

## **Amarex KRT**

Sizes DN 40 to DN 300, 50 Hz

Motor Sizes

2-pole: 3 2.E to 75 2.E

4-pole: 2 4.E to 75 4.E

6-pole: 7 6.E to 55 6.E

8-pole: 11 8.E to 45 8.E

## **Installation/Operating Manual**



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Installation/Operating Manual Amarex KRT

Original operating manual

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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.

### Grey water

Faecal-free waste water

### 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

## 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 |
| 100-403 | D             | D                | D    | D    | -    | -                    | -    | -    |
| 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    |
| 150-317 | D             | D                | D    | D    | -    | -                    | -    | -    |
| 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 | D             | D                | D    | D    | -    | -                    | -    | -    |

| Size    | Impeller type | Material variant |    |    |    |                      |    |    |
|---------|---------------|------------------|----|----|----|----------------------|----|----|
|         |               | Grey cast iron   |    |    |    | Industrial materials |    |    |
|         |               | G                | G1 | G2 | GH | H                    | C1 | C2 |
| 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  |
| 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 | D             | D                | D  | D  | -  | -                    | -  | -  |
| 200-402 | K             | K                | K  | K  | K  | K                    | K  | K  |
| 200-403 | K             | K                | K  | K  | K  | K                    | K  | K  |
| 200-405 | D             | D                | D  | D  | -  | -                    | -  | -  |
| 250-400 | D             | D                | D  | -  | -  | -                    | -  | -  |
| 250-401 | K             | K                | K  | K  | K  | K                    | K  | K  |
| 250-402 | D             | D                | D  | D  | -  | -                    | -  | -  |
| 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  |
| 300-402 | D             | D                | D  | D  | -  | -                    | -  | -  |
| 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 KSB service facility to maintain the right to claim under warranty.

## 1.2 Installation of partly completed machinery

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

## 1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 14)

## 1.4 Other applicable documents

**Table 2:** Overview of other applicable documents

| Document                                      | Contents                                                                                                  |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Data sheet                                    | Description of the 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 <sup>1)</sup>        | Sectional drawing of the pump set                                                                         |
| Sub-supplier product literature <sup>1)</sup> | Operating manuals and other product literature describing accessories and integrated machinery components |
| Spare parts lists <sup>1)</sup>               | Description of spare parts                                                                                |
| Supplementary operating manual <sup>1)</sup>  | Description of the proper and safe use of special accessories, for example                                |

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.<br>2.                                                                            | Step-by-step instructions                                                                  |
|  | Note<br>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                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>DANGER</b>  | <b>DANGER</b><br>This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.                                                                                                                                                         |
|  <b>WARNING</b> | <b>WARNING</b><br>This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.                                                                                                                                                     |
|  <b>CAUTION</b> | <b>CAUTION</b><br>This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.                                                                                                                                                 |
|                 | <b>Explosion protection</b><br>This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with the UK regulation titled Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016. |

<sup>1</sup> If included in agreed scope of supply

| Symbol                                                                            | Description                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>General hazard</b><br>In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.                                                  |
|  | <b>Electrical hazard</b><br>In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage. |
|  | <b>Machine damage</b><br>In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.                                                                      |



## 2 Safety

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

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

### 2.1 General

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

### 2.2 Intended use

The pump set must only be operated 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 variant.
- 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  $1.2 \times Q_{BEP}$  to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ( $< 0.7 \times Q_{BEP}$ ).
- 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.

|                                                                                   |                                                 |                                                                                                     |
|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|  | Impeller with cutter<br>(impeller type S/S-max) | <b>Suitable for the following fluids:</b><br>fluids containing coarse substances and/or long fibres |
|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------|

Further fluids (impeller type S/S-max):

- Domestic waste water
- Grey water
- Waste water with faeces

|                                                                                   |                                                             |                                                                                                                                                  |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Free-flow impeller<br>(impeller type F/F-max)               | <b>Suitable for the following fluids:</b><br>fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas |
|  | Closed single-channel impeller<br>(impeller type E/E-max)   | <b>Suitable for the following fluids:</b><br>fluids containing solids and stringy material                                                       |
|  | Open, diagonal single-channel impeller<br>(impeller type D) | <b>Suitable for the following fluids:</b><br>fluids containing solid substances and long fibres                                                  |
|  | Open radial multi-vane impeller<br>(impeller type D-max)    | <b>Suitable for the following fluids:</b><br>fluids containing solid substances and long fibres                                                  |

Further fluids (impeller types F/F-max, E/E-max, D/D-max):

- Activated sludge
- Digested sludge
- Heating sludge
- Mixed water
- Raw waste water
- Raw sludge
- Recirculated sludge

|                                                                                     |                                                          |                                                                                                                      |
|-------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|  | Closed multi-channel impeller<br>(impeller type K/K-max) | <b>Suitable for the following fluids:</b><br>contaminated, solids-laden, non-gaseous fluids without stringy material |
|-------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|

Further fluids (impeller type K/K-max):

- Activated sludge
- Landfill waste water
- Industrial waste water
- Industrial grey water
- Mechanically treated waste water
- Pre-screened waste water
- Stormwater

- 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

### 2.3 Personnel qualification and training

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

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

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

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

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

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

### 2.5 Safety awareness

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

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

### 2.6 Safety information for the operator/user

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.

- Contain leakages (e.g. at the shaft seal) of hazardous fluids handled (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)
- If stopping the pump does not increase potential risk, fit an emergency-stop control device in the immediate vicinity of the pump (set) during pump set installation.

### 2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 62)
- Decontaminate pumps which handle fluids posing a health hazard. (⇒ Section 7.3, Page 77)
- 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 56)

### 2.8 Unauthorised modes of operation

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

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

### 2.9 Explosion protection

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

Sections of the manual marked by the symbol opposite apply to explosion-proof pump sets also when temporarily operated outside potentially explosive atmospheres. Pumps / pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

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

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

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

Prevent impermissible modes of operation.



**2.9.1 Repair**

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

### 3 Transport/Storage/Disposal

#### 3.1 Checking the condition upon delivery

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

#### 3.2 Transport

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Improper transport</b><br/>           Danger to life from falling parts!<br/>           Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Use the attachment point provided for attaching the lifting accessory.</li> <li>▷ Never lift the pump set by the electric cables.</li> <li>▷ 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.</li> <li>▷ Securely attach the lifting chain/rope to the pump and crane.</li> <li>▷ Use tested, marked and approved lifting accessories only.</li> <li>▷ Observe the regional transport regulations.</li> <li>▷ Observe the documentation of the lifting accessory manufacturer.</li> <li>▷ 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.</li> <li>▷ Maintain a safe distance during lifting operations (load may swing when being lifted).</li> </ul> |
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Incorrect handling of the electric cable</b><br/>           Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Secure electric cables against falling down.</li> <li>▷ Avoid electric cables being laid on surfaces without fastening.</li> <li>▷ When moving the pump set keep at a safe distance to the electric cables.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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

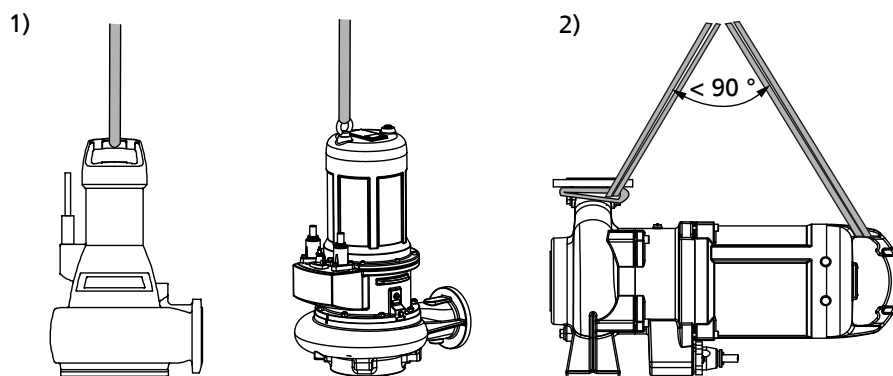


**Fig. 1:** Transporting the pump set 1) vertical installation 2) horizontal installation

### 3.2.1 Placing the pump set down

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p><b>⚠ WARNING</b></p> <p><b>Incorrect positioning/placing down</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Position the pump set vertically with the motor on top.</li> <li>▷ Use appropriate means to secure the pump set against tilting and tipping over.</li> <li>▷ Refer to the weights given in the data sheet/on the name plate.</li> </ul>                                                                                                                                                                                                                                                                                |
|    | <p><b>⚠ WARNING</b></p> <p><b>Improper placing of pump sets in a vertical/horizontal position</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use appropriate means to secure the pump set against tilting or tipping over.</li> <li>▷ 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).</li> <li>▷ Secure electric cables against falling down.</li> <li>▷ Use additional supports for the transport holder to secure it against tilting.</li> <li>▷ Maintain adequate safety distance during lifting operations.</li> </ul> |
|   | <p><b>⚠ WARNING</b></p> <p><b>Improper lifting/moving of heavy assemblies or components</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                         |
|  | <p><b>⚠ WARNING</b></p> <p><b>Placing the pump set on unsecured and uneven surfaces</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Always place the pump set on a solid and level surface with the pump set in a vertical position and the motor on top.</li> <li>▷ Only place the pump set on a surface of sufficient load-carrying capacity.</li> <li>▷ Use appropriate means to secure the pump set against tilting or tipping over.</li> </ul>                                                                                                                                                                                     |

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:

|                                                                                   |                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION</b><br><br><b>Improper storage</b><br>Damage to the electric cables!<br><ul style="list-style-type: none"> <li>▷ Support the electric cables at the cable gland to prevent permanent deformation.</li> <li>▷ Only remove the protective caps from the electric cables at the time of installation.</li> </ul> |
|  | <b>CAUTION</b><br><br><b>Damage during storage due to humidity, dirt or vermin</b><br>Corrosion/contamination of the pump (set)!<br><ul style="list-style-type: none"> <li>▷ For outdoor storage cover the pump (set) or the packaged pump (set) and accessories with waterproof material.</li> </ul>                    |
|  | <b>CAUTION</b><br><br><b>Wet, contaminated or damaged openings and connections</b><br>Leakage or damage to the pump!<br><ul style="list-style-type: none"> <li>▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.</li> </ul>                                            |

**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 in dry, vibration-free conditions and, 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 nozzle and discharge nozzle.
    - ⇒ It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).

|                                                                                     |                                                                                                         |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|  | <b>NOTE</b><br><br>Observe the manufacturer's instructions for application/removal of the preservative. |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|

### 3.4 Return to supplier

1. Drain the pump properly. (⇒ Section 7.3, Page 77)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.  
Indicate any safety measures and decontamination measures taken.  
(⇒ Section 11, Page 138)

|                                                                                     |                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>NOTE</b><br><br>If required, a blank certificate of decontamination can be downloaded from the following web site: <a href="http://www.ksb.com/certificate_of_decontamination">www.ksb.com/certificate_of_decontamination</a> |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 3.5 Disposal

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  <b>WARNING</b>                                                                                                                                                                                                                                                                                                                                                           |
|                                                                                   | <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</li> <li>▷ Wear protective clothing and a protective mask if required.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul> |

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

## **4 Description of the Pump (Set)**

### **4.1 General description**

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 Product information**

#### **4.2.1 Product information as per Regulation No. 1907/2006 (REACH)**

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

### 4.3 Designation

**Example: 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 12)                                                                        |
| 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 <sup>2)</sup>                                      |
| WE            | Non-explosion-proof, for fluid temperatures of up to 60 °C <sup>2)</sup>                                      |
| XE            | Explosion protection Ⓢ II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 40 °C <sup>2)</sup>           |
| YE            | Explosion protection Ⓢ II 2G Ex db h IIB T4 Gb, for fluid temperatures of up to 40 °C <sup>2)</sup>           |
| ZE            | Explosion protection Ⓢ II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 60 °C <sup>2)</sup>           |
| G             | Material variant                                                                                              |
| G             | Standard variant, gray 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 24)                                                                    |
| IE3           | Motor efficiency classification                                                                               |
| <sup>3)</sup> | No efficiency classification                                                                                  |
| IE3           | Efficiency classification <sup>4)</sup>                                                                       |

<sup>2)</sup> Maximum fluid temperature and ambient temperature

<sup>3)</sup> Blank

<sup>4)</sup> The IEC 60034-30 standard is not binding for submersible motor pumps. Efficiencies are calculated / determined by analogy with the measurement method specified in IEC 60034-2. The marking is used for submersible motors that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.

## 4.4 Name plate

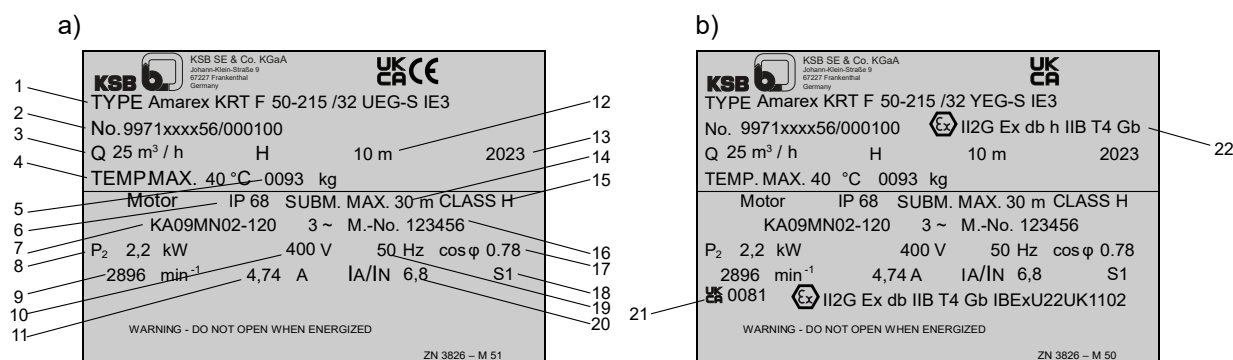


**Fig. 2:** Name plate (example) a) for non-explosion-proof model, b) for explosion-proof model

|    |                                                                         |    |                                                                |
|----|-------------------------------------------------------------------------|----|----------------------------------------------------------------|
| 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 $\nabla$                                   |
| 15 | Thermal class of winding insulation                                     | 16 | Motor number                                                   |
| 17 | Power factor at rated operating point                                   | 18 | Duty type                                                      |
| 19 | Rated frequency                                                         | 20 | Starting current ratio                                         |
| 21 | Marking for use in potentially explosive atmospheres, submersible motor | 22 | Marking for use in potentially explosive atmospheres, pump set |

## 4.5 Design details

### Design

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

### Impeller type

- Various application-oriented impeller types (⇒ Section 2.2, Page 12)

### Shaft seal

Standard bearings:

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

Reinforced bearings: (⇒ Section 9.2.8, Page 115)

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

### Bearings

Drive end:

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

Pump end:

- Standard bearings
  - Grease-packed bearings sealed for life

- Maintenance-free
- Reinforced bearings (⇒ Section 9.2.8, Page 115)
  - 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<br>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<br>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.

### 4.7 Configuration and function

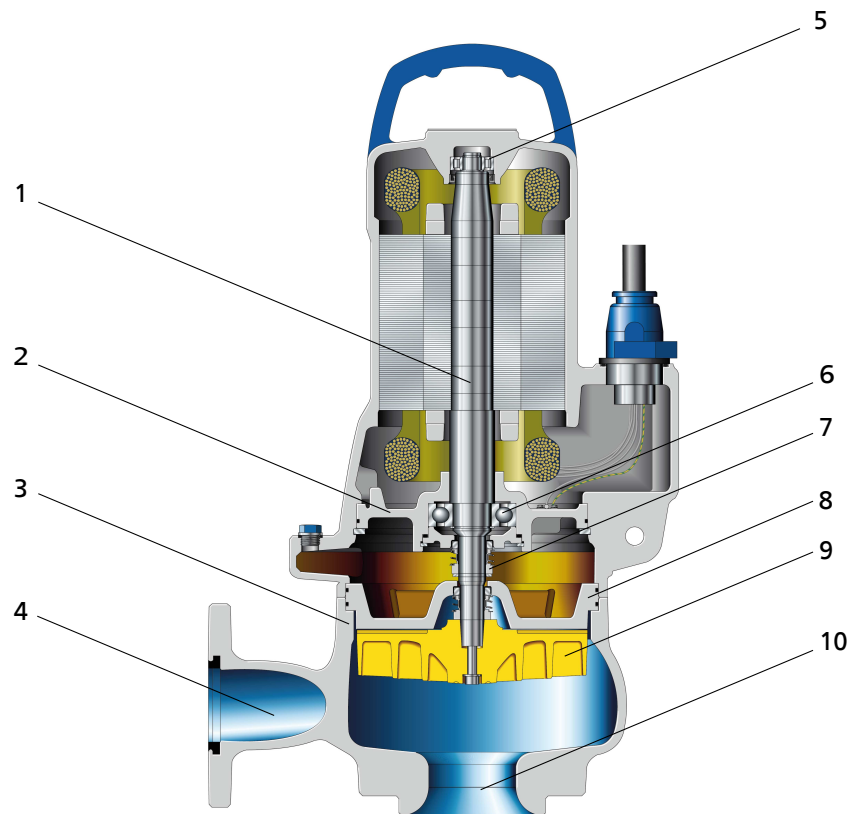


**Fig. 4:** Sectional drawing

|   |                    |    |                   |
|---|--------------------|----|-------------------|
| 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.

### 4.8 Noise characteristics

**Table 7:** Surface sound pressure level ( $L_{pA}$ <sup>5) 6)</sup>) depending on speed (n) and rated power ( $P_2$ )

| $P_2$ | $L_{pA}$                   |                            |                           |
|-------|----------------------------|----------------------------|---------------------------|
|       | n = 2900 min <sup>-1</sup> | n = 1450 min <sup>-1</sup> | n = 960 min <sup>-1</sup> |
| [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 electric cables
- Claw with sealing elements and fasteners
- Lifting rope/lifting chain
- Mounting bracket with fasteners
- Flanged bend and fastening elements
- Guide wire / guide rail  
(guide rails are not included in KSB's scope of supply)

A separate name plate is included in the 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 electric cables
- Foot plate or pump stool with fasteners
- Lifting rope/lifting chain

A separate name plate is included in the 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.

<sup>5</sup> Measured at a distance of 1 m from the pump outline (as per DIN 45635 Parts 1 and 24)

<sup>6</sup> 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 electric cables
- Foundation rails (for horizontal installation)
- Suction-side flanged spacer with inspection hole<sup>7)</sup> (optional)
- Suction elbow (for vertical installation)

A separate name plate is included in the 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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<sup>7</sup> For nominal discharge nozzle diameter  $\geq$  DN 100

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## 5 Installation at Site

### 5.1 Safety regulations

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div data-bbox="507 322 683 360"><b>! DANGER</b></div> <p><b>Improper installation in potentially explosive atmospheres</b></p> <p>Explosion hazard!<br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▸ Comply with the applicable local explosion protection regulations.</li> <li>▸ Observe the information given in the data sheet and on the name plate of the pump set.</li> </ul>                                                                                                              |
|    | <div data-bbox="507 638 683 676"><b>! DANGER</b></div> <p><b>Risk of falling when working at a great height</b></p> <p>Danger to life by falling from a great height!</p> <ul style="list-style-type: none"> <li>▸ Do not step onto the pump (set) during installation work or dismantling work.</li> <li>▸ Pay attention to safety equipment, such as railings, covers, barriers, etc.</li> <li>▸ Observe the applicable local health and occupational safety regulations and accident prevention regulations.</li> </ul> |
|  | <div data-bbox="507 963 683 1001"><b>! DANGER</b></div> <p><b>Persons in the tank during pump operation</b></p> <p>Electric shock!<br/>Risk of injury!<br/>Danger of death from drowning!</p> <ul style="list-style-type: none"> <li>▸ Never start up the pump set when there are persons in the tank.</li> </ul>                                                                                                                                                                                                          |
|  | <div data-bbox="507 1249 702 1288"><b>! WARNING</b></div> <p><b>Hands, other body parts or foreign objects in the impeller or intake area</b></p> <p>Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> <li>▸ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area.</li> <li>▸ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.</li> </ul>                    |
|  | <div data-bbox="507 1568 702 1606"><b>! WARNING</b></div> <p><b>Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up</b></p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▸ Check the pump sump/inlet tank for impermissible solid objects before flooding, and remove, if necessary.</li> </ul>                                                                                                                         |

### 5.2 Checks to be carried out prior to installation

#### 5.2.1 Checking the structural requirements

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

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

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

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

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Electrostatic charging of plastic components (e.g. lifting rope)</b></p> <p>Explosion hazard by electrostatic discharge!</p> <ul style="list-style-type: none"> <li>▷ Make sure that no foreseeable electrostatic charging occurs that may cause the lifting ropes and/or plastic components to become electrostatically charged.</li> <li>▷ If a foreseeable electrostatic charging mechanism exists, using lifting ropes and/or plastic components with low electrical conductivity is impermissible in potentially explosive atmospheres.</li> </ul> |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 5.2.2 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.

### 5.2.3 Preparing the place of installation

#### Place of installation for stationary models

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Installation on mounting surfaces which are unsecured and cannot support the load</b></p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class XS1 to BS 206 .</li> <li>▷ The mounting surface must be set, even, and level.</li> <li>▷ Observe the weights indicated.</li> </ul> |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Incorrect positioning/placing down</b></p> <p>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Position the pump set vertically with the motor on top.</li> <li>▷ Use appropriate means to secure the pump set against tilting and tipping over.</li> <li>▷ Refer to the weights given in the data sheet/on the name plate.</li> </ul> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**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.

#### 5.2.4 Checking the lubricant level

|                                                                                                                                                                        |                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> |  <b>DANGER</b>                                                                                                                                                  |
|                                                                                                                                                                        | <p><b>Excessive temperatures at the shaft seal</b></p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <p>► Regularly check the condition of the lubricant in the lubricant reservoir of the mechanical seal. Top it up if required.</p> |

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

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

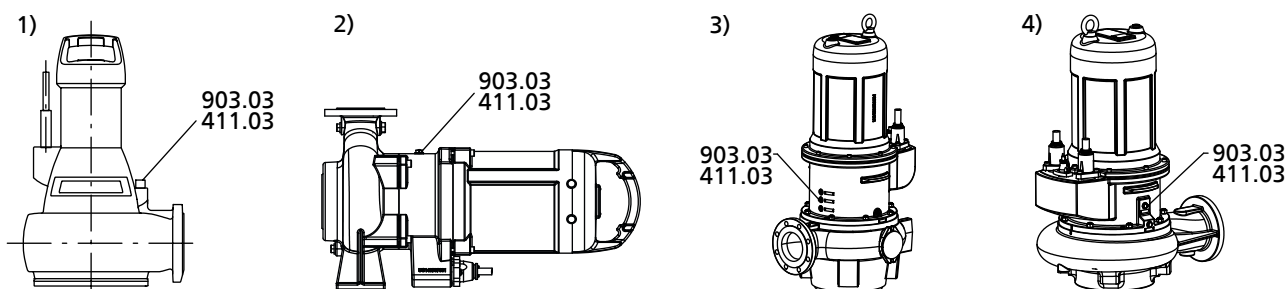


**Fig. 5:** Filling in the lubricant

**Table 8:** Filling in the lubricant

| Motor         | Impeller type        | Variant |   |   |   |
|---------------|----------------------|---------|---|---|---|
|               |                      | 1       | 2 | 3 | 4 |
| 3 2.E-7 2.E   | E, F, K, S           | X       | - | - | - |
| 11 2.E-26 2.E | E, F, K, S           | -       | X | - | - |
| 30 2.E-37 2.E | F, K, D              | -       | X | - | - |
| 55 2.E-75 2.E | D                    | -       | - | X | - |
| 2 4.E-5 4.E   | E, F, K, S           | X       | - | - | - |
| 7 4.E-37 4.E  | D, E, F, K, S, D-max | -       | X | - | - |
| 45 4.E-75 4.E | D                    | -       | - | X | - |
| 45 4.E-75 4.E | E, F, K, D-max       | -       | - | - | X |
| 7 6.E-30 6.E  | D, E, F, K, S, D-max | -       | X | - | - |
| 31 6.E-55 6.E | D                    | -       | - | X | - |
| 31 6.E-55 6.E | E, F, K, D-max       | -       | - | - | X |
| 11 8.E-22 8.E | D, E, F, K, D-max    | -       | X | - | - |
| 30 8.E-45 8.E | D                    | -       | - | X | - |
| 30 8.E-45 8.E | E, F, K, D-max       | -       | - | - | X |

1. Position the pump set as shown.

2. Undo and remove screw plug 903.03 and 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.

### 5.2.5 Checking the direction of rotation

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Pump set running dry</b><br/>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.</li> </ul>                                                                                                                                                 |
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Hands or foreign objects in the pump casing</b><br/>Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Never insert your hands or any other objects into the pump.</li> <li>▷ Check that the inside of the pump is free from any foreign objects.</li> <li>▷ Take suitable precautions (e.g. wear safety goggles).</li> </ul> |
|   | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Improper positioning of pump set when checking the direction of rotation</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use appropriate means to secure the pump set against tilting or tipping over.</li> </ul>                                                                                                |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Pump set running dry</b><br/>Increased vibrations!<br/>Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set for more than 60 seconds without the fluid handled.</li> </ul>                                                                                                                          |

✓ The pump set is connected to the power supply. (⇒ Section 5.4.2, Page 53)

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.

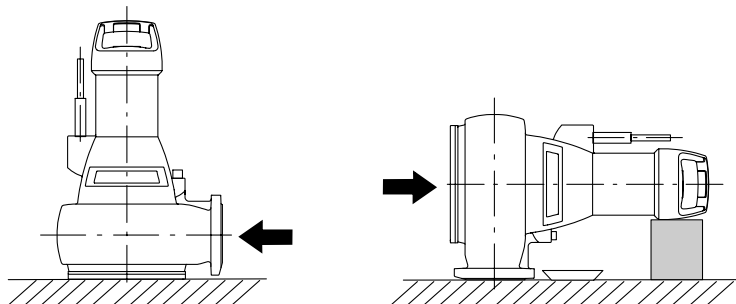


**Fig. 6:** Checking the direction of rotation

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.

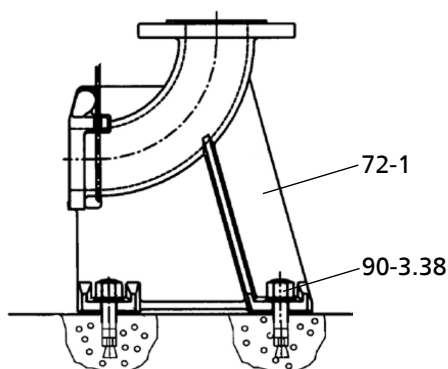


**Fig. 7:** Fastening the duckfoot bend

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

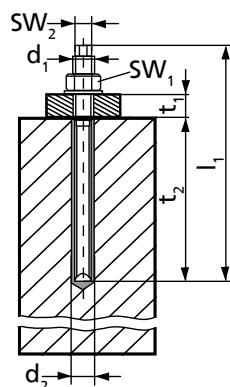


**Fig. 8:** Dimensions

**Table 9:** Chemical anchor dimensions

| Size<br>( $d_1 \times l_1$ ) | $d_2$ | $t_1$ | $t_2$ | $SW_1^{8)}$ | $SW_2^{8)}$ | $M_{d1}$ |
|------------------------------|-------|-------|-------|-------------|-------------|----------|
|                              | [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      |

<sup>8</sup> SW = Width across flats

| Size<br>( $d_1 \times l_1$ )   | $d_2$ | $t_1$ | $t_2$ | $SW_1^{8)}$ | $SW_2^{8)}$ | $M_{d1}$ |
|--------------------------------|-------|-------|-------|-------------|-------------|----------|
|                                | [mm]  |       |       |             |             | [Nm]     |
| M24 $\times$ 300 <sup>9)</sup> | 28    | 65    | 210   | 36          | 17          | 180      |
| M30 $\times$ 380 <sup>9)</sup> | 35    | 65    | 280   | 46          | -           | 400      |

**Table 10:** Curing times of mortar cartridge

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

### 5.3.1.2 Connecting the piping

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Impermissible loads acting on the flange of the bend</b></p> <p>Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> <li>▷ Observe the permissible flange loads.</li> <li>▷ Take appropriate measures to compensate for thermal expansion of the piping.</li> </ul>                                                                                                                                                                                                  |
|   | <div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>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.</p>                                                                                                                                                                                                                                                                                                                                                           |
|  | <div style="background-color: #ffcc00; padding: 5px;"><b>CAUTION</b></div> <p><b>Critical speed of reverse rotation</b></p> <p>Increased vibrations!<br/>Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▷ If long risers are used, fit a swing check valve to prevent excessive rotational speed of the pump running in reverse after it has been stopped.<br/>Watch the venting function when arranging the swing check valve.</li> <li>▷ Observe the maximum permissible speed (depending on the mechanical seal and bearings) in the event of reverse rotation.</li> </ul> |
|  | <div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>For a consultation or any queries please contact KSB Service.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

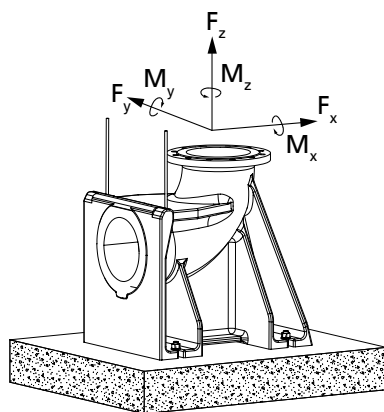


**Fig. 9:** Permissible flange loads

**Table 11:** Permissible flange loads

| Nominal flange diameter | Forces<br>[N] |       |       |            | Moments<br>[Nm] |       |       |            |
|-------------------------|---------------|-------|-------|------------|-----------------|-------|-------|------------|
|                         | $F_y$         | $F_z$ | $F_x$ | $\Sigma F$ | $M_y$           | $M_z$ | $M_x$ | $\Sigma M$ |
| 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       |

### 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 flanged 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.

### Fastening the mounting bracket

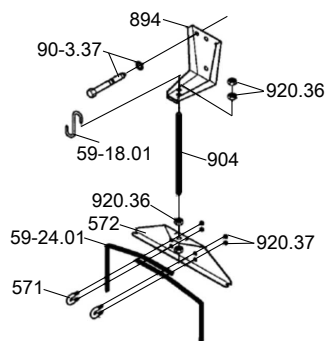


**Fig. 10:** Fitting the mounting bracket

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.

- Fasten fully threaded stud 904 with the pre-assembled clamping arrangement to the mounting bracket with nut 920.36.  
Lightly tighten nut 920.36, allowing sufficient play for subsequently tensioning the guide wire.

## Inserting the guide wire

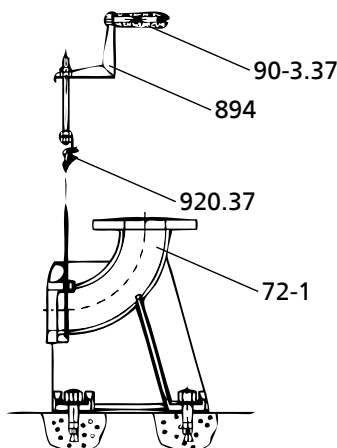


**Fig. 11:** Inserting the guide wire

- Lift clamping piece 571 and insert one end of the guide wire.
- Run wire 59-24.01 around flanged bend 72-1 and back again to suspension bracket 572 and insert it into clamping piece 571.
- Manually tension cable 59-24.01 and secure it by means of hexagon nuts 920.37.
- Pull the wire taut by tightening hexagon nuts 920.36 on the upper side of the mounting bracket to a torque of  $M_A = 14 \text{ Nm}$  and a wire tension force  $P = 6000 \text{ N}$ .
- Secure the nuts with a second hexagon nut.
- The loose cable 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.
- 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 flanged bend which has been fitted to the floor.



### NOTE

The guide rails are not included in the 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

| Size of hydraulic system | Outside diameter | Wall thickness <sup>10)</sup> |      |
|--------------------------|------------------|-------------------------------|------|
|                          |                  | min.                          | max. |
|                          | [mm]             | [mm]                          | [mm] |
| DN 40 to DN 150          | 60               | 2                             | 5    |
| DN 200 to DN 300         | 89               | 3                             | 6    |

<sup>10</sup> To DIN 2440/2442/2462 or equivalent standards

### Fitting the mounting bracket

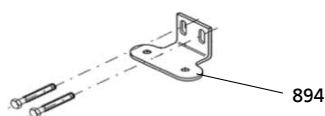


**Fig. 12:** Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the sump opening with suitable fasteners.  
Observe the hole pattern for the fasteners.  
See outline drawing. (⇒ Section 1.4, Page 10)

### 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.

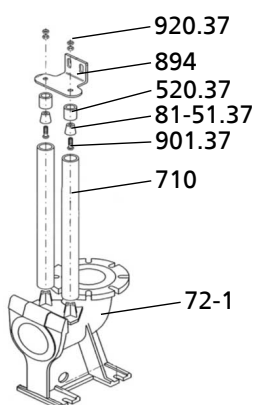


**Fig. 13:** Fitting the guide rails

1. Place rails 710 onto the conical bosses provided on flanged 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 mounting 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

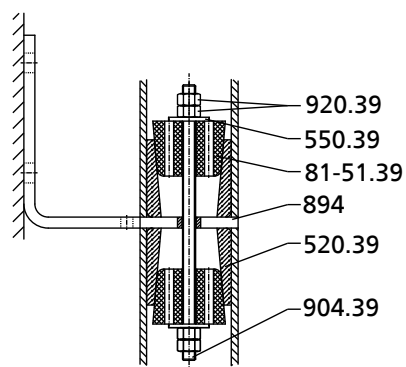


**Fig. 14:** Fitting the middle support

- ✓ The middle support has been properly fitted to the riser or to a cross-beam.

  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. Fit and tighten the locknuts.

### 5.3.1.5 Preparing the pump set

#### Fitting the bracket

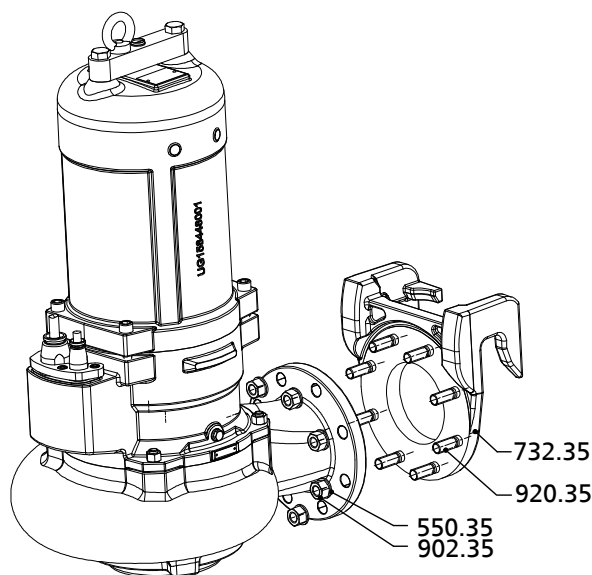


**Fig. 15:** Fitting the bracket

1. Fasten claw 732 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35. Observe the tightening torques..  
Schraubenanzugsmomente beachten.
2. Fit profile seal 410 in the groove of the claw.  
This will seal the base elbow/pump connection.

### Attaching the chain / lifting rope

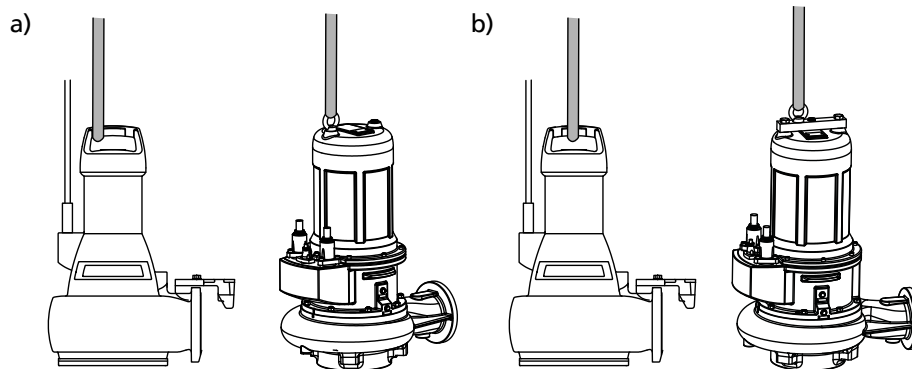


**Fig. 16:** Attaching the chain / lifting rope for stationary wet installation a) with guide wire arrangement b) with guide rail arrangement

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 flanged 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 wire / guide rails and slowly lower it down.

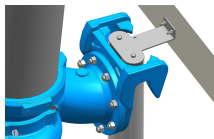


**Fig. 17:** Attaching the claw

⇒ The pump set attaches itself to flanged bend 72-1.

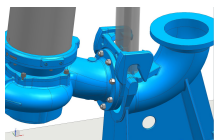


**Fig. 18:** Claw on flanged bend

2. Attach the chain / lifting rope to hook 59-18 at the mounting bracket.

### 5.3.2 Transportable wet-installed model

#### Attaching the lifting chain / lifting rope

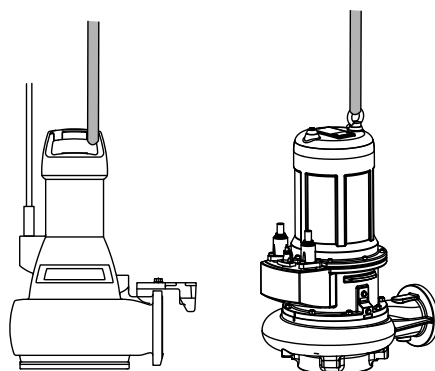


**Fig. 19:** Attaching the lifting chain / lifting rope (transportable wet-installed model)

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.

(⇒ Section 7.6, Page 101)

#### Connecting the piping

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

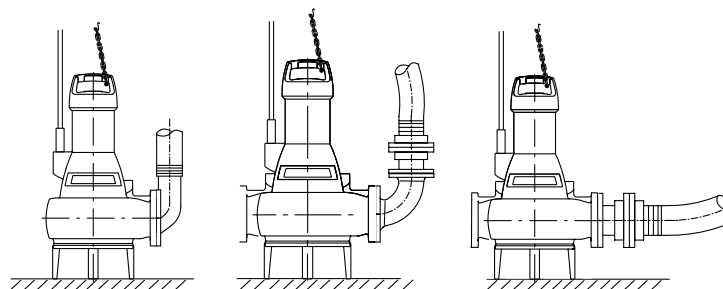


**Fig. 20:** Connection options

### 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 ( $L$ )  $\geq 800$  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.

|  |                                                                                                                                   |
|--|-----------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b>                                                                                                                    |
|  | <p><b>Improper handling of resin</b></p> <p>Skin sensitisation and/or irritation!</p> <p>▷ Wear suitable protective clothing.</p> |

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**

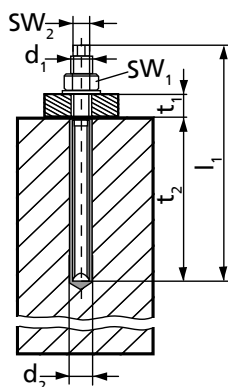


**Fig. 21:** Dimensions

**Table 13:** Chemical anchor dimensions

| Size<br>( $d_1 \times l_1$ ) | $d_2$ | $t_1$ | $t_2$ | $SW_1^{11)}$ | $SW_2^{11)}$ | $M_{d1}$ |
|------------------------------|-------|-------|-------|--------------|--------------|----------|
|                              | [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 <sup>12)</sup>     | 28    | 65    | 210   | 36           | 17           | 180      |
| M30 × 380 <sup>12)</sup>     | 35    | 65    | 280   | 46           | -            | 400      |

**Table 14:** Curing times of mortar cartridge

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

<sup>11</sup> SW = Width across flats

<sup>12</sup> Mounting accessories of the respective manufacturer are required.

### 5.3.3.2 Piping

#### 5.3.3.2.1 Connecting the piping

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <div data-bbox="507 315 683 353" style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Impermissible loads acting on the pump nozzles</b></p> <p>Danger to life from leakage of hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> <li>▷ Do not use the pump as an anchorage point for the piping.</li> <li>▷ Anchor the pipelines in close proximity to the pump and connect them properly without transmitting any stresses or strains.</li> <li>▷ Observe the permissible forces and moments at the pump nozzles.</li> <li>▷ Take appropriate measures to compensate for thermal expansion of the piping.</li> </ul> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <div data-bbox="507 678 643 712" style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Incorrect earthing during welding work at the piping</b></p> <p>Destruction of rolling element bearings (pitting effect)!</p> <ul style="list-style-type: none"> <li>▷ Never earth the electric welding equipment on the pump or baseplate.</li> <li>▷ Prevent current flowing through the rolling element bearings.</li> </ul>                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <div data-bbox="507 929 590 963" style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>Installing check valves and shut-off elements in the system is recommended, depending on the type of plant and pump. Install the pump without any obstructions to its drainage or removal.</p>                                                                                                                                                                                                                                                                                                                                                           |
| <ul style="list-style-type: none"> <li>✓ The suction lift line has been laid with a rising slope, the suction head line with a downward slope towards the pump.<sup>13)</sup></li> <li>✓ A flow stabilisation section having a length equivalent to at least five times the diameter of the suction flange has been provided upstream of the suction flange.<sup>13)</sup></li> <li>✓ The nominal sizes of the pipelines are equal to or greater than the nominal sizes of the pump nozzles.<sup>13)</sup></li> <li>✓ To prevent excessive pressure losses, adapters to larger nominal diameters are designed with a diffuser angle of approx. 8°.<sup>13)</sup></li> <li>✓ The pipelines have been anchored in close proximity to the pump or, for vertical installation, in close proximity to the suction elbow and connected without transmitting any stresses or strains.<sup>13)</sup></li> </ul> <ol style="list-style-type: none"> <li>1. Thoroughly clean, flush and blow through all vessels, pipes and connections (especially of new installations).</li> <li>2. Before installation in the piping, remove the flange covers on the suction nozzle and the discharge nozzle.</li> <li>3. Connect the pump nozzles to the piping.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <div data-bbox="507 1736 643 1769" style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Pumps connected with unbraced expansion joints</b></p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ To prevent impermissible nozzle loads, never connect the pump with unbraced expansion joints.</li> </ul>                                                                                                                                                                                                                                                                                                                            |

<sup>13</sup> If suction line requirements cannot be met, contact KSB Service.

4. If the owner / operator supplies an expansion joint, it has to be braced with external tie rods to prevent impermissible nozzle loads.

### 5.3.3.2 Permissible forces and moments at the pump nozzles

#### Installation on pump feet (horizontal)

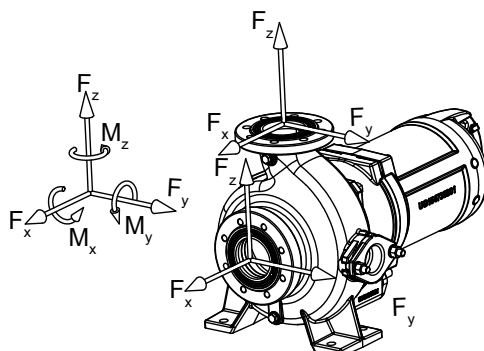


**Fig. 22:** Forces and moments at the pump nozzles for installation on pump feet

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 BS ISO 5199 for horizontal installation of pump family 1A for cast iron at 20 °C.

**Table 15:** Forces [N] and moments [Nm] at the pump nozzles

| Size    | Impeller type | Suction nozzle |                |                |      |                |                |                |      | Discharge nozzle |                |                |      |                |                |                |     |
|---------|---------------|----------------|----------------|----------------|------|----------------|----------------|----------------|------|------------------|----------------|----------------|------|----------------|----------------|----------------|-----|
|         |               | Forces [N]     |                |                |      | Moments [Nm]   |                |                |      | Forces [N]       |                |                |      | Moments [Nm]   |                |                |     |
|         |               | F <sub>y</sub> | F <sub>z</sub> | F <sub>x</sub> | ΣF   | M <sub>y</sub> | M <sub>z</sub> | M <sub>x</sub> | ΣM   | F <sub>y</sub>   | F <sub>z</sub> | F <sub>x</sub> | ΣF   | M <sub>y</sub> | M <sub>z</sub> | M <sub>x</sub> | ΣM  |
|         |               | (+/-)          |                |                |      | (+/-)          |                |                |      | (+/-)            |                |                |      | (+/-)          |                |                |     |
| 40-252  | F, K          | 650            | 600            | 750            | 1150 | 400            | 400            | 550            | 750  | 350              | 450            | 400            | 700  | 300            | 350            | 450            | 650 |
| 50-215  | F             | 650            | 600            | 750            | 1150 | 400            | 400            | 550            | 750  | 500              | 600            | 550            | 900  | 350            | 400            | 500            | 700 |
| 50-216  | F             | 650            | 600            | 750            | 1150 | 400            | 400            | 550            | 750  | 500              | 600            | 550            | 900  | 350            | 400            | 500            | 700 |
| 65-215  | F             | 800            | 700            | 900            | 1400 | 400            | 450            | 600            | 800  | 600              | 750            | 650            | 1150 | 400            | 400            | 550            | 750 |
| 65-216  | E             | 800            | 700            | 900            | 1400 | 400            | 450            | 600            | 800  | 600              | 750            | 650            | 1150 | 400            | 400            | 550            | 750 |
| 65-217  | F             | 800            | 700            | 900            | 1400 | 400            | 450            | 600            | 800  | 600              | 750            | 650            | 1150 | 400            | 400            | 550            | 750 |
| 80-215  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-216  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-216  | E             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-217  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-252  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-253  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-253  | E, K          | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-315  | D             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-315  | K             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-317  | D             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 80-317  | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 700              | 900            | 800            | 1400 | 400            | 450            | 600            | 800 |
| 100-215 | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-253 | E             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-253 | K             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-253 | D             | 1600           | 1400           | 1750           | 2750 | 600            | 700            | 900            | 1300 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-254 | F             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-254 | K             | 1050           | 950            | 1200           | 1850 | 450            | 500            | 600            | 900  | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-315 | D             | 1250           | 1100           | 1400           | 2150 | 550            | 650            | 750            | 1050 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-316 | D             | 1600           | 1400           | 1750           | 2750 | 600            | 700            | 900            | 1300 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-316 | F, K          | 1600           | 1400           | 1750           | 2750 | 600            | 700            | 900            | 1300 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-317 | E             | 1250           | 1100           | 1400           | 2150 | 550            | 650            | 750            | 1050 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |
| 100-400 | K             | 1600           | 1400           | 1750           | 2750 | 600            | 700            | 900            | 1300 | 950              | 1200           | 1050           | 1850 | 450            | 500            | 600            | 900 |

| Size    | Impeller type | Suction nozzle |       |       |            |              |       |       |            | Discharge nozzle |       |       |            |              |       |       |            |
|---------|---------------|----------------|-------|-------|------------|--------------|-------|-------|------------|------------------|-------|-------|------------|--------------|-------|-------|------------|
|         |               | Forces [N]     |       |       |            | Moments [Nm] |       |       |            | Forces [N]       |       |       |            | Moments [Nm] |       |       |            |
|         |               | $F_y$          | $F_z$ | $F_x$ | $\Sigma F$ | $M_y$        | $M_z$ | $M_x$ | $\Sigma M$ | $F_y$            | $F_z$ | $F_x$ | $\Sigma F$ | $M_y$        | $M_z$ | $M_x$ | $\Sigma M$ |
|         |               | (+/-)          |       |       |            | (+/-)        |       |       |            | (+/-)            |       |       |            | (+/-)        |       |       |            |
| 100-401 | E, F, K       | 1250           | 1100  | 1400  | 2150       | 550          | 650   | 750   | 1050       | 950              | 1200  | 1050  | 1850       | 450          | 500   | 600   | 900        |
| 100-403 | D             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 950              | 1200  | 1050  | 1850       | 450          | 500   | 600   | 900        |
| 150-253 | D             | 1600           | 1400  | 1750  | 2750       | 600          | 700   | 900   | 1300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-315 | F             | 1600           | 1400  | 1750  | 2750       | 600          | 700   | 900   | 1300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-315 | D             | 1600           | 1400  | 1750  | 2750       | 600          | 700   | 900   | 1300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-317 | E, K          | 1600           | 1400  | 1750  | 2750       | 600          | 700   | 900   | 1300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-317 | D             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-400 | D, K          | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-401 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-401 | E, F          | 1600           | 1400  | 1750  | 2750       | 600          | 700   | 900   | 1300       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-403 | D             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 150-403 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 151-403 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1400             | 1750  | 1600  | 2750       | 600          | 700   | 900   | 1300       |
| 200-315 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-315 | D             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-316 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-317 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-318 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-400 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-401 | E             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-402 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-402 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-403 | K             | 2100           | 1900  | 2350  | 3650       | 800          | 950   | 1150  | 1700       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 200-405 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 1900             | 2350  | 2100  | 3650       | 800          | 950   | 1150  | 1700       |
| 250-400 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 2400             | 2950  | 2600  | 4550       | 1100         | 1300  | 1550  | 2300       |
| 250-401 | K             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 2400             | 2950  | 2600  | 4550       | 1100         | 1300  | 1550  | 2300       |
| 250-402 | D             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 2400             | 2950  | 2600  | 4550       | 1100         | 1300  | 1550  | 2300       |
| 250-403 | K             | 2600           | 2400  | 2950  | 4550       | 1100         | 1300  | 1550  | 2300       | 2400             | 2950  | 2600  | 4550       | 1100         | 1300  | 1550  | 2300       |
| 300-400 | D, K          | 3150           | 2800  | 3500  | 5500       | 1500         | 1750  | 2100  | 3100       | 2800             | 3500  | 3150  | 5500       | 1500         | 1750  | 2100  | 3100       |
| 300-401 | K             | 3150           | 2800  | 3500  | 5500       | 1500         | 1750  | 2100  | 3100       | 2800             | 3500  | 3150  | 5500       | 1500         | 1750  | 2100  | 3100       |
| 300-402 | D             | 3150           | 2800  | 3500  | 5500       | 1500         | 1750  | 2100  | 3100       | 2800             | 3500  | 3150  | 5500       | 1500         | 1750  | 2100  | 3100       |
| 300-403 | K             | 3150           | 2800  | 3500  | 5500       | 1500         | 1750  | 2100  | 3100       | 2800             | 3500  | 3150  | 5500       | 1500         | 1750  | 2100  | 3100       |

### Installation on a suction elbow (vertical)

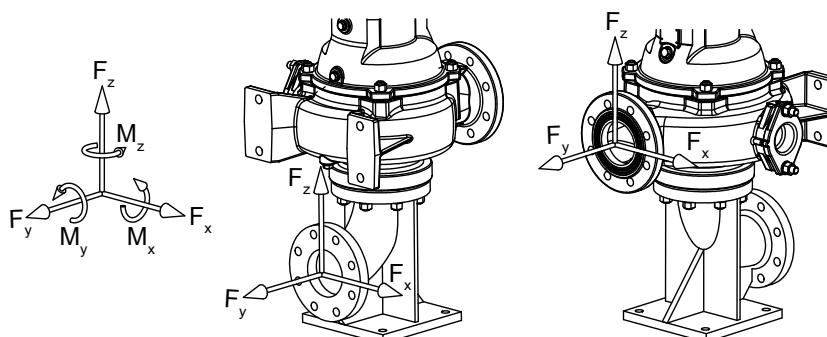


**Fig. 23:** Forces and moments at the pump nozzles for installation on a suction elbow

**Table 16:** Forces [N] and moments [Nm] at the pump nozzles

| Size    | Impeller type | Suction nozzle |                |                |       |                |                |                |      | Discharge nozzle |                |                |      |                |                |                |      |
|---------|---------------|----------------|----------------|----------------|-------|----------------|----------------|----------------|------|------------------|----------------|----------------|------|----------------|----------------|----------------|------|
|         |               | Forces [N]     |                |                |       | Moments [Nm]   |                |                |      | Forces [N]       |                |                |      | Moments [Nm]   |                |                |      |
|         |               | F <sub>y</sub> | F <sub>z</sub> | F <sub>x</sub> | ΣF    | M <sub>y</sub> | M <sub>z</sub> | M <sub>x</sub> | ΣM   | F <sub>y</sub>   | F <sub>z</sub> | F <sub>x</sub> | ΣF   | M <sub>y</sub> | M <sub>z</sub> | M <sub>x</sub> | ΣM   |
|         |               | (+/-)          |                |                |       | (+/-)          |                |                |      | (+/-)            |                |                |      | (+/-)          |                |                |      |
| 40-252  | F, K          | 1700           | 2100           | 1850           | 3300  | 1100           | 1200           | 1500           | 2200 | 450              | 350            | 400            | 700  | 300            | 350            | 450            | 650  |
| 50-215  | F             | 1700           | 2100           | 1850           | 3300  | 1100           | 1200           | 1500           | 2200 | 600              | 500            | 550            | 900  | 350            | 400            | 500            | 700  |
| 50-216  | F             | 1700           | 2100           | 1850           | 3300  | 1100           | 1200           | 1500           | 2200 | 600              | 500            | 550            | 900  | 350            | 400            | 500            | 700  |
| 65-215  | F             | 2050           | 2500           | 2250           | 3950  | 1150           | 1300           | 1600           | 2350 | 750              | 600            | 650            | 1150 | 400            | 400            | 550            | 750  |
| 65-216  | E             | 2050           | 2500           | 2250           | 3950  | 1150           | 1300           | 1600           | 2350 | 750              | 600            | 650            | 1150 | 400            | 400            | 550            | 750  |
| 65-217  | F             | 2050           | 2500           | 2250           | 3950  | 1150           | 1300           | 1600           | 2350 | 750              | 600            | 650            | 1150 | 400            | 400            | 550            | 750  |
| 80-215  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-216  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-216  | E             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-217  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-252  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-253  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-253  | E, K          | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-315  | D             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-315  | K             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-317  | D             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 80-317  | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 900              | 700            | 800            | 1400 | 400            | 450            | 600            | 800  |
| 100-215 | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-253 | E             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-253 | K             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-253 | D             | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-254 | F             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-254 | K             | 2700           | 3350           | 3000           | 5250  | 1250           | 1450           | 1750           | 2600 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-315 | D             | 3200           | 3950           | 3550           | 6200  | 1500           | 1900           | 2100           | 3050 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-316 | D             | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-316 | F, K          | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 100-317 | E             | 3200           | 3950           | 3550           | 6200  | 1500           | 1900           | 2100           | 3050 | 1200             | 950            | 1050           | 1850 | 450            | 500            | 600            | 900  |
| 150-253 | D             | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1750             | 1400           | 1600           | 2750 | 600            | 700            | 900            | 1300 |
| 150-315 | F             | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1750             | 1400           | 1600           | 2750 | 600            | 700            | 900            | 1300 |
| 150-315 | D             | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1750             | 1400           | 1600           | 2750 | 600            | 700            | 900            | 1300 |
| 150-317 | E, K          | 4050           | 5000           | 4500           | 7850  | 1750           | 2050           | 2500           | 3650 | 1750             | 1400           | 1600           | 2750 | 600            | 700            | 900            | 1300 |
| 150-317 | D             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 1750             | 1400           | 1600           | 2750 | 600            | 700            | 900            | 1300 |
| 200-315 | K             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 2350             | 1900           | 2100           | 3650 | 800            | 950            | 1150           | 1700 |
| 200-315 | D             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 2350             | 1900           | 2100           | 3650 | 800            | 950            | 1150           | 1700 |
| 200-316 | K             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 2350             | 1900           | 2100           | 3650 | 800            | 950            | 1150           | 1700 |
| 200-317 | K             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 2350             | 1900           | 2100           | 3650 | 800            | 950            | 1150           | 1700 |
| 200-318 | K             | 5400           | 6700           | 6000           | 10450 | 2300           | 2650           | 3250           | 4800 | 2350             | 1900           | 2100           | 3650 | 800            | 950            | 1150           | 1700 |

### 5.3.3.2.3 Vacuum balance line

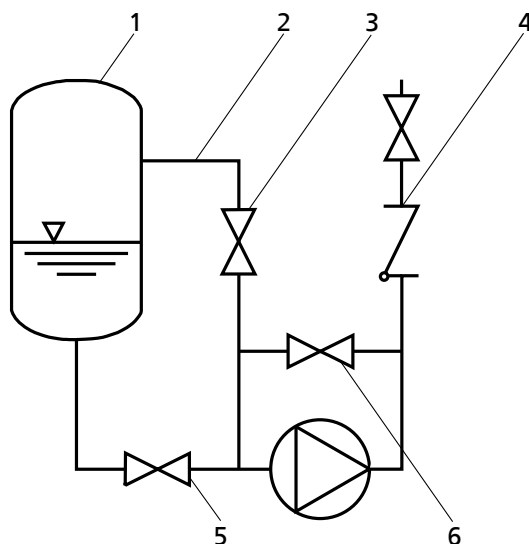


#### NOTE

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. 24:** 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:

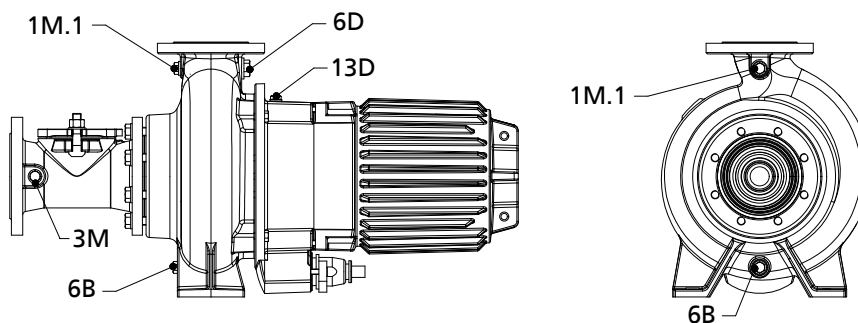

**Fig. 25:** Auxiliary connections

**Table 17:** Size of auxiliary connections

| Size    | Impeller type | Connection     |         |                       |              | Oil filler opening |
|---------|---------------|----------------|---------|-----------------------|--------------|--------------------|
|         |               | Pressure gauge | Vent    | Pressure/vacuum gauge | Casing drain |                    |
|         |               | 1 M.1          | 6 D     | 3 M                   | 6 B          |                    |
| 40-252  | F, K, S       | G 1/2          | G 1/2   | G 1/2                 | G 1/2        | G 1/2              |
| 50-215  | F             | G 1/2          | G 1/2   | G 1/2                 | G 1/2        | G 1/2              |
| 50-216  | F             | G 1/2          | G 1/2   | G 1/2                 | G 1/2        | G 1/2              |
| 50-216  | 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             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 80-216  | 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             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 80-315  | K             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 80-317  | D             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 80-317  | 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             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 100-253 | 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             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 100-315 | E             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 100-315 | F, K          | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 100-316 | D             | G 1/2          | G 1     | G 1/2                 | G 1/2        | G 1/2              |
| 100-316 | 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              |
| 100-403 | D             | 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             | G 1/2          | G 1     | G 1/2                 | G 1          | G 1/2              |
| 150-315 | 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              |
| 150-317 | D             | G 1/2          | G 1     | G 1/2                 | G 1          | G 1/2              |
| 150-400 | D             | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 150-400 | K             | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 150-401 | D             | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 150-401 | E, F          | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 150-403 | D             | 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             | G 1/2          | G 1     | G 1/2                 | G 1          | G 1/2              |

| Size    | Impeller type | Connection     |         |                       |              | Oil filler opening |
|---------|---------------|----------------|---------|-----------------------|--------------|--------------------|
|         |               | Pressure gauge | Vent    | Pressure/vacuum gauge | Casing drain |                    |
|         |               | 1 M.1          | 6 D     | 3 M                   | 6 B          |                    |
| 200-315 | 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              |
| 200-401 | E             | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 200-402 | D             | 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              |
| 200-405 | D             | 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              |
| 250-402 | D             | 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             | G 1/2          | G 1 1/4 | G 1/2                 | G 1          | G 1/2              |
| 300-400 | 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              |
| 300-402 | D             | 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 9.5, Page 127)



#### NOTE

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

The motors can be connected to electrical low-voltage grids with rated voltages and voltage tolerances to IEC 60038. Observe the permissible tolerances.  
(⇒ Section 6.2.2, Page 59)

#### 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 9.5.2.1, Page 128)
- Pump sets with one power cable 4G16 (⇒ Section 9.5.2.5, Page 132)

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 23)  
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.

### 5.4.1.3 Level control

|                                                                                   |                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Pump set running dry</b><br/>Explosion hazard!</p> <p>▷ Never allow an explosion-proof pump set to run dry!</p>                                                    |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Fluid level below the specified minimum</b><br/>Damage to the pump set by cavitation!</p> <p>▷ Never allow the fluid level to drop below the specified minimum.</p> |

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

### 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.

|                                                                                     |                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Operation outside the permitted frequency range</b><br/>Explosion hazard!</p> <p>▷ Never operate an explosion-proof pump set outside the specified range.</p>                     |
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Incorrect selection and setting of the frequency inverter</b><br/>Explosion hazard!</p> <p>▷ Observe the following information on selecting and setting a frequency inverter.</p> |

**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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>! DANGER</b></div> <p><b>Operating an incompletely connected pump set</b></p> <p>Explosion hazard!<br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.</li> </ul> |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Incorrect wiring</b></p> <p>Damage to the sensors!</p> <ul style="list-style-type: none"> <li>▷ Observe the limits stated in the following sections of this manual when connecting the sensors.</li> </ul>                                                                  |

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

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

|                                                                                     |                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>Reliable and safe operation of the pump within the scope of our warranty is only possible if the sensor signals are properly analysed as stipulated in this manual.</p> |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

All sensors are located inside the pump set and connected to the electric cables. 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

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div data-bbox="507 291 683 331"> <b>DANGER</b></div> <div data-bbox="494 353 719 383"><b>Insufficient cooling</b></div> <div data-bbox="494 392 686 418">Explosion hazard!</div> <div data-bbox="494 427 686 456">Winding damage!</div> <div data-bbox="517 468 1366 526"> <ul style="list-style-type: none"> <li>▷ Never operate an explosion-proof pump set without operational temperature monitoring.</li> </ul> </div> |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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.

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div data-bbox="507 775 702 815"> <b>WARNING</b></div> <div data-bbox="494 837 852 866"><b>Incorrect electrical installation</b></div> <div data-bbox="494 875 655 902">Electric shock!</div> <div data-bbox="517 913 911 943"> <ul style="list-style-type: none"> <li>▷ Adequately insulate conductor 22.</li> </ul> </div> |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

For an explosion-proof pump set (motor version XE, YE or ZE) use the temperature switches for motor temperature 2 (terminals 21 and 22, max. 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 a 12-core power cable or several electric cables

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div data-bbox="507 1205 683 1245"> <b>DANGER</b></div> <div data-bbox="494 1267 719 1296"><b>Insufficient cooling</b></div> <div data-bbox="494 1305 686 1332">Explosion hazard!</div> <div data-bbox="494 1341 686 1370">Winding damage!</div> <div data-bbox="517 1382 1431 1543"> <ul style="list-style-type: none"> <li>▷ Never operate a pump set without operational temperature monitoring equipment.</li> <li>▷ For explosion-proof pump sets use a thermistor motor protection relay with manual reset and certification for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.</li> </ul> </div> |
|  | <div data-bbox="507 1588 641 1619"><b>CAUTION</b></div> <div data-bbox="494 1644 681 1673"><b>Incorrect wiring</b></div> <div data-bbox="494 1682 686 1711">Winding damage!</div> <div data-bbox="517 1722 1276 1751"> <ul style="list-style-type: none"> <li>▷ Never rely on the PTC thermistors alone for temperature monitoring.</li> </ul> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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 series-connected PTC thermistors (terminals 10 and 11) in addition to the above. They must be connected to a thermistor tripping unit with manual reset and approval for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors with "flameproof enclosure" Ex db type of protection.

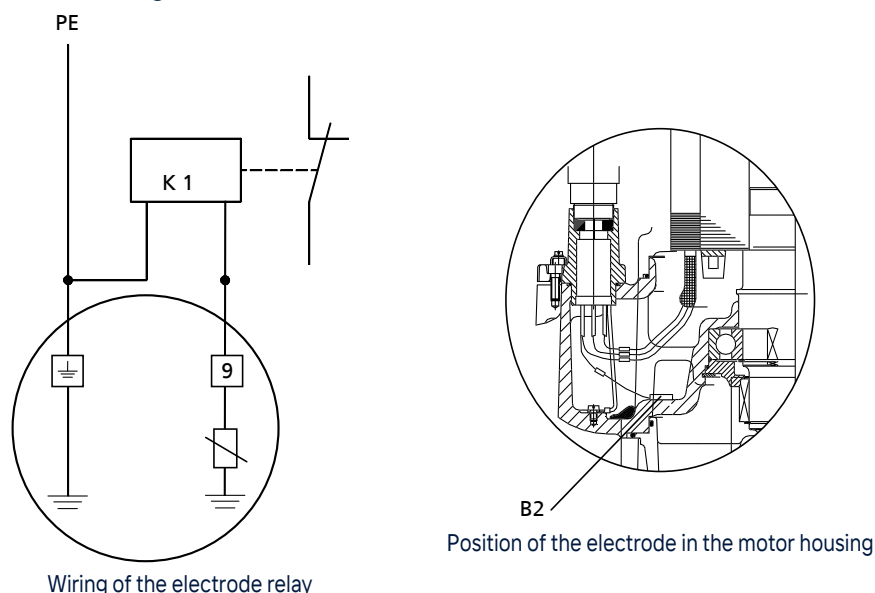
### Pump sets of installation types D, H or K

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px; margin-bottom: 10px;">  <b>DANGER</b> </div> <p><b>Insufficient cooling</b></p> <p>Explosion hazard!<br/>Winding damage!</p> <ul style="list-style-type: none"> <li>▷ Never operate a pump set without operational temperature monitoring equipment.</li> <li>▷ For explosion-proof pump sets use a thermistor motor protection relay with manual reset and certification for use in potentially explosive atmospheres for monitoring the temperature of explosion-proof motors in "flameproof enclosure" type of protection.</li> </ul> |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

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

#### 5.4.1.5.2 Leakage inside the motor



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 trip the motor at an electrical resistance between 3 and 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).

Set the following limits:

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

#### 5.4.2 Connection to power supply

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Electrical connection work by unqualified personnel</b><br/>           Danger of death from electric shock and explosion!</p> <ul style="list-style-type: none"> <li>▸ Always have the electrical connections installed by an electrically qualified person.</li> <li>▸ Observe regulations IEC 60364 and, for explosion-proof versions, BS 60079 .</li> </ul>                                         |
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Incorrect connection to the mains</b><br/>           Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> <li>▸ Observe the technical specifications of the local energy supply companies.</li> </ul>                                                                                                                                                            |
|   | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Improper routing of electric cables</b><br/>           Damage to the electric cables!</p> <ul style="list-style-type: none"> <li>▸ Never move the electric cables at temperatures below -25 °C.</li> <li>▸ Never kink or crush the electric cables.</li> <li>▸ Never lift the pump set by the electric cables.</li> <li>▸ Adjust the length of the electric cables to the site requirements.</li> </ul> |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Motor overload</b><br/>           Damage to the motor!</p> <ul style="list-style-type: none"> <li>▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.</li> </ul>                                                                                                                                                                   |

For electrical connection observe the wiring diagram (⇒ Section 9.5, Page 127) and the information for planning the control system (⇒ Section 5.4.1, Page 48) .

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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Incorrect wiring</b><br/>           Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ 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.</li> </ul> |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div> <b>DANGER</b></div> <p><b>Operating an incompletely connected pump set</b><br/>Explosion hazard!<br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▶ Never start up a pump set with incompletely connected electric cables or non-operational monitoring devices.</li> </ul>                                   |
|  | <div> <b>DANGER</b></div> <p><b>Connection of damaged electric cables</b><br/>Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▶ Check the electric cables for any damage before connecting them.</li> <li>▶ Never connect damaged electric cables.</li> <li>▶ Replace damaged electric cables.</li> </ul> |
|  | <div><b>CAUTION</b></div> <p><b>Flow-induced motion</b><br/>Damage to the cable!</p> <ul style="list-style-type: none"> <li>▶ If the pump is installed in a tank, run the electric cables directly upwards without slack.</li> </ul>                                                                                                                                                                                       |

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

#### 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).

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div> <b>DANGER</b></div> <p><b>Incorrect wiring</b><br/>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▶ Explosion-proof pump sets installed in a tank must never be retrofitted with an external potential equalisation connection!</li> </ul> |
|  | <div> <b>DANGER</b></div> <p><b>Touching the pump set during operation</b><br/>Electric shock!</p> <ul style="list-style-type: none"> <li>▶ Make sure that the pump set cannot be touched during operation.</li> </ul>                                         |

##### 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.

### Connecting the potential equalisation conductor

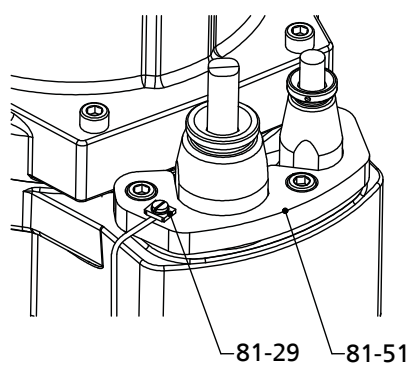


**Fig. 26:** Connecting the potential equalisation conductor

|       |                     |
|-------|---------------------|
| 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

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been filled 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 63)

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #e67e22; color: white; padding: 5px;"> <b>DANGER</b></div> <p><b>Persons in the tank during pump operation</b></p> <p>Electric shock!<br/>Risk of injury!<br/>Danger of death from drowning!</p> <p>▷ Never start up the pump set when there are persons in the tank.</p>                             |
|  | <div style="background-color: #e67e22; color: white; padding: 5px;"> <b>DANGER</b></div> <p><b>Exceeding the operating limits</b></p> <p>Pump casing could burst/leak!<br/>Pressurised hot or toxic fluid could escape!<br/>Flying parts!</p> <p>▷ Maintain an adequate safety distance from pump sets which are in operation.</p> |

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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #e67e22; color: white; padding: 5px;"> <b>DANGER</b></div> <p><b>Shaft seal failure caused by insufficient lubrication</b></p> <p>Hot or toxic fluid could escape!<br/>Damage to the pump!</p> <p>▷ Before starting up the pump set, vent the pump and suction line and prime both with the fluid to be handled.</p> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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).

### 6.1.3 Start-up

#### Wet installation (installation types K, P, S)

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

✓ The fluid level is sufficiently high.

|                                                                                   |                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION</b>                                                                                                                                                                                                                                          |
|                                                                                   | <p><b>Start-up against a closed shut-off element</b></p> <p>Increased vibrations!</p> <p>Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set against a closed shut-off element.</li> </ul> |

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

#### Dry installation (installation types D and H)

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>⚠ DANGER</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                     | <p><b>Non-compliance with the permissible pressure limits and temperature limits if the pump is operated with the suction line and discharge line closed</b></p> <p>Explosion hazard!</p> <p>Hot or toxic fluids escaping!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump with the shut-off elements in the suction line and/or discharge line closed.</li> <li>▷ Only start up the pump set against a slightly open discharge-side shut-off element.</li> </ul> |

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>⚠ DANGER</b>                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                     | <p><b>Excessive temperatures due to dry running or excessive gas content in the fluid handled</b></p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Prime the pump as per operating instructions.</li> <li>▷ Always operate the pump within the permissible operating range.</li> </ul> |

|                                                                                     |                                                                                                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>⚠ WARNING</b>                                                                                                                                 |
|                                                                                     | <p><b>Hot surface</b></p> <p>Risk of burns</p> <ul style="list-style-type: none"> <li>▷ Never touch a pump set which is in operation.</li> </ul> |

|                                                                                   |                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>! WARNING</b>                                                                                                                                                                                                                                                   |
|                                                                                   | <b>Very high noise emission during operation</b><br>Personal injury!<br><ul style="list-style-type: none"> <li>▷ Minimise exposure in the vicinity of the pump set.</li> <li>▷ For required work near running pump sets use appropriate ear protection.</li> </ul> |

|                                                                                   |                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>! WARNING</b>                                                                                                                                                                                                                                                                       |
|                                                                                   | <b>Abnormal noises, vibrations, temperatures or leakage</b><br>Damage to the pump!<br>Risk of personal injury!<br><ul style="list-style-type: none"> <li>▷ Switch off the pump (set) immediately.</li> <li>▷ Eliminate the causes before returning the pump set to service.</li> </ul> |

- ✓ 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.

|                                                                                    |                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION</b>                                                                                                                                                                                                                        |
|                                                                                    | <b>Start-up against open discharge line</b><br>Motor overload!<br><ul style="list-style-type: none"> <li>▷ Make sure the motor has sufficient power reserves.</li> <li>▷ Use a soft starter.</li> <li>▷ Use speed control.</li> </ul> |

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.

|                                                                                     |                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>NOTE</b>                                                                                                                                                                                      |
|                                                                                     | 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.

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

## 6.2 Operating limits

|  |  <b>DANGER</b>                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <p><b>Non-compliance with operating limits</b><br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Comply with the operating data specified in the data sheet.</li> <li>▷ 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.</li> <li>▷ Never operate the pump set outside the limits specified below.</li> </ul> |

### 6.2.1 Frequency of starts

|  | CAUTION                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <p><b>Excessive frequency of starts</b><br/>Risk of damage to the motor!</p> <ul style="list-style-type: none"> <li>▷ Never exceed the specified frequency of starts.</li> </ul> |

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

|  |  <b>DANGER</b>                                                                                                                             |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | <p><b>Permissible tolerances for operation on mains power exceeded</b><br/>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never operate an explosion-proof pump (set) outside the specified range.</li> </ul> |

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

|                                                                                   |                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Operation outside the permitted frequency range</b><br/>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never operate an explosion-proof pump set outside the specified range.</li> </ul>                                                  |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Pumping solids-laden fluids at reduced speed</b><br/>Increased wear and clogging!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.</li> </ul> |

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

|                                                                                    |                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Danger of freezing!</b><br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Drain the pump set or protect it against freezing.</li> </ul> |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

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

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

|                                                                                     |                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Pump set running dry</b><br/>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never allow an explosion-proof pump set to run dry!</li> </ul>                                                    |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Fluid level below the specified minimum</b><br/>Damage to the pump set by cavitation!</p> <ul style="list-style-type: none"> <li>▷ Never allow the fluid level to drop below the specified minimum.</li> </ul> |

#### 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 10)

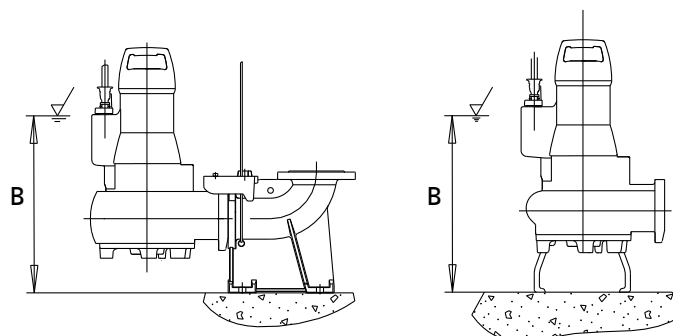


**Fig. 27:** Minimum fluid level



#### 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



#### 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.

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

#### 6.2.4.4 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the pump handles fluids containing abrasive substances, increased wear of the hydraulic system and 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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Unintentional starting of the pump set</b><br/>Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>                                  |
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b><br/>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate pumps which handle fluids posing a health hazard.</li> </ul> |
|  | <div style="background-color: #f4d03f; padding: 5px;"><b>CAUTION</b></div> <p><b>Danger of frost/freezing</b><br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ If there is any danger of frost/freezing, remove the pump set from the fluid handled and clean, preserve and store it.</li> </ul>                                                                                                                                         |

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

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

- ✓ The pump has been properly drained.
- ✓ The safety instructions for dismantling the pump have been observed.  
(⇒ Section 7.1, Page 64)
- ✓ The permissible ambient temperature for storing the pump is observed.  
(⇒ Section 3.3, Page 18)
- 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 and grease, food-approved, if required) to protect them against corrosion.  
Observe the additional instructions on preservation. (⇒ Section 3.3, Page 18)

#### 6.4 Returning to service

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div data-bbox="504 235 703 280">  <b>WARNING</b> </div> <div data-bbox="491 297 1101 329"> <b>Failure to re-install or re-activate protective devices</b> </div> <div data-bbox="491 333 1024 367"> Risk of injury from moving parts or escaping fluid! </div> <div data-bbox="513 376 1391 436"> <ul style="list-style-type: none"> <li>▸ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.</li> </ul> </div> |
|  | <div data-bbox="504 477 592 512"> <b>NOTE</b> </div> <div data-bbox="491 535 1414 568"> On pumps/pump sets older than 5 years we recommend replacing all elastomer seals. </div>                                                                                                                                                                                                                                                                                                                                                                                         |

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 56)

Refer to and comply with the operating limits. (⇒ Section 6.2, Page 59)

For returning the pump set to service after storage also follow the instructions for maintenance/inspection. (⇒ Section 7.2, Page 66)

## 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.

|                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                    | <div data-bbox="507 392 683 436">  <b>DANGER</b> </div> <p><b>Sparks produced during servicing work</b></p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Observe the safety regulations in force at the place of installation!</li> <li>▷ Never open an energised pump set.</li> <li>▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|   | <div data-bbox="507 716 683 761">  <b>DANGER</b> </div> <p><b>Improperly serviced pump set</b></p> <p>Explosion hazard!</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Service the pump set regularly.</li> <li>▷ Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                  | <div data-bbox="507 1041 683 1086">  <b>DANGER</b> </div> <p><b>Electrical connection work by unqualified personnel</b></p> <p>Danger to life from electric shock</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by an electrically qualified person.</li> <li>▷ Observe the IEC 60364 regulations as well as any regional regulations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                  | <div data-bbox="507 1288 683 1332">  <b>DANGER</b> </div> <p><b>Improper lifting/moving of heavy assemblies or components</b></p> <p>Danger to life from falling parts!</p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport equipment, lifting equipment and lifting tackle to move heavy assemblies or components.</li> <li>▷ Use the attachment point provided for attaching the lifting accessory.</li> <li>▷ Never lift the pump set by the electric cables.</li> <li>▷ 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.</li> <li>▷ Securely attach the lifting chain/rope to the pump and crane.</li> <li>▷ Use tested, marked and approved lifting accessories only.</li> <li>▷ Observe the regional transport regulations.</li> <li>▷ Observe the documentation of the lifting accessory manufacturer.</li> <li>▷ 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.</li> <li>▷ Maintain a safe distance during lifting operations (load may swing when being lifted).</li> </ul> |

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div data-bbox="507 197 683 237"> <b>DANGER</b></div> <p><b>Risk of falling when working at a great height</b><br/>           Danger to life by falling from a great height!</p> <ul style="list-style-type: none"> <li>▷ Do not step onto the pump (set) during installation work or dismantling work.</li> <li>▷ Pay attention to safety equipment, such as railings, covers, barriers, etc.</li> <li>▷ Observe the applicable local health and occupational safety regulations and accident prevention regulations.</li> </ul> |
|    | <div data-bbox="507 519 703 560"> <b>WARNING</b></div> <p><b>Unintentional starting of the pump set</b><br/>           Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>                                                                                                              |
|    | <div data-bbox="507 801 703 842"> <b>WARNING</b></div> <p><b>Hands, other body parts or foreign objects in the impeller or intake area</b><br/>           Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> <li>▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area.</li> <li>▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.</li> </ul>                      |
|  | <div data-bbox="507 1115 703 1155"> <b>WARNING</b></div> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b><br/>           Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate pumps which handle fluids posing a health hazard.</li> </ul>                                                                         |
|  | <div data-bbox="507 1469 703 1509"> <b>WARNING</b></div> <p><b>Hot surface</b><br/>           Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>                                                                                                                                                                                                                                                                                                   |
|  | <div data-bbox="507 1680 703 1720"> <b>WARNING</b></div> <p><b>Improper lifting/moving of heavy assemblies or components</b><br/>           Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>                                                                                                                                                                        |

|                                                                                   |                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Insufficient stability</b></p> <p>Risk of crushing hands and feet!</p> <p>▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.</p> |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                   |                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>Special regulations apply to repair work on explosion-proof pump sets. Modification or alteration of the pump set may affect explosion protection and are only permitted after consultation with the manufacturer.</p> |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit <a href="https://www.ksb.com/en-global/contact">https://www.ksb.com/en-global/contact</a>.</p> |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Never use force when dismantling and reassembling the pump set.

## 7.2 Servicing/inspection

KSB recommends the following regular maintenance schedule:

**Table 19:** Overview of maintenance work

| Maintenance interval                        | Maintenance work                                  | For details see ...          |
|---------------------------------------------|---------------------------------------------------|------------------------------|
| Every 4000 operating hours <sup>14)</sup>   | Insulation resistance measurement                 | (⇒ Section 7.2.2.4, Page 68) |
|                                             | Checking the power cables                         | (⇒ Section 7.2.2.3, Page 68) |
|                                             | Visual inspection of lifting chain / lifting rope | (⇒ Section 7.2.2.1, Page 67) |
|                                             | Visual inspection of lifting accessories          | (⇒ Section 7.2.2.2, Page 67) |
| Every 10,000 operating hours <sup>15)</sup> | Checking the sensors                              | (⇒ Section 7.2.2.5, Page 69) |
|                                             | Lubricating the bearings <sup>16)</sup>           | (⇒ Section 7.2.3.2, Page 75) |
|                                             | Checking the mechanical seal leakage              | (⇒ Section 7.2.2.6, Page 69) |
| Every five years                            | General overhaul                                  | -                            |

|                                                                                     |                                                                                                                                                                                                                                                                                   |
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|  | <div style="background-color: #0072bc; color: white; padding: 5px;"><b>NOTE</b></div> <p>In demanding conditions (e.g. high mechanical and hydraulic loads) reduce the maintenance interval accordingly.</p> <p>For a consultation or any queries please contact KSB Service.</p> |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

<sup>14</sup> At least once a year

<sup>15</sup> At least every three years

<sup>16</sup> For reinforced bearings only

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

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <div data-bbox="507 235 683 280"> <b>DANGER</b></div> <p><b>Risk of potentially explosive atmosphere inside the pump</b></p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ 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.</li> <li>▷ Provide sufficient inlet pressure.</li> <li>▷ Provide an appropriate monitoring system.</li> </ul> |
|   | <div data-bbox="507 589 643 622"><b>CAUTION</b></div> <p><b>Increased wear due to dry running</b></p> <p>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set without liquid fill.</li> <li>▷ Never close the shut-off element in the suction line and/or supply line during pump operation.</li> </ul>                                                                                                                                                                                                                    |
|  | <div data-bbox="507 869 643 902"><b>CAUTION</b></div> <p><b>Impermissibly high temperature of fluid handled</b></p> <p>Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Prolonged operation against a closed shut-off element is not permitted (heating up of the fluid).</li> <li>▷ Observe the temperature limits in the data sheet and in the section on operating limits.</li> </ul>                                                                                                                                                              |

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 (shackles) for any visible damage.
  2. Replace any damaged components by original spare parts.
  3. Assess the lifting chain/lifting rope/shackle in accordance with the locally applicable regulations for lifting tackle.
  4. In addition, observe the operating manual of the lifting accessories.

#### 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.
3. If strongly corroded, the lifting accessory must be replaced by a lifting accessory made of a material suitable for the fluid handled.
4. Assess the bail / eyebolt against the locally applicable regulations for lifting tackle.

### 7.2.2.3 Checking the power cable

|                                                                                   |                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></div> <p><b>Defective earth conductor</b></p> <p>Electric shock!</p> <p>▷ Never switch on a pump set with a defective earth conductor.</p> |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- |                                     |                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Visual inspection</b>            | <ul style="list-style-type: none"> <li>✓ The pump set has been lifted out of the pump sump and cleaned.               <ol style="list-style-type: none"> <li>1. Inspect the power cables for visible damage.</li> <li>2. Replace any damaged components by original spare parts.</li> </ol> </li> </ul>                                                                             |
| <b>Checking the earth conductor</b> | <ul style="list-style-type: none"> <li>✓ The pump set has been lifted out of the pump sump and cleaned.               <ol style="list-style-type: none"> <li>1. Measure the resistance between the earth conductor and chassis ground. The electrical resistance must be lower than 1 Ω.</li> <li>2. Replace any damaged components by original spare parts.</li> </ol> </li> </ul> |

### 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 is 500 V (maximum permissible voltage: 1000 V).
  1. Measure the winding to chassis ground.  
To do so, connect all winding ends together.
  2. Measure the winding temperature sensor to chassis ground.  
To do so, connect all core ends of the winding temperature sensor together and connect all winding ends to chassis ground.
- ⇒ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.  
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

|                                                                                     |                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>If the insulation resistance of the power cable is lower than 1 MΩ, the power cable is defective. The power cable must be replaced.</p> |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                     |                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #2980b9; color: white; padding: 5px;"><b>NOTE</b></div> <p>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.</p> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 7.2.2.5 Checking the sensors

|  |                                                                                                                               |
|--|-------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION</b>                                                                                                                |
|  | <b>Excessive test voltage</b><br>Damage to the sensors!<br>▶ Use a commercially available ohmmeter to measure the resistance. |

The tests described below measure the resistance at the core ends of the power cable/ control 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 <sup>17)</sup>          | < 1        |
| 21 and 22                         | < 1        |
| 10 and 11 <sup>17)</sup>          | 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 ... | Electrical resistance |
|-----------------------------------|-----------------------|
|                                   | [kΩ]                  |
| 9 and earth conductor (PE)        | > 60                  |

Lower resistance values suggest water ingress into the motor. In this case, open and service the motor section.

#### 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 Checking the mechanical seal leakage

|  |                                                                                                                                                                                                                                                                                                                                                                                      |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b>                                                                                                                                                                                                                                                                                                                                                                       |
|  | <b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b><br>Hazard to persons and the environment!<br>▶ Collect and properly dispose of flushing fluid and any residues of the fluid handled.<br>▶ Wear protective clothing and a protective mask if required.<br>▶ Observe all legal regulations on the disposal of fluids posing a health hazard. |
|  | <b>WARNING</b>                                                                                                                                                                                                                                                                                                                                                                       |
|  | <b>Excess pressure inside the pump set</b><br>Risk of injury when opening the pump set!<br>▶ Be careful when opening the inner chambers.                                                                                                                                                                                                                                             |



### NOTE

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

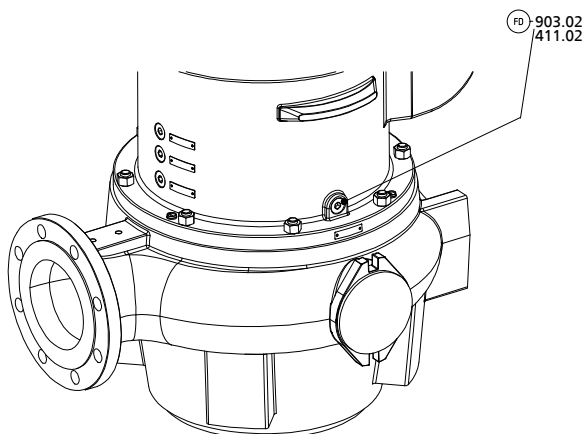


**Fig. 28:** Checking the mechanical seal leakage

**Table 23:** Symbols key

| Symbol | Description                                                                                            |
|--------|--------------------------------------------------------------------------------------------------------|
|        | Always apply a <b>liquid sealant</b> (e.g. Hylomar SQ32M) to sealing surfaces marked with this symbol. |

✓ The pump set has been placed down in a vertical position.

1. Place a suitable container under screw plug 903.02.
2. Remove screw plug 903.02 and joint ring 411.02.
3. Drain the leakage.



### NOTE

If more than 0.5 litres of leakage should escape we recommend to replace the mechanical seals.

4. Close screw plug 903.02, fitting joint ring 411.02 and applying liquid sealant.

#### 7.2.2.7 Visual inspection through the inspection hole (for inspection types D and H only and for pump sets with nominal diameters $\geq 100$ )

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



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

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div style="background-color: #f4a460; padding: 5px;"><b>! WARNING</b></div> <p><b>Hands or foreign objects in the pump casing</b></p> <p>Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Check that the inside of the pump is free from any foreign objects. Remove any foreign objects.</li> <li>▷ 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.</li> </ul> |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

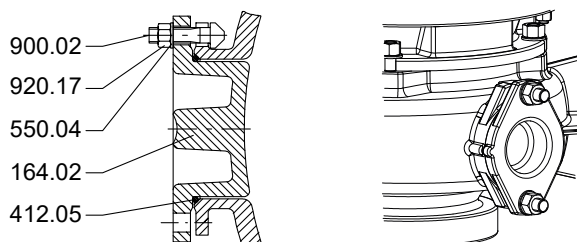


**Fig. 29:** Inspection hole in the casing

#### 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

|                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <div style="background-color: #e67e22; padding: 5px;"><b>! DANGER</b></div> <p><b>Excessive temperatures at the shaft seal</b></p> <p>Explosion hazard!<br/>Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Regularly check the condition of the lubricant in the lubricant reservoir of the mechanical seal. Top it up if required.</li> </ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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:

#### Recommended lubricant quality

#### Alternative

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

**Table 24:** Lubricant quality

| Description                     | Properties                        |                         |
|---------------------------------|-----------------------------------|-------------------------|
| Paraffin oil<br>or<br>white oil | Kinematic viscosity<br>at 40 °C   | < 20 mm <sup>2</sup> /s |
|                                 | Flash point (to Cleveland)        | >160 °C                 |
|                                 | Solidification point (pour point) | < -15 °C                |



**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 25:** Lubricant quantity [l] depending on the motor

| Size   | Impeller type | Lubricant quantity<br>depending on the motor |                                           |                                                |                                                                                      |                                                                                                  |                                                                                                                                          |
|--------|---------------|----------------------------------------------|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|        |               | 3 2.E<br>2 4.E<br>3 4.E                      | 4 2.E<br>5 2.E<br>7 2.E<br>4 4.E<br>5 4.E | 11 2.E<br>15 2.E<br>18 2.E<br>22 2.E<br>26 2.E | 7 4.E<br>11 4.E<br>15 4.E<br>18 4.E<br>22 4.E<br>7 6.E<br>11 6.E<br>15 6.E<br>18 6.E | 30 2.E<br>37 2.E<br>30 4.E<br>37 4.E<br>22 6.E<br>30 6.E<br>11 8.E<br>15 8.E<br>18 8.E<br>22 8.E | 55 2.E<br>65 2.E<br>75 2.E<br>45 4.E<br>55 4.E<br>65 4.E<br>75 4.E<br>31 6.E<br>37 6.E<br>45 6.E<br>55 6.E<br>30 8.E<br>37 8.E<br>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                                                                                  | -                                                                                                | -                                                                                                                                        |

| Size    | Impeller type | Lubricant quantity<br>depending on the motor |                                           |                                                |                                                                                      |                                                                                                  |                                                                                                                                          |
|---------|---------------|----------------------------------------------|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|         |               | 3 2.E<br>2 4.E<br>3 4.E                      | 4 2.E<br>5 2.E<br>7 2.E<br>4 4.E<br>5 4.E | 11 2.E<br>15 2.E<br>18 2.E<br>22 2.E<br>26 2.E | 7 4.E<br>11 4.E<br>15 4.E<br>18 4.E<br>22 4.E<br>7 6.E<br>11 6.E<br>15 6.E<br>18 6.E | 30 2.E<br>37 2.E<br>30 4.E<br>37 4.E<br>22 6.E<br>30 6.E<br>11 8.E<br>15 8.E<br>18 8.E<br>22 8.E | 55 2.E<br>65 2.E<br>75 2.E<br>45 4.E<br>55 4.E<br>65 4.E<br>75 4.E<br>31 6.E<br>37 6.E<br>45 6.E<br>55 6.E<br>30 8.E<br>37 8.E<br>45 8.E |
|         |               | [l]                                          | [l]                                       | [l]                                            | [l]                                                                                  | [l]                                                                                              | [l]                                                                                                                                      |
| 80-252  | F             | -                                            | 2,7                                       | 2,6                                            | 2,6                                                                                  | -                                                                                                | -                                                                                                                                        |
| 80-253  | E, F, K       | -                                            | 2,4                                       | 2,5                                            | 2,5                                                                                  | -                                                                                                | -                                                                                                                                        |
| 80-315  | D             | -                                            | -                                         | -                                              | 4,5                                                                                  | 3,6                                                                                              | 1,4                                                                                                                                      |
| 80-315  | K             | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 80-317  | D             | -                                            | -                                         | -                                              | 4,1                                                                                  | 3,6                                                                                              | -                                                                                                                                        |
| 80-317  | F             | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 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                                                                                  | 3,6                                                                                              | 1,4                                                                                                                                      |
| 100-315 | E             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | -                                                                                                                                        |
| 100-315 | F, K          | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | -                                                                                                                                        |
| 100-316 | D             | -                                            | -                                         | -                                              | 4,5                                                                                  | 3,6                                                                                              | -                                                                                                                                        |
| 100-316 | F, K          | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 100-317 | E             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | -                                                                                                                                        |
| 100-400 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 100-401 | E, F, K       | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 100-403 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 150-253 | D             | -                                            | -                                         | -                                              | 2,5                                                                                  | -                                                                                                | -                                                                                                                                        |
| 150-315 | D             | -                                            | -                                         | -                                              | 4,1                                                                                  | 3,6                                                                                              | -                                                                                                                                        |
| 150-315 | F             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 150-317 | E, K          | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 150-317 | D             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 150-400 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 1,4                                                                                                                                      |
| 150-400 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 150-401 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 1,4                                                                                                                                      |
| 150-401 | E, F          | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 150-403 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 150-403 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 151-403 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 200-315 | D             | -                                            | -                                         | -                                              | 4,1                                                                                  | 3,6                                                                                              | -                                                                                                                                        |
| 200-315 | K             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | -                                                                                                                                        |
| 200-316 | K             | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | -                                                                                                                                        |
| 200-317 | K             | -                                            | -                                         | -                                              | 4,5                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |

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| Size    | Impeller type | Lubricant quantity<br>depending on the motor |                                           |                                                |                                                                                      |                                                                                                  |                                                                                                                                          |
|---------|---------------|----------------------------------------------|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|         |               | 3 2.E<br>2 4.E<br>3 4.E                      | 4 2.E<br>5 2.E<br>7 2.E<br>4 4.E<br>5 4.E | 11 2.E<br>15 2.E<br>18 2.E<br>22 2.E<br>26 2.E | 7 4.E<br>11 4.E<br>15 4.E<br>18 4.E<br>22 4.E<br>7 6.E<br>11 6.E<br>15 6.E<br>18 6.E | 30 2.E<br>37 2.E<br>30 4.E<br>37 4.E<br>22 6.E<br>30 6.E<br>11 8.E<br>15 8.E<br>18 8.E<br>22 8.E | 55 2.E<br>65 2.E<br>75 2.E<br>45 4.E<br>55 4.E<br>65 4.E<br>75 4.E<br>31 6.E<br>37 6.E<br>45 6.E<br>55 6.E<br>30 8.E<br>37 8.E<br>45 8.E |
|         |               | [l]                                          | [l]                                       | [l]                                            | [l]                                                                                  | [l]                                                                                              | [l]                                                                                                                                      |
| 200-318 | K             | -                                            | -                                         | -                                              | 4,1                                                                                  | 4,5                                                                                              | 4,4                                                                                                                                      |
| 200-400 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 1,4                                                                                                                                      |
| 200-401 | E             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 200-402 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 200-402 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 200-403 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 200-405 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 250-400 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 1,4                                                                                                                                      |
| 250-401 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 250-402 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 250-403 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 300-400 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 1,4                                                                                                                                      |
| 300-400 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 300-401 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 300-402 | D             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |
| 300-403 | K             | -                                            | -                                         | -                                              | -                                                                                    | 6,5                                                                                              | 6,6                                                                                                                                      |

### 7.2.3.1.4 Changing the lubricant

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  <b>WARNING</b><br><b>Lubricants posing a health hazard and/or hot lubricants</b><br>Hazard to persons and the environment!<br><ul style="list-style-type: none"> <li>▷ When draining the lubricant take appropriate measures to protect persons and the environment.</li> <li>▷ Wear safety clothing and a protective mask if required.</li> <li>▷ Collect and dispose of any lubricants.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul> |
|                                                                                     |  <b>WARNING</b><br><b>Excess pressure in the lubricant reservoir</b><br>Liquid spurting out when the lubricant reservoir is opened at operating temperature!<br><ul style="list-style-type: none"> <li>▷ Open the screw plug of the lubricant reservoir very carefully.</li> </ul>                                                                                                                                                                                                               |

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### Draining the lubricant

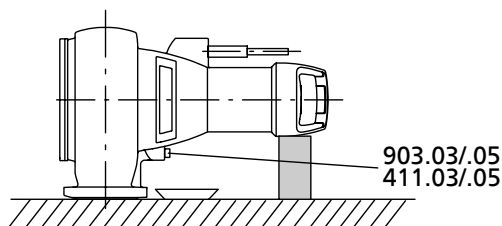


**Fig. 30:** Draining the lubricant

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

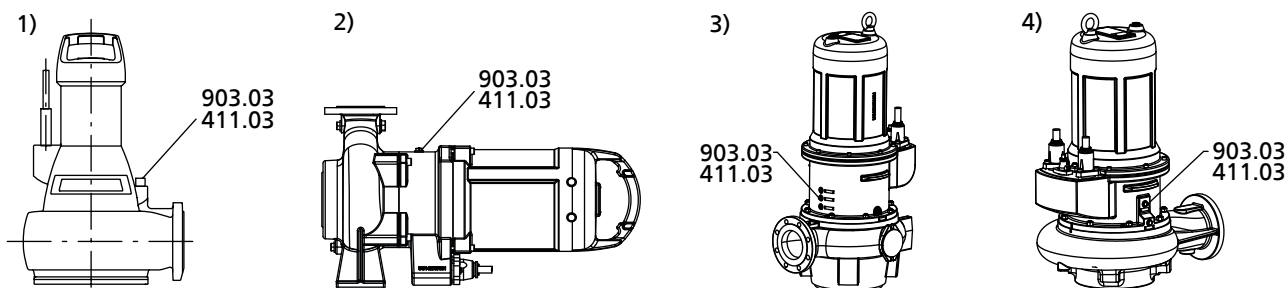


**Fig. 31:** Filling in the lubricant

**Table 26:** Filling in the lubricant

| Motor         | Impeller type        | Variant |   |   |   |
|---------------|----------------------|---------|---|---|---|
|               |                      | 1       | 2 | 3 | 4 |
| 3 2.E-7 2.E   | E, F, K, S           | X       | - | - | - |
| 11 2.E-26 2.E | E, F, K, S           | -       | X | - | - |
| 30 2.E-37 2.E | F, K, D              | -       | X | - | - |
| 55 2.E-75 2.E | D                    | -       | - | X | - |
| 2 4.E-5 4.E   | E, F, K, S           | X       | - | - | - |
| 7 4.E-37 4.E  | D, E, F, K, S, D-max | -       | X | - | - |
| 45 4.E-75 4.E | D                    | -       | - | X | - |
| 45 4.E-75 4.E | E, F, K, D-max       | -       | - | - | X |
| 7 6.E-30 6.E  | D, E, F, K, S, D-max | -       | X | - | - |
| 31 6.E-55 6.E | D                    | -       | - | X | - |
| 31 6.E-55 6.E | E, F, K, D-max       | -       | - | - | X |
| 11 8.E-22 8.E | D, E, F, K, D-max    | -       | X | - | - |
| 30 8.E-45 8.E | D                    | -       | - | X | - |
| 30 8.E-45 8.E | E, F, K, D-max       | -       | - | - | X |

1. Position the pump set as shown.
2. Undo and remove screw plug 903.03 and 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 grease-packed and maintenance-free, with the exception described below.

On pump sets with reinforced bearings the pump-end rolling element bearings must be re-lubricated as part of the maintenance work.

|  |                                                                                                                                                           |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>! WARNING</b>                                                                                                                                          |
|  | <b>Shaft seal ring overheating</b><br>Explosion hazard!<br>Bearings overheating!<br>▸ When fitting new shaft seal rings, apply grease to the sealing lip. |

### 7.2.3.2.1 Grease quality

|  |                                                                                                                                                           |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>CAUTION</b>                                                                                                                                            |
|  | <b>Mix of different grease types</b><br>Damage to the pump set!<br>▸ Make sure to use the right type of grease.<br>▸ Never mix different types of grease. |

**Grease quality**  
**Recommended commercially available brands**

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

- Lithium soap grease suitable for high temperatures
- Multis Complex EP2, made by TOTAL
- ESSO UNIREX N3
- TEXACO HYTEX EP3/DEA Pragon

**Table 27:** Lubricant characteristics

| Type | Base oil    | Thickener            | NLGI grade (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, made by TOTAL
  - ESSO UNIREX N3
  - TEXACO HYTEX EP3/DEA Pragon

### 7.2.3.2.2 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.

|  |                                                                                                                                                                                                                                                 |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>! DANGER</b>                                                                                                                                                                                                                                 |
|  | <b>Dry running</b><br>Explosion hazard!<br>▸ Re-lubricate explosion-proof pump sets outside potentially explosive atmospheres.                                                                                                                  |
|  | <b>! WARNING</b>                                                                                                                                                                                                                                |
|  | <b>Hands inside the pump casing</b><br>Risk of injuries, damage to the pump!<br>▸ 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                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <p><b>Incomplete re-lubrication</b><br/>Bearing damage!</p> <ul style="list-style-type: none"> <li>▸ Always re-lubricate the bearings with the pump set in operation.</li> </ul> |

- ✓ 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 53)

|  | CAUTION                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                   | <p><b>Pump set running dry</b><br/>Increased vibrations!<br/>Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▸ Never operate the pump set for more than 60 seconds without the fluid handled.</li> </ul> |

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

#### 7.2.3.2.1 Grease quantity

Use 30 g of grease to lubricate the rolling element bearings.

### 7.3 Drainage/cleaning

|  |  <b>WARNING</b>                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     | <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b><br/>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▸ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</li> <li>▸ Wear protective clothing and a protective mask if required.</li> <li>▸ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul> |

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 138)

## 7.4 Dismantling the pump set

### 7.4.1 General information/Safety regulations

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div data-bbox="507 315 683 360">  <b>DANGER</b> </div> <div data-bbox="496 376 1070 409"> <b>Insufficient preparation of work on the pump (set)</b> </div> <div data-bbox="496 416 639 445"> Risk of injury! </div> <div data-bbox="517 456 1238 651"> <ul style="list-style-type: none"> <li>▷ Properly shut down the pump set.</li> <li>▷ Close the shut-off elements in the suction line and discharge line.</li> <li>▷ Drain the pump and release the pump pressure.</li> <li>▷ Shut off any auxiliary feed lines.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul> </div> |
|    | <div data-bbox="507 689 703 734">  <b>WARNING</b> </div> <div data-bbox="496 750 847 784"> <b>Components with sharp edges</b> </div> <div data-bbox="496 790 863 819"> Risk of cutting or shearing injuries! </div> <div data-bbox="517 831 1270 904"> <ul style="list-style-type: none"> <li>▷ Always use appropriate caution for installation and dismantling work.</li> <li>▷ Wear work gloves.</li> </ul> </div>                                                                                                                                                                                         |
|   | <div data-bbox="507 940 703 985">  <b>WARNING</b> </div> <div data-bbox="496 1001 1155 1034"> <b>Unqualified personnel performing work on the pump (set)</b> </div> <div data-bbox="496 1041 639 1070"> Risk of injury! </div> <div data-bbox="517 1081 1382 1144"> <ul style="list-style-type: none"> <li>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</li> </ul> </div>                                                                                                                                                                             |
|  | <div data-bbox="507 1187 703 1232">  <b>WARNING</b> </div> <div data-bbox="496 1247 635 1276"> <b>Hot surface</b> </div> <div data-bbox="496 1283 639 1312"> Risk of injury! </div> <div data-bbox="517 1323 1158 1355"> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul> </div>                                                                                                                                                                                                                                                                |
|  | <div data-bbox="507 1395 703 1440">  <b>WARNING</b> </div> <div data-bbox="496 1456 1187 1489"> <b>Improper lifting/moving of heavy assemblies or components</b> </div> <div data-bbox="496 1496 927 1525"> Personal injury and damage to property! </div> <div data-bbox="517 1536 1406 1599"> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul> </div>                                                                                                                                    |

- Observe the safety instructions and information.
- For dismantling and reassembly observe the general assembly drawing.
- In the event of damage you can always contact KSB Service.

### 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 77)
  - ✓ 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.

#### 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 79)
  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

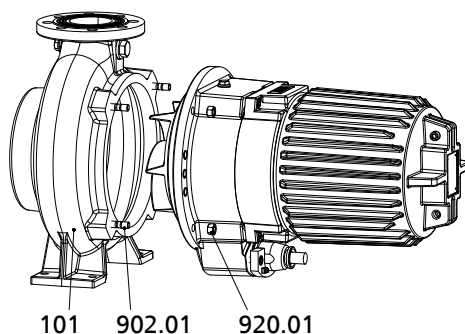


**Fig. 32:** Removing the back pull-out unit

#### 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.

### 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. The forcing screw can be ordered separately from KSB.

**Table 28:** Forcing screws for pulling off the impeller

| Size    | Impeller type | Forcing screw |       |
|---------|---------------|---------------|-------|
|         |               | Thread        | Code  |
| 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 5 |
| 100-401 | E, F, K       | M24           | ADS 5 |
| 100-403 | D             | M24           | ADS 5 |
| 150-253 | D             | M16           | ADS 3 |
| 150-315 | D             | M20           | ADS 4 |
| 150-315 | F             | M20           | ADS 2 |

| Size    | Impeller type | Forcing screw |       |
|---------|---------------|---------------|-------|
|         |               | Thread        | Code  |
| 150-317 | E, K          | M20           | ADS 2 |
| 150-317 | D             | M20           | ADS 4 |
| 150-400 | D             | M24           | ADS 5 |
| 150-400 | K             | M24           | ADS 5 |
| 150-401 | D             | M24           | ADS 5 |
| 150-401 | E, F          | M24           | ADS 5 |
| 150-403 | D             | M24           | ADS 5 |
| 150-403 | K             | M24           | ADS 5 |
| 151-403 | K             | M24           | ADS 5 |
| 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             | M24           | ADS 5 |
| 200-402 | D             | M24           | ADS 5 |
| 200-402 | K             | M24           | ADS 5 |
| 200-403 | K             | M24           | ADS 5 |
| 200-405 | D             | M24           | ADS 5 |
| 250-400 | D             | M24           | ADS 5 |
| 250-401 | K             | M24           | ADS 5 |
| 250-402 | D             | M24           | ADS 9 |
| 250-403 | K             | M24           | ADS 5 |
| 300-400 | D             | M24           | ADS 5 |
| 300-400 | K             | M24           | ADS 5 |
| 300-401 | K             | M24           | ADS 5 |
| 300-402 | D             | M24           | ADS 9 |
| 300-403 | K             | M24           | ADS 5 |

#### 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.

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

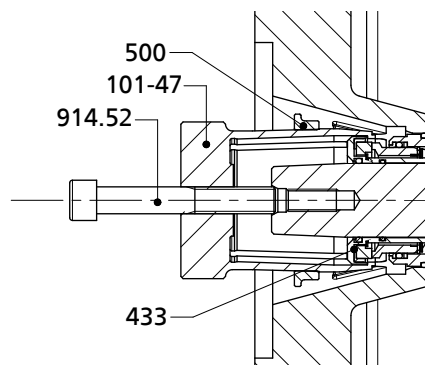


**Fig. 33:** Removing the double cartridge seal

- ✓ 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.**

### 7.4.3.2.5 Removing the C055/065M1-4STQ-SV double cartridge mechanical 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 to hand.
- ✓ The pump's back pull-out unit has been removed from the pump casing. It has been safely placed down 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. Undo grub screws 904.53.
- 3. Use the groove in mating ring carrier 487 to remove the mechanical seal cartridge. Remove evenly, using a suitable extraction tool.
- 4. Carefully pull the complete cartridge mechanical seal off the shaft.

5. 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 (for D impeller only)

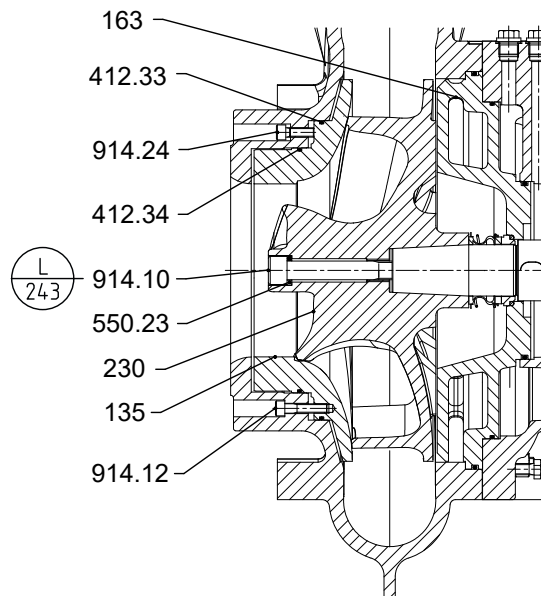


**Fig. 34:** Removing the wear plate

- ✓ 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 with O-rings 412.33/412.34.

#### 7.4.4 Dismantling the motor section

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

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

## 7.5 Reassembling the pump set

### 7.5.1 General information/Safety regulations

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Improper lifting/moving of heavy assemblies or components</b><br/>Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul> |
|    | <div style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></div> <p><b>Components with sharp edges</b><br/>Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> <li>▷ Always use appropriate caution for installation and dismantling work.</li> <li>▷ Wear work gloves.</li> </ul>                                           |
|    | <div style="background-color: #f4c400; padding: 5px;"><b>CAUTION</b></div> <p><b>Improper reassembly</b><br/>Damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Reassemble the pump (set) in accordance with the general rules of sound engineering practice.</li> <li>▷ Use original spare parts only.</li> </ul>                                  |
|  | <div style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></div> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Refer to the "Flamepaths" annex for the position of the flamepaths.</p>               |

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

- 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 seal faces immediately before assembly takes place.
  - Make sure the surface of the shaft is absolutely clean and undamaged.
  - Immediately before installing the mechanical seal, wet the seal faces with a drop of oil.
  - For easier installation of 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 9.4.2, Page 126)

**Table 29:** Installation dimension "A" for mechanical seal with covered springs (HJ)

| Size    | Impeller type | Installation dimension "A"<br>(⇒ Section 9.4.2, Page 126) |
|---------|---------------|-----------------------------------------------------------|
|         |               | [mm]                                                      |
| 100-400 | K             | 48,3                                                      |
| 100-401 | E, F, K       | 48,3                                                      |
| 100-403 | D             | 48,3                                                      |
| 150-400 | D             | 48,3                                                      |
| 150-400 | K             | 48,3                                                      |
| 150-401 | D             | 48,3                                                      |
| 150-401 | E, F          | 48,3                                                      |
| 150-403 | D             | 48,3                                                      |
| 150-403 | K             | 48,3                                                      |
| 151-403 | K             | 48,3                                                      |
| 200-400 | D             | 48,3                                                      |
| 200-401 | E             | 48,3                                                      |
| 200-402 | D             | 48,3                                                      |
| 200-402 | K             | 48,3                                                      |
| 200-403 | K             | 48,3                                                      |
| 200-405 | D             | 48,3                                                      |
| 250-400 | D             | 48,3                                                      |
| 250-401 | K             | 48,3                                                      |
| 250-402 | D             | 48,3                                                      |
| 250-403 | K             | 48,3                                                      |
| 300-400 | D             | 48,3                                                      |
| 300-400 | K             | 48,3                                                      |
| 300-401 | K             | 48,3                                                      |

| Size    | Impeller type | Installation dimension "A"<br>(⇒ Section 9.4.2, Page 126) |
|---------|---------------|-----------------------------------------------------------|
|         |               | [mm]                                                      |
| 300-402 | D             | 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.

### 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 joint ring) 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.

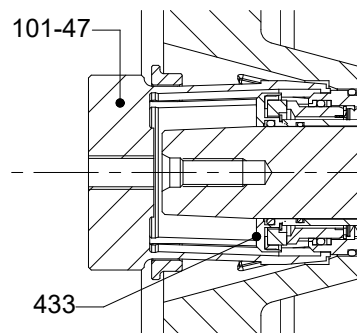


**Fig. 35:** Mounting device 101-47

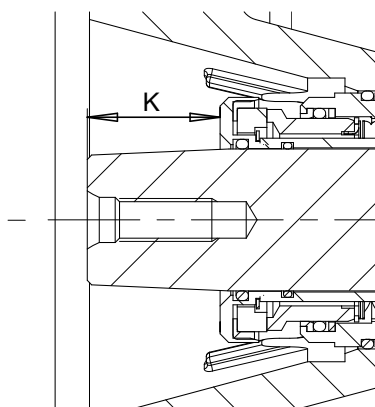


**Fig. 36:** Reference dimension "K" from shaft end to mechanical seal

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 30:** Reference dimension "K"

| Size   | Impeller type | Reference dimension<br>"K" |
|--------|---------------|----------------------------|
|        |               | [mm]                       |
| 40-252 | F, K, S       | 39 +/- 0,5                 |
| 50-215 | F             | 25 +/- 0,5                 |
| 50-216 | F             | 25 +/- 0,5                 |
| 50-216 | 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             | 43 +/- 0,5                 |
| 80-315 | K             | 43 +/- 0,5                 |

2553.8207/04-EN

| Size    | Impeller type | Reference dimension "K" |
|---------|---------------|-------------------------|
|         |               | [mm]                    |
| 80-317  | D             | 43 +/- 0,5              |
| 80-317  | F             | 43 +/- 0,5              |
| 100-215 | F             | 25 +/- 0,5              |
| 100-253 | D             | 43 +/- 0,5              |
| 100-253 | E, K          | 43 +/- 0,5              |
| 100-254 | F, K          | 39 +/- 0,5              |
| 100-315 | D             | 43 +/- 0,5              |
| 100-315 | E             | 43 +/- 0,5              |
| 100-315 | F, K          | 43 +/- 0,5              |
| 100-316 | D             | 43 +/- 0,5              |
| 100-316 | F, K          | 43 +/- 0,5              |
| 100-317 | E             | 43 +/- 0,5              |
| 150-253 | D             | 43 +/- 0,5              |
| 150-315 | D             | 43 +/- 0,5              |
| 150-315 | F             | 43 +/- 0,5              |
| 150-317 | E, K          | 43 +/- 0,5              |
| 150-317 | D             | 43 +/- 0,5              |
| 200-315 | D             | 43 +/- 0,5              |
| 200-315 | K             | 43 +/- 0,5              |
| 200-316 | K             | 43 +/- 0,5              |
| 200-317 | K             | 43 +/- 0,5              |
| 200-318 | K             | 43 +/- 0,5              |

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

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>WARNING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                     | <b>Components with sharp edges</b><br>Risk of cutting or shearing injuries!<br><ul style="list-style-type: none"> <li>▷ Always use appropriate caution for installation and dismantling work.</li> <li>▷ Wear work gloves.</li> </ul>                                                                                                                                                                                                           |
|  | <b>CAUTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                     | <b>Use of grease or other permanent lubricants</b><br>Torque transmission impeded / overheating of and damage to the pump!<br><ul style="list-style-type: none"> <li>▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal.</li> <li>▷ Use soft soap to reduce any friction caused during assembly.</li> <li>▷ Never coat the mechanical seal faces with grease or oil.</li> </ul> |
|  | <b>CAUTION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                     | <b>Improper installation of the mechanical seal</b><br>Damage to the seal faces!<br><ul style="list-style-type: none"> <li>▷ Install the mechanical seal using the supplied mounting device C.</li> <li>▷ Prevent sudden forces acting on the mounting device and mechanical seal.</li> </ul>                                                                                                                                                   |

- ✓ The relevant documentation for installing the mechanical seal is observed.
  - ✓ The back pull-out unit has been removed from the pump casing. It has been safely placed down and secured in a horizontal position.
  - ✓ The original 4STQ cartridge mechanical seal is fully assembled and undamaged.
  - ✓ Mounting device C is available.
1. Fit the circlip in the shaft groove.

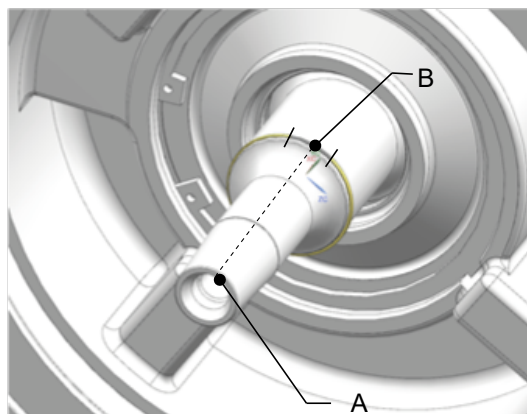


**Fig. 37:** Marking the shaft end

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

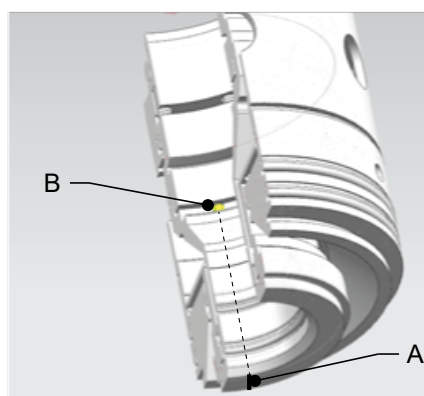


**Fig. 38:** Marking the mechanical seal

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

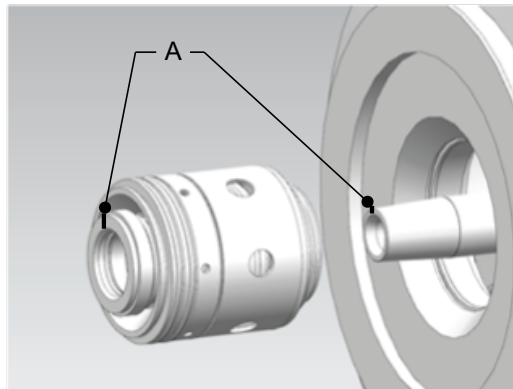


**Fig. 39:** Aligning the markings

5. 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.

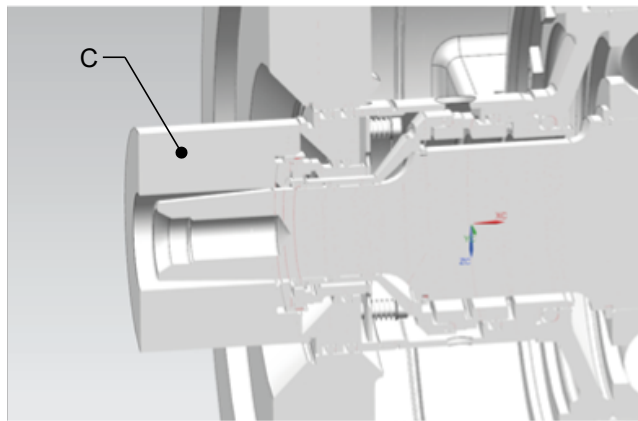


**Fig. 40:** Mounting device C

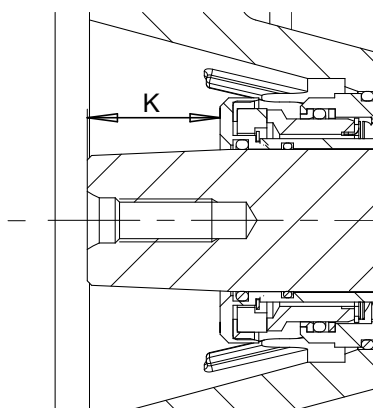


**Fig. 41:** Reference dimension "K" from shaft end to mechanical seal

6. 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.

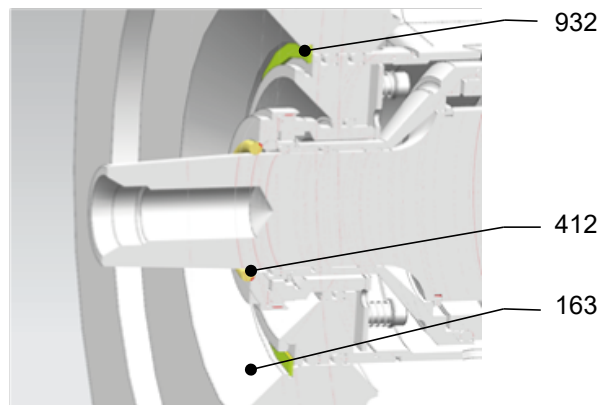


**Fig. 42:** Final assembly

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

#### 7.5.2.4 Installing the double cartridge mechanical seal C055/065M1-4STQ-SV

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <p><b>WARNING</b></p> <p><b>Components with sharp edges</b><br/>Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> <li>▷ Always use appropriate caution for installation and dismantling work.</li> <li>▷ Wear work gloves.</li> </ul>                                                                                                                                                                                                           |
|  | <p><b>CAUTION</b></p> <p><b>Use of grease or other permanent lubricants</b><br/>Torque transmission impeded / overheating of and damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Never use grease or other permanent lubricants for fitting the torque-transmitting elements of a mechanical seal.</li> <li>▷ Use soft soap to reduce any friction caused during assembly.</li> <li>▷ Never coat the mechanical seal faces with grease or oil.</li> </ul> |
|  | <p><b>CAUTION</b></p> <p><b>Improper installation of the mechanical seal</b><br/>Damage to the seal faces!</p> <ul style="list-style-type: none"> <li>▷ Install the mechanical seal using the supplied mounting device C.</li> <li>▷ Prevent sudden forces acting on the mounting device and mechanical seal.</li> </ul>                                                                                                                                                   |

- ✓ The relevant documentation for installing the mechanical seal is observed.
  - ✓ The back pull-out unit has been removed from the pump casing. It has been safely placed down and secured in a horizontal position.
  - ✓ The original 4STQ cartridge mechanical seal is fully assembled and undamaged.
  - ✓ Mounting device C is available.
1. Guide the mechanical seal (without external O-rings) onto the shaft as far as it will go.

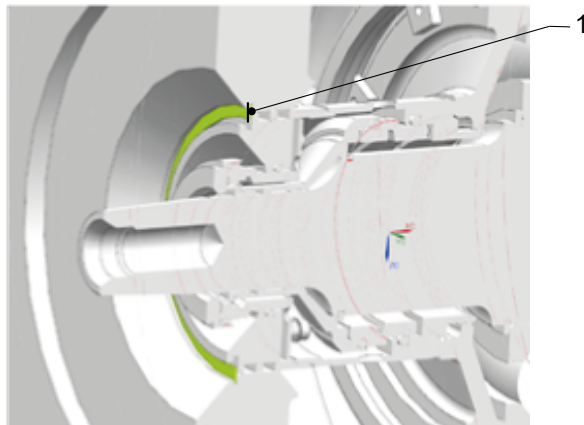


**Fig. 43:** Illustration of the groove

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.

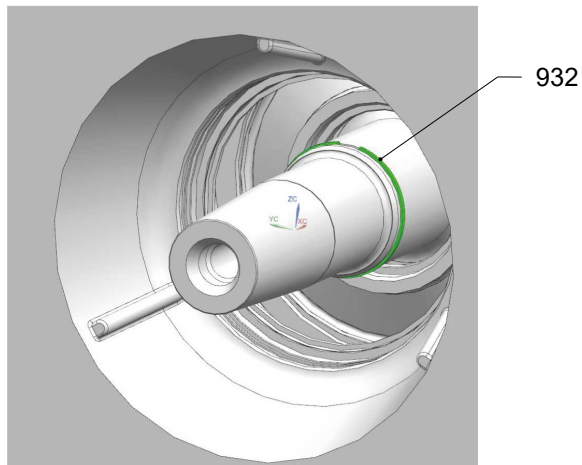


**Fig. 44:** Fitting the circlip in the shaft groove

4. Fit circlip 932 in the shaft groove. Make sure it is correctly seated.

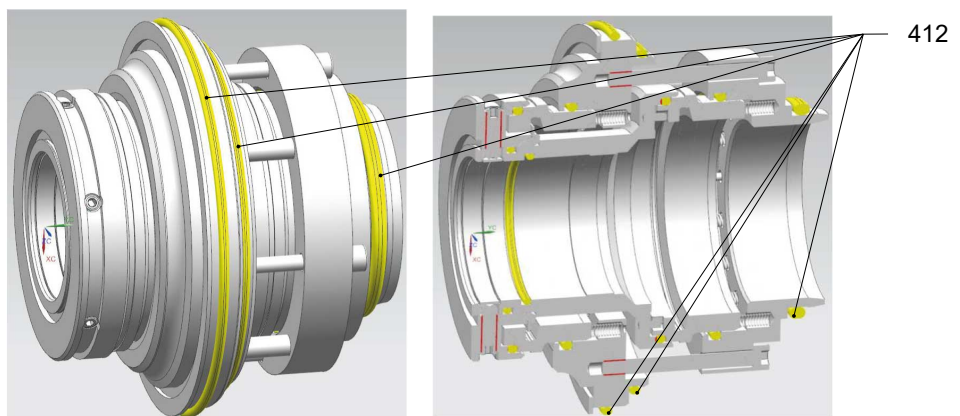


**Fig. 45:** Fitting the external O-rings

5. Fit external O-rings 412 and wet them with a suitable lubricant (e.g. soap solution).

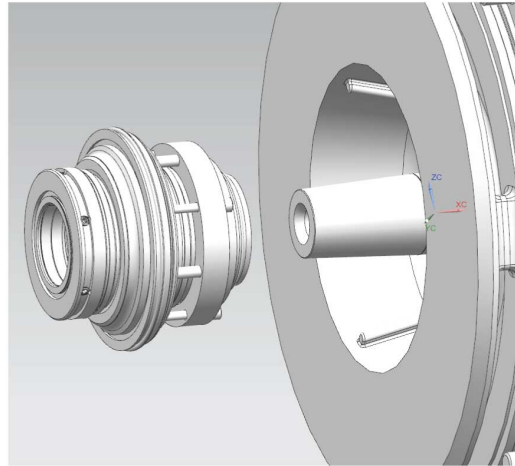


**Fig. 46:** Positioning the mechanical seal

6. Place the mechanical seal on the shaft. Guide it as far into the discharge cover as possible.

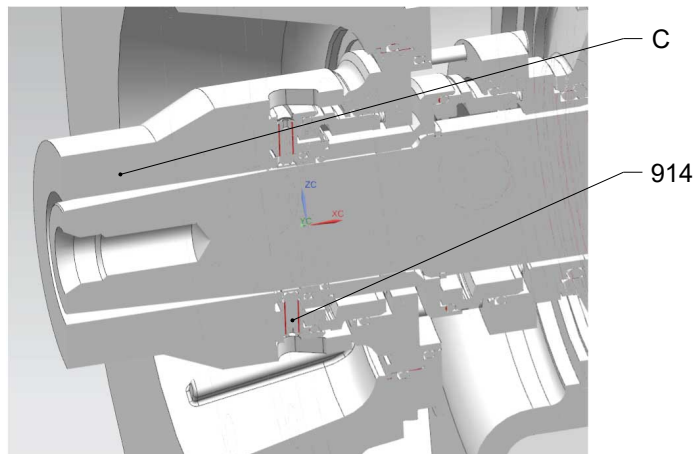


**Fig. 47:** Mounting device C

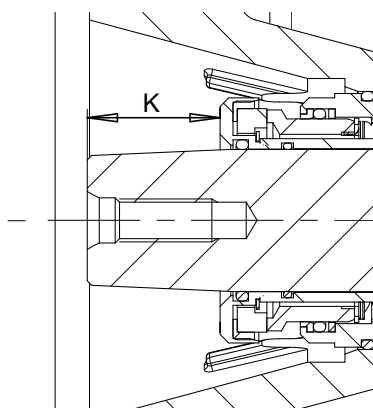
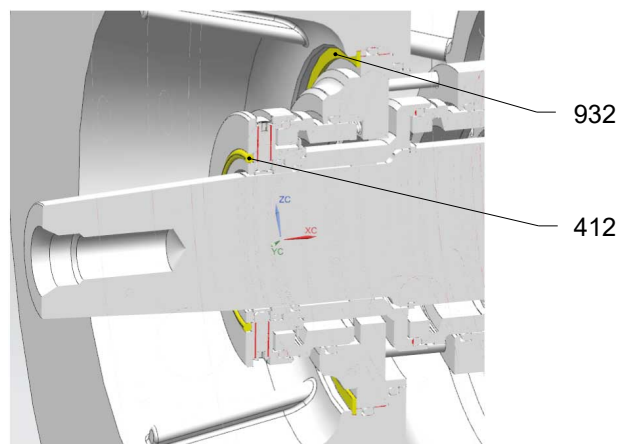


**Fig. 48:** Reference dimension "K" from shaft end to mechanical seal

7. Position mounting device C on the front face of the mechanical seal. Align the mechanical seal in the axial direction. Lock in position using hexagon socket head cap screws 914. Verify the position of the mechanical seal with reference dimension "K" =  $83 \pm 0.5$  mm; adjust the position if necessary.


**Fig. 49:** Final assembly

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

#### 7.5.2.5 Fitting the impeller



#### NOTE

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

- ✓ 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 thread-locking agent Loctite 243 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 depending on the bolt/screw materials (⇒ Section 7.6, Page 101) .

**Table 31:** 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             | M8     | 26                |
| 50-216 | 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             | M16    | 150               |

| Size    | Impeller type | Thread | Tightening torque |
|---------|---------------|--------|-------------------|
|         |               |        | [Nm]              |
| 80-317  | 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             | M16    | 150               |
| 100-315 | F, K          | M16    | 150               |
| 100-316 | D             | M16    | 150               |
| 100-316 | F, K          | M16    | 150               |
| 100-317 | E             | M16    | 150               |
| 100-400 | K             | M20    | 290               |
| 100-401 | E, F, K       | M20    | 290               |
| 100-403 | D             | M20    | 290               |
| 150-253 | D             | M10    | 35                |
| 150-315 | D             | M16    | 150               |
| 150-315 | F             | M16    | 150               |
| 150-317 | E, K          | M16    | 150               |
| 150-317 | D             | M16    | 150               |
| 150-400 | D             | M20    | 290               |
| 150-400 | K             | M20    | 290               |
| 150-401 | D             | M20    | 290               |
| 150-401 | E, F          | M20    | 290               |
| 150-403 | D             | M20    | 290               |
| 150-403 | K             | M20    | 290               |
| 151-403 | K             | M20    | 290               |
| 200-315 | D             | M16    | 150               |
| 200-315 | 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 | D             | M20    | 290               |
| 200-402 | K             | M20    | 290               |
| 200-403 | K             | M20    | 290               |
| 200-405 | D             | M20    | 290               |
| 250-400 | D             | M20    | 290               |
| 250-401 | K             | M20    | 290               |
| 250-402 | D             | M20    | 290               |
| 250-403 | K             | M20    | 290               |
| 300-400 | D             | M20    | 290               |
| 300-400 | K             | M20    | 290               |
| 300-401 | K             | M20    | 290               |
| 300-402 | D             | M20    | 290               |
| 300-403 | K             | M20    | 290               |

## 7.5.2.6 Installing the back pull-out unit

### 7.5.2.6.1 Fitting the cutter

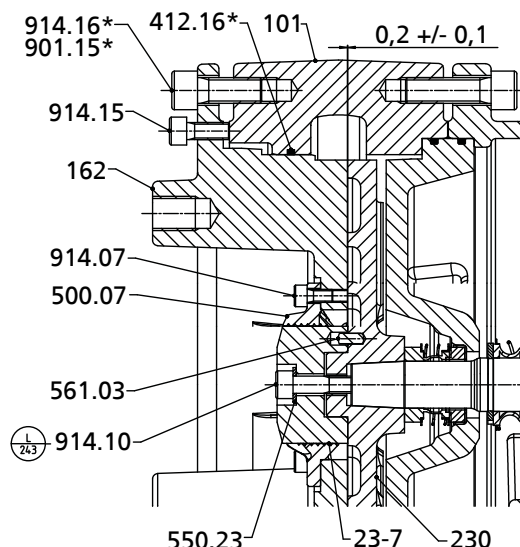


**Fig. 50:** Fitting the cutter

- ✓ 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.

### 7.5.2.6.2 Adjusting the cutter

- ✓ The cutter has been fitted.

  1. Measure the distance between the impeller and the suction cover. Distance S should measure approximately  $0.2 \pm 0.1$  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.

### 7.5.2.6.3 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.

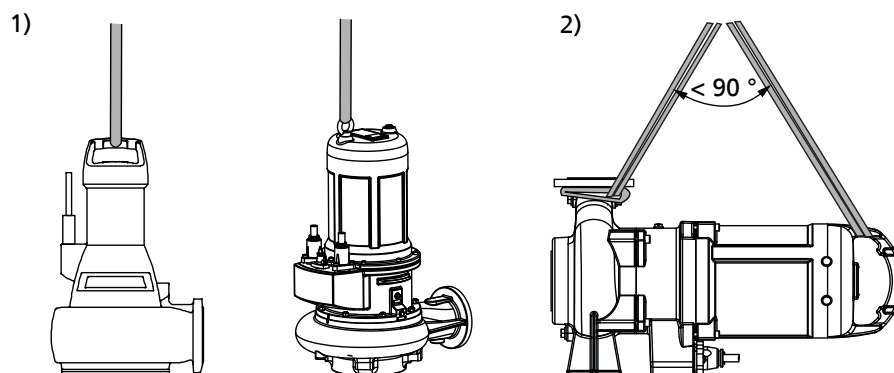


**Fig. 51:** Suspending the pump set 1) Vertical installation 2) Horizontal installation

#### 7.5.2.6.4 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  $A = 0.3 \pm 0.1$  mm.

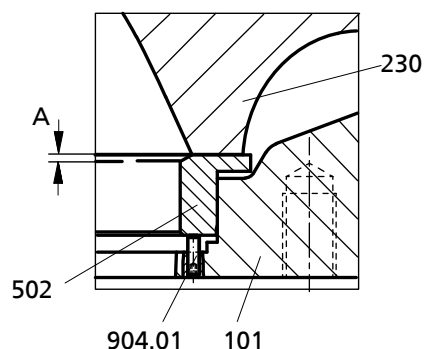


**Fig. 52:** Fitting the casing wear ring

#### 7.5.2.6.5 Fitting the wear plate (for D impeller only)

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

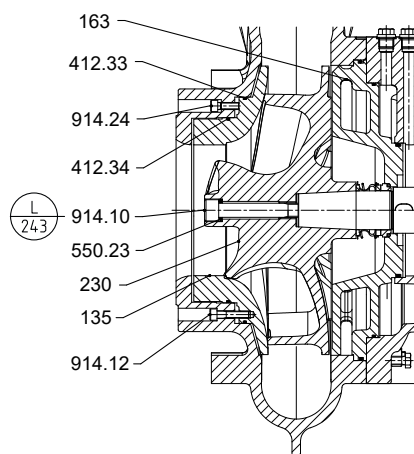


**Fig. 53:** Fitting the wear plate

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.

#### 7.5.2.6.6 Installing the back pull-out unit

- ✓ The shaft, rolling element bearings, mechanical seal and impeller have been assembled properly.
1. Insert the complete back pull-out unit into the pump casing.
  2. Evenly tighten bolted/screwed connection 920.01 and 902.01 and/or 914.74 between pump casing and bearing housing 350.

#### 7.5.2.6.7 Adjusting the wear plate (for D impeller only)

- ✓ The pump set has been suspended and lifted/placed down as described in (⇒ Section 3.2.1, Page 18) .
  - ✓ The complete back pull-out unit has been inserted into the pump casing.
1. Adjust the wear plate.

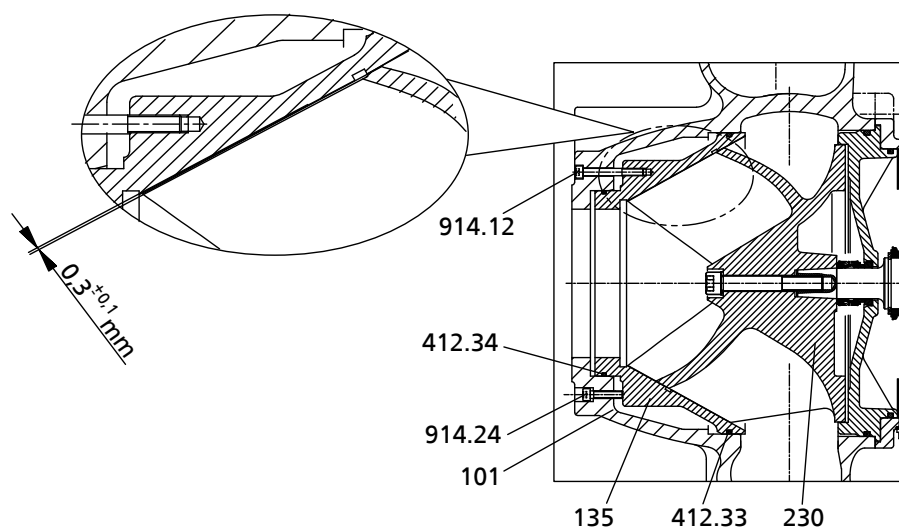


**Fig. 54:** Adjusting the wear plate

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.

- ⇒ For D impeller (single-vane impeller), the clearance equals  $0.3^{+0.1}$  mm (measured on the suction side from the outer surface of the impeller vane to the wear plate).
- ⇒ For D impeller (multi-vane impeller), the clearance equals  $0.3^{+0.1}$  mm (measured at the outer diameter from the outer surface of the impeller vane to the wear plate).

#### 7.5.2.6.8 Reassembling the motor section

|                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                       | <p><b>NOTE</b></p> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex <b>Flamepaths on explosion-proof motors</b>. (⇒ Section 9.3, Page 123) Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite type 243).</p> |
| <br> | <p><b>! DANGER</b></p> <p><b>Wrong screws/bolts</b></p> <p>Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Always use the original screws/bolts for assembling an explosion-proof pump set.</li> <li>▷ Never use screws/bolts of different dimensions or of a lower property class.</li> </ul>                                                                                                                                                                                                                              |

#### 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

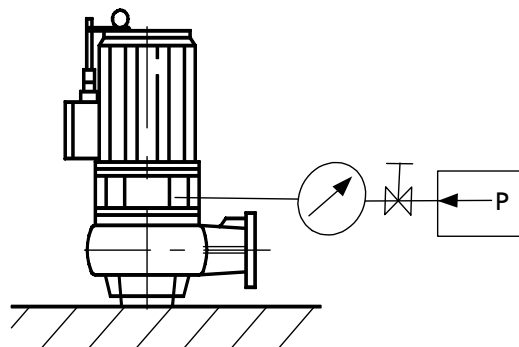


**Fig. 55:** Screwing in the testing device

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 electric cables after reassembly. (⇒ Section 7.2.2, Page 67)

### 7.6 Tightening torques

**Table 32:** Tightening torques [Nm] depending on thread, material and property class

| Thread | Material                                            |       |       |        |       |             |
|--------|-----------------------------------------------------|-------|-------|--------|-------|-------------|
|        | A4-50                                               | A4-70 | A4-70 | 1.4462 | D6-80 | 8.8 / C3-80 |
|        | Property class Rp 0.2 <sup>N</sup> /mm <sup>2</sup> |       |       |        |       |             |
|        | 210                                                 | 250   | 450   | 450    | 600   | 640         |
| M5     | -                                                   | -     | 4     | 4      | -     | 6           |
| M6     | -                                                   | -     | 7     | 7      | -     | 10          |
| M8     | -                                                   | -     | 17    | 17     | 23    | 25          |
| M10    | -                                                   | -     | 35    | 35     | 46    | 50          |
| M12    | -                                                   | -     | 60    | 60     | 79    | 85          |
| M14    | -                                                   | -     | 90    | 90     | 121   | 130         |
| M16    | -                                                   | -     | 150   | 150    | 196   | 210         |
| M20    | -                                                   | -     | 290   | 290    | 384   | 410         |
| M24    | 230                                                 | 278   | -     | 500    | 656   | 700         |
| M30    | 460                                                 | -     | -     | 1000   | 1312  | 1400        |
| M42    | 1300                                                | -     | -     | 2750   | 3656  | 3900        |
| M48    | 1950                                                | -     | -     | 4200   | 5625  | 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 105)
- 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 33:** Quantity of spare parts for recommended spare parts stock<sup>18)</sup>

| 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 %       |

<sup>18</sup> For two years of continuous operation or 17,800 operating hours

## 8 Trouble-shooting

|                                                                                   |                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  <b>WARNING</b>                                                                                                                                                         |
|                                                                                   | <b>Improper work to remedy faults</b><br>Risk of injury!<br><p>► For any work performed to remedy faults, observe the relevant information given in this operating manual and/or in the product literature provided by the accessories manufacturer.</p> |

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

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

**Table 34:** Trouble-shooting

| A | B | C | D | E | Possible cause                                                                                                        | Remedy                                                                                                                                                                                     |
|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| - | X | X | X | X | Excessive clearance between the impeller and the casing wear ring / wear plate                                        | Check and adjust the clearance.                                                                                                                                                            |
| - | X | - | - | - | Pump delivers against an excessively high pressure.                                                                   | Re-adjust to duty point.                                                                                                                                                                   |
| - | X | - | - | - | Gate valve in the discharge line is not fully open.                                                                   | Fully open the gate valve.                                                                                                                                                                 |
| - | - | X | - | X | Pump running in off-design conditions (part load / over-load)                                                         | Check the pump's operating data.                                                                                                                                                           |
| X | - | - | - | - | Pump and/or piping are not completely vented.                                                                         | Installation type S:<br>Vent by lifting the pump off the flanged bend and lowering it again.<br><br>Installation types D and H:<br>Vent / prime the pump via auxiliary vent connection 6D. |
| X | - | - | - | - | Pump intake clogged by deposits                                                                                       | Clean the intake, pump components and lift check valve.                                                                                                                                    |
| - | X | - | X | X | Supply line or impeller clogged                                                                                       | Remove deposits in the pump and/or piping.                                                                                                                                                 |
| - | - | X | - | X | Dirt/fibres in the clearance between the casing wall and impeller; sluggish rotor.                                    | Check that the impeller can rotate freely.<br>Clean the impeller if necessary.                                                                                                             |
| - | X | X | X | X | Wear of internal components                                                                                           | Replace worn components by new ones.                                                                                                                                                       |
| X | X | - | X | - | Defective riser (pipe and sealing elements)                                                                           | Replace defective risers,<br>replace sealing elements.                                                                                                                                     |
| - | X | - | X | X | Impermissible air or gas content in the fluid handled                                                                 | Contact the manufacturer.                                                                                                                                                                  |
| - | - | - | - | X | System-induced vibrations                                                                                             | Contact the manufacturer.                                                                                                                                                                  |
| - | X | X | X | X | Wrong direction of rotation                                                                                           | Check the electrical connection of the motor and the control system if any.                                                                                                                |
| - | - | X | - | - | Wrong supply voltage                                                                                                  | Check the power cables.<br>Check the cable connections.                                                                                                                                    |
| X | - | - | - | - | Motor is not running because of lack of voltage.                                                                      | Check the electrical installation.<br>Contact the energy supplier.                                                                                                                         |
| X | - | X | - | - | Motor winding or power cable defective                                                                                | Replace by new original KSB parts or contact KSB.                                                                                                                                          |
| - | X | - | X | - | In case of star-delta configuration: motor running in star configuration only                                         | Check star-delta contactor.                                                                                                                                                                |
| - | - | - | - | X | Defective rolling element bearing                                                                                     | Contact the manufacturer.                                                                                                                                                                  |
| - | X | - | - | - | Water level lowered too much during operation                                                                         | Check level control equipment.                                                                                                                                                             |
| X | - | - | - | - | 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.                                                                                                                              |

| A        | B | C | D | E | Possible cause                                                                                                                     | Remedy                                                                   |
|----------|---|---|---|---|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>X</b> | - | - | - | - | 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. |
| <b>X</b> | - | - | - | - | Motor has been tripped by leakage sensor.                                                                                          | Have cause determined and eliminated by qualified and trained personnel. |

## 9 Related Documents

### 9.1 Cross sectional 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

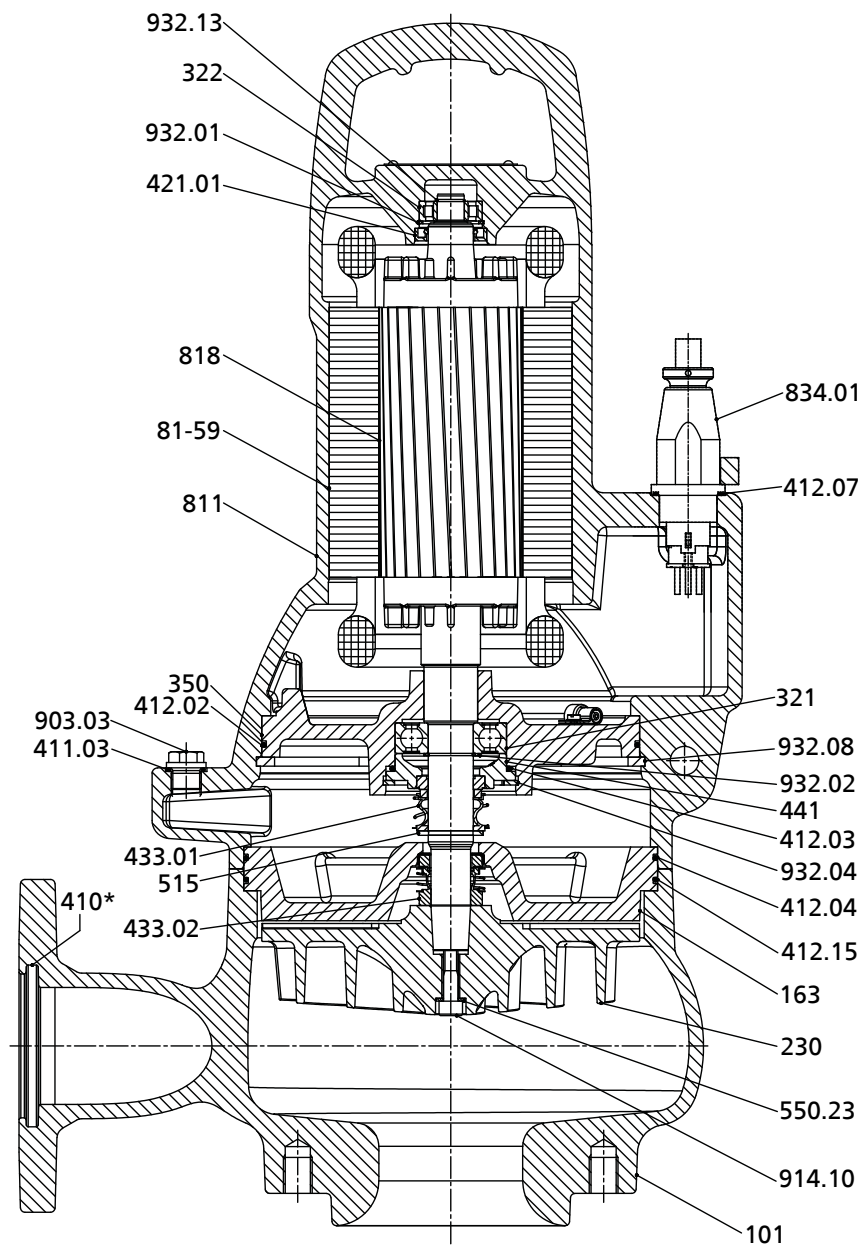


**Fig. 56:** General assembly drawing Amarex KRT, motor type 1

\*: On specific designs only

**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             |
| 322      | Radial roller bearing | 811      | Motor housing      |

| Part No.               | Description     | Part No.               | Description                   |
|------------------------|-----------------|------------------------|-------------------------------|
| 350                    | Bearing housing | 818                    | Rotor                         |
| 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

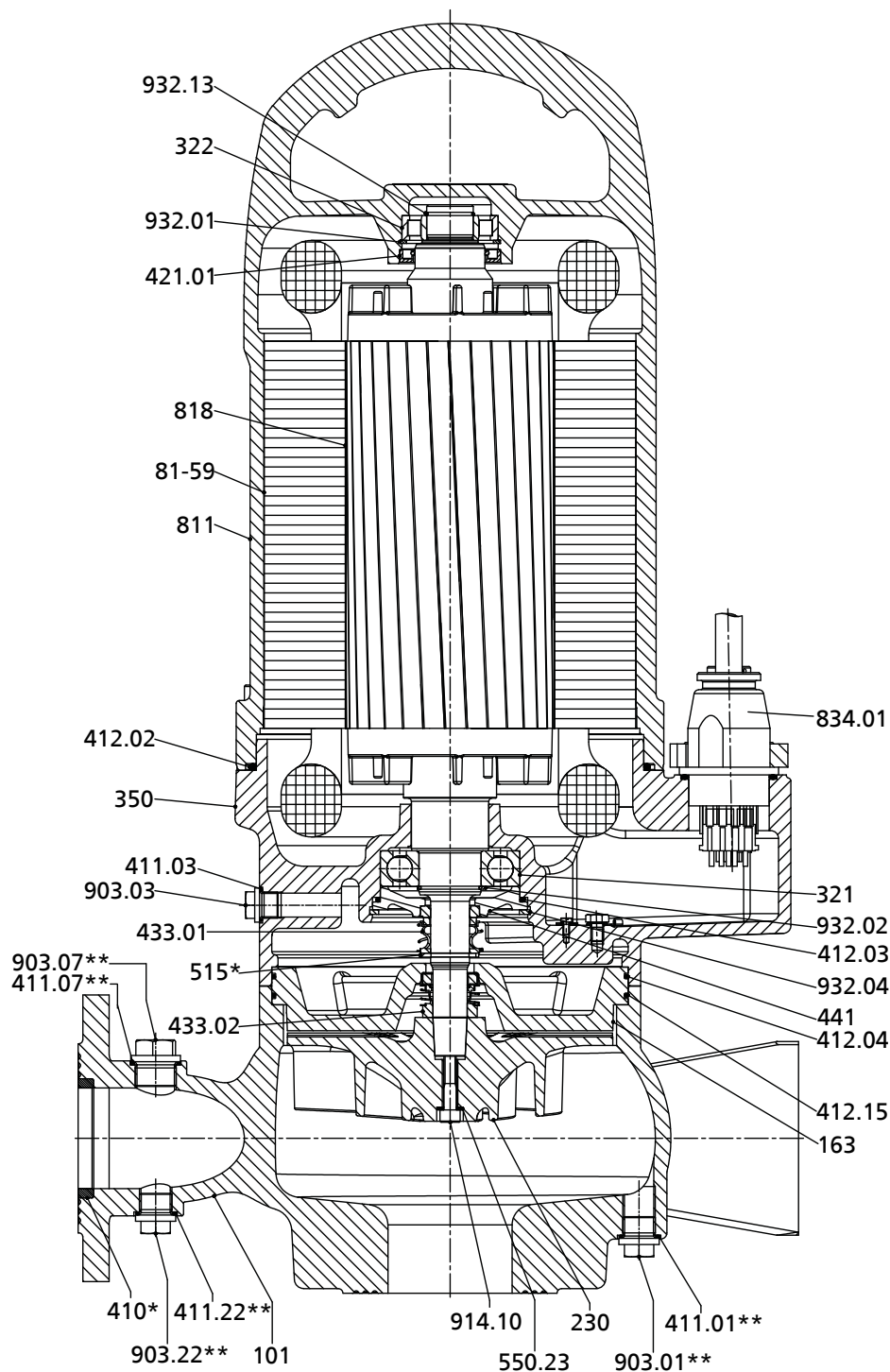


**Fig. 57:** General assembly drawing Amarex KRT, motor type 2

\*: On specific designs only

\*\* Only for installation types K, D and H

**Table 36:** 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               |

| Part No.           | Description           | Part No.           | Description                   |
|--------------------|-----------------------|--------------------|-------------------------------|
| 321                | Radial ball bearing   | 81-59              | Stator                        |
| 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:**

80-315  
80-317  
100-315  
100-316  
100-317  
100-400  
100-401  
100-403  
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  
200-403  
200-405  
250-400  
250-401  
250-402  
250-403  
300-400  
300-401  
300-402  
300-403

**Motors:**

30 2 ; 37 2 ; 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

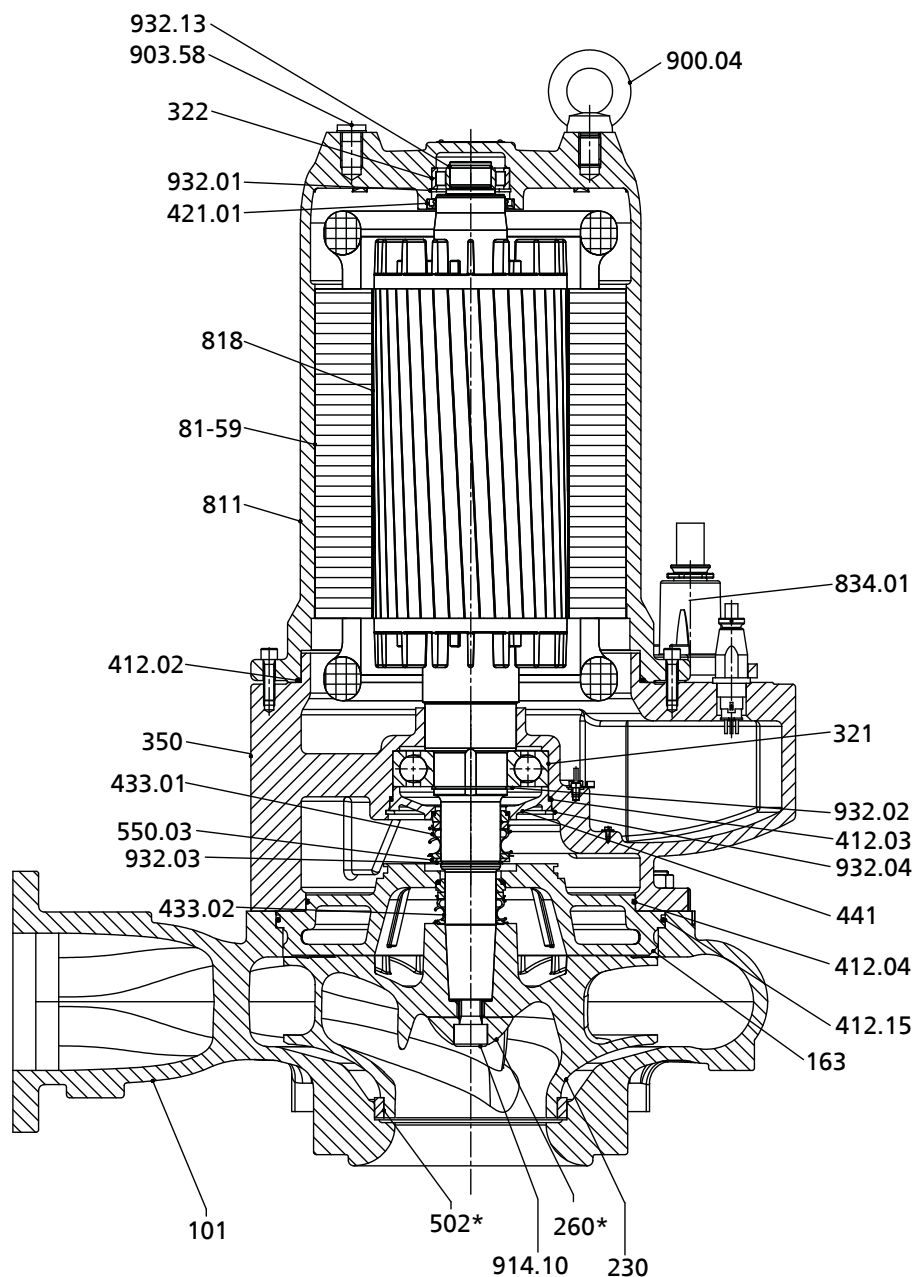


**Fig. 58:** General assembly drawing of Amarex KRT, motor type 3

\*: On specific designs only

**Table 37:** 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                    |
| 421.01             | Lip seal              | 914.10   | Hexagon socket head cap screw |

| Part No.   | Description        | Part No.               | Description |
|------------|--------------------|------------------------|-------------|
| 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

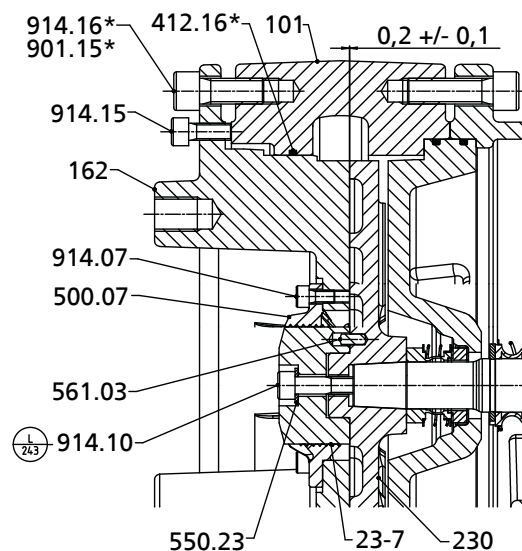


**Fig. 59:** Impeller type S

\*: On specific designs only

**Table 38:** 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

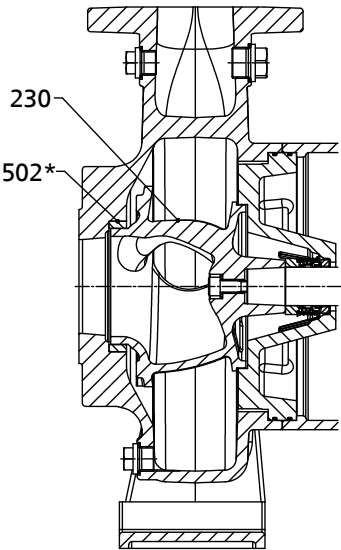


Fig. 60: Impeller type E

\*: On specific designs only

Table 39: Impeller type E

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

9.2.3 Impeller type D (single-vane impeller)

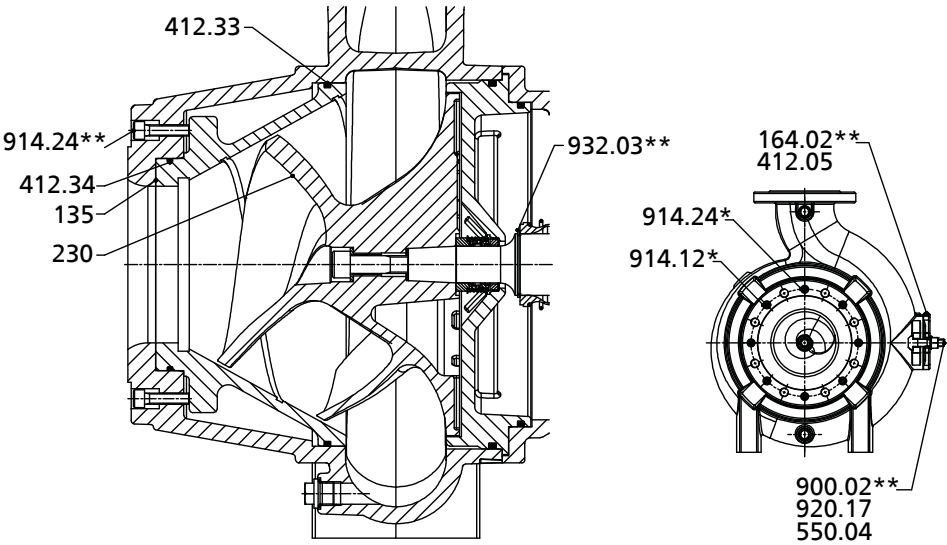


Fig. 61: Impeller type D (single-vane impeller)

\*: On specific designs only

\*\* Only for installation types K, D and H

Table 40: Impeller type D

| Part No. | Description      | Part No. | Description                   |
|----------|------------------|----------|-------------------------------|
| 135      | Wear plate       | 900      | Bolt/screw                    |
| 164      | Inspection cover | 914      | Hexagon socket head cap screw |
| 230      | Impeller         | 920      | Nut                           |

2553.8207/04-EN

| Part No. | Description | Part No. | Description |
|----------|-------------|----------|-------------|
| 412      | O-ring      | 932      | Circlip     |
| 550      | Disc        |          |             |

### 9.2.4 Impeller type D (multi-vane impeller)

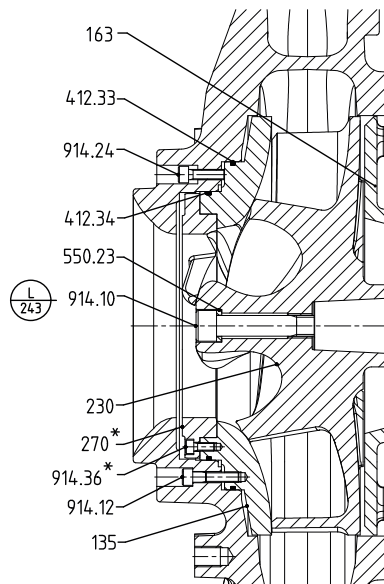


**Fig. 62:** Impeller type D (multi-vane impeller)

\*: On specific designs only

**Table 41:** Impeller type D

| Part No. | Description     | Part No. | Description                   |
|----------|-----------------|----------|-------------------------------|
| 135      | Wear plate      | 412      | O-ring                        |
| 163      | Discharge cover | 550      | Disc                          |
| 230      | Impeller        | 914      | Hexagon socket head cap screw |
| 270      | Deflector       |          |                               |

### 9.2.5 Impeller type K

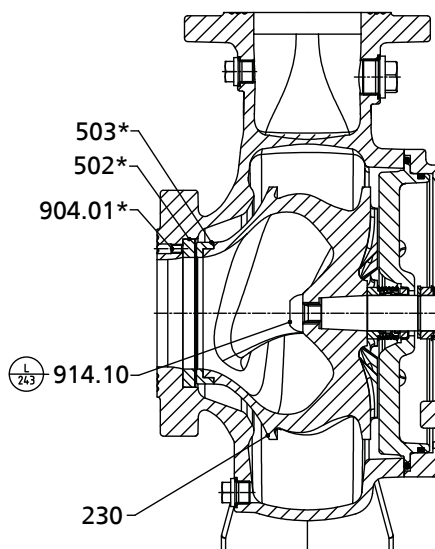


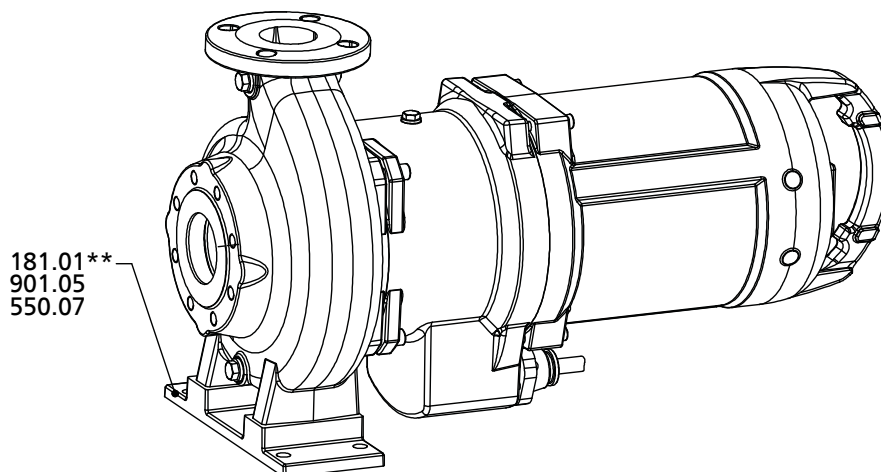
**Fig. 63:** Impeller type K

\*: On specific designs only

**Table 42:** Impeller type K

| Part No. | Description        | Part No. | Description                   |
|----------|--------------------|----------|-------------------------------|
| 230      | Impeller           | 904      | Grub screw                    |
| 502      | Casing wear ring   | 914      | Hexagon socket head cap screw |
| 503      | Impeller wear ring |          |                               |

### 9.2.6 Horizontal installation


**Fig. 64:** Horizontal installation

\*\* Only for installation types K, D and H

**Table 43:** Horizontal installation

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

### 9.2.7 Transportable wet-installed model

**Table 44:** Illustrations assigned to each size

| 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       | X                | X        | -     | -        | X  | X  | -               |
| 50-215 | F             | X                | X        | -     | -        | X  | X  | -               |
| 50-216 | F             | X                | X        | -     | -        | X  | X  | -               |
| 50-216 | S             | X                | X        | -     | -        | X  | X  | -               |
| 65-215 | F             | X                | X        | -     | -        | X  | X  | -               |
| 65-216 | E             | X                | X        | -     | -        | X  | X  | -               |
| 65-217 | F             | X                | X        | -     | -        | X  | X  | -               |
| 65-253 | K             | -                | -        | -     | -        | -  | -  | -               |
| 80-215 | F             | X                | X        | -     | -        | X  | X  | -               |
| 80-216 | E             | X                | X        | -     | -        | X  | X  | -               |
| 80-216 | F             | X                | X        | -     | -        | X  | X  | -               |
| 80-252 | F             | X                | X        | -     | -        | X  | X  | -               |
| 80-253 | E, F, K       | X                | X        | -     | -        | X  | X  | -               |
| 80-315 | D             | -                | -        | -     | -        | -  | -  | X               |

| 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 |
| 80-315  | K             | X                | X        | -     | -        | X  | X  | -               |
| 80-317  | D             | -                | -        | -     | -        | -  | -  | X               |
| 80-317  | F             | X                | X        | -     | -        | X  | X  | X               |
| 100-215 | F             | X                | X        | -     | -        | X  | X  | -               |
| 100-253 | D             | X                | X        | -     | -        | X  | X  | X               |
| 100-253 | E, K          | X                | X        | -     | -        | X  | X  | -               |
| 100-254 | F, K          | X                | X        | -     | -        | X  | X  | -               |
| 100-315 | D             | -                | -        | X     | X        | X  | X  | X               |
| 100-315 | E             | -                | -        | X     | X        | X  | X  | -               |
| 100-315 | F, K          | -                | -        | X     | X        | X  | X  | -               |
| 100-316 | D             | -                | -        | X     | X        | X  | X  | X               |
| 100-316 | F, K          | -                | -        | X     | X        | X  | X  | -               |
| 100-317 | E             | -                | -        | X     | X        | -  | -  | -               |
| 100-400 | K             | -                | -        | -     | -        | -  | -  | X               |
| 100-401 | E, F, K       | -                | -        | -     | -        | -  | -  | X               |
| 100-403 | D             | -                | -        | -     | -        | -  | -  | X               |
| 150-253 | D             | X                | X        | -     | -        | -  | -  | -               |
| 150-315 | D             | X                | X        | -     | -        | X  | X  | -               |
| 150-315 | F             | -                | -        | X     | X        | X  | X  | -               |
| 150-317 | E, K          | -                | -        | X     | X        | X  | X  | -               |
| 150-317 | D             | X                | X        | -     | -        | -  | -  | -               |
| 150-400 | D             | -                | -        | -     | -        | -  | -  | X               |
| 150-400 | K             | -                | -        | -     | -        | -  | -  | X               |
| 150-401 | D             | -                | -        | -     | -        | -  | -  | X               |
| 150-401 | E, F          | -                | -        | -     | -        | -  | -  | X               |
| 150-403 | D             | -                | -        | -     | -        | -  | -  | X               |
| 150-403 | K             | -                | -        | -     | -        | -  | -  | X               |
| 151-403 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-315 | D             | -                | -        | -     | -        | -  | -  | X               |
| 200-315 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-316 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-317 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-318 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-400 | D             | -                | -        | -     | -        | -  | -  | X               |
| 200-401 | E             | -                | -        | -     | -        | -  | -  | X               |
| 200-402 | D             | -                | -        | -     | -        | -  | -  | X               |
| 200-402 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-403 | K             | -                | -        | -     | -        | -  | -  | X               |
| 200-405 | D             | -                | -        | -     | -        | -  | -  | X               |
| 250-400 | D             | -                | -        | -     | -        | -  | -  | X               |
| 250-401 | K             | -                | -        | -     | -        | -  | -  | X               |
| 250-402 | D             | -                | -        | -     | -        | -  | -  | X               |
| 250-403 | K             | -                | -        | -     | -        | -  | -  | X               |
| 300-400 | D             | -                | -        | -     | -        | -  | -  | X               |
| 300-400 | K             | -                | -        | -     | -        | -  | -  | X               |

| 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 |
| 300-401 | K             | -                | -        | -     | -        | -  | -  | X               |
| 300-402 | D             | -                | -        | -     | -        | -  | -  | X               |
| 300-403 | K             | -                | -        | -     | -        | -  | -  | X               |

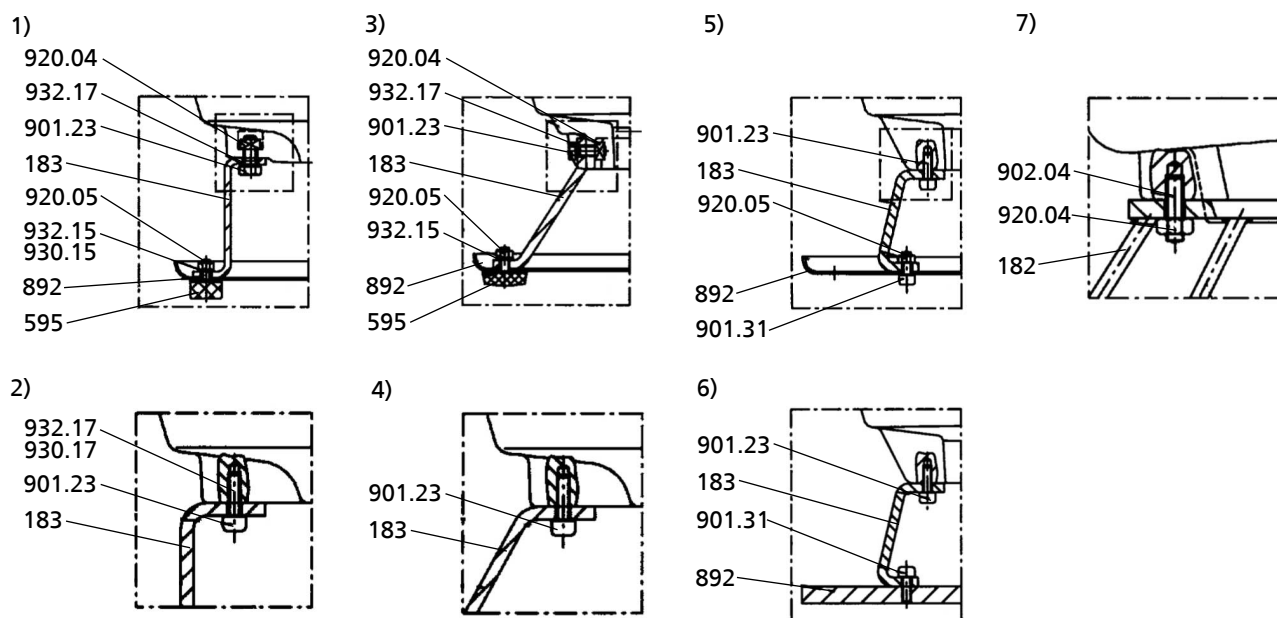


Fig. 65: Transportable wet-installed model

Table 45: 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 |            |               |

## 9.2.8 Reinforced bearings

Table 46: 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             | X                              | X      | X      | -      | -      | -      | -      | -      | -      | -      | -      | -      | -      | -      |
| 100-315 | D             | X                              | X      | X      | -      | -      | -      | -      | -      | -      | -      | -      | -      | -      | -      |
| 150-400 | D             | -                              | -      | -      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      |
| 150-401 | D             | -                              | -      | -      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      |
| 200-400 | D             | -                              | -      | -      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      |
| 250-400 | D             | -                              | -      | -      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      |
| 300-400 | D             | -                              | -      | -      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      | X      |

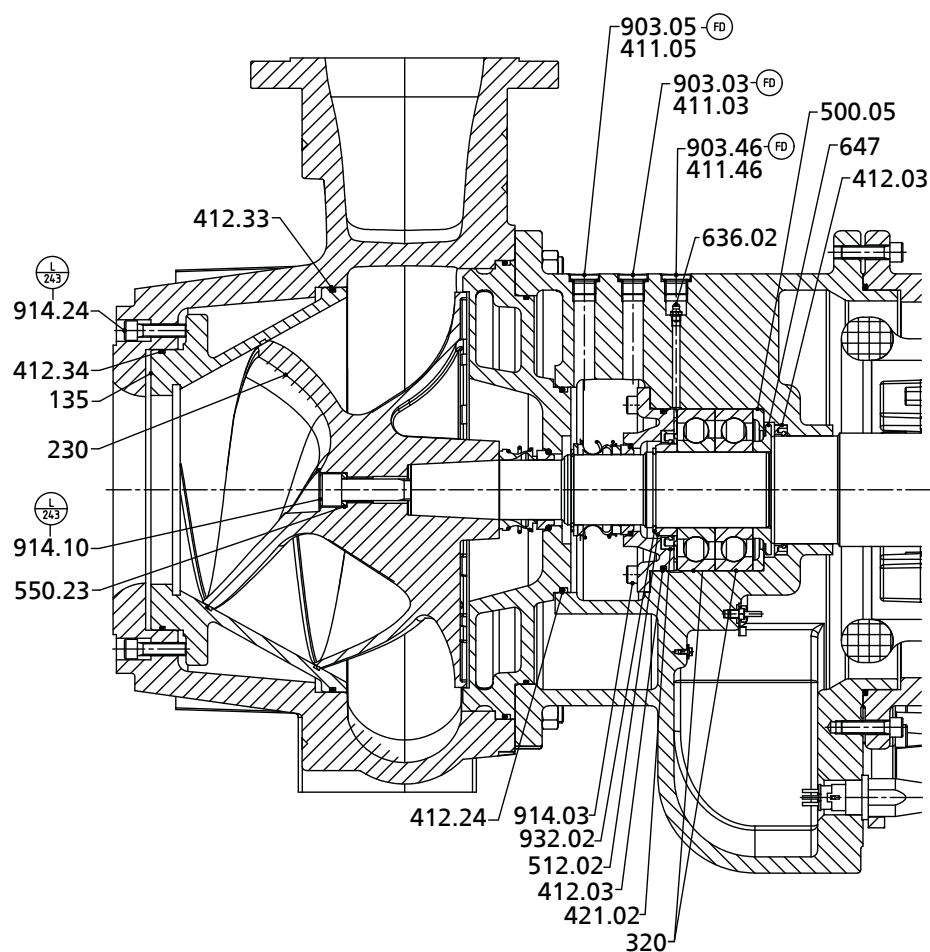


**Fig. 66:** Reinforced bearings

**Table 47:** 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                       |

### 9.2.9 Attachment elements

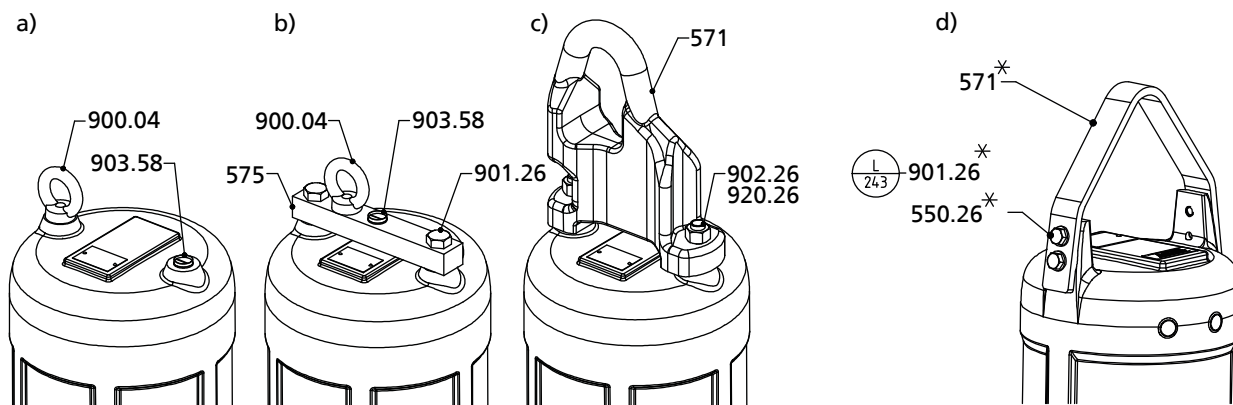


**Fig. 67:** Attachment elements a) bolt for guide wire arrangement b) bolt for guide rail arrangement c) bail d) stainless steel bail

\*: On specific designs only

**Table 48:** 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 | 550.26   | Disc        |

**Table 49:** Symbols key

| Symbol | Description                                                                         |
|--------|-------------------------------------------------------------------------------------|
|        | Always secure screwed connections marked with this symbol with <b>Loctite 243</b> . |

### 9.2.10 Electrode for leakage monitoring

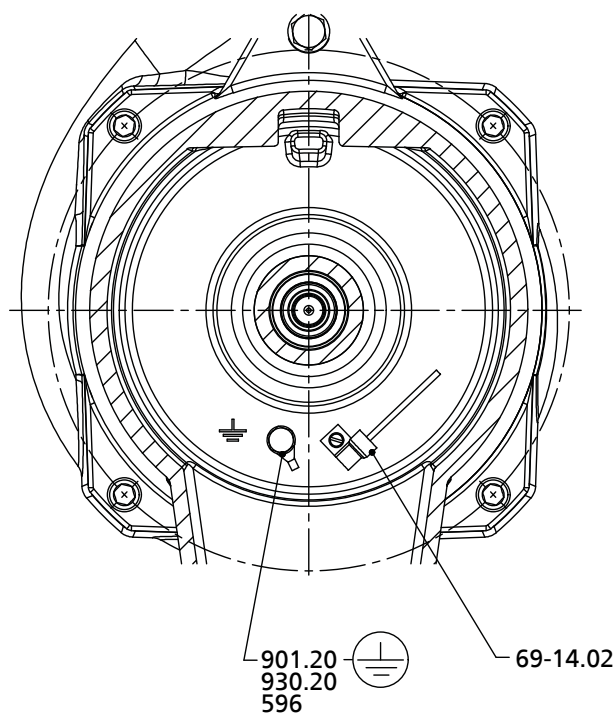


**Fig. 68:** Electrode for leakage monitoring

**Table 50:** 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     |

### 9.2.11 Electrode for leakage monitoring and motor temperature sensor

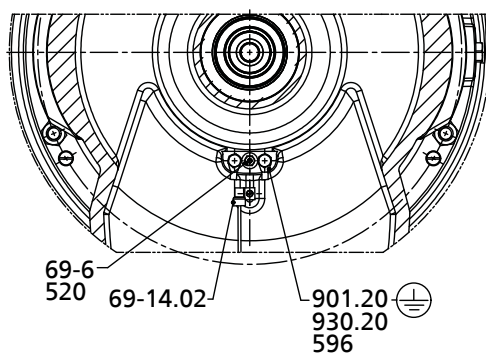

**Fig. 69:** Electrode for leakage monitoring and motor temperature sensor

**Table 51:** 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     |

## 9.2.12 Motor and fastening elements for the cable glands

### 9.2.12.1 Amarex KRT, motor type 1

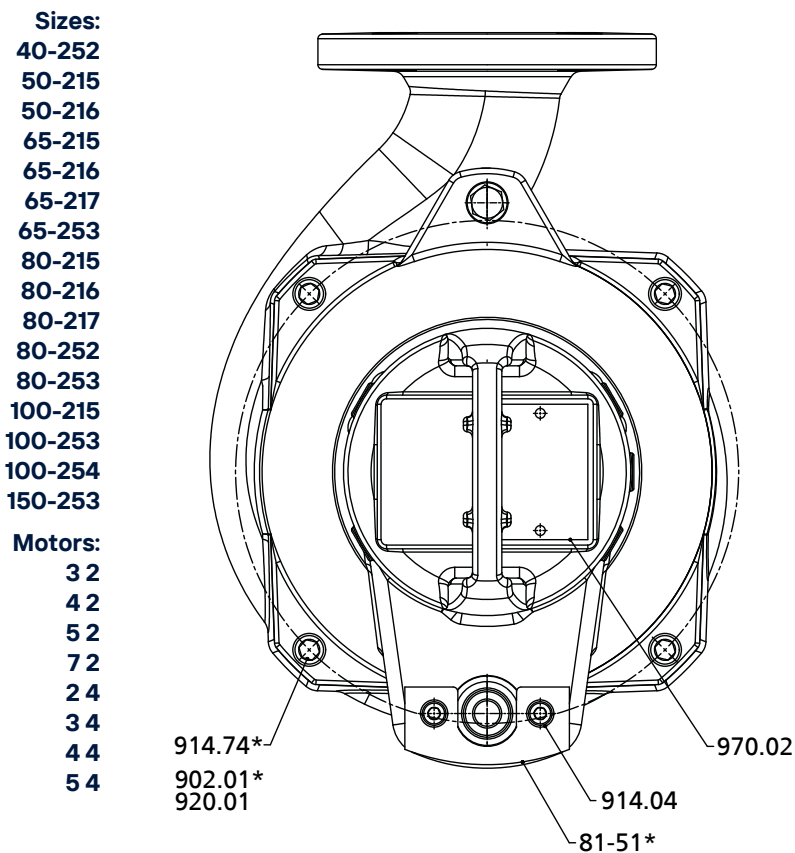


**Fig. 70:** Motor and fastening elements for the cable glands Amarex KRT, motor type 1

\*: On specific designs only

**Table 52:** 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 |          |             |

### 9.2.12.2 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

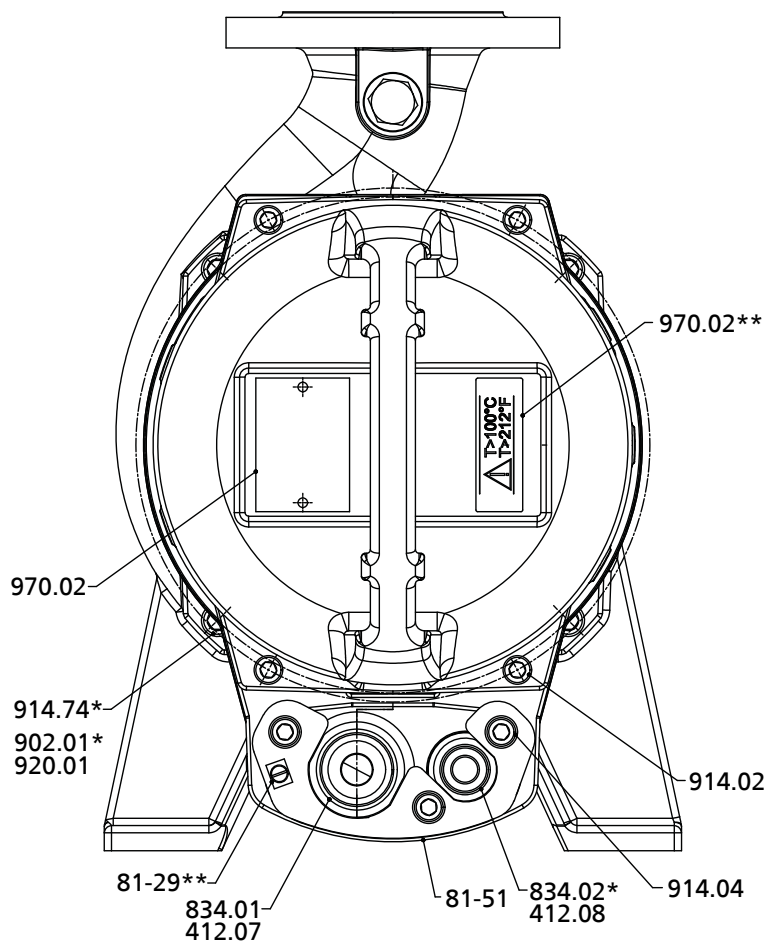


**Fig. 71:** Motor and fastening elements for the cable glands Amarex KRT, motor type 2

\*: On specific designs only

\*\* Only for installation types K, D and H

**Table 53:** 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                   |

### 9.2.12.3 Amarex KRT, motor type 3

#### Motor type 3 with one or two electric cables

Sizes:

80-315  
80-317  
100-315  
100-316  
100-317  
100-400  
100-401  
100-403  
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  
200-403  
200-405  
250-400  
250-401  
250-402  
250-403  
300-400  
300-401  
300-402  
300-403

Motors:

30 2  
37 2  
30 4  
37 4  
22 6  
30 6  
11 8  
15 8  
18 8  
22 8

**Fig. 72:** Motor and fastening elements for the cable glands Amarex KRT, motor type 3 with one or two electric cables

\*: On specific designs only

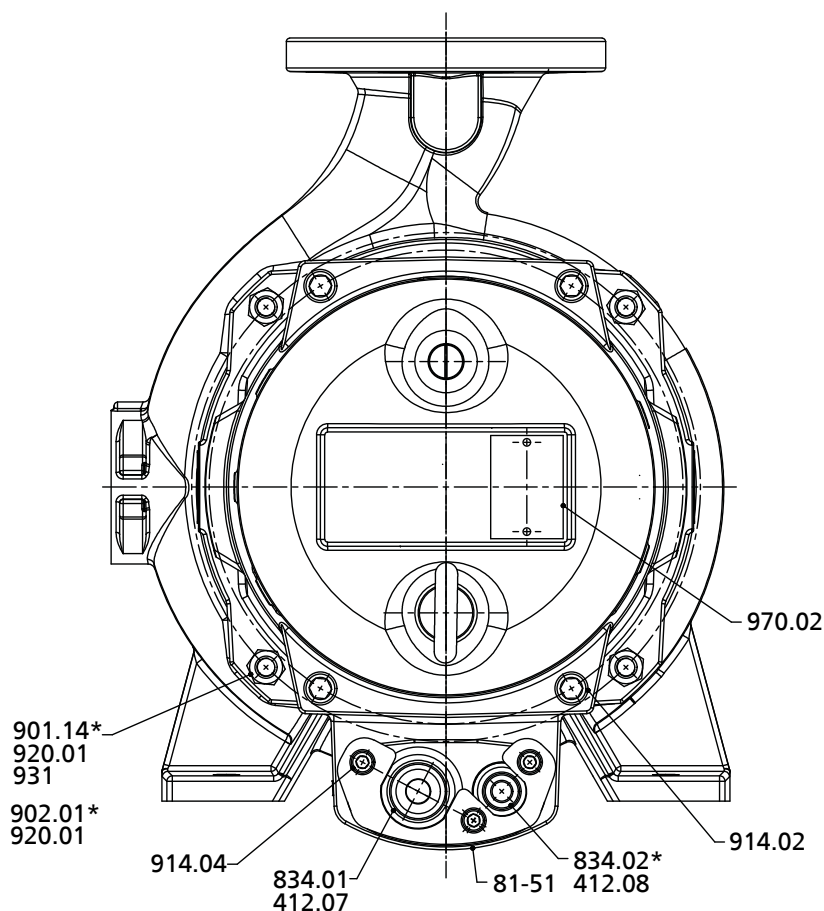


**Table 54:** List of components

| 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 electric cables

#### Sizes:

80-315  
100-315  
100-316  
100-400  
100-401  
100-403  
150-315  
150-317  
150-400  
150-401  
150-403  
151-401  
200-317  
200-318  
200-330  
200-400  
200-401  
200-402  
200-405  
250-400  
250-401  
250-402  
300-400  
300-401  
300-402

#### 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

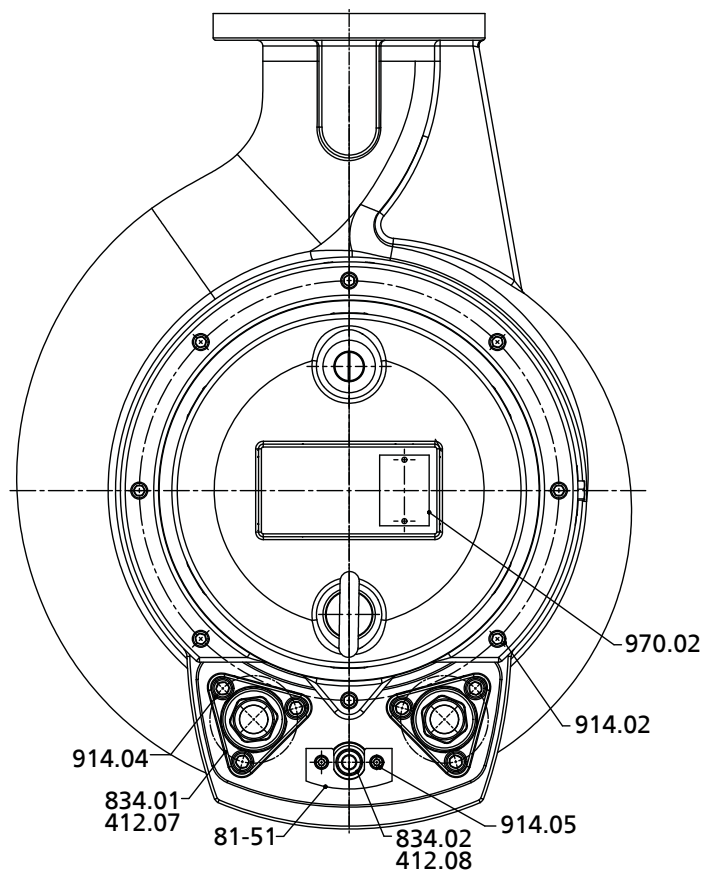


**Fig. 73:** Motor and fastening elements for the cable glands Amarex KRT, motor type 3, three electric cables

**Table 55:** 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 Flamepaths on explosion-proof motors

#### 9.3.1 Amarex KRT, motor type 1

Motors:

3 2

4 2

5 2

7 2

2 4

3 4

4 4

5 4

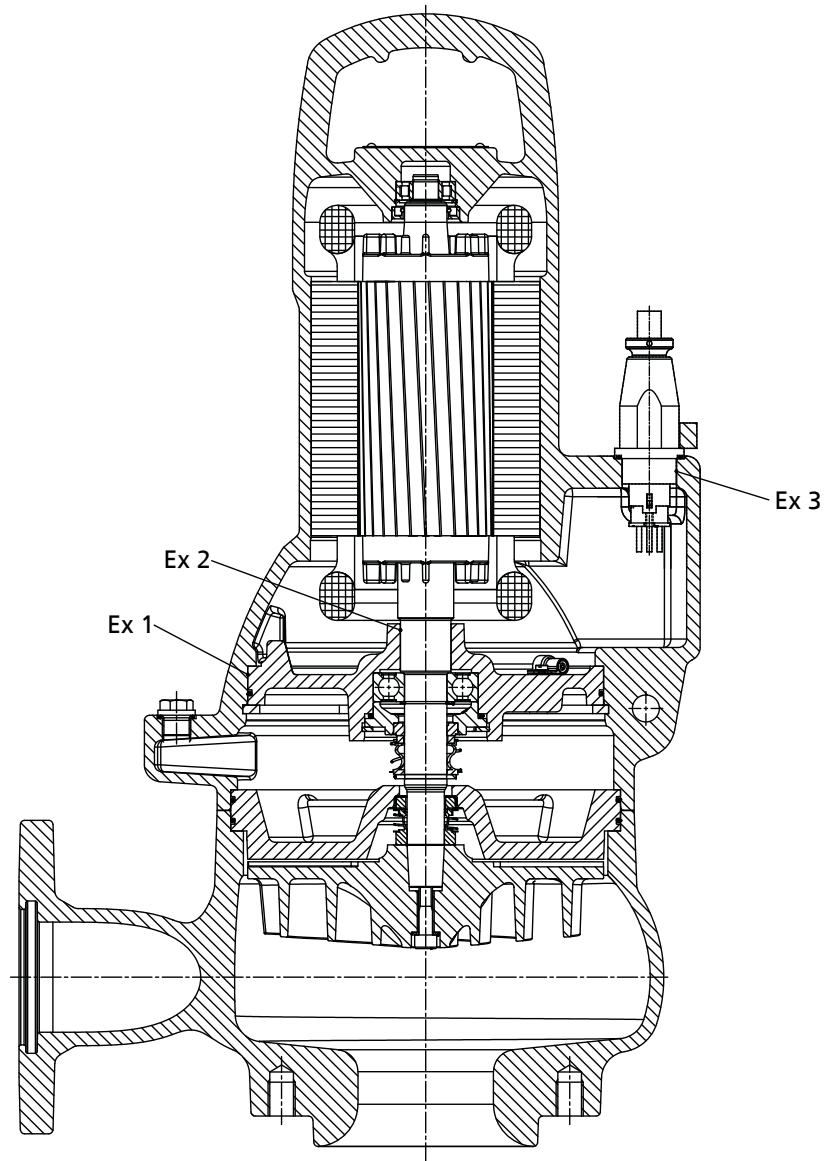


**Fig. 74:** Flamepaths Amarex KRT, motor type 1

### 9.3.2 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

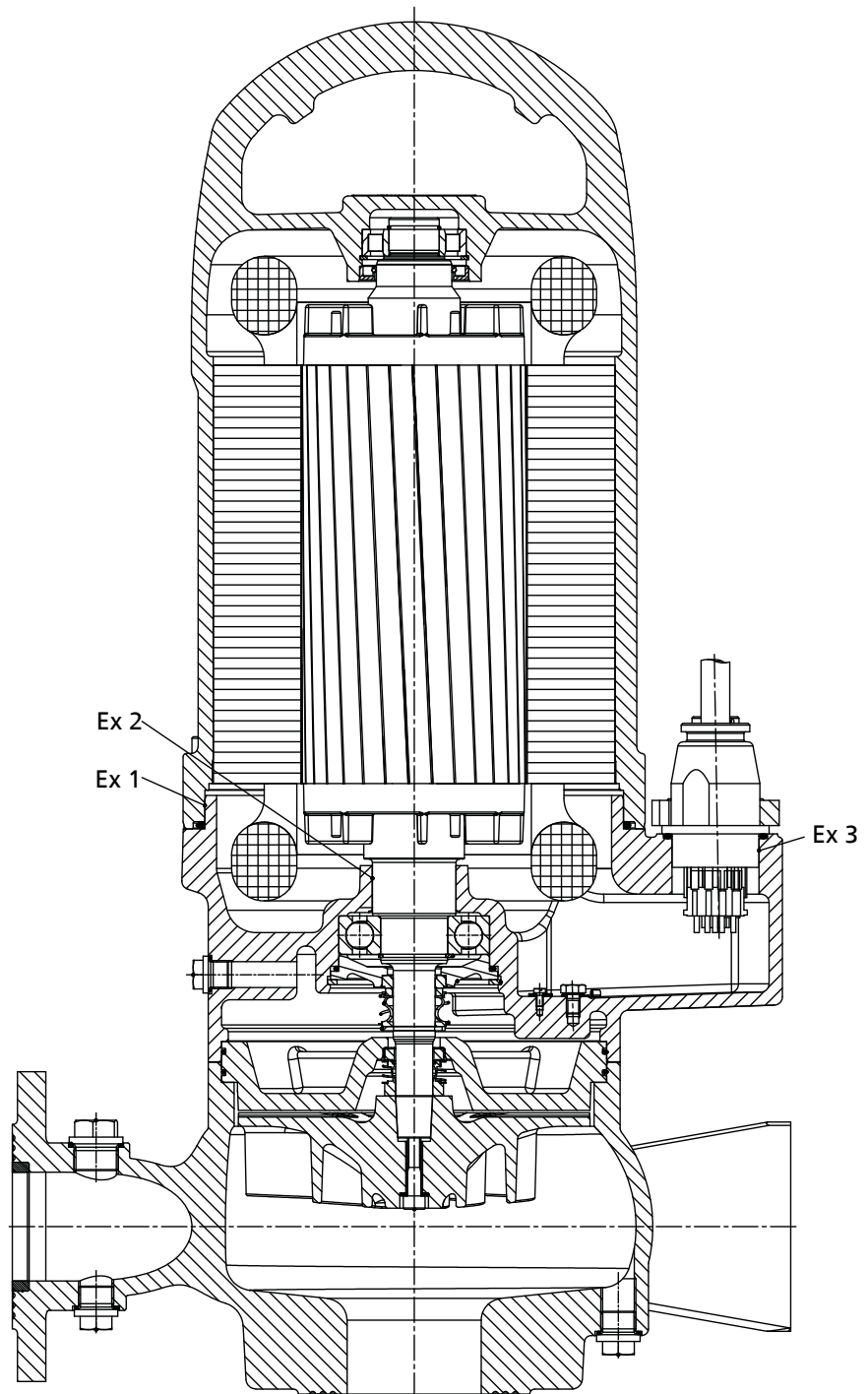


**Fig. 75:** Flamepaths Amarex KRT, motor type 2

### 9.3.3 Amarex KRT, motor type 3

**Motors:**

30 2  
 37 2  
 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

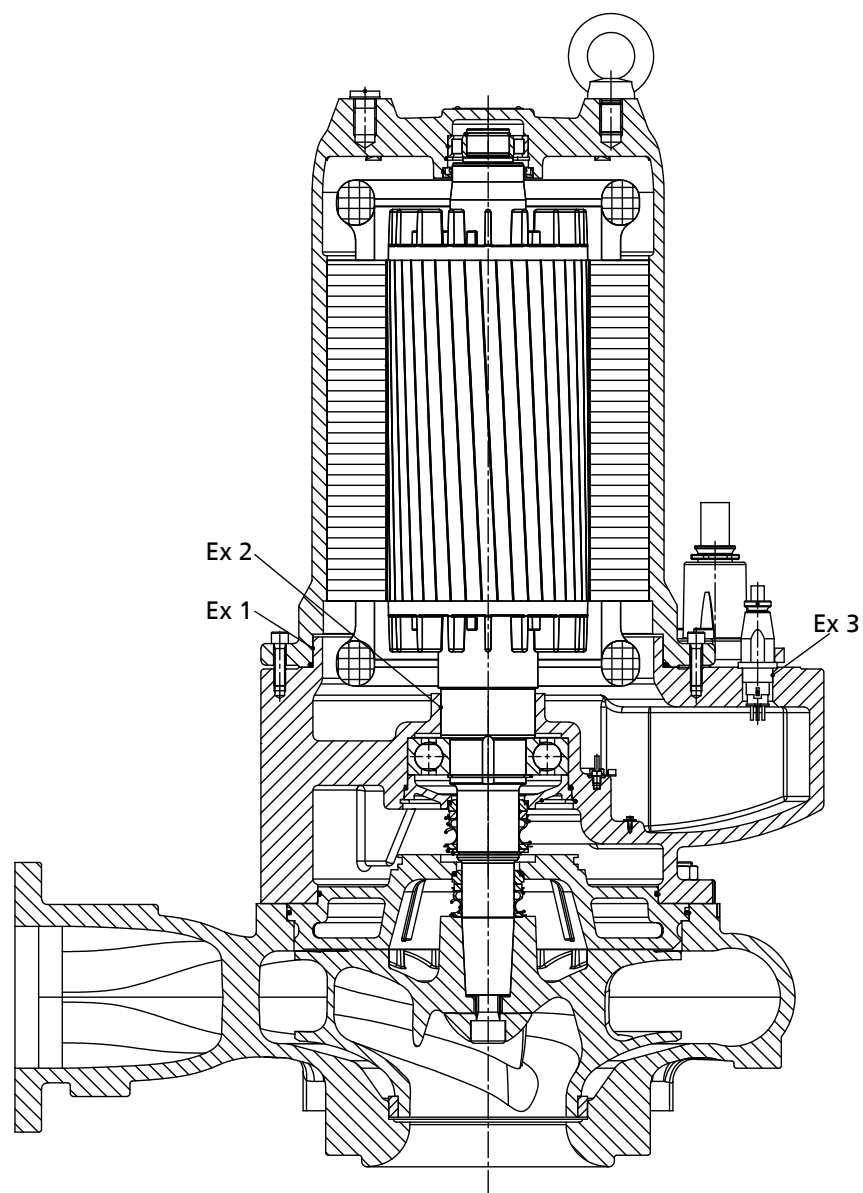


**Fig. 76:** Flamepaths Amarex KRT, motor type 3

## 9.4 Sectional drawings of the mechanical seal

### 9.4.1 Bellows-type mechanical seal

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

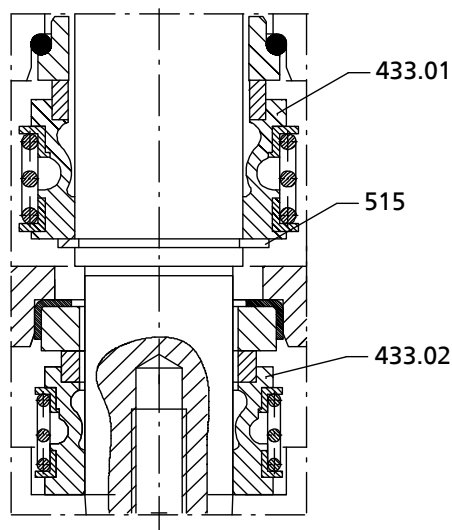


**Fig. 77:** Installation drawing for bellows-type mechanical seal

**Table 56:** Bellows-type mechanical seal

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

### 9.4.2 Mechanical seal with covered springs (HJ)

Mechanical seal for material variants H, C2<sup>19)</sup>

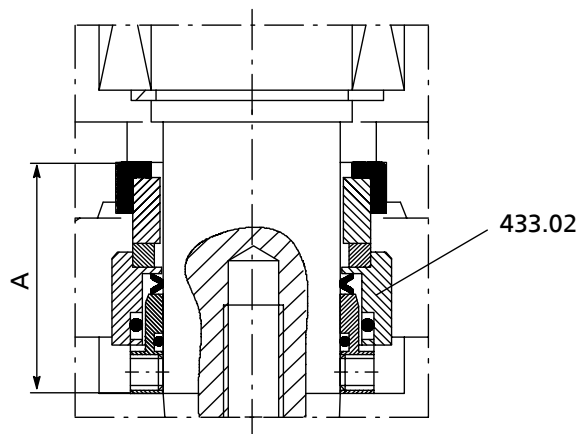


**Fig. 78:** Installation drawing for mechanical seal with covered springs (HJ)

**Table 57:** Mechanical seal with covered springs (HJ)

| Part. No. | Description     | Part. No. | Description |
|-----------|-----------------|-----------|-------------|
| 433.02    | Mechanical seal |           |             |

<sup>19</sup> Optional for material variants G, G1, G2, GH, C1

### 9.4.3 Double cartridge seal

Mechanical seal for material variants H, C2<sup>20)21)</sup>

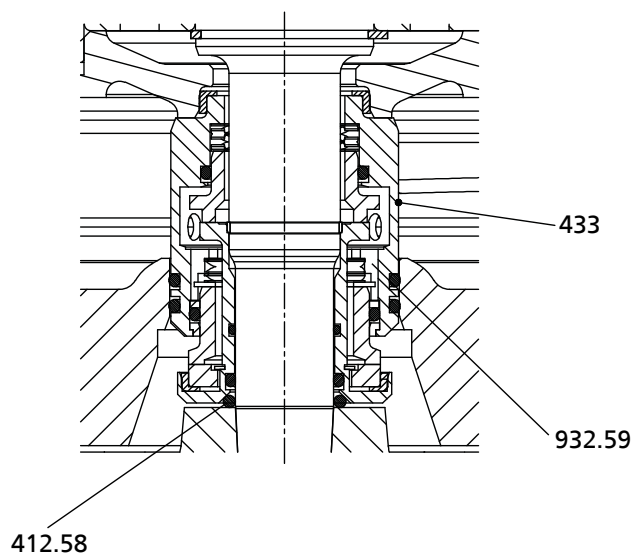


**Fig. 79:** Installation drawing for double cartridge seal

**Table 58:** Double cartridge seal

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

## 9.5 Wiring diagrams

### 9.5.1 Planning the control system

For electrical connection of the pump set observe the "Information for planning the control system". (⇒ Section 5.4.1, Page 48)

<sup>20</sup> Only on sizes 50-215, 50-216, 65-215, 65-216, 65-217, 80-215, 80-216, 80-217, 100-215

<sup>21</sup> Optional for material variants G, G1, G2, GH, C1

## 9.5.2 Wiring diagrams for installation types P and S

### 9.5.2.1 Wiring diagram for one power cable 8G1.5

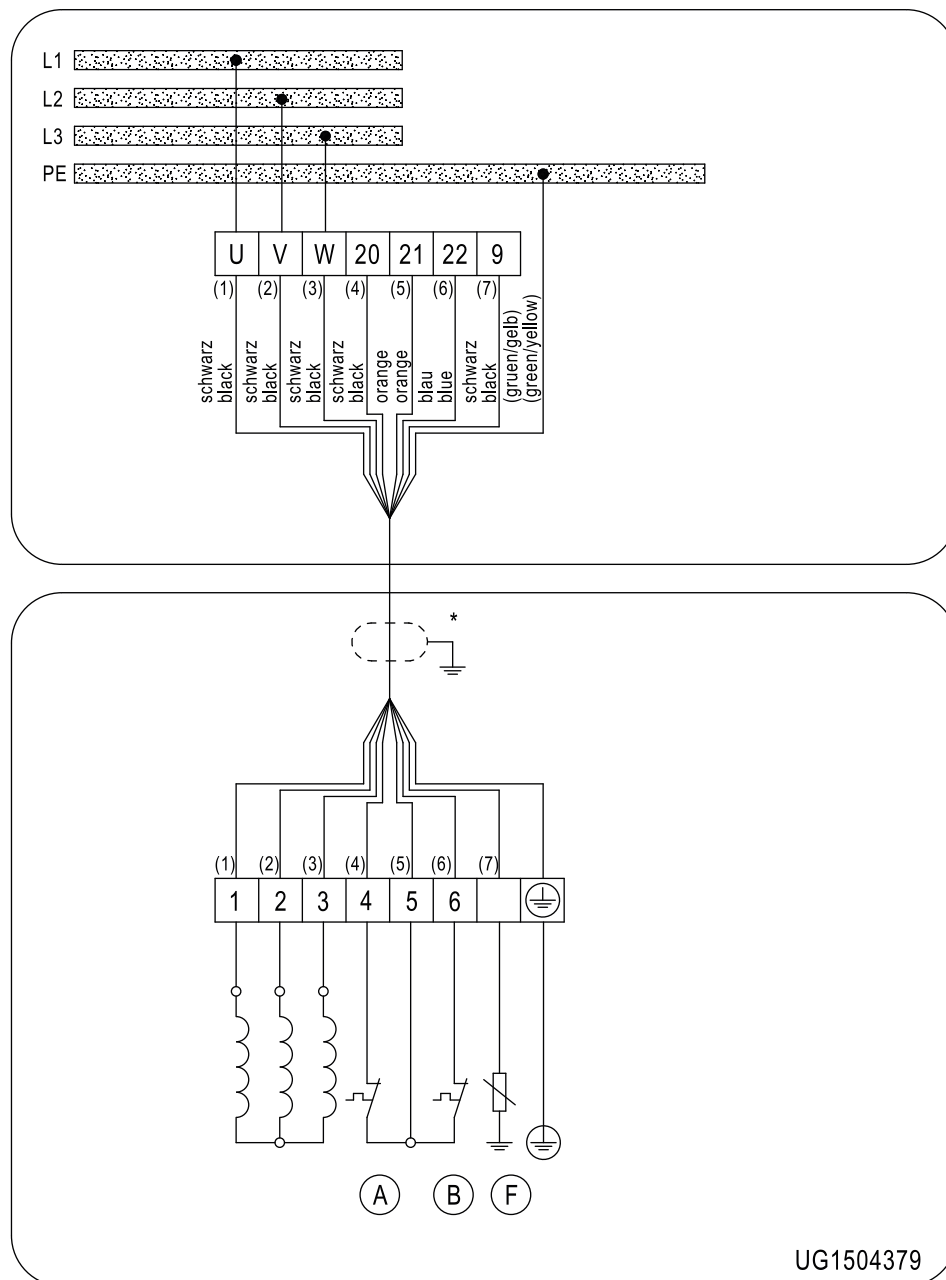


**Fig. 80:** Wiring diagram for pump sets of installation types P or S with one power cable 8G1.5

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

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

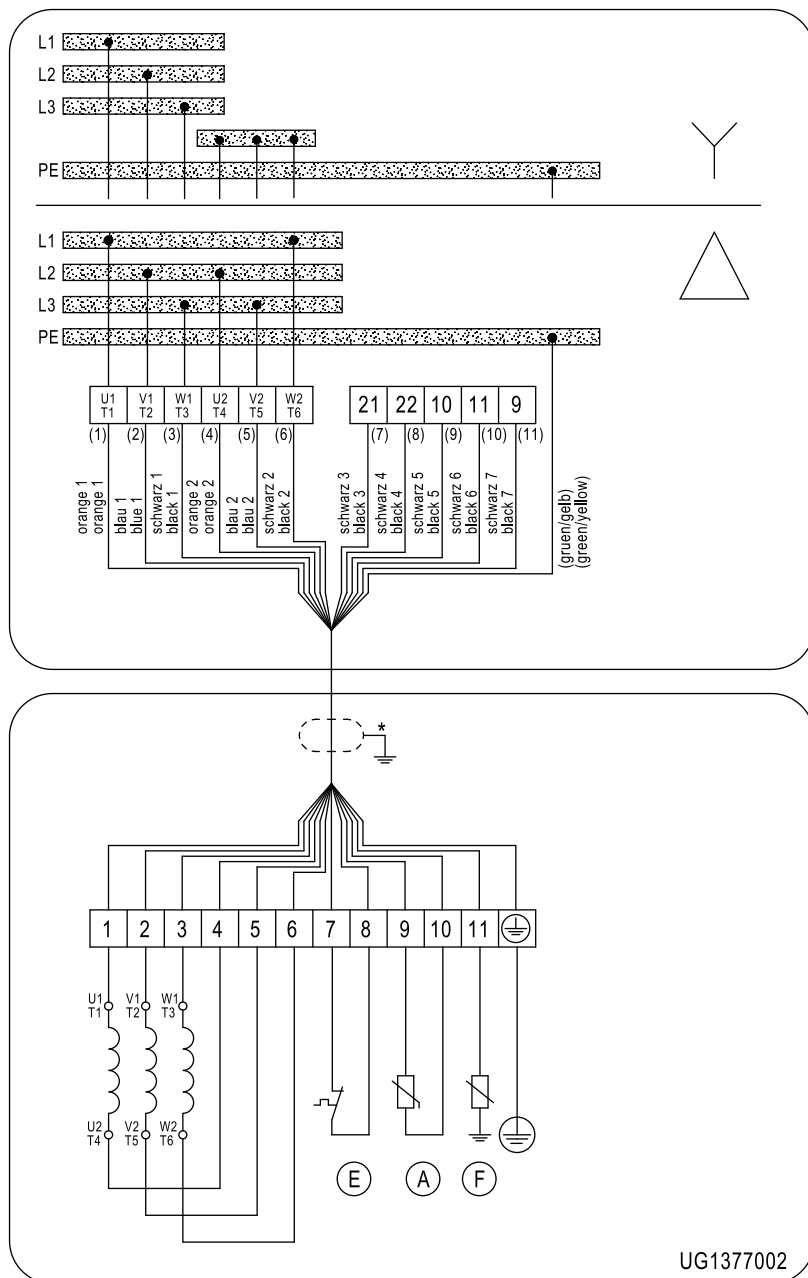


**Fig. 81:** Wiring diagram for pump sets with one power cable 12G1.5 or 12G2.5

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

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

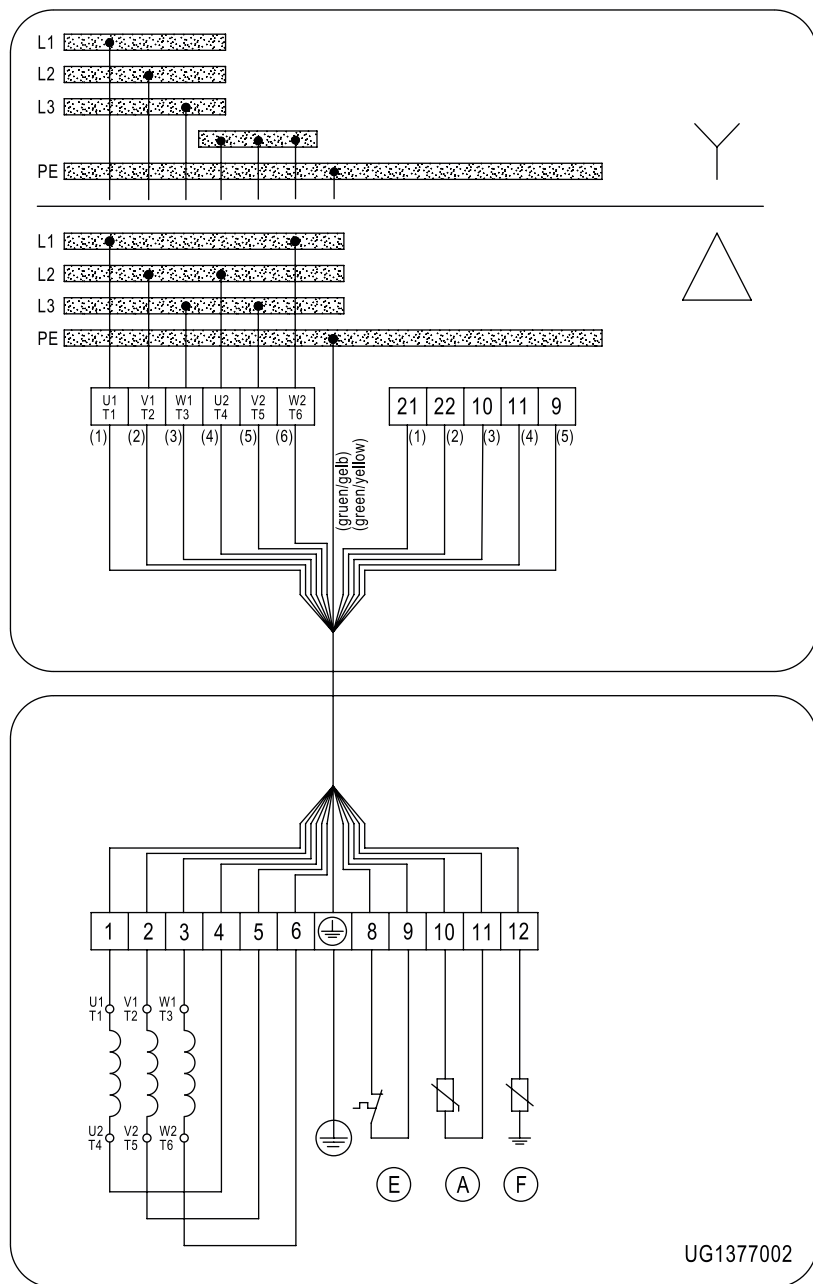


**Fig. 82:** Wiring diagram for pump sets with one power cable 7G4 + 5×1.5, 7G6 + 5×1.5 or 7G10 + 5×1.5

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

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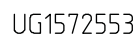


**Fig. 83:** Wiring diagram for one power cable 7GX and one control cable 8G1.5

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

9.5.2.5 Wiring diagram for one power cable 4G16 and one control cable 8G1.5

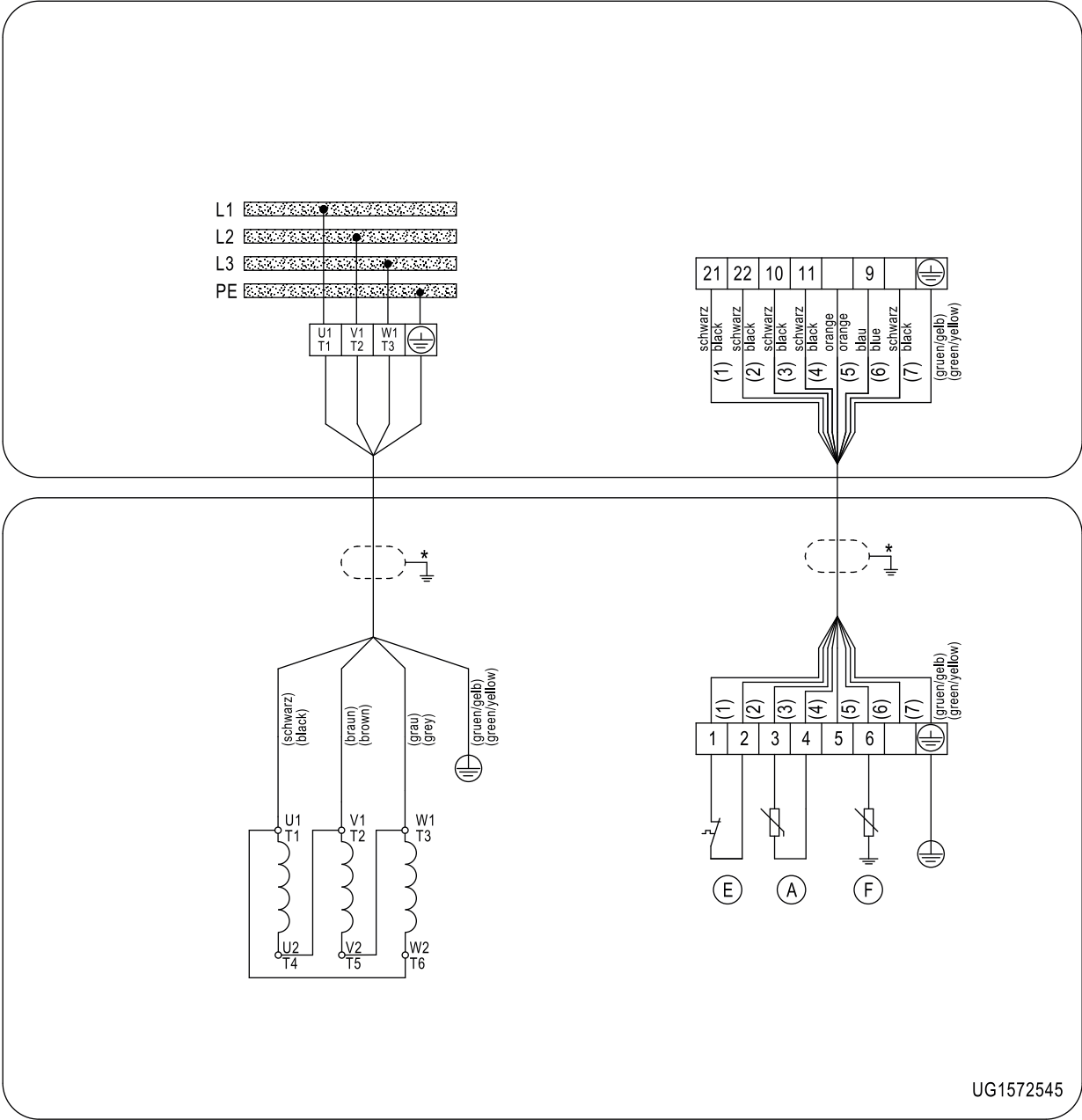


**Fig. 84:** Wiring diagram for one power cable 4G16 and one control cable 8G1.5

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

### 9.5.2.6 Wiring diagram for two power cables 4GXX and one control cable 8G1.5

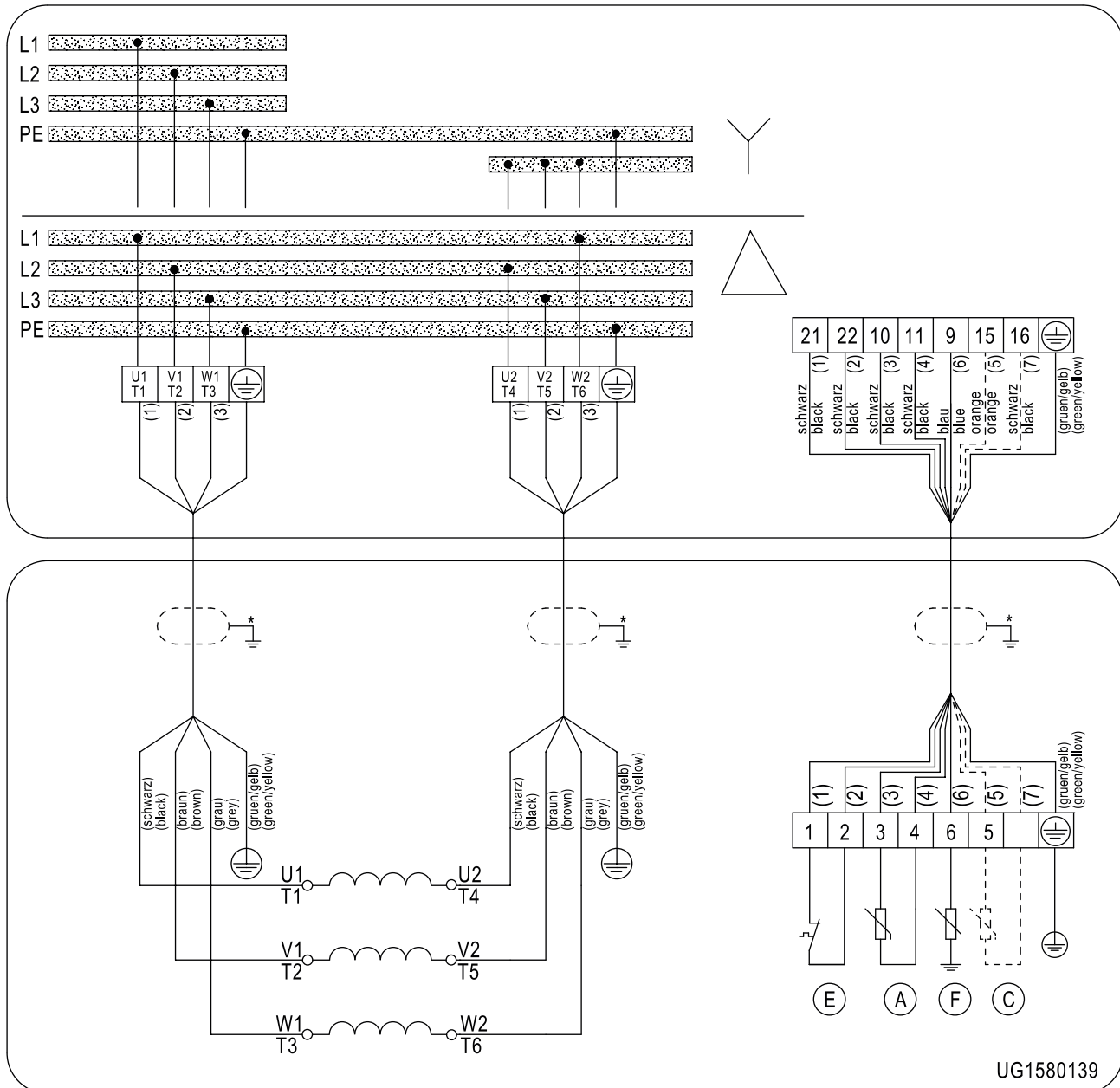


**Fig. 85:** Wiring diagram for two power cables 4GXX and one control cable 8G1.5

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

### 9.5.2.7 Wiring diagram for two power cables 4GXX and one control cable 8G1.5 for pumps with optional bearing temperature monitoring

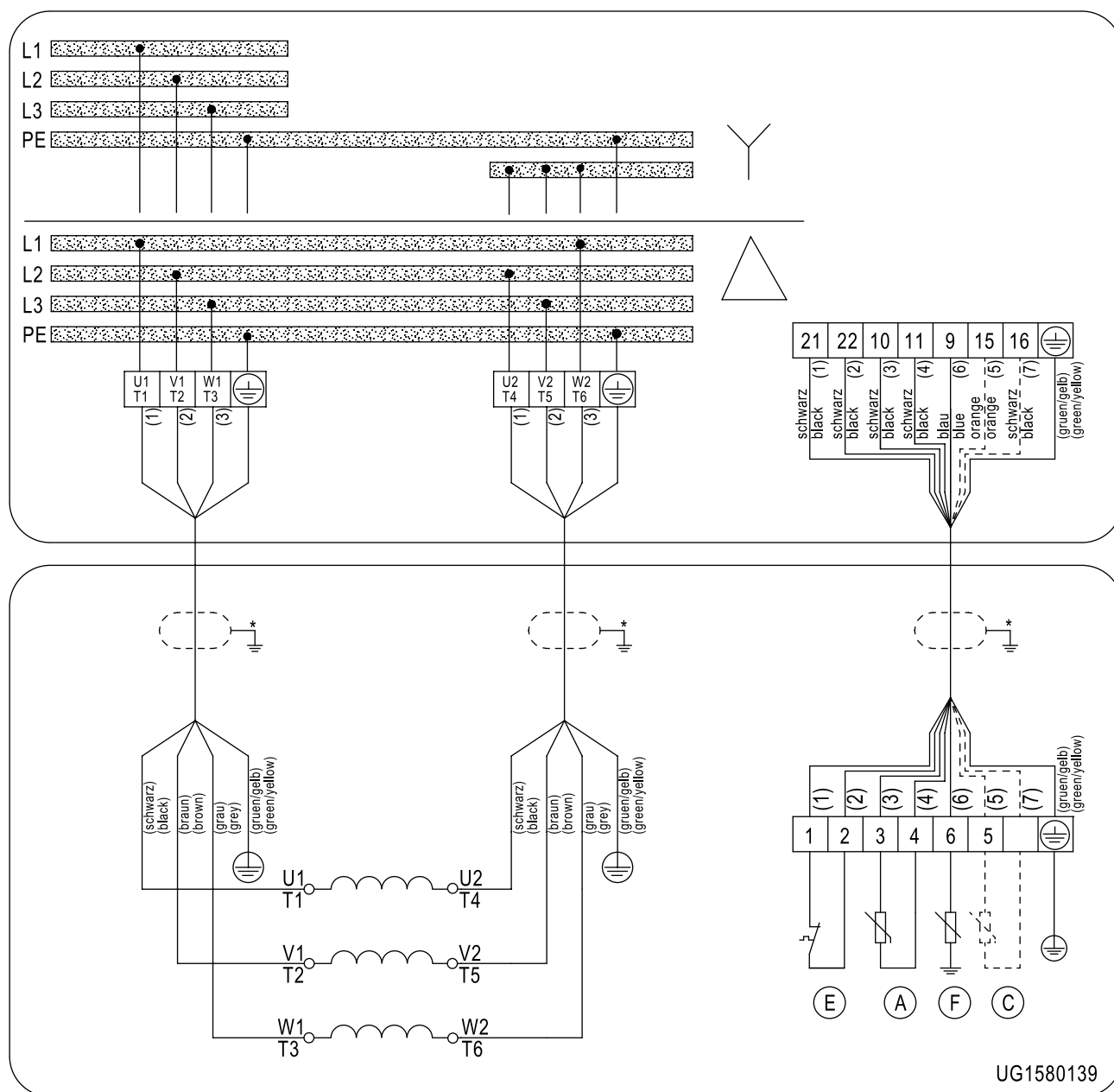


**Fig. 86:** Wiring diagram for two power cables 4GXX and one control cable 8G1.5 for pumps with optional bearing temperature monitoring

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

### 9.5.3 Wiring diagrams for installation types D, H and K

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

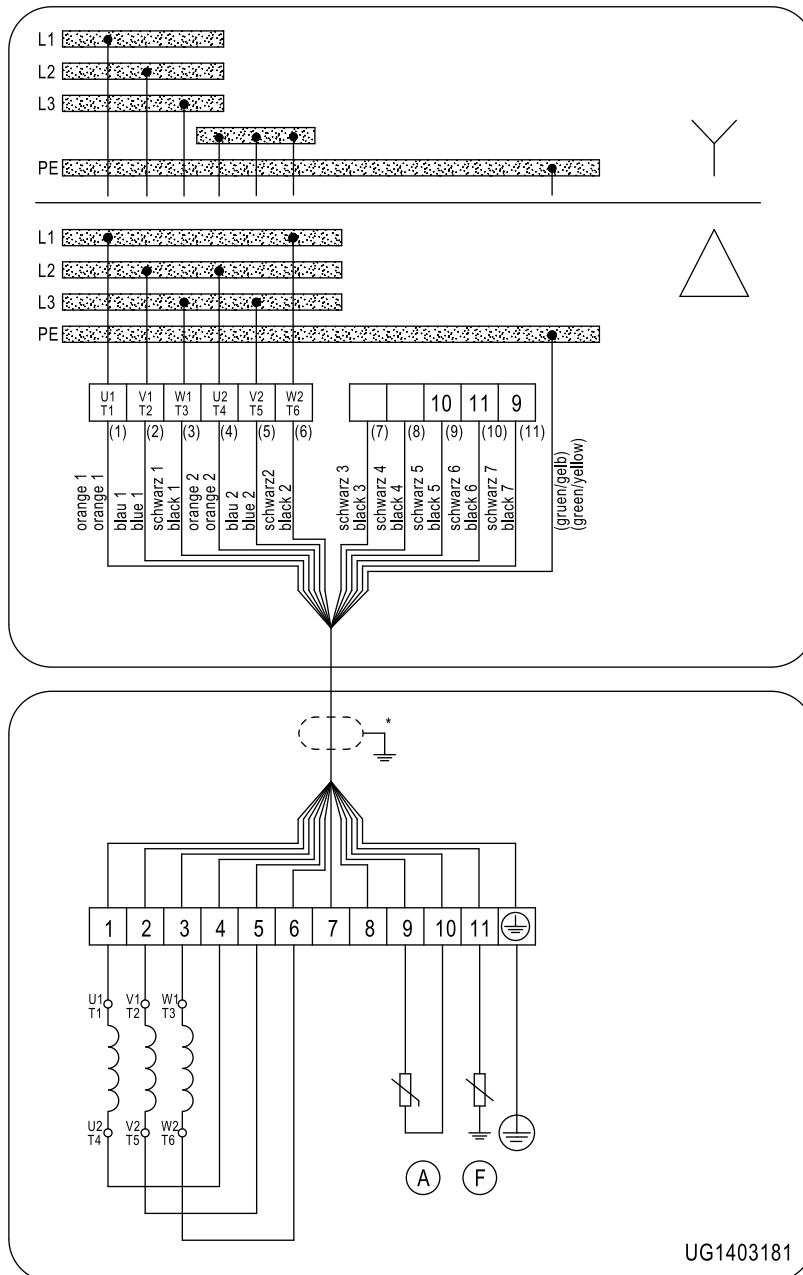


**Fig. 87:** Wiring diagram for one power cable 12G1.5 or 12G2.5

|   |                          |
|---|--------------------------|
| Ⓐ | Motor temperature 1      |
| ⓕ | Leakage inside the motor |
| * | Shielded cable option    |

### 9.5.3.2 Wiring diagram for one power cable 7GX + 5×1.5

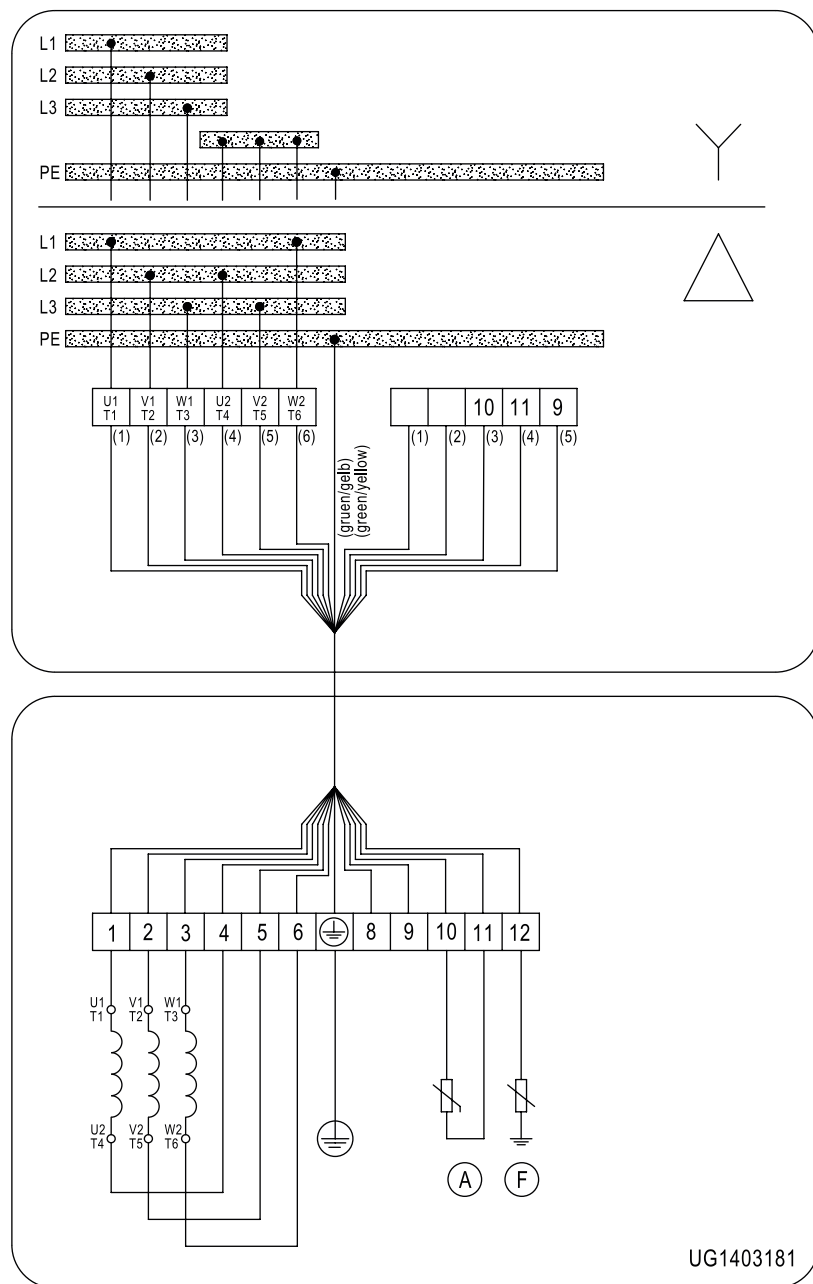


**Fig. 88:** Wiring diagram for one power cable 7GX + 5×1.5

|   |                          |
|---|--------------------------|
| Ⓐ | Motor temperature 1      |
| Ⓔ | Leakage inside the motor |
| * | Shielded cable option    |

## 10 UK Declaration of Conformity

Manufacturer:

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

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

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

### Amarex KRT

KSB order number:

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

The manufacturer also declares that

- the following *designated standards*<sup>22)</sup> have been applied:
  - EN ISO 12100:2010 (8 April 2011)
  - EN 809:1998+A1:2009/AC:2010 (18 December 2009)
  - EN 60034-1:2010 (8 July 2016), EN 60034-5:2001/A1:2007 (8 July 2016)

Person authorised to compile the technical file:

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

The UK Declaration of Conformity was issued in/on:

Place, date

.....<sup>23)</sup>.....

Name  
Function  
Company  
Address

---

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

**23** A signed, legally binding UK Declaration of Conformity is supplied with the product.

## 11 Certificate of Decontamination

Type: .....

Order number /  
Order item number<sup>24)</sup>: .....

Delivery date: .....

Application: .....

Fluid handled<sup>24)</sup>: .....

Please tick where applicable<sup>24)</sup>:


☐

Corrosive


☐

Oxidising


☐

Flammable


☐

Explosive


☐

Hazardous to health


☐

Seriously hazardous to health


☐

Toxic


☐

Radioactive


☐

Bio-hazardous


☐

Safe

Reason for return<sup>24)</sup>: .....

Comments: .....

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

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

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

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

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

.....

.....

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

.....  
Place, date and signature

.....  
Address

.....  
Company stamp

<sup>24</sup> Required field

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