support the pump set.

✓ The pump set has been disconnected from the piping.
(⇨ Section 7.4.2.2.1, Page 71)

1. Suspend the pump set as specified for transport.
2. Depending on the type of installation, loosen the fastening bolts at the pump foot or at the soleplate.
3. Place the pump set in a horizontal position.

7.4.2.2.3 Removing the back pull-out unit

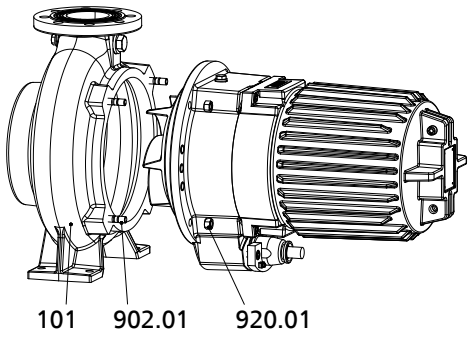

Fig. 29: Removing the back pull-out unit

Vertical installation

Standard claw, guide wire arrangement / dry installation:

1. Remove screw plug 903.58. Screw a second eyebolt 900 or a suitable swivel eyebolt into motor housing cover 812.
2. Undo screwed connection 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101.
3. Place the back pull-out unit in a safe and dry assembly area. Secure it against tipping over or rolling off.

Standard claw, guide rail arrangement:

1. Unscrew and remove eyebolt 900.04 from strip 575.
2. Remove screw plug 903.56 from the middle of strip 575.
3. Screw eyebolt 900.04 into this threaded hole.
4. Undo screwed connection 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101.
5. Place the back pull-out unit in a safe and dry assembly area. Secure it against tipping over or rolling off.

Option with bail:

1. Undo nuts 920.13. Remove bail 571.
2. Screw suitable (swivel) eye nuts onto studs 902.13.
3. Undo screwed connection 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101.
4. Place the back pull-out unit in a safe and dry assembly area. Secure it against tipping over or rolling off.

Horizontal installation

1. For pulling out the back pull-out unit lay a round sling between motor housing 811 and bearing housing 350.
2. Attach an additional round sling to the integrally cast bail at the motor housing to prevent the back pull-out unit from tilting.
3. Undo screwed connection 902.01 and 920.01. Pull the complete back pull-out unit out of pump casing 101.
4. Place the back pull-out unit in a safe and dry assembly area. Secure it against tipping over or rolling off.

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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 impeller

1. Remove pump casing 101.
2. Undo and remove impeller fastening screw 914.10.
   The impeller/shaft connection is a tapered fit.
3. For dismantling of the impeller, an M10 jacking thread is provided at the impeller hub.
   Screw in the forcing screw and remove the impeller.

NOTE

The forcing screw is not included in the scope of supply. It can be ordered separately from .

Table 27: Forcing screws for pulling off the impeller

Size	Impeller type	Forcing screw	
		Thread	Description
40-252	F, K, S	M16	ADS 8
50-215	F	M10	ADS 0
50-216	F	M10	ADS 6
50-216	S	M10	ADS 0
65-215	F	M10	ADS 6
65-216	E	M12	ADS 7
65-217	F	M10	ADS 6
65-253	K	M20	ADS 2
80-215	F	M10	ADS 6
80-216	E	M12	ADS 7
80-216	F	M10	ADS 6
80-252	F	M16	ADS 8
80-253	E, F, K	M20	ADS 2
80-315	D	M24	ADS 5
80-315	K	M20	ADS 2
80-317	D	M20	ADS 2
80-317	F	M20	ADS 2
100-215	F	M10	ADS 6
100-253	D	M16	ADS 3
100-253	E, K	M20	ADS 2
100-254	F, K	M16	ADS 8
100-315	D	M24	ADS 5
100-315	E	M20	ADS 2
100-315	F, K	M20	ADS 2
100-316	D	M20	ADS 2
100-316	F, K	M20	ADS 2
100-317	E	M20	ADS 2
100-400	K	M24	ADS 9
100-401	E, F, K	M24	ADS 9
150-253	D	M16	ADS 3
150-315	D	M20	ADS 4
150-315	F	M20	ADS 2

Size	Impeller type	Forcing screw	
		Thread	Description
150-317	E, K	M20	ADS 2
150-400	D	M24	ADS 5
150-400	K	M24	ADS 9
150-401	D	M24	ADS 5
150-401	E, F	M24	ADS 9
150-403	K	M24	ADS 9
151-403	K	M24	ADS 9
200-315	D	M20	ADS 4
200-315	K	M20	ADS 2
200-316	K	M20	ADS 2
200-317	K	M20	ADS 2
200-318	K	M20	ADS 2
200-400	D	M24	ADS 5
200-401	E, K	M24	ADS 9
200-402	K	M24	ADS 9
200-403	K	M24	ADS 9
250-400	D	M24	ADS 5
250-401	K	M24	ADS 9
250-403	K	M24	ADS 9
300-400	D	M24	ADS 5
300-400	K	M24	ADS 9
300-401	K	M24	ADS 9
300-403	K	M24	ADS 9

7.4.3.2 Dismantling the mechanical seal

Dismantle the mechanical seal in accordance with the general arrangement drawings.

7.4.3.2.1 Removing 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 motor housing 811 or bearing housing 350.
3. Press the stationary seat of mechanical seal 433.02 out of discharge cover 163.

7.4.3.2.2 Removing the drive-end mechanical seal

✓ The back pull-out unit and the impeller have been removed as described above.

1. Remove locking ring 515 or circlip 932.03.
2. Pull the rotating assembly of mechanical seal 433.01 off shaft 210.

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7.4.3.2.3 Removing the C022/025M1-4STQ and C033/033M1-4STQ double cartridge seals

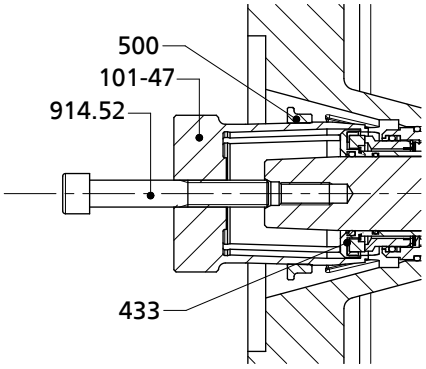

Fig. 30: Removing the double cartridge seal

✓ The back pull-out unit and impeller have been removed.

1. Fix discharge cover 163 to bearing housing 350 using suitable bolts/screws and washers.
2. Remove O-ring 412.58 from the shaft.
3. Slide puller 101-47 over the shoulder of mechanical seal 433 and lock with ring 500.
4. Press forcing screw 914.52 against shaft 210 and pull mechanical seal 433 out of discharge cover 163.

7.4.3.2.4 Removing the C033/055M1-4STQ double cartridge seal

The rules of sound engineering practice and the pump manufacturer's general provisions apply. Tidiness and cleanliness are essential for proper execution of the installation work.

✓ The operating manual for the pump is on hand.

✓ The back pull-out unit of the pump has been removed from the pump casing and safely positioned and secured in a horizontal position.

✓ The impeller and keys have been removed from the pump shaft.

1. Remove circlip 932.53 from discharge cover 163.
2. Use the radial groove in shaft sleeve 523 to remove the mechanical seal cartridge. Remove evenly, using a suitable extraction tool.
3. Carefully pull the complete cartridge seal off the shaft.
4. Clean the pump components in the area of the mechanical seal, pump shaft 210, discharge cover 163 and bearing bracket 330. Check for any damage.

Further dismantling of the mechanical seal is carried out at KSB.

7.4.3.3 Removing the wear plate

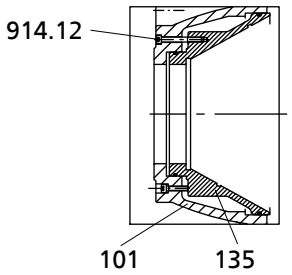

Fig. 31: Removing the wear plate

- ✓ The back pull-out unit has been separated from the pump casing.
- ✓ The inside of the casing has been cleaned.
- ✓ The wear plate needs to be replaced as a result of visual inspection.

1. Undo hexagon socket head cap screws 914.12.
2. Remove wear plate 135 and O-rings 412.34.

7.4.4 Dismantling the motor section

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

	NOTE
	The motors of explosion-proof pump sets are supplied in "flameproof enclosure" type of protection. Any work on the motor part 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.

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

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7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

CAUTION

Improper reassembly

Damage to the pump!

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

NOTE

Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Refer to the "Flamepaths" annex for the position of the flamepaths.

Sequence

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

Sealing elements

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

Tightening torques

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

7.5.2 Reassembling the pump section

7.5.2.1 Fitting the mechanical seal

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

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

✓ The shaft and rolling element bearings have been properly fitted in the motor.

1. Slide drive-end mechanical seal 433.01 onto shaft 210. Secure it with locking ring 515.
2. Insert O-rings 412.04 and 412.15 in discharge cover 163.
3. Insert discharge cover 163 into bearing housing 350 or motor housing 811 as far as it will go.
4. Slide pump-end mechanical seal 433.02 onto shaft 210.

For special mechanical seals with covered spring, tighten the socket head cap screw at the rotating assembly before fitting the impeller. Observe installation dimension "A". (⇨ Section 9.5.2, Page 121)

Table 28: Installation dimension "A" for mechanical seal with covered springs (HJ)

Size	Impeller type	Installation dimension A (⇨ Section 9.5.2, Page 121)
		[mm]
100-400	K	48,3
100-401	E, F, K	48,3
150-400	D, K	48,3
150-401	D, E, F	48,3
150-403	K	48,3
151-403	K	48,3
200-400	D	48,3
200-401	E	48,3
200-402	K	48,3
200-403	K	48,3
250-400	D	48,3
250-401	K	48,3
250-403	K	48,3
300-400	D, K	48,3
300-401	K	48,3
300-403	K	48,3

NOTE

The puller / mounting device for the KSB double cartridge seal is not included in the scope of supply. It can be ordered separately from KSB.

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7.5.2.2 Installing the C022/025M1-4STQ and C033/033M1-4STQ double cartridge seals

CAUTION

Use of grease or other permanent lubricants

Torque transmission impeded / overheating of and damage to the pump!

- ▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal.
- ▷ Use soft soap to reduce any friction caused during assembly.
- ▷ Never coat the mechanical seal faces with grease or oil.

CAUTION

Improper installation of the mechanical seal

Damage to the seal faces!

- ▷ Install the mechanical seal using the supplied mounting device 101-47.
- ▷ Prevent sudden forces acting on the mounting device and mechanical seal.

- ✓ The relevant documentation for installing the mechanical seal is observed.
- ✓ The back pull-out unit has been removed from the pump casing and safely positioned and secured in a horizontal position.
- ✓ The original 4STQ cartridge seal is fully assembled and undamaged.
- ✓ Mounting device 101-47 is available.

1. Insert circlip 932.59 in the shaft groove and make sure that circlip 932.59 is positioned correctly in the shaft groove. When fitting the circlip take care to prevent damage to the shaft.
2. Prior to assembly, wet the external elastomers (O-rings and gasket) and the seats of the mechanical seal at the shaft, discharge cover 163 and seal housing with a suitable lubricant (e.g. soap solution).
3. Press mechanical seal 433 into discharge cover 163 by hand as far as possible.

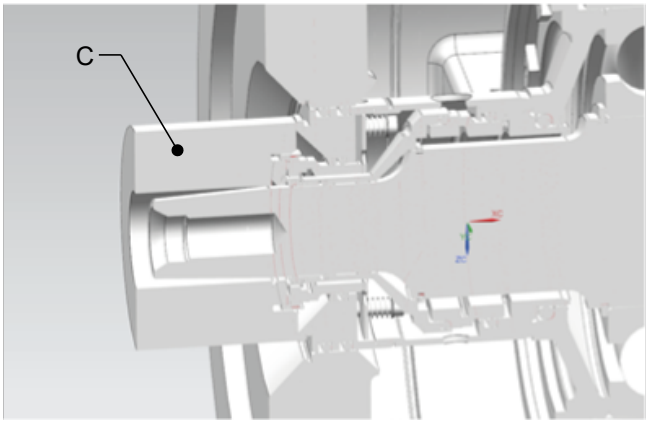

Fig. 32: Mounting device 101-47

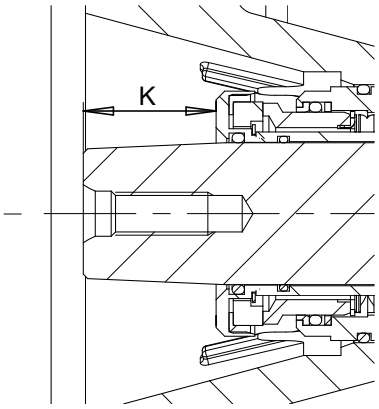

Fig. 33: Reference dimension "K" from shaft end to mechanical seal

4. Fit mechanical seal 433 using mounting device 101-47. Check the mechanical seal position against reference dimension "K" (see table: Reference dimension "K") and correct the installation position if required.
5. Slide O-ring 412.58 over the shaft until it abuts against the mechanical seal.

Table 29: Reference dimension "K"

Size	Impeller type	Reference dimension "K"
		[mm]
40-252	F, K, S	39 +/- 0,5
50-215	F	25 +/- 0,5
50-216	F, S	25 +/- 0,5
65-215	F	25 +/- 0,5
65-216	E	33 +/- 0,5
65-217	F	25 +/- 0,5
65-253	K	43 +/- 0,5
80-215	F	25 +/- 0,5
80-216	E	33 +/- 0,5
80-216	F	25 +/- 0,5
80-252	F	39 +/- 0,5
80-253	E, F, K	43 +/- 0,5
80-315	D, K	43 +/- 0,5
80-317	D, F	43 +/- 0,5
100-215	F	25 +/- 0,5
100-253	D, E, K	43 +/- 0,5
100-254	F, K	39 +/- 0,5
100-315	D, E, F, K	43 +/- 0,5
100-316	D, F, K	43 +/- 0,5
100-317	E	43 +/- 0,5
150-253	D	43 +/- 0,5
150-315	D, F	43 +/- 0,5
150-317	E, K	43 +/- 0,5
200-315	D, K	43 +/- 0,5
200-316	K	43 +/- 0,5
200-317	K	43 +/- 0,5
200-318	K	43 +/- 0,5

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7.5.2.3 Installing the C033/055M1-4STQ double cartridge seal

⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

CAUTION

Use of grease or other permanent lubricants

Torque transmission impeded / overheating of and damage to the pump!

- ▹ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal.
- ▹ Use soft soap to reduce any friction caused during assembly.
- ▹ Never coat the mechanical seal faces with grease or oil.

CAUTION

Improper installation of the mechanical seal

Damage to the seal faces!

- ▹ Install the mechanical seal using the supplied mounting device 101-47.
- ▹ Prevent sudden forces acting on the mounting device and mechanical seal.

✓ The relevant documentation for installing the mechanical seal is observed.

✓ The back pull-out unit has been removed from the pump casing and safely positioned and secured in a horizontal position.

✓ The original 4STQ cartridge seal is fully assembled and undamaged.

✓ Mounting device 101-47 is available.

1. Guide the mechanical seal (without external O-rings) onto the shaft as far as it will go.

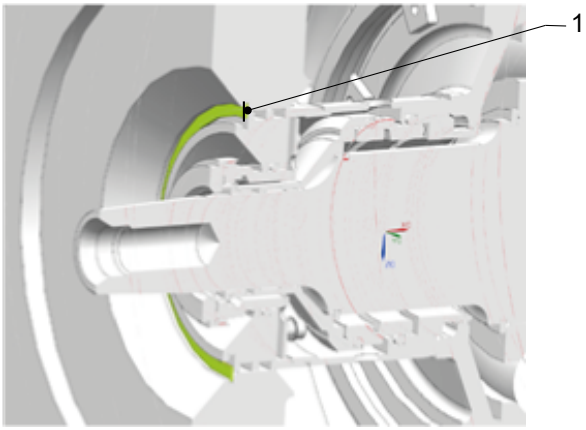

Fig. 34: Illustration of the groove.

2. Visually check that the groove for the circlip in discharge cover 1 aligns with the corresponding surface of the mechanical seal (seal housing).
3. Pull the mechanical seal off the shaft.
4. Fit the circlip in the shaft groove.

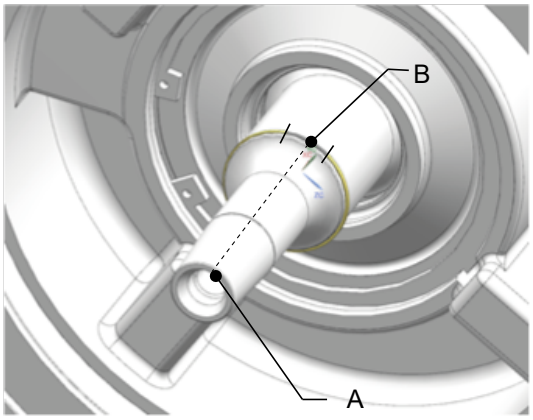

Fig. 35: Marking the shaft end

5. Mark the front face of shaft end A. To do so extend the central position of ring opening B in the axial direction.

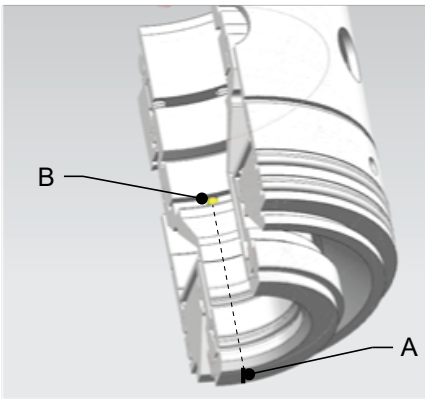

Fig. 36: Marking the mechanical seal

6. Mark the front face of mechanical seal A. To do so extend the central position of the anti-rotation pin B in the axial direction.
7. Fit the external O-rings and wet them with a suitable lubricant (e.g. soap solution).

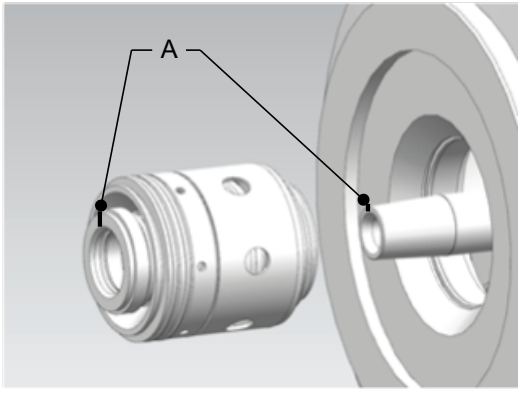

Fig. 37: Aligning the markings

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8. Place the mechanical seal on the shaft. Guide it as far into the discharge cover as possible. Verify that the markings A are aligned with each other.

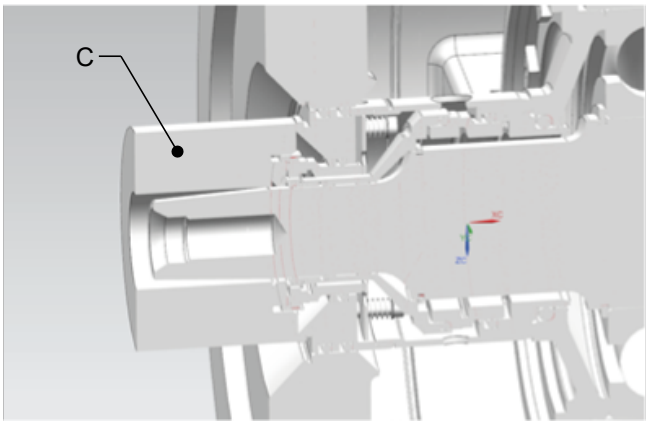

Fig. 38: Mounting device C

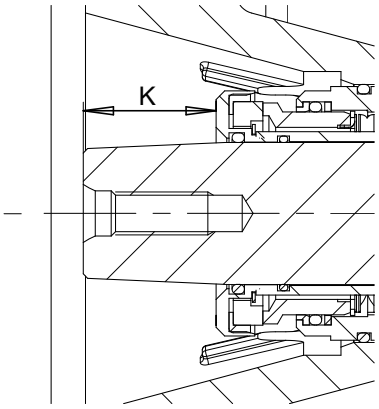

Fig. 39: Reference dimension "K" from shaft end to mechanical seal

9. Position mounting device C on the front face of the mechanical seal. Fit the mechanical seal. Verify the position of the mechanical seal with reference dimension "K" = 43+/- 0.5 mm; adjust the position if necessary.

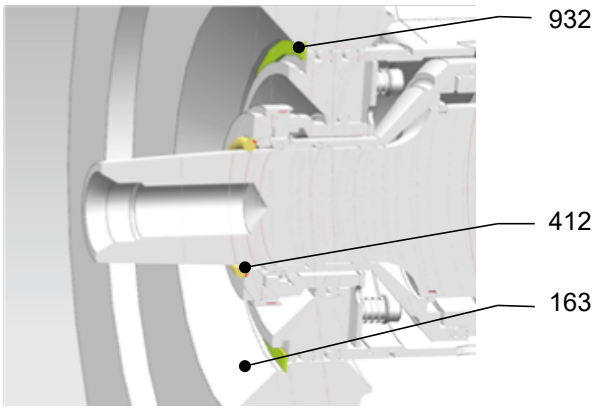

Fig. 40: Final assembly

10. Fit circlip 932 in the groove of discharge cover 163. Make sure it is correctly seated.
11. Slide O-ring 412 over the shaft until it abuts against the mechanical seal.

7.5.2.4 Fitting the impeller

NOTE

For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and assembled free from grease.

✓ The shaft and rolling element bearings have been properly installed.

✓ The mechanical seals have been properly installed.

1. Slide impeller 230 onto the shaft end.
2. Apply Loctite 243 as thread-locking agent to the thread of the impeller screw.
3. Screw in impeller screw 914.10 and disc 550.23 if any. Tighten with a torque wrench. Observe the tightening torques.

Table 30: Tightening torques for the impeller screws

Size	Impeller type	Thread	Tightening torque [Nm]
40-252	F, K, S	M10	35
50-215	F	M8	26
50-216	F, S	M8	26
65-215	F	M8	26
65-216	E	M10	35
65-217	F	M8	26
65-253	K	M16	150
80-215	F	M8	26
80-216	E	M10	35
80-216	F	M8	26
80-252	F	M10	35
80-253	E, F, K	M16	150
80-315	D	M20	290
80-315	K	M16	150
80-317	D, F	M16	150
100-215	F	M8	26
100-253	D	M10	35
100-253	E, K	M16	150
100-254	F, K	M10	35
100-315	D	M20	290
100-315	E, F, K	M16	150
100-316	D, F, K	M16	150
100-317	E	M16	150
100-400	K	M20	290
100-401	E, F, K	M20	290
150-253	D	M10	35
150-315	D, F	M16	150
150-317	E , K	M16	150
150-400	D, K	M20	290
150-401	D, E, F	M20	290
150-403	K	M20	290

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Size	Impeller type	Thread	Tightening torque [Nm]
151-403	K	M20	290
200-315	D, K	M16	150
200-316	K	M16	150
200-317	K	M16	150
200-318	K	M16	150
200-400	D	M20	290
200-401	E	M20	290
200-402	K	M20	290
200-403	K	M20	290
250-400	D	M20	290
250-401	K	M20	290
250-403	K	M20	290
300-400	D, K	M20	290
300-401	K	M20	290
300-403	K	M20	290

7.5.2.5 Installing the back pull-out unit

7.5.2.5.1 Fitting the cutter

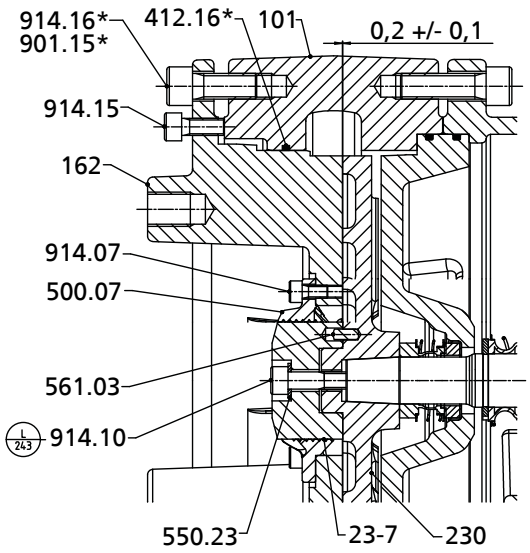

Fig. 41: Fitting the cutter

✓ Pump-end mechanical seal 433.02 has been installed.

1. Slide impeller 230 onto the conical shaft end.
2. Insert grooved pin 561.03 into the impeller and fit impeller body 23-7 on the centring hub.
3. Screw in hexagon socket head cap screw 914.10 and use a torque wrench to tighten the screw to a torque of 26 Nm.
4. Fasten the pump casing with hexagon socket head cap screw 914.74. Tighten the screw with a torque wrench.
5. Fasten ring 500.07 with hexagon socket head cap screw 914.07 in the suction cover.

6. Insert the suction cover into the pump casing, making sure the suction cover touches the impeller vanes.
7. Screw in hexagon socket head cap screw 914.16 to hold the suction cover in place. Do not tighten it yet.

7.5.2.5.2 Adjusting the cutter

✓ The cutter has been fitted.

1. Measure the distance between the impeller and the suction cover.
   Distance S should measure approximately 0.2 ± 0.1 mm.
2. If required, adjust the position of the suction cover in relation to the pump casing using hexagon socket head cap screw 914.15.
3. Tighten hexagon socket head cap screw 914.16.
4. Rotate the impeller body to check that the impeller turns smoothly.
   Make sure that the suction cover and impeller do not touch each other.

7.5.2.5.3 Fitting the casing wear ring with axial clearance

NOTE

After casing wear rings with a radial clearance have been fitted in pump casing 101, they have the required inside diameter and do not need to be readjusted.

NOTE

The axial clearance must be adjusted quickly before the Loctite hardens.

1. Apply Loctite 2701 to the outside diameter of the casing wear ring.
2. Use a rubber mallet to insert casing wear ring 502 into pump casing 101 as far as it will go.
3. Insert the complete back pull-out unit into the pump casing.
4. Evenly tighten bolted/screwed connection 902.01 and 920.01 and/or 914.74 between pump casing and bearing housing.

CAUTION

Axial displacement of the rotor

Damage to shaft seal and bearings!

▷ Always adjust and check the axial clearance with the pump set in a vertical position.

5. To lift the pump set suspend it from the lifting tackle as shown.

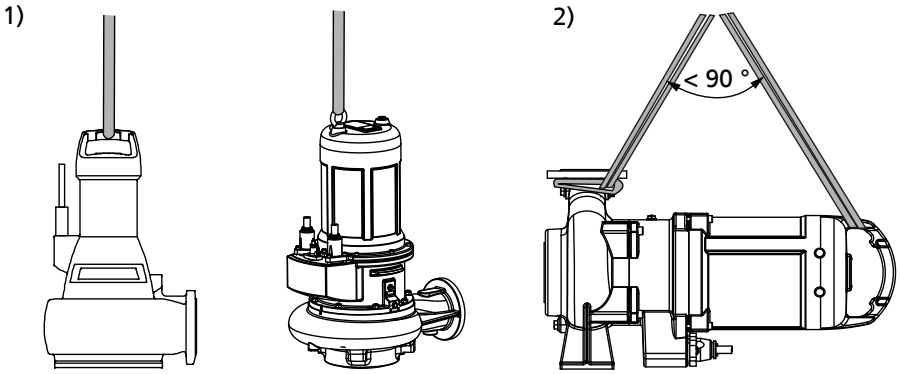

Fig. 42: Suspending the pump set 1) vertical installation 2) horizontal installation

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7.5.2.5.4 Adjusting the axial clearance at the casing wear ring

1. Use the rubber mallet or grub screw 904.01 to push casing wear ring 502 close to impeller 230.
2. Adjust the axial clearance to A = 0.3 ± 0.1 mm.

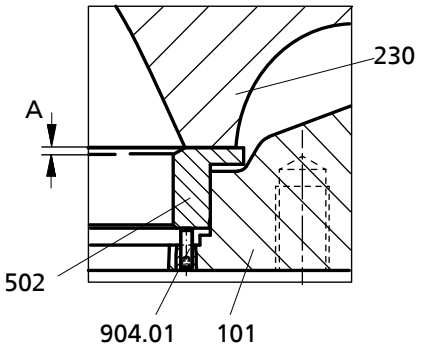

Fig. 43: Fitting the casing wear ring

7.5.2.5.5 Fitting the wear plate

✓ The shaft, rolling element bearings, mechanical seal and impeller have been assembled properly.

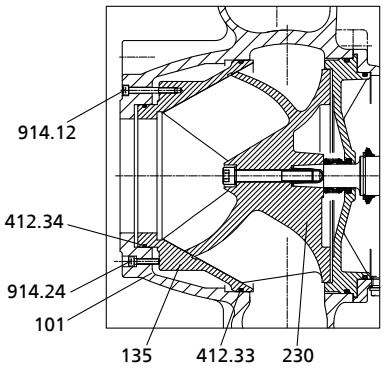

Fig. 44: Fitting the wear plate

1. Equip wear plate 135 with two new O-rings 412.33 and 412.34.
2. Insert wear plate 135 into pump casing 101.
3. Fasten wear plate 135 to pump casing 101 with hexagon socket head cap screws 914.12.
4. Adjust the clearance between impeller 230 and wear plate 135 by tightening and loosening screws 914.12 and 914.24.
   - ⇨ Screw 914.24 pushes the wear plate in the direction of the impeller.
   - ⇨ The clearance equals 0.4 $^{+0.2}$ mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).
5. Insert the complete back pull-out unit into the pump casing.
6. Evenly tighten bolted/screwed connection 920.01 and 902.01 and/or 914.74 between pump casing and bearing housing.

7.5.2.5.6 Adjusting the wear plate

1. Insert the complete back pull-out unit into the pump casing.
2. Evenly tighten bolted/screwed connection 920.01 and 902.01 and/or 914.74 between pump casing and bearing housing.

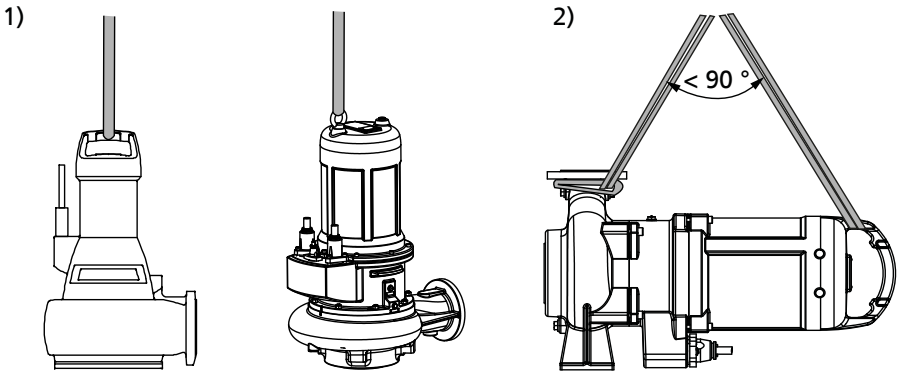

Fig. 45: Transporting the pump set 1) vertical installation 2) horizontal installation

✓ The pump set has been suspended and lifted as illustrated.

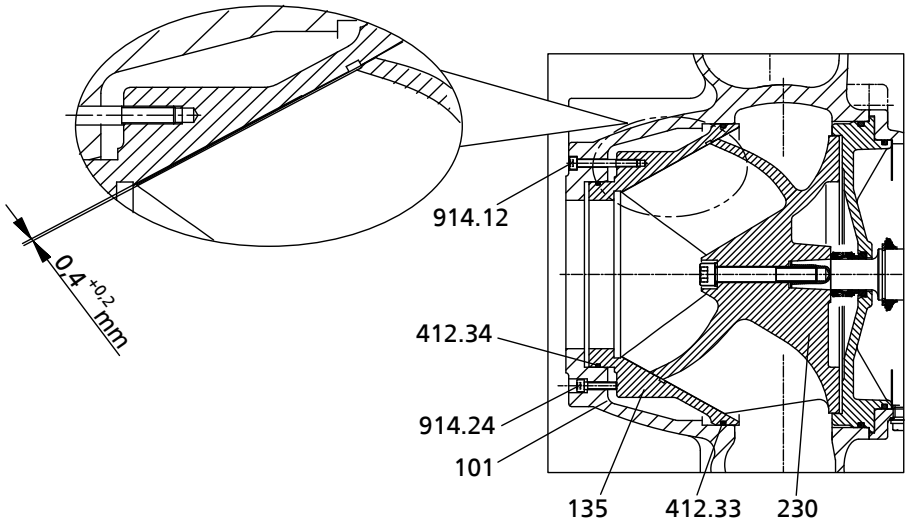

Fig. 46: Adjusting the wear plate

1. Adjust the clearance between impeller 230 and wear plate 135 by tightening and loosening screws 914.12 and 914.24.
   ⇨ Screw 914.24 pushes the wear plate in the direction of the impeller.
   ⇨ The clearance equals 0.4 $^{+0.2}$ mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).

7.5.2.5.7 Reassambling the motor section

	NOTE
Ex	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 for explosion-proof pumps. Observe the flamepath positions specified in the Annex (Flamepaths on explosion-proof motors). (⇨ Section 9.4, Page 118) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).

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

7.5.3 Leak testing

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

Observe the following values for leak testing:

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

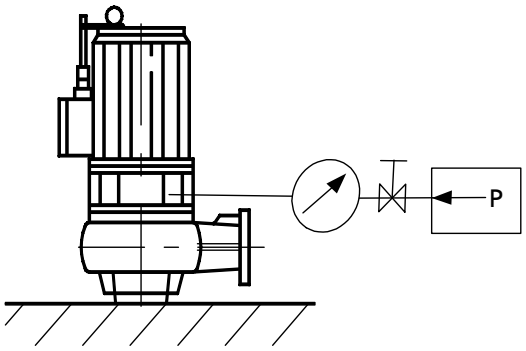

Fig. 47: Screwing in the testing device

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

7.5.4 Checking the connection of motor/power supply

Check the power cables after reassembly. (⇨ Section 7.2.2, Page 61)

7.6 Tightening torques

Table 31: Tightening torques [Nm] depending on thread, material and property class

Thread	Material				
	A4-50	A4-70		1.4462	8.8
	Property class Rp 0.2 $^{N}/_{mm^2}$				
	210	250	450	450	640
	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
M 5	-	-	4	4	6
M 6	-	-	7	7	10
M8	-	-	17	17	25
M10	-	-	35	35	50
M12	-	-	60	60	85

Thread	Material				
	A4-50	A4-70		1.4462	8.8
	Property class Rp 0.2 $^{N}/_{mm^2}$				
	210	250	450	450	640
	[Nm]	[Nm]	[Nm]	[Nm]	[Nm]
M14	-	-	90	90	130
M16	-	-	150	150	210
M20	-	-	290	290	410
M24	230	278	-	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:

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 92)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 32: Quantity of spare parts for recommended spare parts stock[16)]

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

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

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8 Trouble-shooting

A Pump is running, but does not deliver

B Pump delivers insufficient flow rate

C Excessive current/power input

D Insufficient discharge head

E Vibrations and noise during pump operation

Table 33: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
-	✗	✗	✗	✗	Excessive clearance between the impeller and the casing wear ring / wear plate	Check and adjust the clearance.
-	✗	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point.
-	✗	-	-	-	Gate valve in the discharge line is not fully open.	Fully open the gate valve.
-	-	✗	-	✗	Pump is running in the off-design range (part load/overload).	Check the pump's operating data.
✗	-	-	-	-	Pump and/or piping are not completely vented.	Vent by lifting the pump off the duckfoot bend and lowering it again.
✗	-	-	-	-	Pump intake clogged by deposits	Clean the intake, pump components and lift check valve.
-	✗	-	✗	✗	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
-	-	✗	-	✗	Dirt/fibres in the clearance between the casing wall and impeller; sluggish rotor.	Check whether the impeller can be easily rotated. Clean the impeller if required.
-	✗	✗	✗	✗	Wear of internal components	Replace worn components by new ones.
✗	✗	-	✗	-	Defective riser (pipe and sealing element)	Replace defective riser pipes, replace sealing elements.
-	✗	-	✗	✗	Impermissible air or gas content in the fluid handled	Contact the manufacturer.
-	-	-	-	✗	System-induced vibrations	Contact the manufacturer.
-	✗	✗	✗	✗	Wrong direction of rotation	Check the electrical connection of the motor and the control system if any.
-	-	✗	-	-	Wrong supply voltage	Check the mains power supply. Check the cable connections.
✗	-	-	-	-	Motor is not running because of lack of voltage.	Check the electrical installation. Contact the energy supplier.
✗	-	✗	-	-	Motor winding or power cable are defective.	Replace by new original KSB parts or contact KSB.
-	✗	-	✗	-	In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.
-	-		-	✗	Defective rolling element bearing	Contact the manufacturer.
-	✗	-	-	-	Water level lowered too much during operation	Check level control equipment.
✗	-	-	-	-	Temperature control device monitoring the winding has tripped the pump as a result of excessive winding temperatures.	The motor will restart automatically once it has cooled down.
✗	-	-	-	-	Temperature limiter (explosion protection) has tripped the pump as a result of the permissible winding temperature being exceeded.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General assembly drawings with list of components

9.1.1 Amarex KRT, motor type 1

Sizes:
40-252
50-215
50-216
65-215
65-216
65-217
65-253
80-215
80-216
80-217
80-252
80-253
100-215
100-253
100-254
150-253

Motors:
3 2
4 2
5 2
7 2
2 4
3 4
4 4
5 4

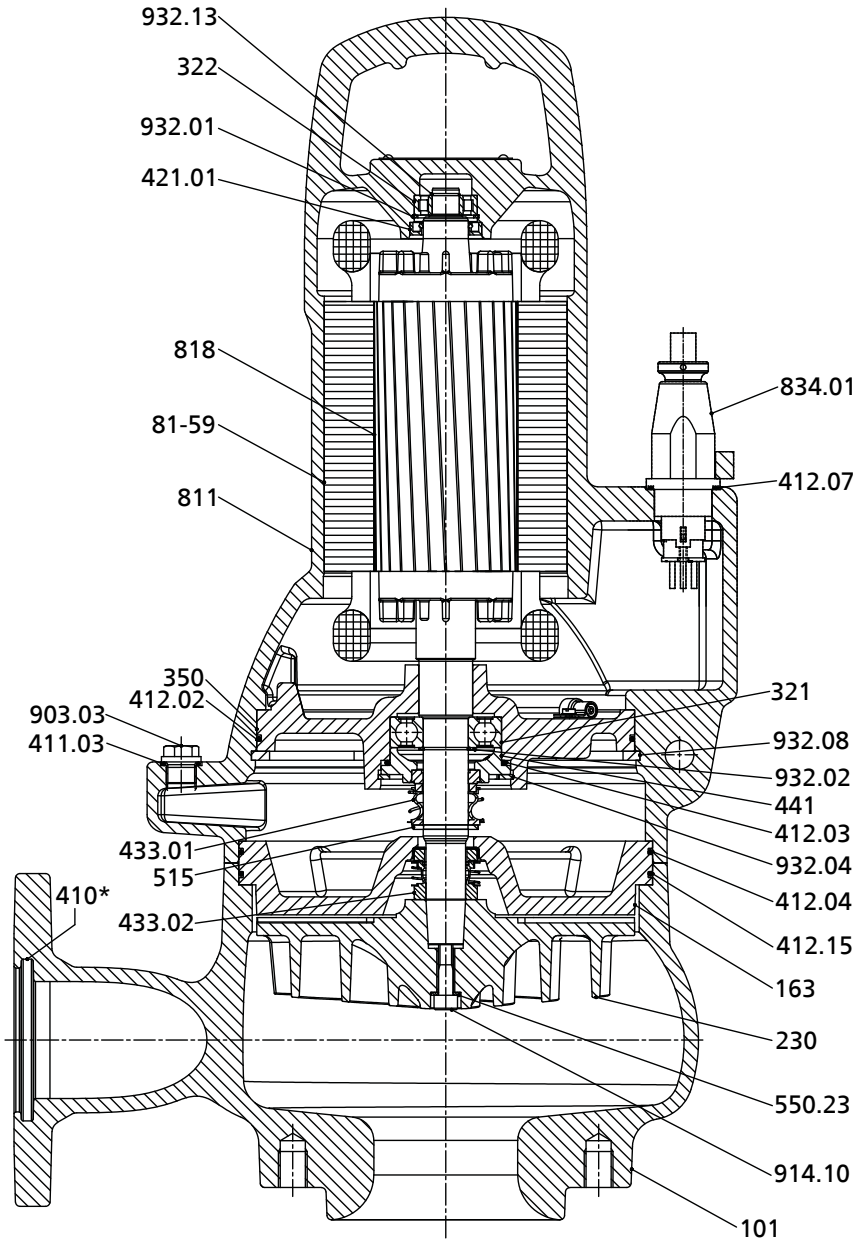

Fig. 48: General assembly drawing Amarex KRT, motor type 1

*: On specific designs only

Table 34: List of components

Part No.	Description	Part No.	Description
101	Pump casing	441	Shaft seal housing
163	Discharge cover	515	Locking ring
230	Impeller	550.23	Disc
321	Radial ball bearing	81-59	Stator
322	Radial roller bearing	811	Motor housing
350	Bearing housing	818	Rotor

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Part No.	Description	Part No.	Description
410	Profile seal	834.01	Cable gland
411.03	Joint ring	903.03	Screw plug
412.02/.03/.04/.07/.15	O-ring	914.10	Hexagon socket head cap screw
421.01	Lip seal	932.01/.02/.04/.08/.13	Circlip
433.01/.02	Mechanical seal		

9.1.2 Amarex KRT, motor type 2

Sizes:
40-252
50-215
50-216
65-215
65-216
65-217
65-253
80-215
80-216
80-217
80-252
80-253
80-315
80-317
100-215
100-253
100-254
150-253
150-315
150-317
200-315
200-316
200-317
200-318

Motors:
11 2
15 2
18 2
22 2
26 2
7 4
11 4
15 4
18 4
22 4
7 6
11 6
15 6
18 6

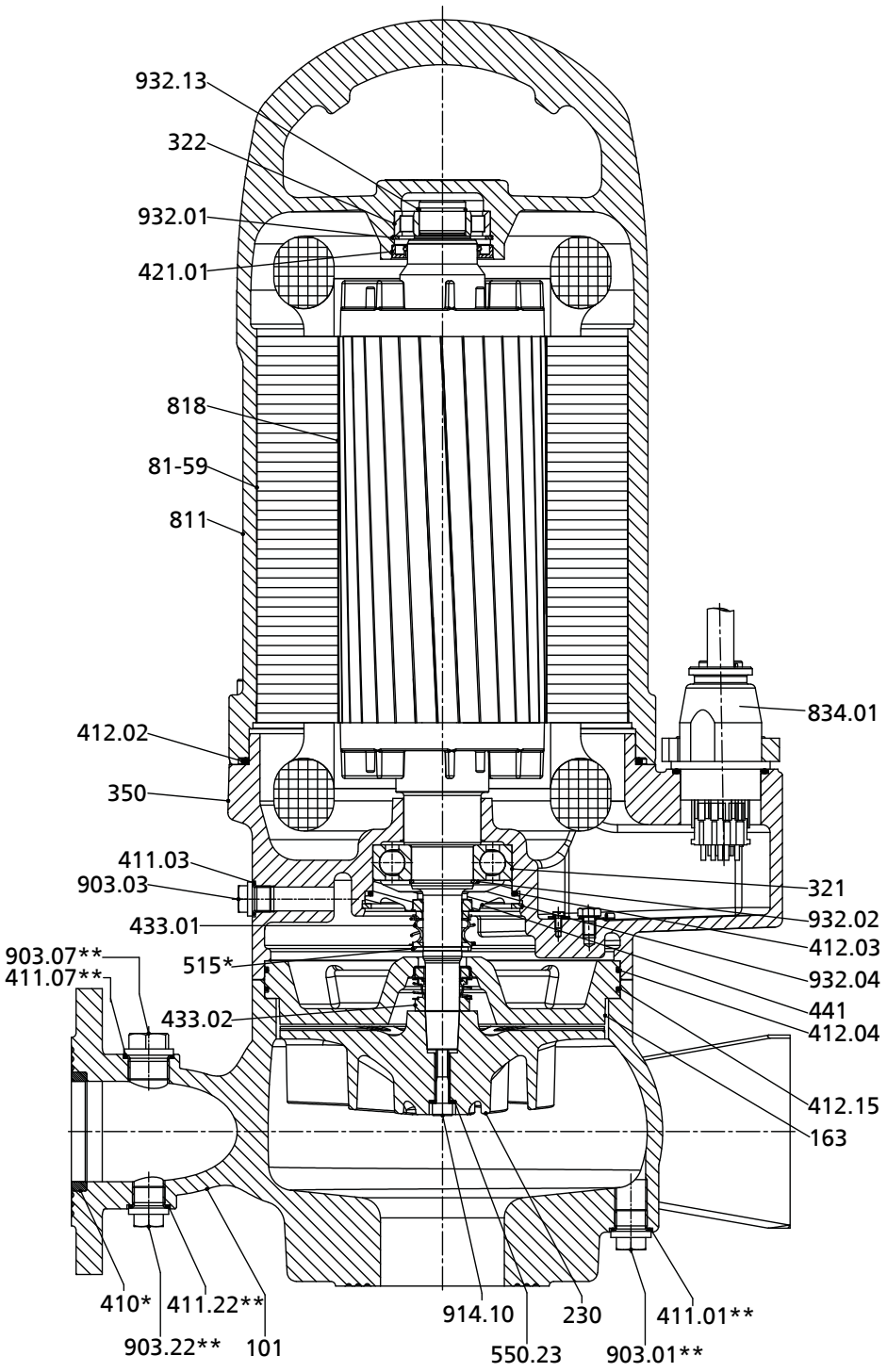

Fig. 49: General assembly drawing Amarex KRT, motor type 2

*: On specific designs only

** Only for installation types K, D and H

Table 35: List of components

Part No.	Description	Part No.	Description
101	Pump casing	441	Shaft seal housing
163	Discharge cover	515	Locking ring
230	Impeller	550.23	Disc
321	Radial ball bearing	81-59	Stator

Part No.	Description	Part No.	Description
322	Radial roller bearing	811	Motor housing
350	Bearing housing	818	Rotor
410	Profile seal	834.01	Cable gland
411.01/.03/.07/.22	Joint ring	903.01/.03/.07/.22	Screw plug
412.02/.03/.04/.15	O-ring	914.10	Hexagon socket head cap screw
421.01	Lip seal	932.01/.02/.04/.13	Circlip
433.01/.02	Mechanical seal		

9.1.3 Amarex KRT, motor type 3

Sizes:
100-315
100-316
100-317
100-400
100-401
150-315
150-317
150-400
150-401
150-403
151-403
200-315
200-316
200-317
200-318
200-330
200-400
200-401
200-402
250-400
250-401
250-403
300-400
300-401
300-403

Motors:
55 2
65 2
75 2
30 4
37 4
45 4
55 4
65 4
75 4
22 6
30 6
31 6
37 6
45 6
55 6
11 8
15 8
18 8
22 8
30 8
37 8
45 8

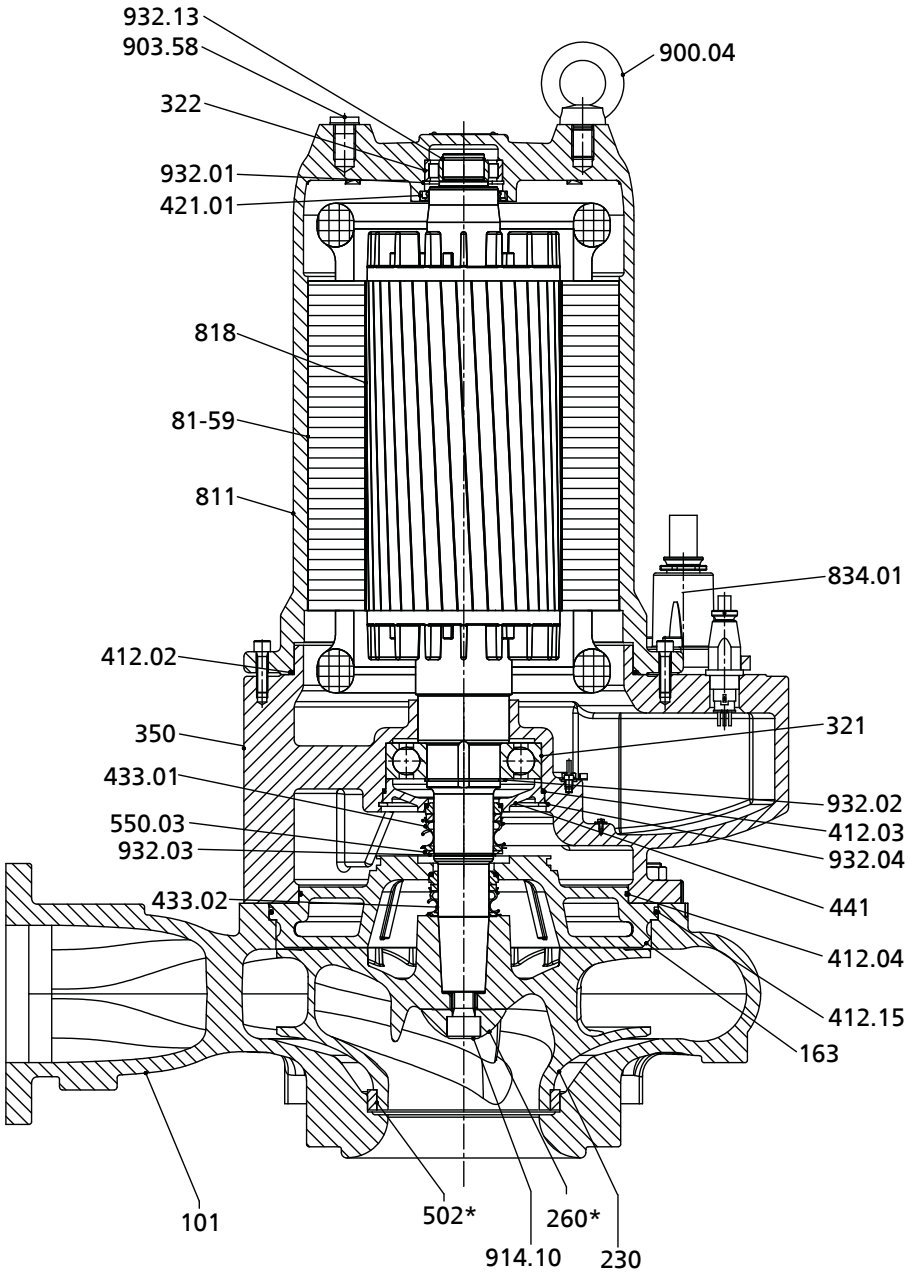

Fig. 50: General assembly drawing Amarex KRT, motor type 3

*: On specific designs only

Table 36: List of components

Part. No.	Description	Part. No.	Description
101	Pump casing	502	Casing wear ring
163	Discharge cover	550.03	Disc
230	Impeller	81-59	Stator
260	Impeller hub cap	811	Motor housing
321	Radial ball bearing	818	Rotor
322	Radial roller bearing	834.01	Cable gland
350	Bearing housing	900.04	Bolt/screw
412.02/.03/.04/.15	O-ring	903.58	Screw plug

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Part. No.	Description	Part. No.	Description
421.01	Lip seal	914.10	Hexagon socket head cap screw
433.01/.02	Mechanical seal	932.01/.02/.03/.04/.13	Circlip
441	Shaft seal housing		

9.2 Detail drawings

9.2.1 Impeller type S

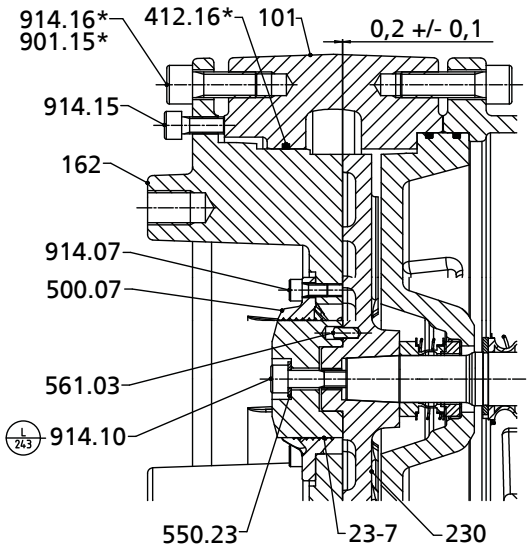

Fig. 51: Impeller type S

*: On specific designs only

Table 37: Impeller type S

Part. No.	Description	Part. No.	Description
101	Pump casing	500.07	Ring
162	Suction cover	550.23	Disc
23-7	Impeller body	561.03	Grooved pin
230	Impeller	901.15	Hexagon head bolt
412.16	O-ring	914.07/.10/.15/.16	Hexagon socket head cap screw

9.2.2 Impeller type E

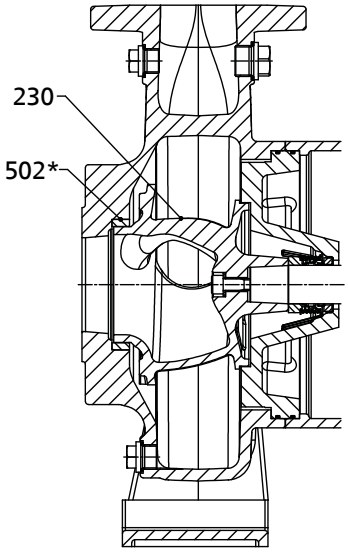

Fig. 52: Impeller type E

*: On specific designs only

Table 38: Impeller type E

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

9.2.3 Impeller type D

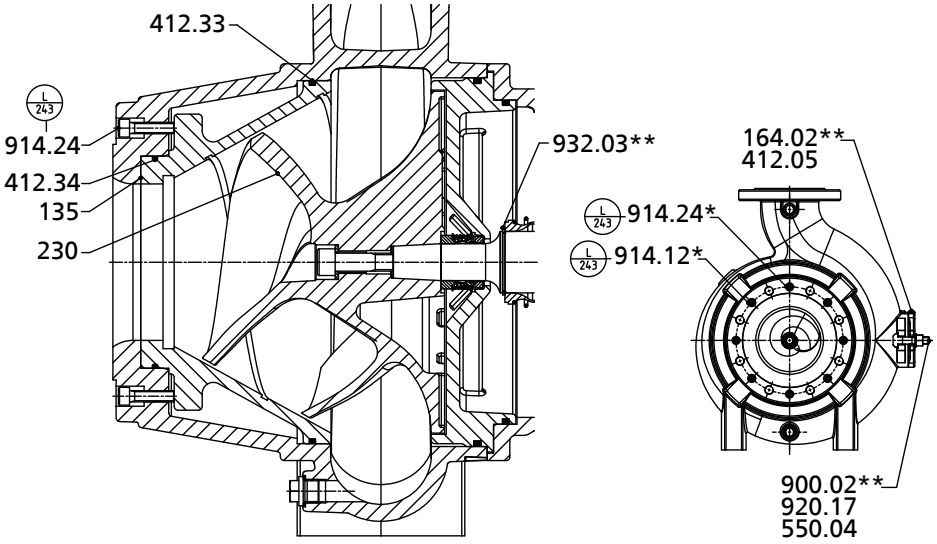

Fig. 53: Impeller type D

*: On specific designs only

** Only for installation types K, D and H

Table 39: Impeller type D

Part. No.	Description	Part. No.	Description
135	Wear plate	900.02	Bolt/screw
164.02	Inspection cover	914.12/.24	Hexagon socket head cap screw
230	Impeller	920.17	Nut
412.05/.33/.34	O-ring	932.03	Circlip
550.04	Disc		

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9.2.4 Impeller type K

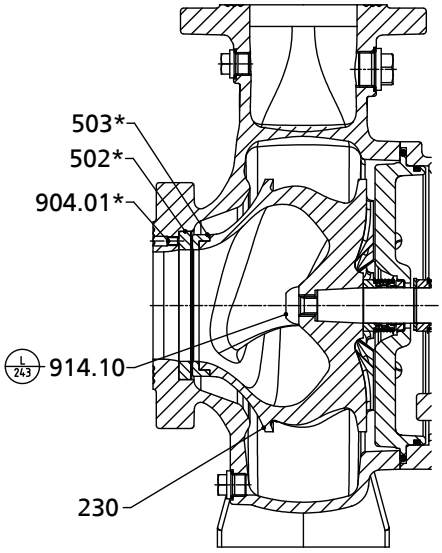

Fig. 54: Impeller type K

*: On specific designs only

Table 40: Impeller type K

Part. No.	Description	Part. No.	Description
230	Impeller	904.01	Grub screw
502	Casing wear ring	914.10	Hexagon socket head cap screw
503	Impeller wear ring		

9.2.5 Horizontal installation

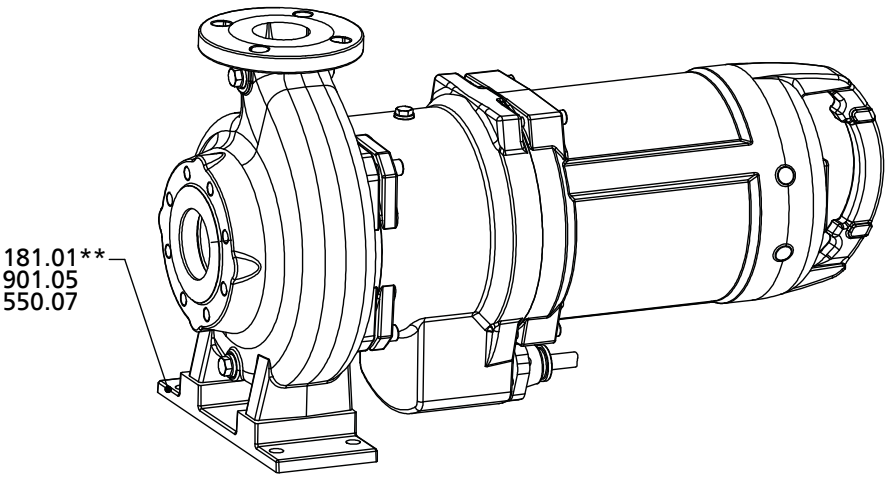

Fig. 55: Horizontal installation

** Only for installation types K, D and H

Table 41: Horizontal installation

Part. No.	Description	Part. No.	Description
181.01	Pump stool	901.05	Hexagon head bolt
550.07	Disc		

9.2.6 Transportable wet-installed model

Table 42: Illustrations assigned to each size/material variants

Size	Impeller type	Variant						
		1	2	3	4	5	6	7
		Material variant						
		G, GH, H	G, GH, H	G, GH	G, GH, H	C1	C2	G, GH, H C1, C2
40-252	F, K, S	✗	✗	-	-	✗	✗	-
50-215	F	✗	✗	-	-	✗	✗	-
50-216	F, S	✗	✗	-	-	✗	✗	-
65-215	F	✗	✗	-	-	✗	✗	-
65-216	E	✗	✗	-	-	✗	✗	-
65-217	F	✗	✗	-	-	✗	✗	-
65-253	K	-	-	-	-	-	-	-
80-215	F	✗	✗	-	-	✗	✗	-
80-216	E, F	✗	✗	-	-	✗	✗	-
80-252	F	✗	✗	-	-	✗	✗	-
80-253	E, F, K	✗	✗	-	-	✗	✗	-
80-315	D	-	-	-	-	-	-	✗
80-315	K	✗	✗	-	-	✗	✗	-
80-317	D	-	-	-	-	-	-	✗
80-317	F	✗	✗	-	-	✗	✗	✗
100-215	F	-	-	-	-	✗	✗	-
100-253	D	✗	✗	-	-	✗	✗	✗
100-253	E, K	✗	✗	-	-	✗	✗	-
100-254	F, K	✗	✗	-	-	✗	✗	-
100-315	D	-	-	✗	✗	✗	✗	✗
100-315	E, F, K	-	-	✗	✗	✗	✗	-
100-316	D	-	-	✗	✗	✗	✗	✗
100-316	F, K	-	-	✗	✗	✗	✗	-
100-317	E	-	-	✗	✗	-	-	-
100-400	K	-	-	-	-	-	-	✗
100-401	E, F, K	-	-	-	-	-	-	✗
150-253	D	✗	✗	-	-	-	-	-
150-315	D	✗	✗	-	-	✗	✗	-
150-315	F	-	-	✗	✗	✗	✗	-
150-317	E, K	-	-	✗	✗	✗	✗	-
150-400	D, K	-	-	-	-	-	-	✗
150-401	D, E, F	-	-	-	-	-	-	✗
150-403	K	-	-	-	-	-	-	✗
151-403	K	-	-	-	-	-	-	✗
200-315	D, K	-	-	-	-	-	-	✗
200-316	K	-	-	-	-	-	-	✗
200-317	K	-	-	-	-	-	-	✗
200-318	K	-	-	-	-	-	-	✗
200-400	D	-	-	-	-	-	-	✗
200-401	E	-	-	-	-	-	-	✗
200-402	K	-	-	-	-	-	-	✗
200-403	K	-	-	-	-	-	-	✗
250-400	D	-	-	-	-	-	-	✗
250-401	K	-	-	-	-	-	-	✗

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Size	Impeller type	Variant						
		1	2	3	4	5	6	7
		Material variant						
		G, GH, H	G, GH, H	G, GH	G, GH, H	C1	C2	G, GH, H C1, C2
250-403	K	-	-	-	-	-	-	✗
300-400	D, K	-	-	-	-	-	-	✗
300-401	K	-	-	-	-	-	-	✗
300-403	K	-	-	-	-	-	-	✗

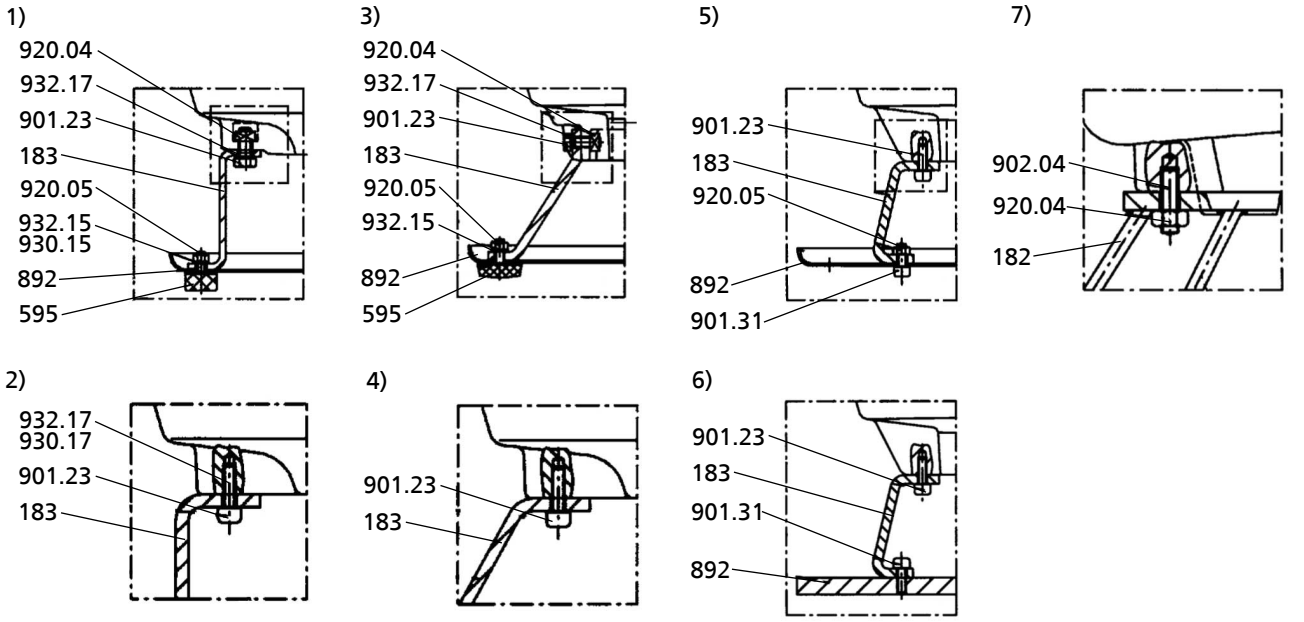

Fig. 56: Transportable wet-installed model

Table 43: List of components

Part No.	Description	Part No.	Description
182	Foot	902.04	Stud
183	Support foot	920.04/.05	Nut
595	Buffer	930.15/.17	Safety device
892	Foot plate	932.15/.17	Circlip
901.23/.31	Hexagon head bolt		

9.2.7 Reinforced bearings

Table 44: Sizes with reinforced bearings

Size	Impeller type	Motor size and number of poles												
		55 2.E	65 2.E	75 2.E	45 4.E	55 4.E	65 4.E	75 4.E	31 6.E	37 6.E	45 6.E	55 6.E	30 8.E	37 8.E	45 8.E
80-315	D	✗	✗	✗	-	-	-	-	-	-	-	-	-	-	-
100-315	D	✗	✗	✗	-	-	-	-	-	-	-	-	-	-	-
150-400	D	-	-	-	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
150-401	D	-	-	-	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
200-400	D	-	-	-	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
250-400	D	-	-	-	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
300-400	D	-	-	-	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗

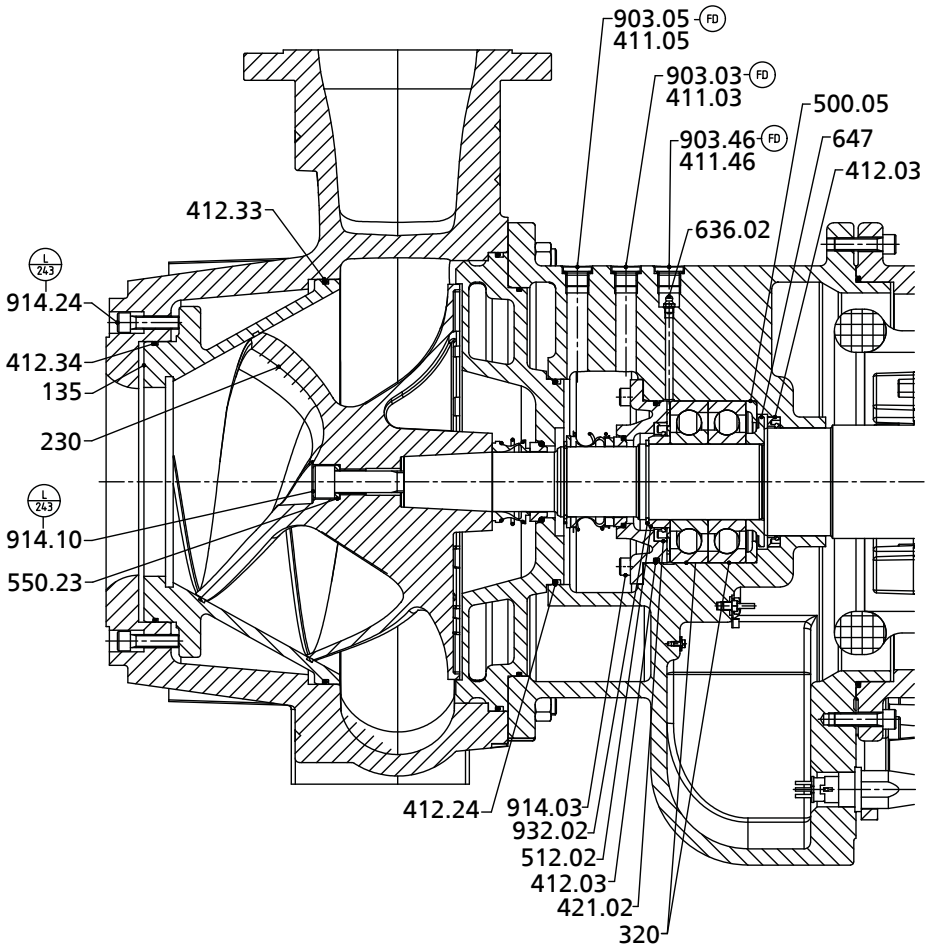

Fig. 57: Reinforced bearings

Table 45: Reinforced bearings

Part. No.	Description	Part. No.	Description
135	Wear plate	512.02	Wear ring
230	Impeller	550.23	Disc
320	Rolling element bearing	636.02	Lubricating nipple
411.03/.05/.46	Joint ring	647	Grease regulator
412.03/.24/.33/.34	O-ring	903.03/.05/.46	Screw plug
421.02	Lip seal	914.03/.10/.24	Hexagon socket head cap screw
500.05	Ring	932.02	Circlip

9.2.8 Attachment elements

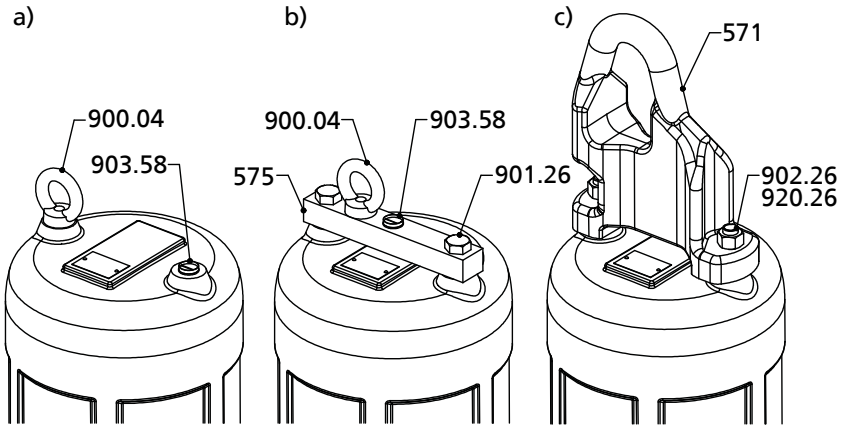

Fig. 58: Attachment elements a) bolt for guide wire arrangement b) bolt for guide rail arrangement c) bail

Table 46: Attachment elements

Part. No.	Description	Part. No.	Description
571	Bail	902.26	Stud
575	Strip	903.58	Screw plug
900.04	Bolt/screw	920.26	Nut
901.26	Hexagon head bolt		

9.2.9 Electrode for leakage monitoring

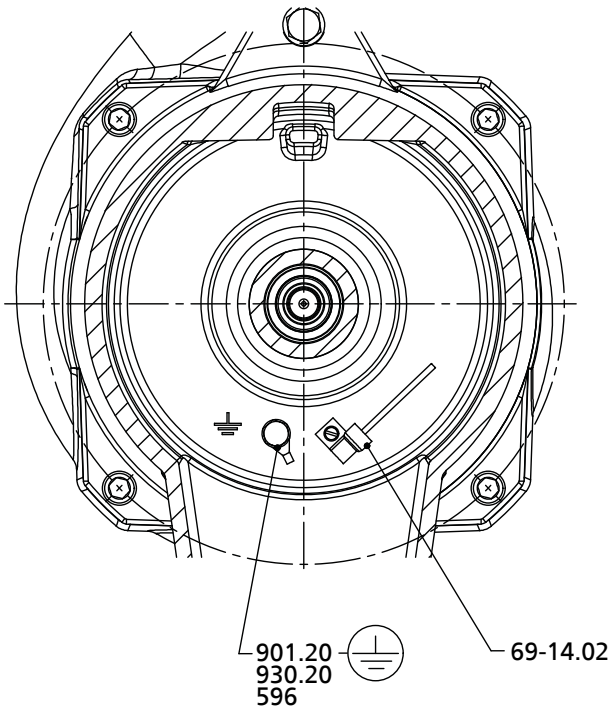

Fig. 59: Electrode for leakage monitoring

Table 47: Electrode for leakage monitoring

Part. No.	Description	Part. No.	Description
596	Wire	901.20	Hexagon head bolt
69-14.02	Leakage monitor	930.20	Safety device

9.2.10 Electrode for leakage monitoring and motor temperature sensor

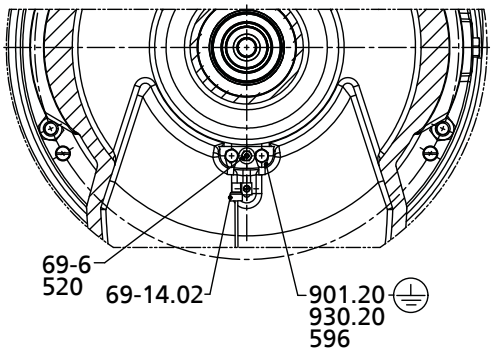

Fig. 60: Electrode for leakage monitoring and motor temperature sensor

Table 48: Electrode for leakage monitoring and motor temperature sensor

Part. No.	Description	Part. No.	Description
520	Sleeve	69-14.02	Leakage monitor
596	Wire	901.20	Hexagon head bolt
69-6	Temperature sensor	930.20	Safety device

9.2.11 Motor and fastening elements for the cable glands

9.2.11.1 Amarex KRT, motor type 1

Sizes:
40-252
50-215
50-216
65-215
65-216
65-217
65-253
80-215
80-216
80-217
80-252
80-253
100-215
100-253
100-254
150-253

Motors:
3 2
4 2
5 2
7 2
2 4
3 4
4 4
5 4

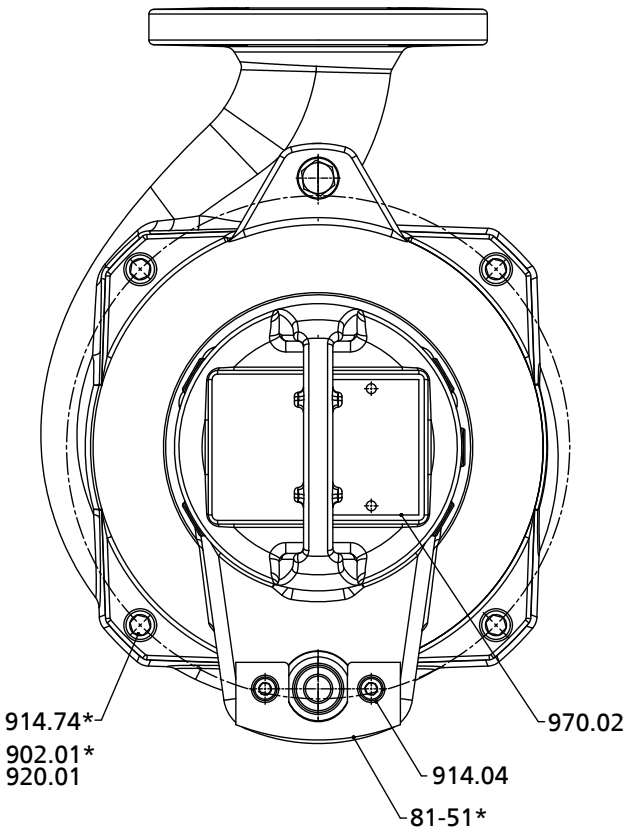

Fig. 61: Motor and fastening elements for the cable glands Amarex KRT, motor type 1
*: On specific designs only

Table 49: List of components

Part No.	Description	Part No.	Description
81-51*	Clamp	920.01*	Nut
902.01*	Stud	970.02	Label/plate
914.04/.74*	Hexagon socket head cap screw		

9.2.11.2 Amarex KRT, motor type 2

Sizes:
40-252
50-215
50-216
65-215
65-216
65-217
65-253
80-215
80-216
80-217
80-252
80-253
80-315
80-317
100-215
100-253
100-254
150-253
150-315
150-317
200-315
200-316
200-317
200-318

Motors:
11 2
15 2
18 2
22 2
26 2
7 4
11 4
15 4
18 4
22 4
7 6
11 6
15 6
18 6

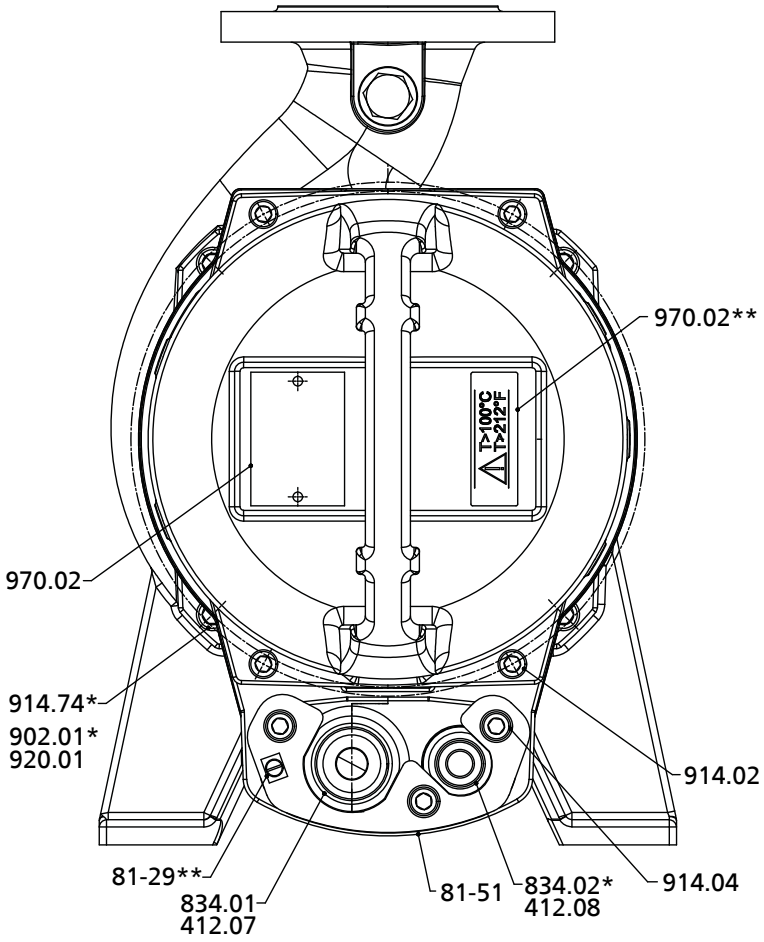

Fig. 62: Motor and fastening elements for the cable glands Amarex KRT, motor type 2

*: On specific designs only

** Only for installation types K, D and H

Table 50: List of components

Part No.	Description	Part No.	Description
412.07/.08*	O-ring	902.01*	Stud
81-29**	Terminal	914.02/.04/.74*	Hexagon socket head cap screw
81-51	Clamp	920.01*	Nut
834.01/.02*	Cable gland	970.02/.20**	Label/plate

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9.2.11.3 Amarex KRT, motor type 3

Motor type 3 with one or two power cables

Sizes:
100-315
100-316
100-317
100-400
100-401
150-315
150-317
150-400
150-401
150-403
151-401
151-403
200-315
200-316
200-317
200-318
200-330
200-400
200-401
200-402
250-400
250-401
250-403
300-400
300-401
300-403

Motors:
30 4
37 4
22 6
30 6
11 8
15 8
18 8
22 8

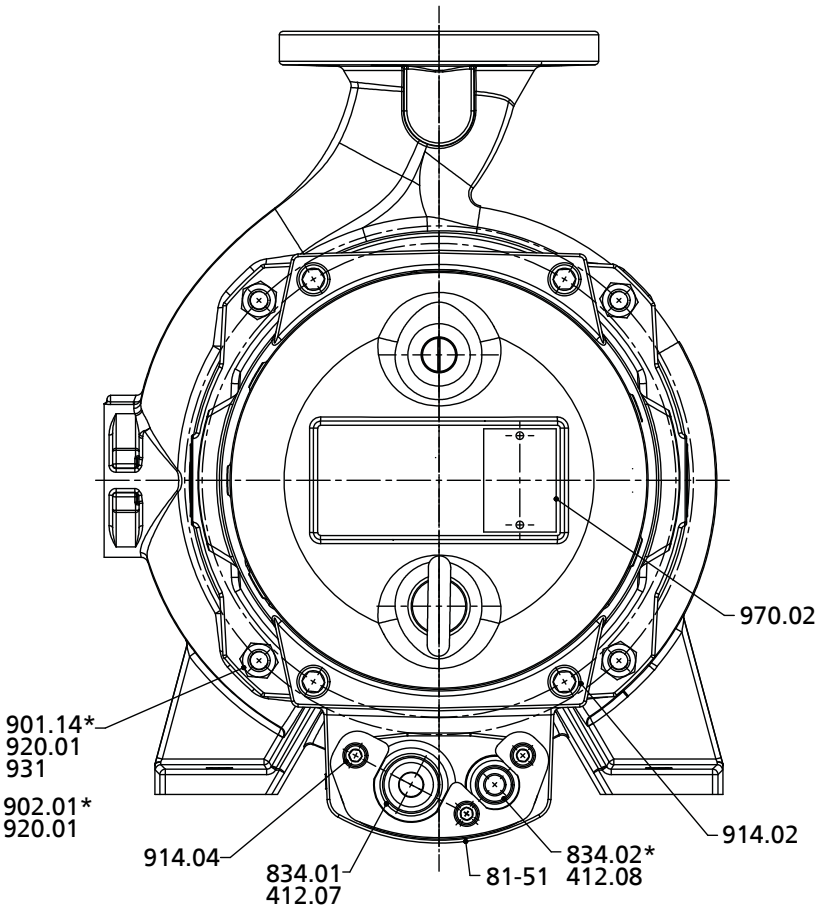

Fig. 63: Motor and fastening elements for the cable glands Amarex KRT, motor type 3 with one or two power cables

*: On specific designs only

Table 51: List of components

Part. No.	Description	Part. No.	Description
412.07/.08	O-ring	914.02/.04	Hexagon socket head cap screw
81-51	Clamping element	920.01	Nut
834.01/02*	Cable gland	931	Lock washer
901.14*	Hexagon head bolt	970.02	Label/plate
902.01	Stud		

Motor type 3 with three power cables

Sizes:
80-315
100-315
100-316
100-400
100-401
150-315
150-317
150-400
150-401
151-401
200-317
200-318
200-330
200-400
200-401
250-400
250-401
300-400
300-401

Motors:
55 2
65 2
75 2
45 4
55 4
65 4
75 4
31 6
37 6
45 6
55 6
30 8
37 8
45 8

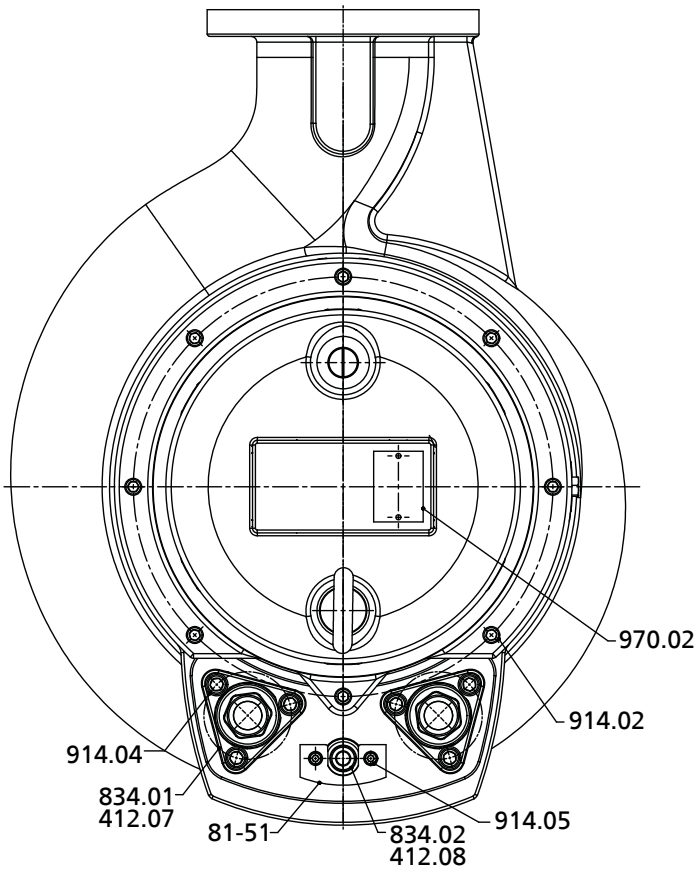

Fig. 64: Motor and fastening elements for the cable glands Amarex KRT, motor type 3, three power cables

Table 52: List of components

Part. No.	Description	Part. No.	Description
412.07/.08	O-ring	914.02/.04/.05	Hexagon socket head cap screw
81-51	Clamping element	970.02	Label/plate
834.01/02	Cable gland		

9.3 Wiring diagrams

9.3.1 Planning the control system

For electrical connection of the pump set observe the “Information for planning the control system”. (⇨ Section 5.4.1, Page 42)

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9.3.2 Wiring diagrams for installation types P and S

9.3.2.1 Wiring diagram for one power cable 8G1.5

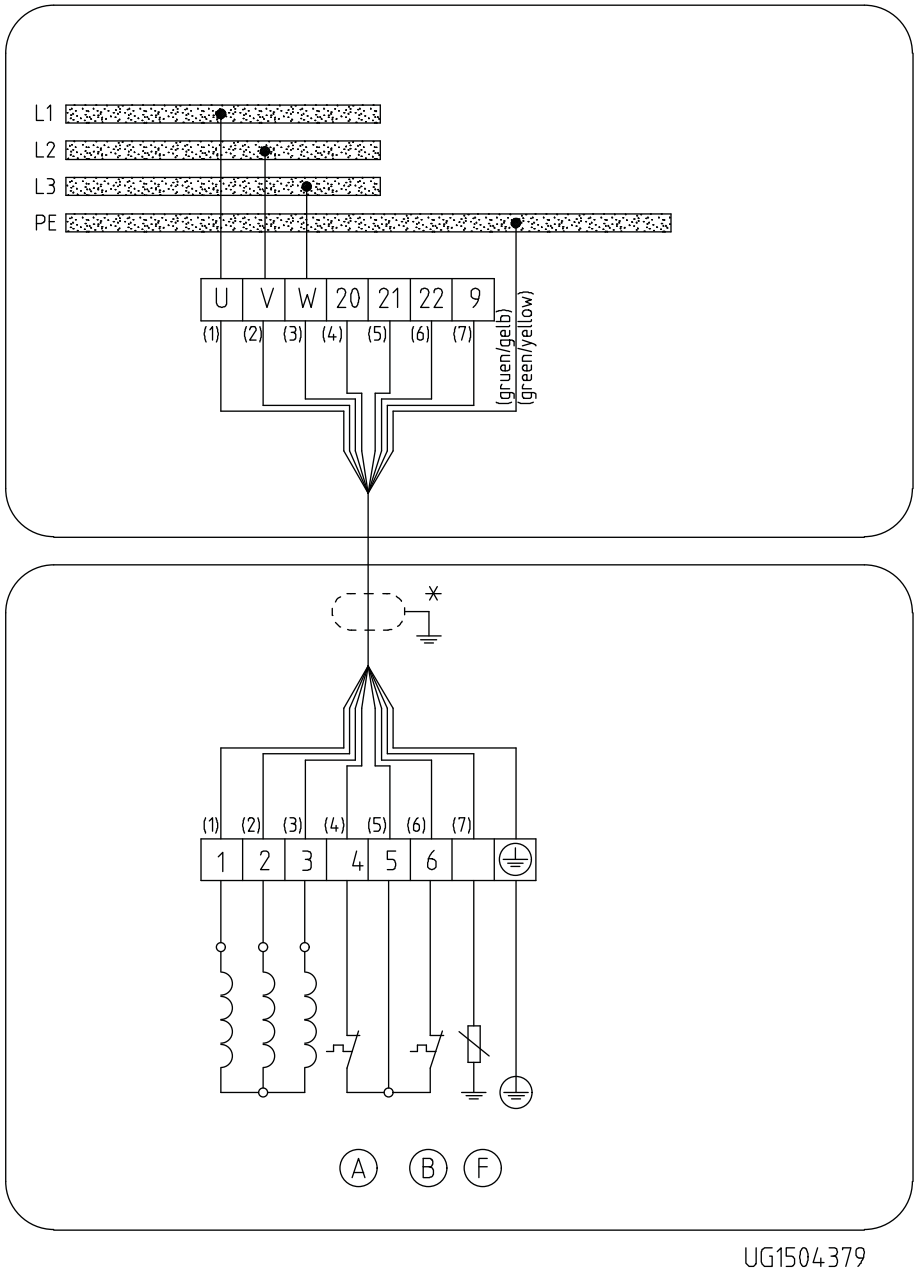

Fig. 65: Wiring diagram for pump sets of installation types P or S with one power cable 8G1.5

Ⓐ	Motor temperature 1
Ⓑ	Motor temperature 2
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.2.2 Wiring diagram for one power cable 12G1.5 or 12G2.5

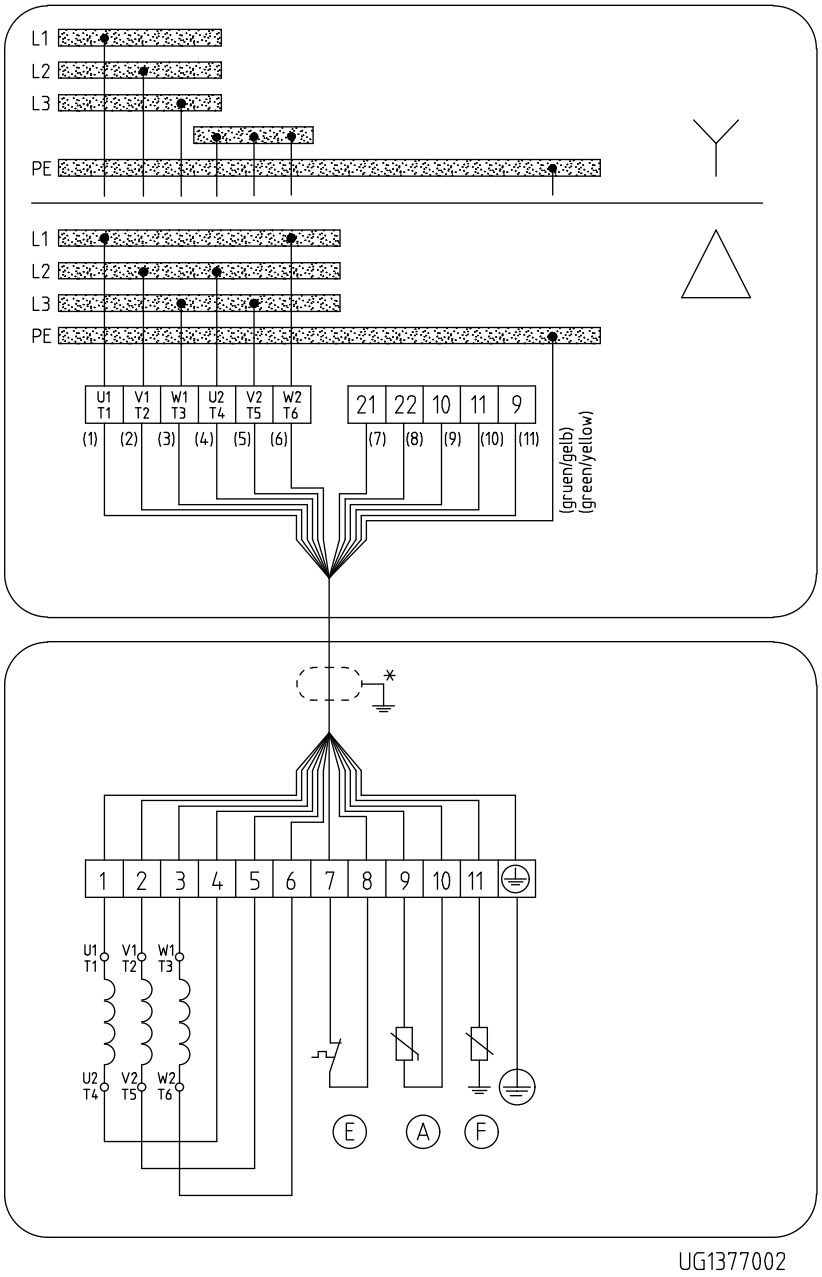

Fig. 66: Wiring diagram for pump sets with one power cable 12G1.5 or 12G2.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.2.3 Wiring diagram for one power cable 7G4 + 5×1.5, 7G6 + 5×1.5 or 7G10 + 5×1.5

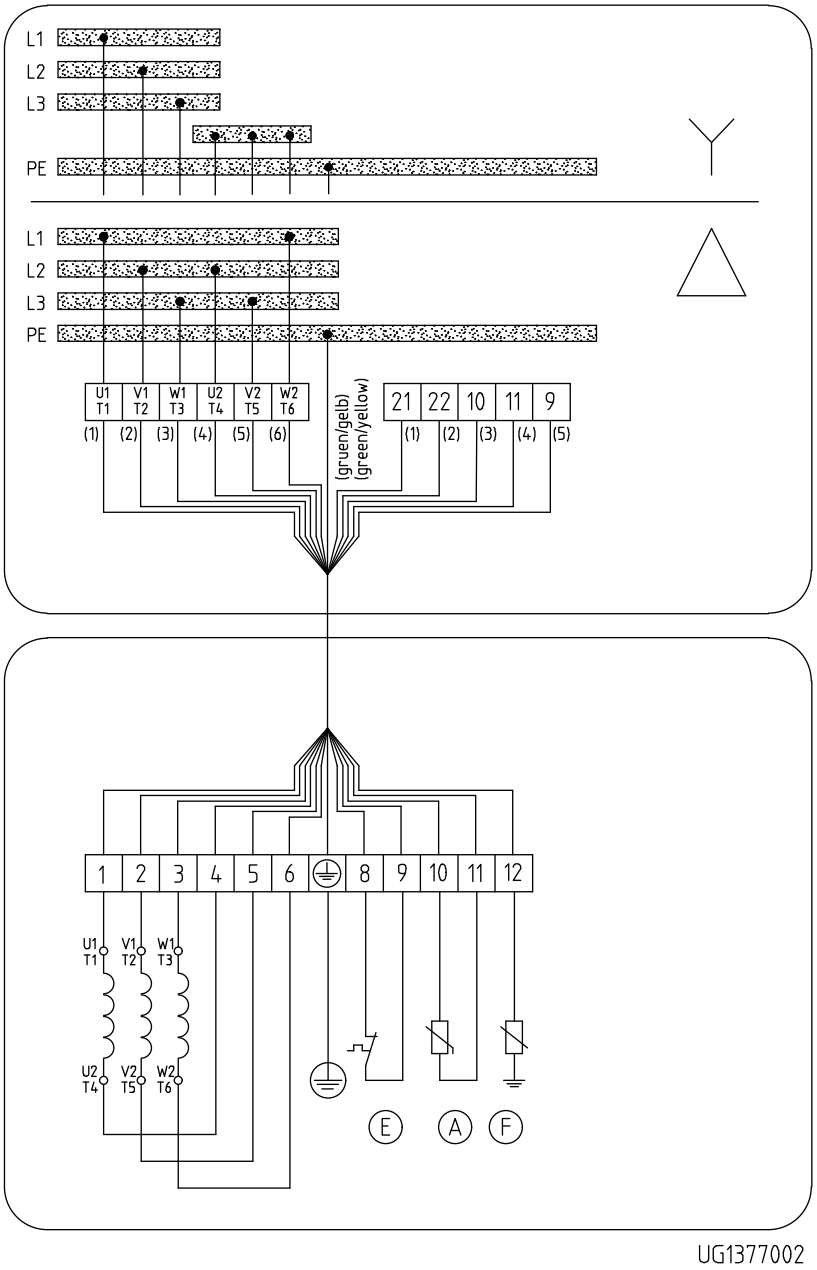

Fig. 67: Wiring diagram for pump sets with one power cable 7G4 + 5×1.5, 7G6 + 5×1.5 or 7G10 + 5×1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor

9.3.2.4 Wiring diagram for two power cables 7G4 or 7G6 and 8G1.5

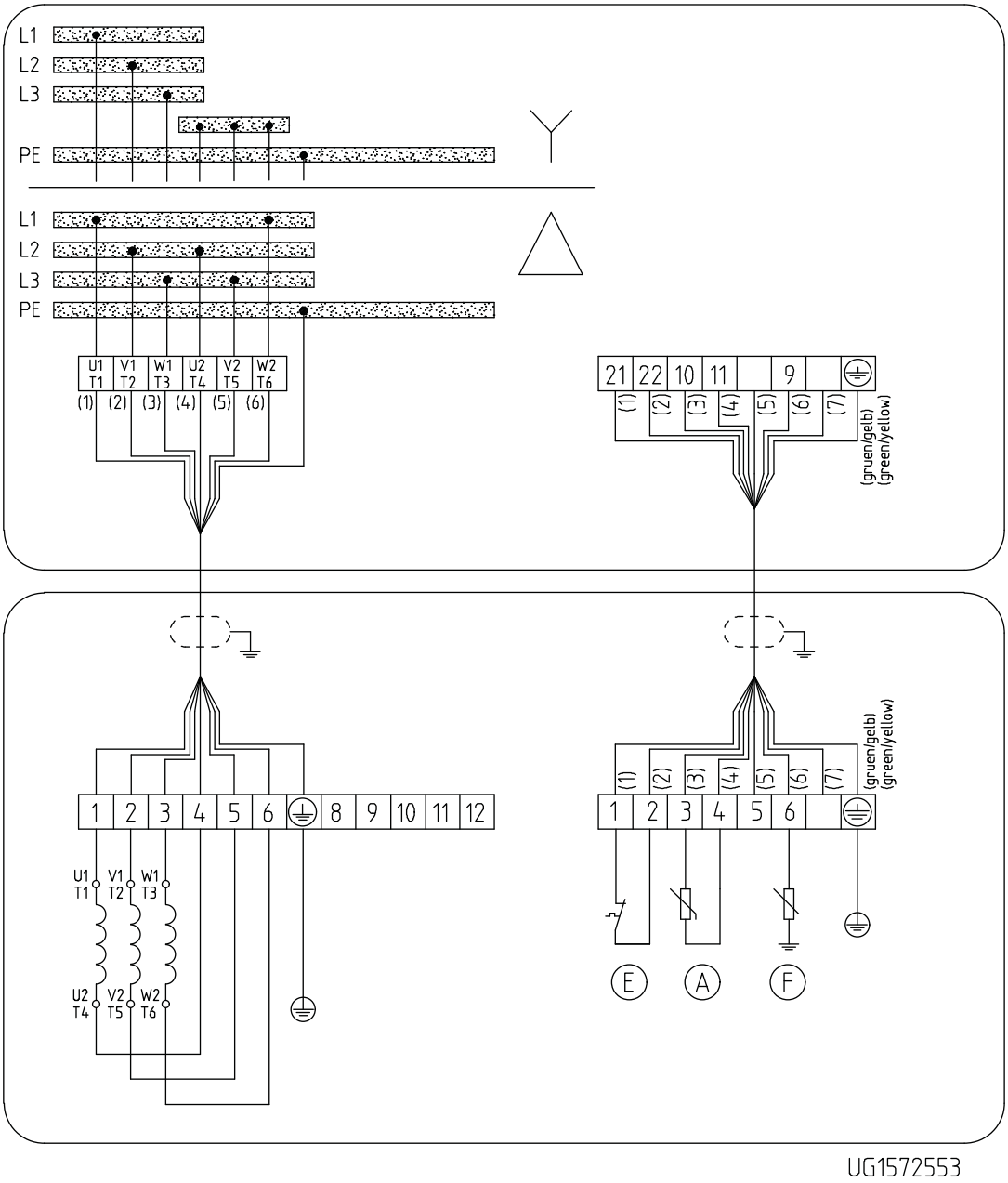

Fig. 68: Wiring diagram for pump sets with two power cables 7G4 or 7G6 and 8G1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.2.5 Wiring diagram for two power cables 4G16 and 8G1.5

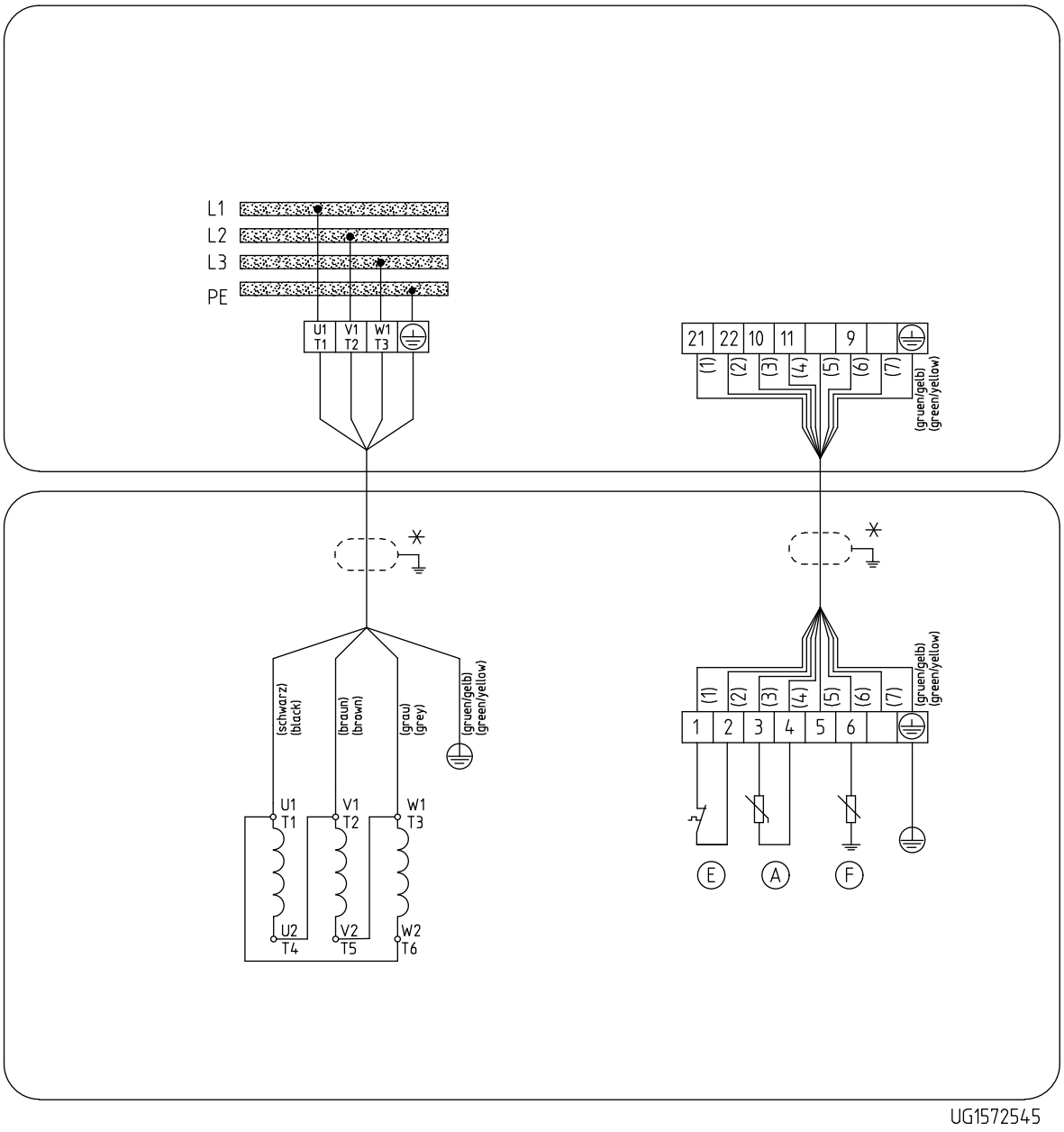

Fig. 69: Wiring diagram for pump sets with two power cables 4G16 and 8G1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.2.6 Wiring diagram for three power cables 2 x 4GXX and 8G1.5

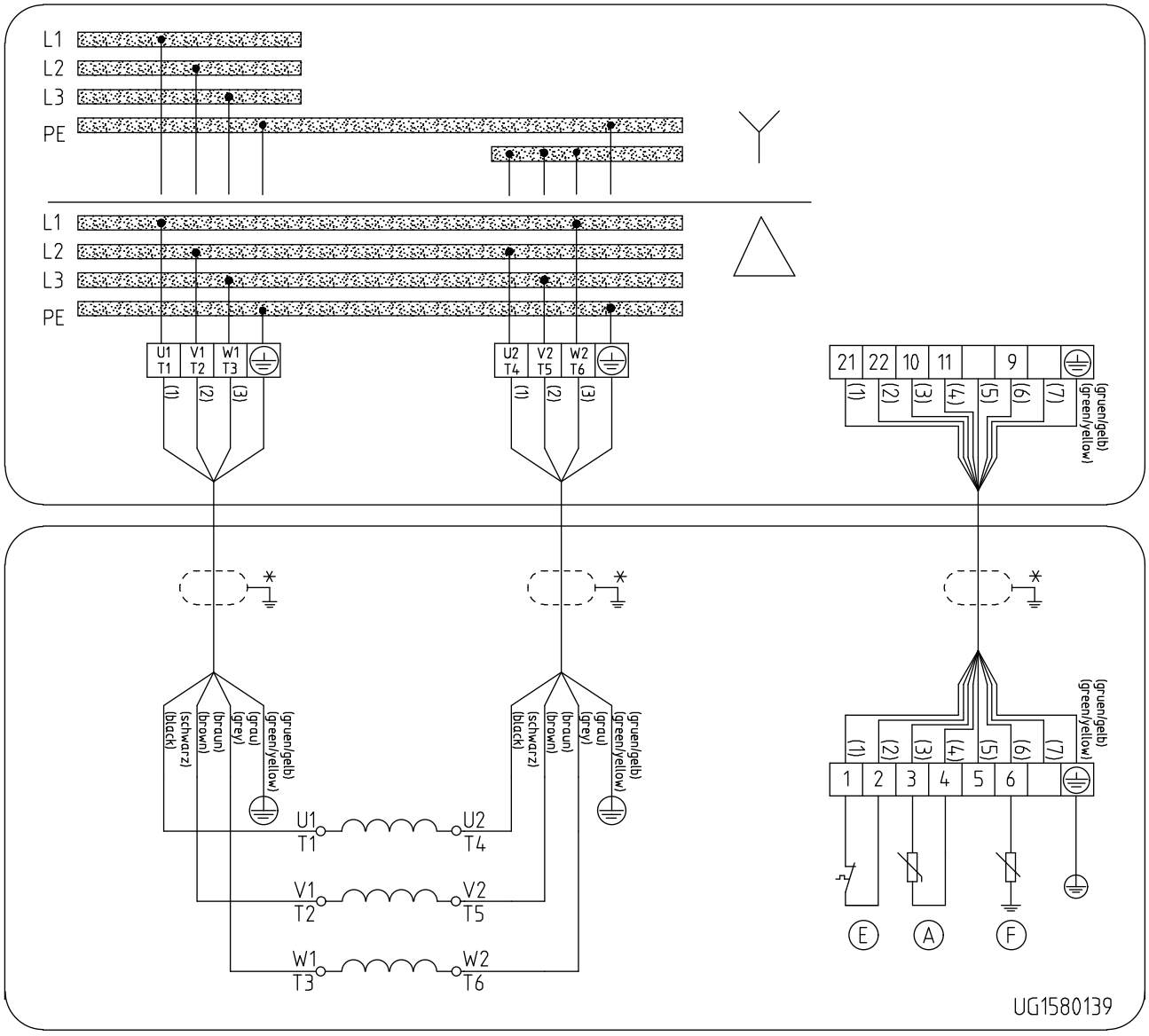

Fig. 70: Wiring diagram for pump sets with three power cables 2 × 4GXX and 8G1.5

Ⓐ	Motor temperature (PTC thermistor)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.2.7 Wiring diagram for three power cables 2×4GXX and 8G1.5 for pumps with optional bearing temperature monitoring

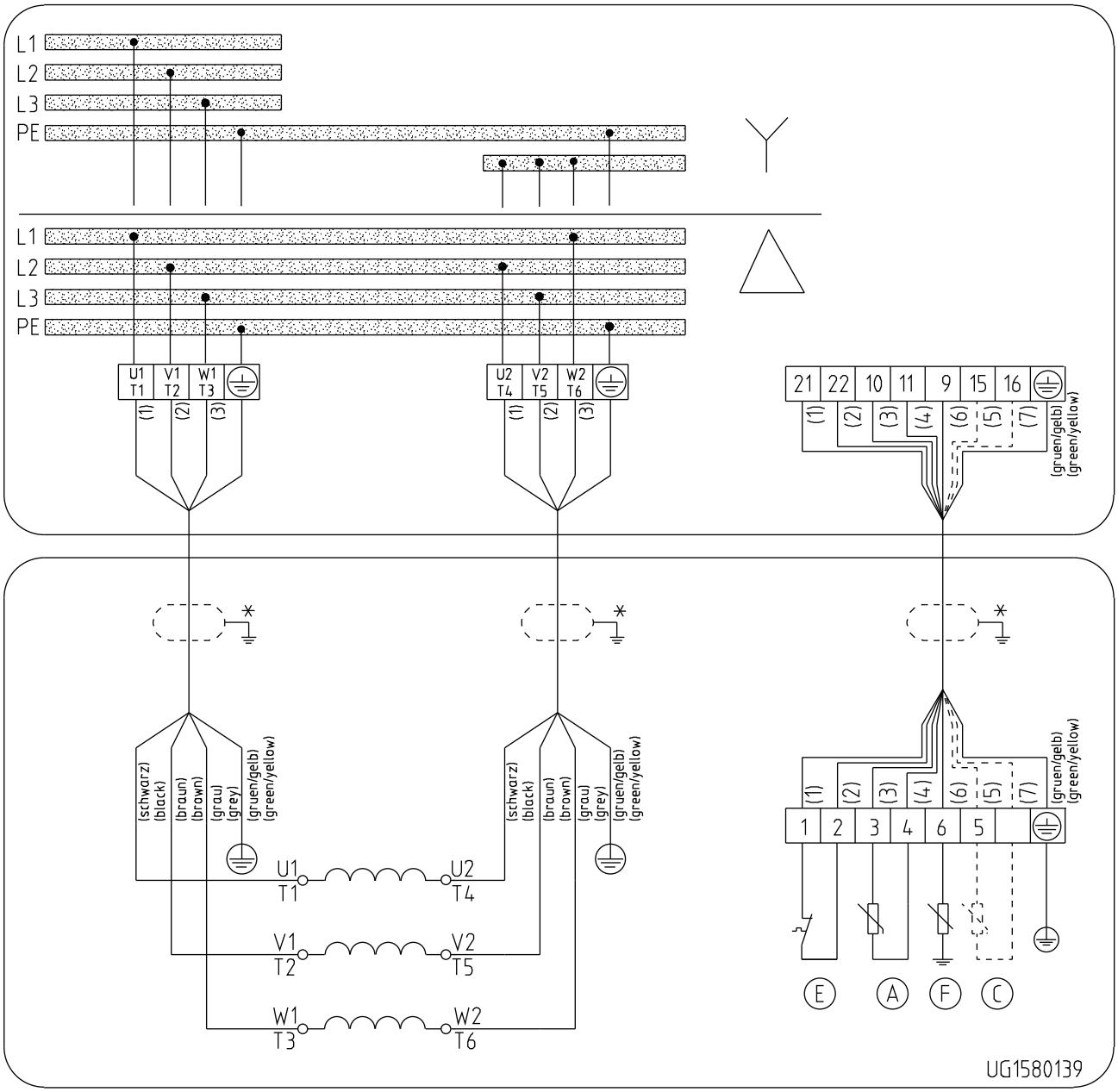

Fig. 71: Wiring diagram for three power cables 2×4GXX and 8G1.5 for pumps with optional bearing temperature monitoring

Ⓐ	Motor temperature (PTC thermistor)
Ⓒ	Bearing temperature (lower bearing assembly, optional)
Ⓔ	Motor temperature
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.3.3 Wiring diagrams for installation types D, H and K

9.3.3.1 Wiring diagram for one power cable 12G1.5 or 12G2.5

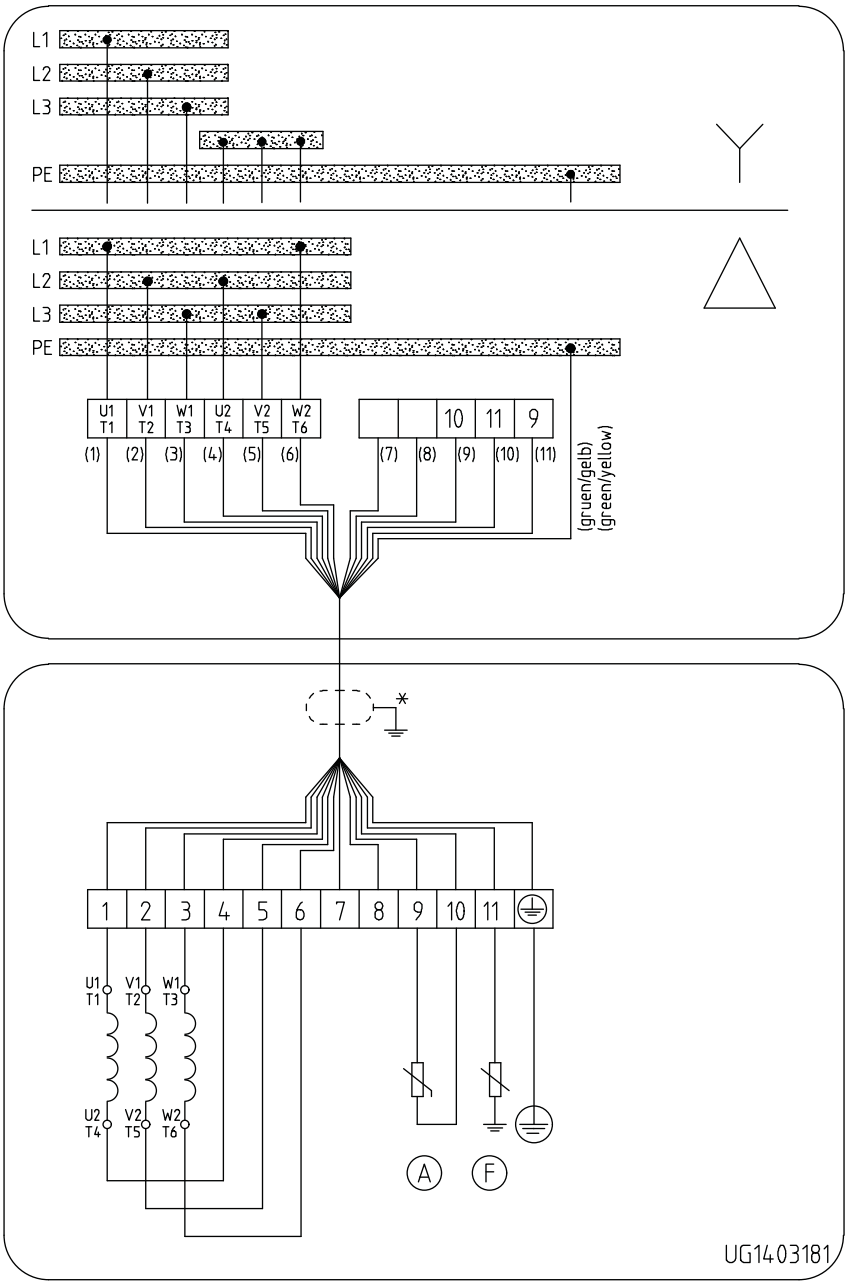

Fig. 72: Wiring diagram for pump sets of installation types D, H or K with power cables 12G1.5 and 12G2.5

Ⓐ	Motor temperature 1
Ⓕ	Leakage inside the motor
*	Shielded cable option

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9.3.3.2 Wiring diagram for one power cable 7G4 + 5×1.5, 7G6 + 5×1.5 or 7G10 + 5×1.5

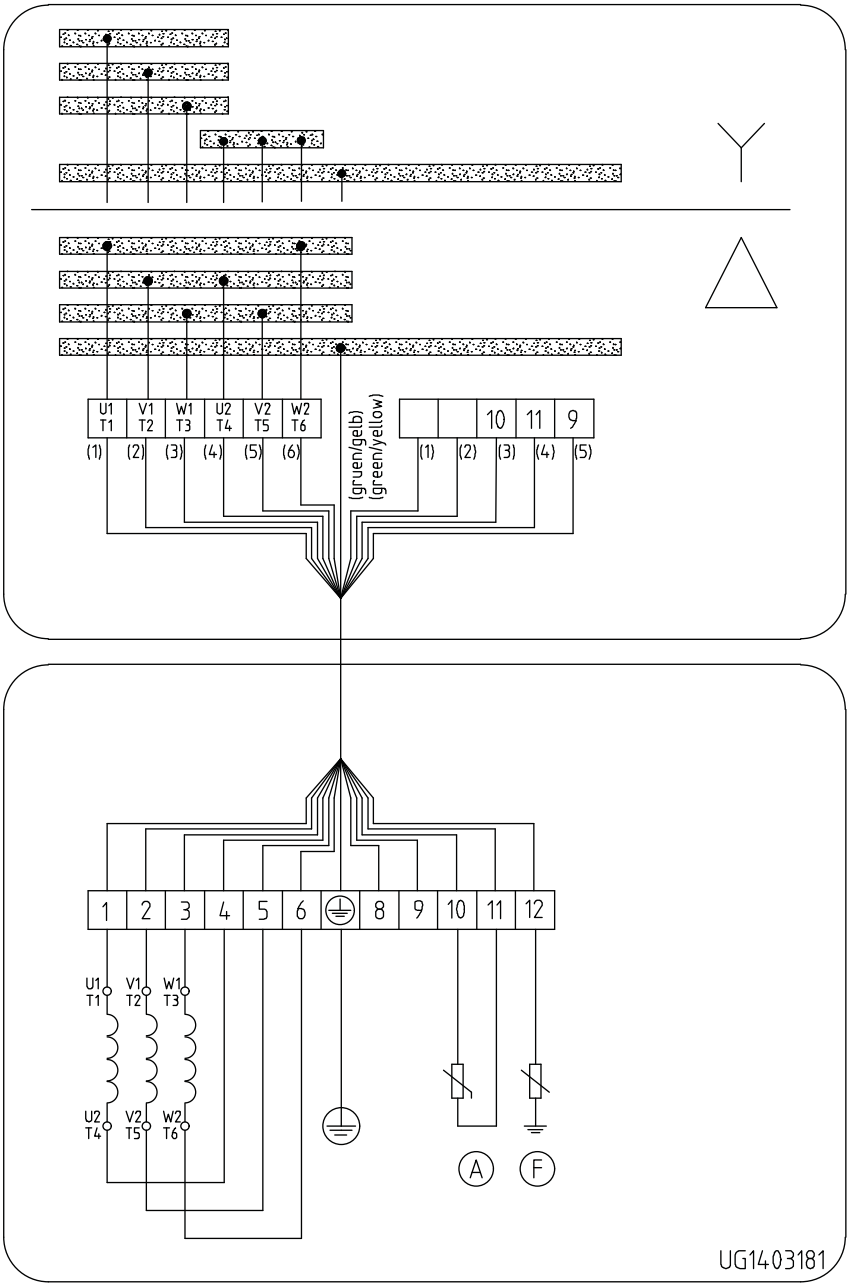

Fig. 73: Wiring diagram for pump sets of installation types D, H or K with power cables 7G4 + 5×1.5, 7G6 + 5×1.5 or 7G10 + 5×1.5

Ⓐ	Motor temperature 1
Ⓕ	Leakage inside the motor
*	Shielded cable option

9.4 Flamepaths on explosion-proof motors

9.4.1 Amarex KRT, motor type 1

Motors:
3 2
4 2
5 2
7 2
2 4
3 4
4 4
5 4

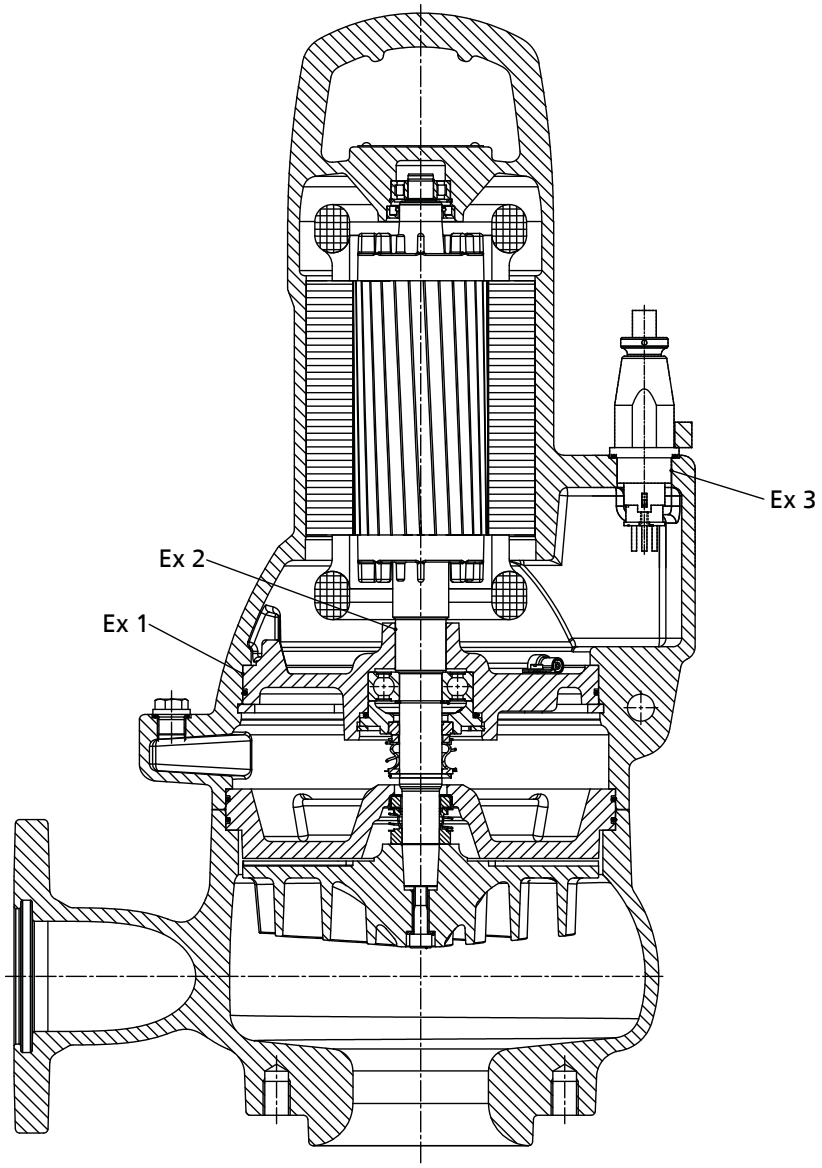

Fig. 74: Flamepaths Amarex KRT, motor type 1

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9.4.2 Amarex KRT, motor type 2

Motors:
11 2
15 2
18 2
22 2
26 2
7 4
11 4
15 4
18 4
22 4
7 6
11 6
15 6
18 6

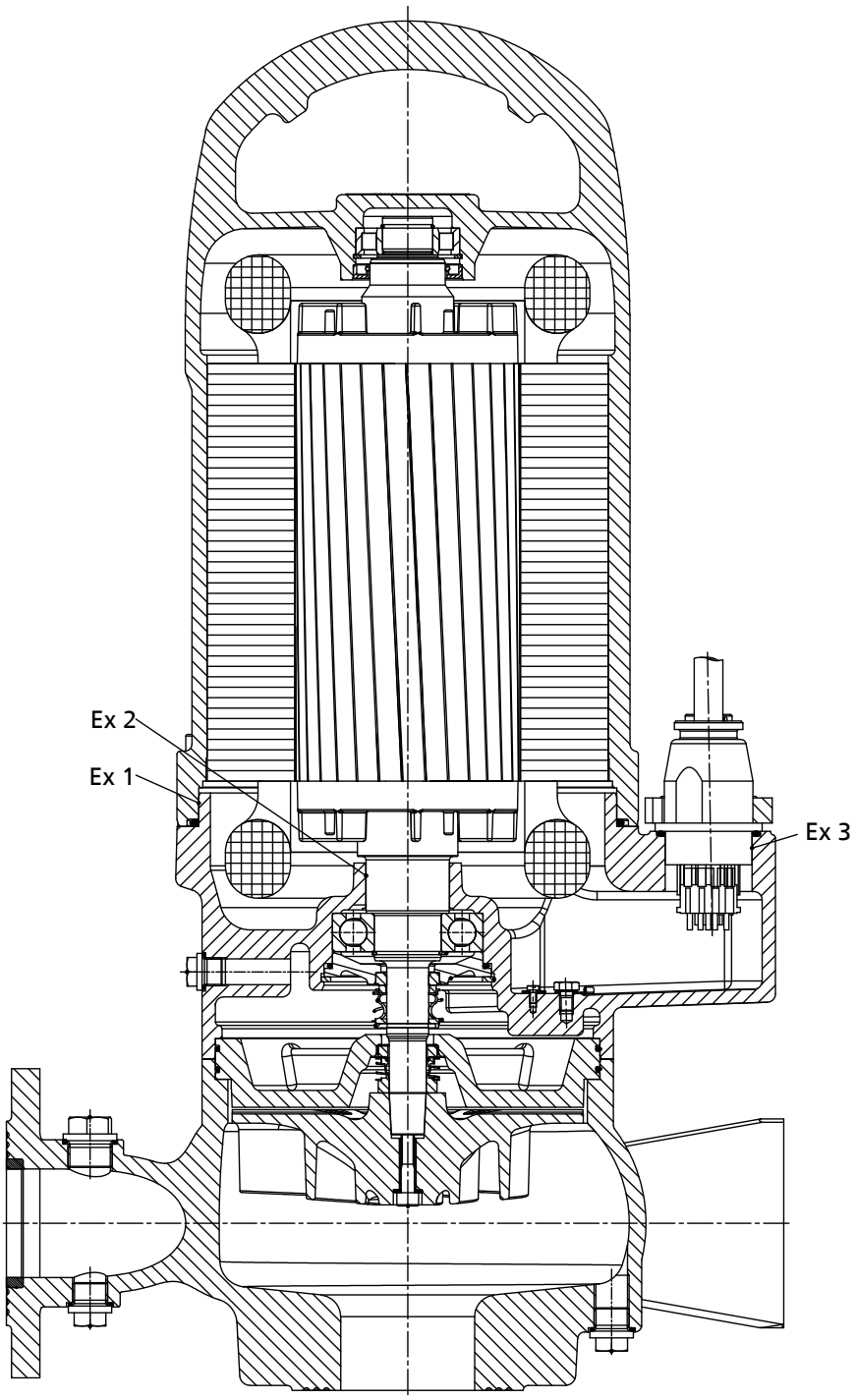

Fig. 75: Flamepaths Amarex KRT, motor type 2

9.4.3 Amarex KRT, motor type 3

Motors:
55 2
65 2
75 2
30 4
37 4
45 4
55 4
65 4
75 4
22 6
30 6
31 6
37 6
45 6
55 6
11 8
15 8
18 8
22 8
30 8
37 8
45 8

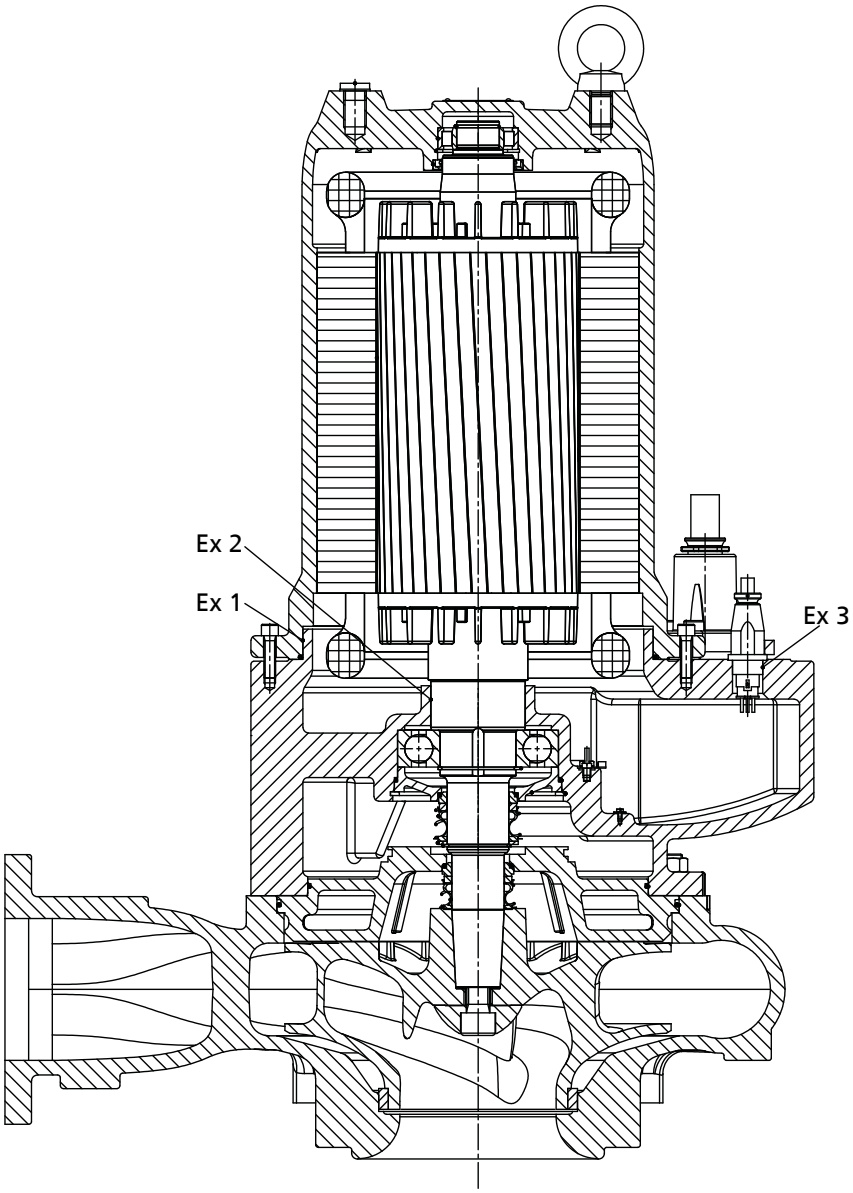

Fig. 76: Flamepaths Amarex KRT, motor type 3

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9.5 Sectional drawings of the mechanical seal

9.5.1 Bellows-type mechanical seal

Mechanical seal for material variants G, G1, G2, GH, C1

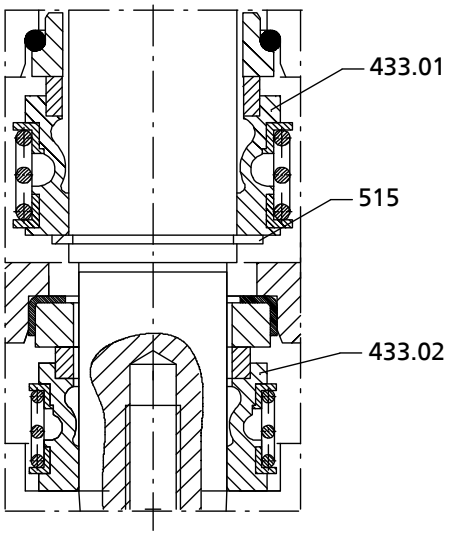

Fig. 77: Installation drawing for bellows-type mechanical seal

Table 53: Bellows-type mechanical seal

Part. No.	Description	Part. No.	Description
433.01/.02	Mechanical seal	515	Locking ring

9.5.2 Mechanical seal with covered springs (HJ)

Mechanical seal for material variants H, C2[17)]

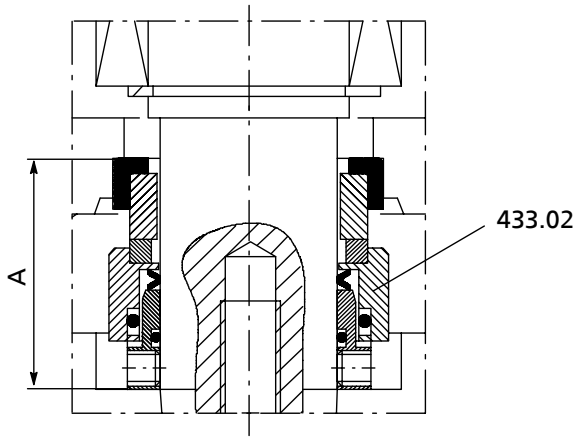

Fig. 78: Installation drawing for mechanical seal with covered springs (HJ)

Table 54: Mechanical seal with covered springs (HJ)

Part. No.	Description	Part. No.	Description
433.02	Mechanical seal		

17) Optional for material variants G, G1, G2, GH, C1

9.5.3 Double cartridge seal

Mechanical seal for material variants H, C2[18)19)]

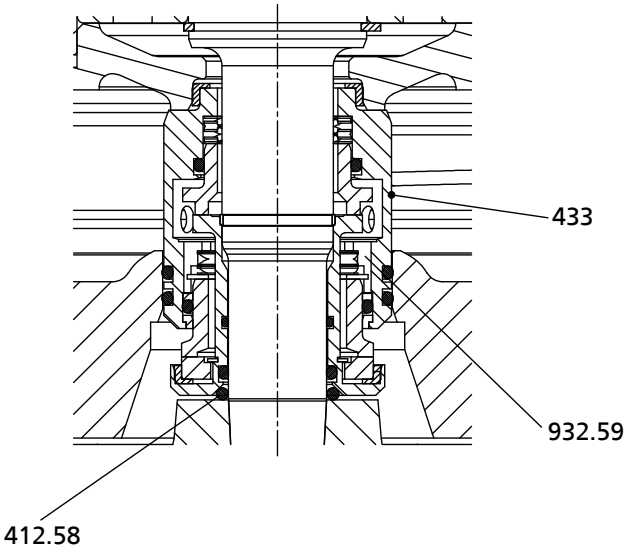

Fig. 79: Installation drawing for double cartridge seal

Table 55: Double cartridge seal

Part No.	Description	Part No.	Description
412.58	O-ring	932.59	Circlip
433	Mechanical seal		

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18) Only on sizes 50-215, 50-216, 65-215, 65-216, 65-217, 80-215, 80-216, 80-217, 100-215
19) Optional for material variants G, G1, G2, GH, C1

10 EU Declaration of Conformity

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

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

Amarex KRT

KSB order number: .....

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Pump set: 2006/42/EC Machinery Directive
- the following harmonised international standards[20] have been applied:
  - ISO 12100
  - EN 809
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[21].....

Name

Function

Company
Address

20) Apart from the standards listed here referring to the Machinery Directive, further standards are observed for explosion-proof versions (ATEX Directive) as applicable and are listed in the legally binding EU Declaration of Conformity.
21) A signed, legally binding EU Declaration of Conformity is supplied with the product.

11 Certificate of Decontamination

Type: .....

Order number/

Order item number[22]: .....

Delivery date: .....

Applications: .....

Fluid handled[22]: .....

Please tick where applicable[22]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return[22]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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22) Required fields

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2553.820/09-EN (01654388)

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