

## Submersible Motor Pump

# Amarex N

Pump Sizes DN 50 to DN 100

Motors:

2 Poles: 002 to 042

4 Poles: 004 to 044

Non-ATEX

## Installation/Operating Manual



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Installation/Operating Manual Amarex N

Original operating manual

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## Glossary

### **Certificate of decontamination**

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

### **Close-coupled design**

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

### **Hydraulic system**

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

## 1 General

### 1.1 Principles

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

**Table 1:** Variants covered by this manual

Sizes	Impeller types	Material variant			
		G	G1	G2	GH <sup>1)</sup>
50-170	F, S	F, S	F	F	F
50-172	S	S	-	-	-
50-220	F, S	F, S	F	F	F
50-222	S	S	-	-	-
65-170	F	F	F	F	F
65-220	F	F	F	F	F
80-220	F, D	F, D	F	F	F
100-220	F, D	F, D	F	F	F

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

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

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

### 1.2 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 2.4, Page 9)

### 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	Description of mating and installation dimensions for the pump (set), weights
Hydraulic characteristic curve	Characteristic curves showing head, flow rate, efficiency and power input
General assembly drawing <sup>2)</sup>	Sectional drawing of the pump
Spare parts lists <sup>2)</sup>	Description of spare parts
Supplementary operating manuals <sup>2)</sup>	e.g. for installation parts for stationary wet installation

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

1) Variant GH only for pump sets WL and YL  
2) If agreed to be included in the scope of supply

### 1.5 Symbols

**Table 3:** Symbols used in this manual

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







## 2 Safety



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

### 2.1 Key to safety symbols/markings

Table 4: Definition of safety symbols/markings

Symbol	Description
 <b>DANGER</b>	<b>DANGER</b> 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> 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> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>Explosion protection</b> This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EC Directive 94/9/EC (ATEX).
	<b>General hazard</b> 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> 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> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

### 2.2 General

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

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

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

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

Information attached directly to the pump must always be complied with and be kept in a perfectly legible condition at all times. This applies to, for example:

- Arrow indicating the direction of rotation
- Markings for connections
- Name plate



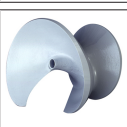
The operator is responsible for ensuring compliance with all local regulations not taken into account in this manual.

### 2.3 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 to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the system without the fluid to be handled.
- Observe the limits for continuous duty specified in the data sheet or product literature ( $Q_{min}$  and  $Q_{max}$ ) (to prevent damage such as shaft fracture, bearing failure, mechanical seal damage, etc).
- When untreated waste water is handled, the duty points in continuous operation lie within  $0.7$  to  $1.2 \times Q_{opt}$  to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ( $< 0.7 \times Q_{opt}$ ).
- Observe the maximum flow rates 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 (impeller type S)	<b>Suitable for the following fluids:</b> faeces, domestic sewage and waste water containing long fibres
	Free-flow impeller (impeller type F)	<b>Suitable for the following fluids:</b> fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas
	Open, diagonal single-vane impeller (impeller type D)	<b>Suitable for the following fluids:</b> fluids containing solid substances and long fibres

**Prevention of foreseeable misuse**

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

**2.4 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.

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

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

### **2.6 Safety awareness**

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

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

### **2.7 Safety information for the operator/user**

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

### **2.8 Safety information for maintenance, inspection and installation work**

- Modifications or alterations of the pump are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that all maintenance, inspection and installation work is performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- The pump casing must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 37)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 34)

## 2.9 Unauthorised modes of operation

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

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

## 2.10 Explosion protection



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

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

Only pumps/pump sets marked as explosion-proof **and** identified as such in the data sheet must be used in potentially explosive atmospheres.

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

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

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

Prevent impermissible modes of operation at all times.

### 2.10.1 Repair

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

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

### 3 Transport/Temporary Storage/Disposal

#### 3.1 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 (as applicable) and the insurer about the damage in writing immediately.

#### 3.2 Transport

	<b>⚠ DANGER</b>
	<p><b>Improper transport</b>            Danger to life from falling parts!            Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Use the attachment point provided (pump handle) for attaching lifting accessories.</li> <li>▷ Never suspend the pump set by its power cable.</li> <li>▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering/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 any regional transport regulations.</li> <li>▷ Observe the product literature supplied by 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> </ul>

#### 3.3 Storage/Preservation

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

	<b>CAUTION</b>
	<p><b>Improper storage</b>            Damage to the power cables!</p> <ul style="list-style-type: none"> <li>▷ Support the power cables at the cable entry to prevent permanent deformation.</li> <li>▷ Only remove the protective caps from the power cables at the time of installation.</li> </ul>
	<b>CAUTION</b>
	<p><b>Damage during storage due to humidity, dirt, or vermin</b>            Corrosion/contamination of the pump (set)!</p> <ul style="list-style-type: none"> <li>▷ For outdoor storage cover the packed or unpacked pump (set) and accessories with waterproof material.</li> </ul>
	<b>CAUTION</b>
	<p><b>Wet, contaminated or damaged openings and connections</b>            Leakage or damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Only remove caps/covers from the openings of the pump set at the time of installation.</li> </ul>

**Table 5:** Ambient conditions for storage

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

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

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

**3.4 Return to supplier**

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 45)
2. Always flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump set 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 set 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 (set).  
Always indicate any safety and decontamination measures taken.  
(⇒ Section 11, Page 68)

	<b>NOTE</b>
	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, consumables and supplies which are hot and/or pose a health hazard</b> 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 safety 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

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

### 4.2 Designation

Example: Amarex N F 50 - 170 / 012 YLG 120

Table 6: Designation key

Code	Description
Amarex N	Type series
F	Impeller type, e.g. F = free flow impeller
50	Nominal discharge nozzle diameter [mm]
170	Code number for hydraulic system size
01	Code number for motor size
2	Number of poles
YL	Motor version, e.g. YL = with explosion protection T4 (40 °C)
G	Casing material, e.g. G = grey cast iron
120	Nominal impeller diameter [mm]

### 4.3 Name plate

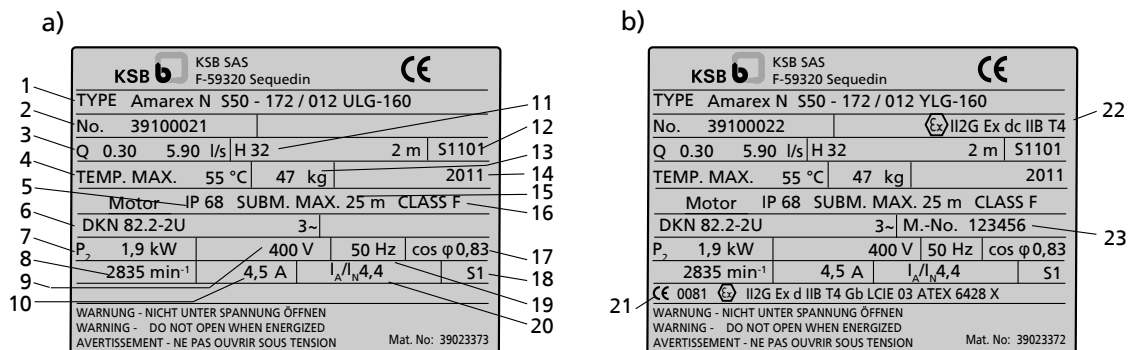


Fig. 1: Name plate (example) a) Standard pump set b) Explosion-proof pump set

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

#### Key to the series code

S = series, 11 = year of construction 2011, 01 = week 1

#### 4.4 Design details

##### Design

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

##### Drive

- Three-phase asynchronous squirrel-cage motor
- Motors integrated in explosion-proof pump sets are supplied in Ex d IIB type of protection.

##### Shaft seal

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

##### Impeller type

- Various application-oriented impeller types

##### Bearings

Standard bearings:

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

Reinforced bearings (optional, only for S impeller)

- Amarex N S 50-172, motor version YL / motor size and number of poles 002, 012, 022
- Amarex N S 50-222, motor version YL / motor size and number of poles 032, 042

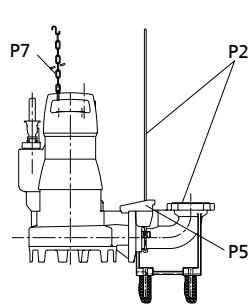
Pump-end bearings:

- Grease-packed bearings sealed for life

### 4.5 Installation types

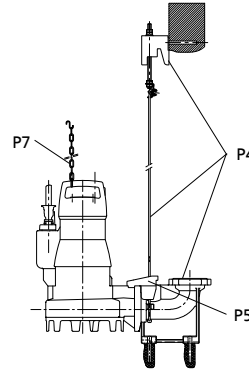
**Table 7: Overview of installation types**

#### Installation type S - stationary wet installation



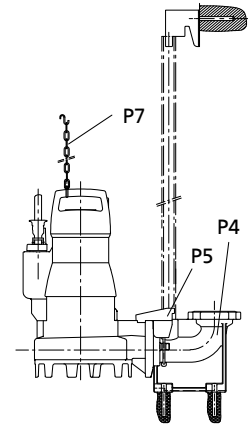
**Guide hoop arrangement**

P2: installation parts for guide hoop arrangement (Amarex N 50 and 65 only), installation depth<sup>3)</sup> = 1.5 m / 1.8 m / 2.1 m  
 P5: claw  
 P7: chain and shackle, length = 2 m



**Guide wire arrangement**

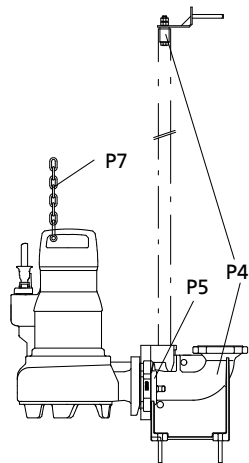
P4: installation parts for guide wire arrangement, installation depth<sup>3)</sup> = 4.5 m  
 P5: claw  
 P7: chain and shackle, length = 5 m



**Single guide rail arrangement**

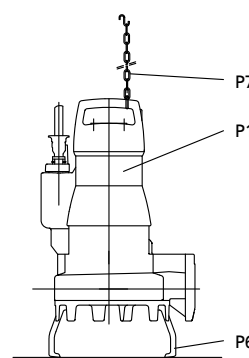
P4: installation parts for single guide rail arrangement,  
 P5: claw  
 P7: chain and shackle, length = 5 m

#### Installation type P - transportable wet installation



**Twin guide rail arrangement**

P4: installation parts for twin guide rail arrangement,  
 P5: claw and adapter  
 P7: chain and shackle, length = 5 m

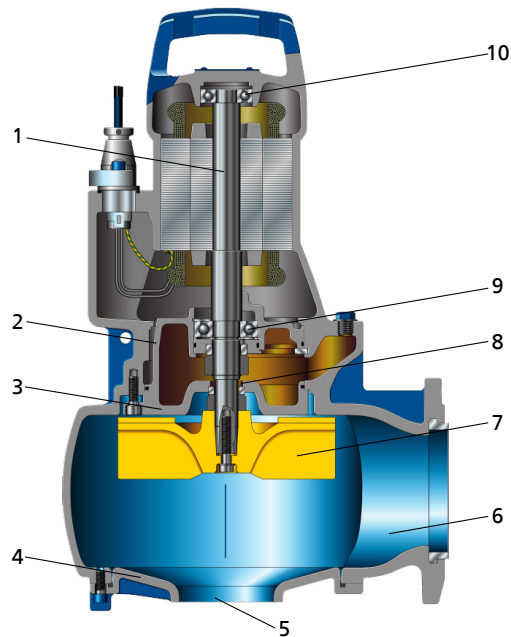


P1: pump  
 P6: foot  
 P7: chain and shackle, length = 5 m

<sup>3)</sup> Installation depth from the lower edge of the access opening to the bottom of the pump sump.



#### 4.6 Configuration and function



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

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

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

**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.

#### 4.7 Scope of supply

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

##### Stationary wet-installed model (installation type S)

- Pump set complete with power cables
- Claw with sealing elements and fasteners
- Lifting rope/lifting chain<sup>4)</sup>
- Mounting bracket with fasteners
- Duckfoot bend with mounting elements
- Guiding accessories  
(guide rails are not included in KSB's scope of supply)

4) Optional

**Transportable wet-installed model (installation type P)**

- Foot plate or pump stool with fasteners
- Lifting rope/lifting chain<sup>5)</sup>

**NOTE**

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

**4.8 Dimensions and weights**





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

---

5) Optional

## 5 Installation at Site


### 5.1 Safety regulations

 	<p><b>⚠ DANGER</b></p> <p><b>Improper installation in potentially explosive atmospheres</b> Explosion hazard! 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>
	<p><b>⚠ DANGER</b></p> <p><b>Persons in the tank during pump operation</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Never start up the pump set when there are persons in the tank.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Impermissible solid objects (tools, screws/bolts or similar) in the pump sump/inlet tank during pump start-up</b> 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 Preparing the place of installation

##### Place of installation for stationary models

	<p><b>⚠ WARNING</b></p> <p><b>Installation on mounting surfaces which are unsecured and cannot support the load</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Ensure the concrete's compressive strength is sufficient (in accordance with C35/45 in exposure class XC1 to EN 206-1).</li> <li>▷ The mounting surface must have set and must be completely horizontal and even.</li> <li>▷ Observe the weights indicated.</li> </ul>
---	---

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

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

## Place of installation for transportable models

	<b>WARNING</b>
	<p><b>Incorrect positioning</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Place the pump set down in a vertical position 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>

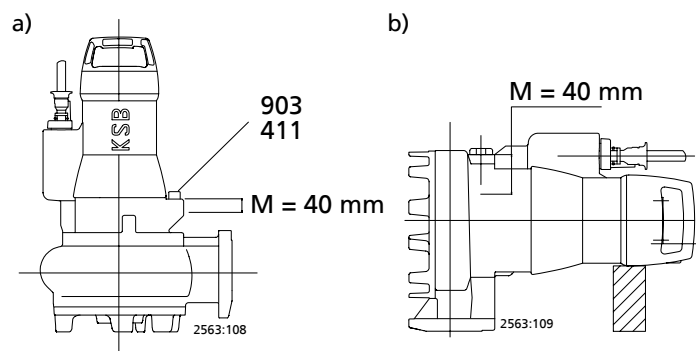
**Resonances** Any resonances at the usual excitation frequencies (1 x and 2 x rotational frequency, rotational noise) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

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

## 5.2.2 Checking the lubricant level

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

1. Position the pump set as shown.



**Fig. 2:** Checking the lubricant level a) Versions YL and WL; b) Versions YL and WL for pump sizes 50-17... and 65-220

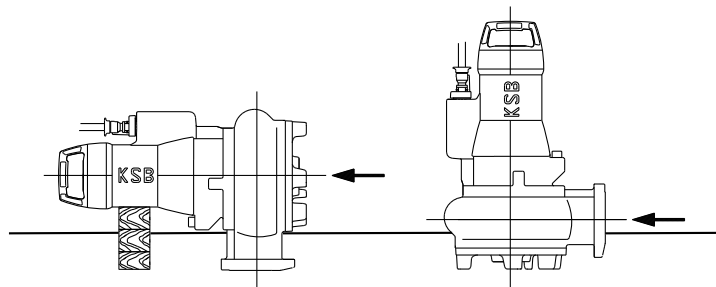
2. Unscrew and remove screw plug 903 with joint ring 411.  
⇒ The lubricant level must be 40 mm below the filler opening.
3. If the lubricant level is lower, top up the lubricant reservoir through the filler opening until the indicated level is reached.
4. Screw in screw plug 903 with joint ring 411. Observe the tightening torques.  
(⇒ Section 7.6, Page 52)

## 5.2.3 Checking the direction of rotation

	<b>DANGER</b>
	<p><b>Pump set running dry</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Check the direction of rotation of explosion-proof pump sets outside the potentially explosive atmosphere.</li> </ul>

	<p><b>⚠ WARNING</b></p> <p><b>Hands or objects inside the pump casing</b> Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> <li>▷ Never put your hands or any other objects into the pump.</li> <li>▷ Prior to energising the pump, check that the inside of the pump is free from any foreign objects.</li> <li>▷ Never hold the pump set in your hands when checking the direction of rotation.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Pump set running dry</b> Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▷ Never operate the pump set for more than 60 seconds outside the fluid to be handled.</li> </ul>

- ✓ The pump set is connected to the power supply.
- 1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
- 2. Check the direction of rotation.  
Impeller rotation must be anti-clockwise, seen from the pump mouth. (The direction of rotation is marked by an arrow on the pump casing.)



**Fig. 3:** 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 switched on unintentionally.

### 5.3 Installing the pump set

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

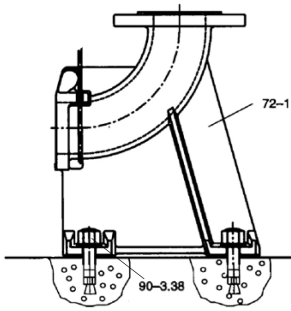
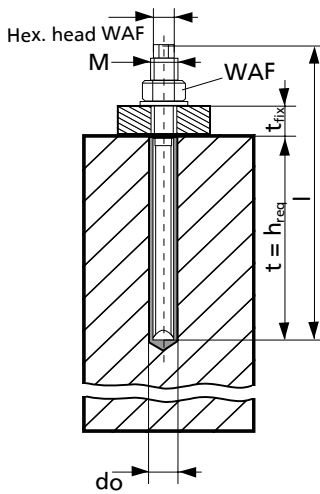
#### 5.3.1 Stationary wet installation

##### 5.3.1.1 Fastening the duckfoot bend

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

**Fastening the duckfoot bend with chemical anchors**

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.


**Fig. 4:** Fastening the duckfoot bend

**Fig. 5:** Dimensions

**Table 8:** Chemical anchor bolt dimensions

Bolt size	$d_o$ [mm]	$t=h_{req}$ [mm]	$t_{fix}$ [mm]	WAF [mm]	M [mm]	Hex. head WAF [mm]	Torque <sub>assy</sub> [Nm]
M 10x130	12	90	20	17	10	7	20
M 16x190	18	125	35	24	16	12	60

**Table 9:** Curing times of mortar cartridge

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

**5.3.1.2 Connecting the piping**

	<b>⚠ DANGER</b>
	<p><b>Impermissible loads acting on the flange of the duckfoot bend</b>                      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 without transmitting any stresses or strains.</li> <li>▷ Observe the permissible flange loads.</li> <li>▷ Take appropriate measures to compensate thermal expansion of the piping.</li> </ul>
	<b>NOTE</b>
	<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>

	<b>CAUTION</b>
	<p><b>Critical speed</b> Increased vibrations! Damage to mechanical seals and bearings!</p> <p>▷ Install a swing check valve in longer riser pipes to prevent the pump from excessive running in reverse. When fitting a swing check valve, make sure that the unit can still be vented properly.</p>

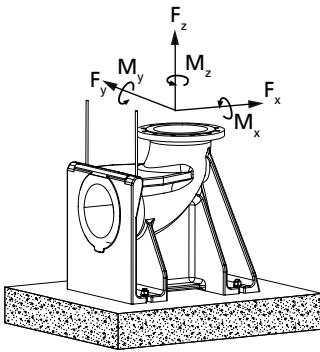


Fig. 6: Permissible flange loads

Table 10: Permissible flange loads

Nominal flange diameter	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
50-65	1350	1650	1500	2600	1000	1150	1400	2050
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600

### 5.3.1.3 Fitting the guide wire arrangement

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

	<b>NOTE</b>
	<p>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.</p>

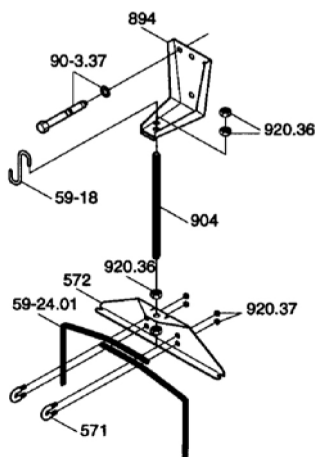


Fig. 7: Fitting the mounting bracket

### Fitting the mounting bracket

1. Fasten mounting bracket 894 to the edge of the tank/sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts to a tightening torque of 10 Nm.
2. Feed clamping pieces 571 through the holes of suspension bracket 572 and fasten with nuts 920.36.
3. Fasten fully threaded stud 904 with the pre-assembled clamping arrangement to the mounting bracket with nut 920.36.  
Do not tighten nut 920.36 too much in order to allow sufficient play for subsequently tensioning the guide wire.

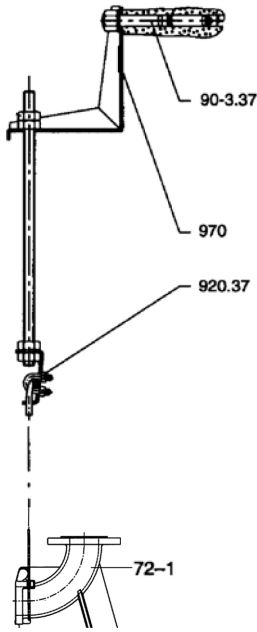


Fig. 8: Inserting the guide wire

**Inserting the guide wire**

1. Lift clamping piece 571 and insert one end of the guide wire.
2. Run wire 59-24.01 around duckfoot bend 72-1 and back again to suspension bracket 572 and insert it into clamping piece 571.
3. Manually tension wire 59-24.01 and secure it by means of hexagon nuts 920.37.
4. Pull the wire taut by tightening hexagon nut(s) 920.36 on the upper side of the mounting bracket.  
Observe the table "Guide wire tension".
5. Secure the nut(s) with a second hexagon nut.
6. The loose wire ends at guide wire suspension bracket 572 can either be twisted into a ring or the end can be cut off.  
After length adjustment, tape the ends to avoid fraying.
7. Attach hook 59-18 to mounting bracket 894 for attaching the lifting chain/rope at a later stage.

Table 11: Guide wire tension

Pump size	Tightening torque $M_A$ [Nm]	Guide wire tension P [N]
50-17...	7	3000
50-22...		
65-170	9	4000
65-220		
80-220	14	6000
100-220		

**5.3.1.4 Fitting the guide rail arrangement (1 or 2 guide rails)**

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

	<b>NOTE</b>
	The guide rails are not included in KSB's scope of supply. Select guide rail materials which are suitable for the fluid handled or as specified by the operator.

Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

Size of hydraulic system	Outside diameter [mm]	Wall thickness [mm] <sup>6)</sup>	
		Minimum	Maximum
DN 50 ... DN 65	33.7	2	5
DN 80 ... DN 100	60.3	2	5

**Fitting the mounting bracket**

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

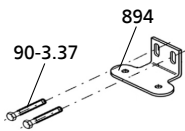


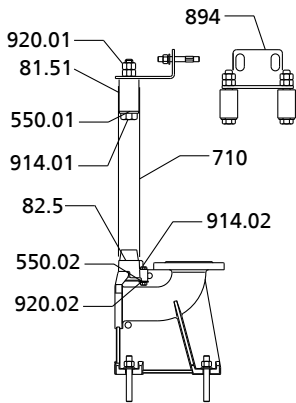
Fig. 9: Fitting the mounting bracket

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

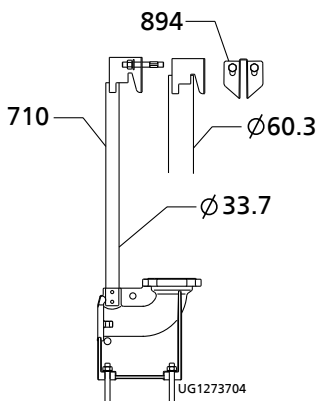


**Fitting the guide rails (arrangement with 2 guide rails)**

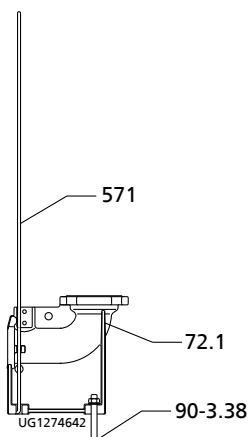
	<b>CAUTION</b>
<b>Improper installation of the guide rails</b> Damage to the guide rail arrangement! ▷ Always adjust the guide rails so that they are in a perfectly vertical position.	


**Fig. 10: Fitting 2 guide rails**

1. Position adapter 82.5 on duckfoot bend 72.1 and fasten it with screws 914.2, discs 550.02 and nuts 920.02.
2. Place rails 710 onto the conical bosses of adapter 82.5 and position them vertically.
3. 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.
4. Shorten rails 710 with a 90° cut to the pipe axis. Debur the rails inside and outside.
5. Insert mounting bracket 894 with clamping sleeves 81.51 into guide rails 710 until the mounting bracket rests on the rail ends.
6. Tighten nuts 920.01.  
This expands the clamping sleeves so that they clamp the rails at the inside rail diameter.
7. Secure nut 920.01 with a second nut.

**Fitting the guide rails (arrangement with 1 guide rail)**

**Fig. 11: Fitting 1 guide rail**

1. Position rail 710 (for DN 50 - DN 65) into the recess of duckfoot bend 72.1 or (for DN 80 - DN 100) on the conical boss. Place the rail in a vertical position.
2. Mark the length of rail 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 rail 710 with a 90° cut to the pipe axis. Debur the rail inside and outside.
4. Insert mounting bracket 894 into guide rail 710 until the mounting bracket rests on the rail end.

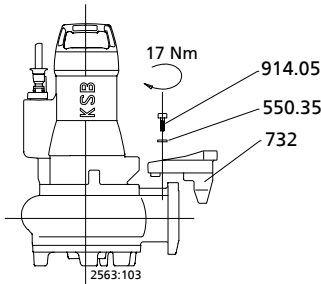
**5.3.1.5 Fitting the guide hoop arrangement (for DN 50 and DN 65 only)**

**Fig. 12: Fitting the guide hoop arrangement**

1. Insert the ends of guide hoop 571 into the grooves of duckfoot bend 72.1.
2. Fasten the duckfoot bend to the tank/sump floor with 2 anchor bolts 90-3.38.  
(⇒ Section 5.3.1.1, Page 21)

**5.3.1.6 Preparing the pump set**

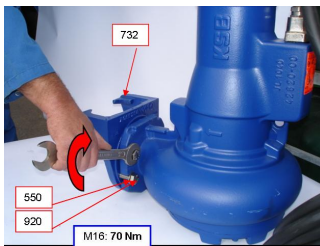
**Fastening the claw for guide wire, single guide rail and guide hoop arrangement**

1. Fasten claw 723 with screw 914.05 and disc 550.35 to the discharge flange (see drawing). Tighten the screw to a torque of 17 Nm.



**Fastening the claw for guide rail arrangements with 2 guide rails**

1. Fasten claw 732 with screws 920 and discs 550 to the discharge flange (see illustration). Tighten the screw to a torque of 70 Nm.
2. Fit profile joint 410 in the groove of the claw. This will seal the duckfoot bend/pump connection.

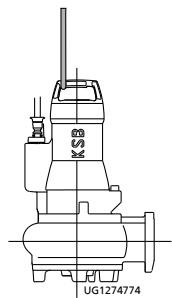


**Attaching the lifting chain/rope**

**Fig. 14:** Fastening the claw for guide rail arrangements with 2 guide rails

**Stationary wet installation**

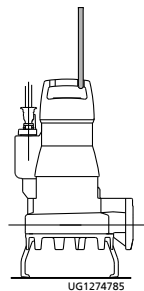
1. Attach the lifting chain with shackle or the lifting rope to the recess in the pump handle opposite the discharge nozzle. This attachment point achieves a forward inclination of the pump set towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.



**Attaching the lifting chain/rope - stationary wet installation**

**Transportable wet installation**

1. Attach the lifting chain with shackle or the lifting rope to the recess in the pump handle on the discharge nozzle side of the pump set. This attachment point achieves an upright position of the pump set.



**Attaching the lifting chain/rope - transportable wet installation**

**Table 13:** Types of attachment

Drawing	Type of attachment	
<p>UG1274869</p>	<b>Shackle with chain at the pump casing</b>	
	59-17	Shackles
	59-18	Hook
	885	Lifting chain/rope
<p>UG1274897</p>	<b>Shackle with chain at the lifting bail</b>	
	59-17	Shackle
	59-18	Hook
	571	Lifting bail
	885	Lifting chain/rope

**5.3.1.7 Installing the pump set**

	<b>NOTE</b>
	For pumping water containing sludge and suspended solids pump sets with impeller type S (cutter) are preferable. In such cases using an inclined claw is recommended.
	<b>NOTE</b>
	Make sure the pump set with the pre-assembled claw can easily be slipped over the mounting bracket, threaded onto the guide rails and lowered down. If required, alter the position of the crane during installation.

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

**5.3.2 Transportable wet installation**

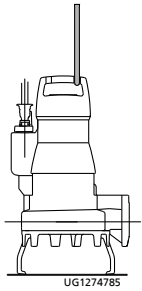
Before installing the pump set, fit the 3 pump feet and foot plate, if applicable.

**Fitting the pump feet**

1. Undo screws 914.03.
2. Guide pump feet 182 into the opening in the suction cover.
3. Tighten screws 914.03 again to the indicated tightening torque. (⇒ Section 7.6, Page 52)

**Fitting the foot plate**

1. Fit the foot plate to the three pump feet with screws, discs and nuts. Observe the tightening torques. (⇒ Section 7.6, Page 52)



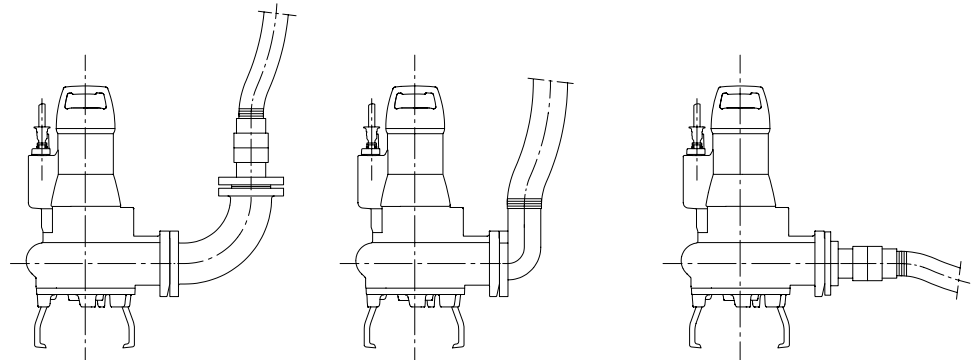
UG1274785  
**Fig. 15: Attaching the lifting chain/rope**

**Attaching the lifting chain/rope**

1. Attach the lifting chain or rope to the shackle on the discharge nozzle side (see drawing and table "Types of attachment").

**Connecting the piping**

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




**Fig. 16: Connection options**

**5.4 Electrical system**

**5.4.1 Information for planning the control system**

For the electrical connection of the pump set observe the wiring diagrams contained in the Annex.

The pump set is supplied with power cables; it is wired for DOL starting.




	<b>NOTE</b>
	When laying a cable between the control system and the pump set's connection point, make sure 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 networks with nominal voltages and voltage tolerances as per IEC 38 or other networks or supply systems with rated voltage tolerances of max. ±10 %.

**5.4.1.1 Overload protection**

1. Protect the pump set against overloading by using a thermal time-lag overload protection device in accordance with IEC 947 and local regulations. (⇒ Section 9.3, Page 63)
2. Set the overload protection device to the rated current specified on the name plate.




**5.4.1.2 Level control**

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

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

Observe the minimum fluid level. (⇒ Section 6.2.4.2, Page 36)

**5.4.1.3 Frequency inverter operation**

	<p><b>⚠ DANGER</b></p>
	<p><b>Operation outside the permitted frequency range</b> Explosion hazard!</p> <p>▷ Never operate an explosion-proof pump set outside the specified range.</p>
	<p><b>NOTE</b></p>
	<p>The motors can also be operated on frequency inverters. Make sure to observe the design data of the motor in this case. To prevent an inadmissible heat build-up in the motor, motors operated on frequency inverters must always be equipped with bimetal switches in the stator. When reaching the temperature limit, the motor must be cut out by means of a tripping unit for the equipment to comply with the ATEX 100a Directive. This tripping unit shall be connected to the measuring points provided to ensure the temperature class stipulated for the plant is observed.</p>
	<p><b>⚠ DANGER</b></p>
	<p><b>Incorrect setting of frequency inverter current limit</b> Explosion hazard!</p> <p>▷ Set the current limit to max. 1.2 times the rated current indicated on the name plate.</p>

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

- Data provided by the manufacturer
- Electrical data of the pump set, particularly the rated current

**Start-up**

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

**Operation**

Observe the following limits when operating the pump set via frequency inverter:

- Only utilise up to 95 % of the motor rating  $P_2$  indicated on the name plate.
- Frequency range 30-50 Hz



**Electromagnetic compatibility**


Frequency inverter operation produces RFI emissions whose level varies depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a submersible motor and a frequency inverter, from exceeding the limits stipulated in EN 50081 always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends using a shielded power cable, make sure to use a pump set with a shielded power cable.

**Interference immunity**

The pump set generally meets the interference immunity requirements to EN 50082. 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, it is recommended to use a special relay available from KSB.


## 5.4.1.4 Sensors

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

	<b>CAUTION</b>
	<p><b>Incorrect connection</b> 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 is equipped with sensors designed to prevent hazards and damage to the pump set.

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

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

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



## 5.4.1.5 Motor temperature

	 <b>DANGER</b>
	<p><b>Insufficient cooling</b> Explosion hazard! Winding damage!</p> <ul style="list-style-type: none"> <li>▷ Never operate an explosion-proof pump set without operational temperature monitoring.</li> </ul>

**Standard pump sets (versions UL and WL):**

Two bimetal switches (terminals 21 and 22, max. 250 V~/2 A) serve as temperature control devices which open when the winding temperature is too high.

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

	 <b>WARNING</b>
	<p><b>Incorrect electrical connection</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Adequately insulate conductor 20.</li> </ul>

Conductor 20 has no function on standard pump sets.

However, it can be live and must, therefore, be insulated or connected to a dummy terminal.

**Explosion-proof pump sets (version YL)**

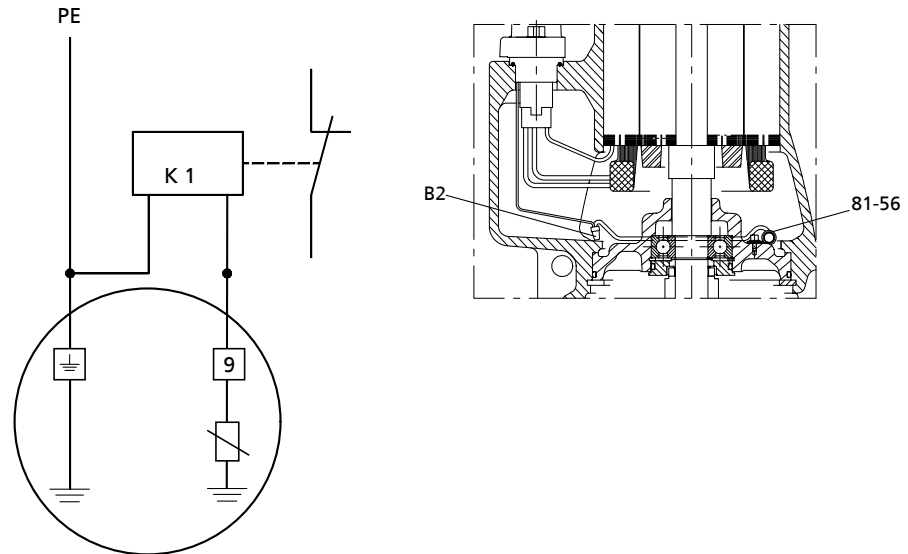
Explosion-proof pump sets are equipped with double monitoring of the winding temperature. Two bimetal switches (terminals 20 and 21, max. 250 V~/2 A) serve as temperature control devices which open when the winding temperature is too high.

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

Two additional bimetal switches (terminals 21 and 22, max. 250 V~/2 A) serve as temperature limiters which open when the temperature limit is exceeded.

Opening of the switch contacts must result in the pump set cutting out. The pump set must not re-start automatically.

**5.4.1.6 Leakage inside the motor (optional)**



Connecting the electrode relay      Position of the electrode in the motor housing

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

Every time the relay trips the pump set, the pump set needs to be inspected and its insulation resistance measured.




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

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

**Example**      ▪ Telemécanique RM4-LG01





**5.4.2 Electrical connection**

	<p><b>⚠ DANGER</b></p>
	<p><b>Work on the pump set by unqualified personnel</b>                  Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by a trained and qualified electrician.</li> <li>▷ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.</li> </ul>

	<p><b>⚠ WARNING</b></p> <p><b>Incorrect connection to the mains</b>          Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> <li>▷ Observe the technical specifications of the local energy supply companies.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Improper routing of power cable</b>          Damage to the power cables!</p> <ul style="list-style-type: none"> <li>▷ Never move the power cables at temperatures below - 25 °C.</li> <li>▷ Never kink or crush the power cables.</li> <li>▷ Never lift the pump set by the power cables.</li> <li>▷ Adjust the length of the power cables to the site requirements.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Motor overload</b>          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 947 and local regulations.</li> </ul>

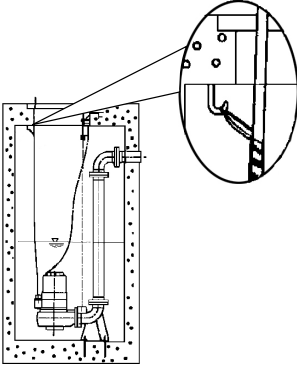
For electrical connection observe the wiring diagrams in the Annex and the information for planning the control system.

The pump set is supplied complete with power cable. Always connect all marked conductors.

	<p><b>⚠ DANGER</b></p> <p><b>Incorrect connection</b>          Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ The connection point of the cable ends must be located outside the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.</li> </ul>
 	<p><b>⚠ DANGER</b></p> <p><b>Operating an incompletely connected pump set</b>          Explosion hazard!          Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never start up a pump set with incompletely connected power connection cables or non-operational monitoring devices.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Connection of damaged power cables</b>          Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Check the power cables for damage before connecting them to the power supply.</li> <li>▷ Never connect damaged power cables.</li> </ul>



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



**Fig. 17:** Fastening the power cables

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

**Potential equalisation conductor**

Potential equalisation shall be provided for in compliance with EN 60 204. On versions YL and WL the pump casing is designed with an inner thread for a M8 x 20 socket head cap screw.



	<b>DANGER</b>
	<p><b>Touching the pump set during operation</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▸ Make sure that the pump set cannot be touched during operation.</li> </ul>

 	<b>DANGER</b>
	<p><b>Chemically corrosive fluids</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▸ If the pump set is used in chemically corrosive fluids, never use the external terminal for potential equalisation.</li> <li>▸ Connect the potential equalisation conductor to a non-wetted flange of the discharge line and establish an electric connection between the newly fitted potential equalisation and the pump set.</li> </ul>

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/start-up



#### 6.1.1 Preconditions for commissioning/startup


	 <b>DANGER</b>
	<p><b>Fluid level too low</b> Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Completely prime the pump set with the fluid to be handled to reliably prevent the formation of a potentially explosive atmosphere.</li> <li>▷ Always operate the pump set in such a way that air cannot ingress into the pump casing.</li> <li>▷ Never allow the fluid level to drop below the specified minimum (R3). (⇒ Section 6.2.4.2, Page 36)</li> <li>▷ For continuous operation (S1) operate the pump in fully submerged condition.</li> </ul>

Before starting up the pump set make sure that the following requirements are met:


- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled.
- The direction of rotation has been checked.
- The lubricant has been checked (only for versions YL and WL).
- After prolonged shutdown of the pump (set), the required activities have been carried out. (⇒ Section 6.4, Page 38)

#### 6.1.2 Start-up

	 <b>DANGER</b>
	<p><b>Persons in the tank during pump operation</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Never start up the pump set when there are persons in the tank.</li> </ul>




	<b>CAUTION</b>
	<p><b>Re-starting while motor is still running down</b> 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>Pump start-up against a closed shut-off element</b> Increased vibrations! 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.

### 6.2 Operating limits

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

	<b>CAUTION</b>
	<p><b>Excessive frequency of starts</b> 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, do not exceed the following number of start-ups per hour.

**Table 14:** Frequency of starts

Interval	Maximum frequency of starts [No. of starts]
per hour	30
per year	5000



These values apply to mains start-up (DOL, autotransformer, soft starter). Frequency inverter operation is not limited by these values.

#### 6.2.2 Supply voltage

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

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

#### 6.2.3 Frequency inverter operation

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

Frequency inverter operation of the pump set is permitted in the following frequency ranges:

- 50 Hz: 30 to 50 Hz
- 60 Hz: 30 to 60 Hz

	<b>CAUTION</b>
	<p><b>Pumping solids-laden fluids at reduced speed</b> 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>

**6.2.4 Fluid handled**

**6.2.4.1 Temperature of the fluid handled**

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

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

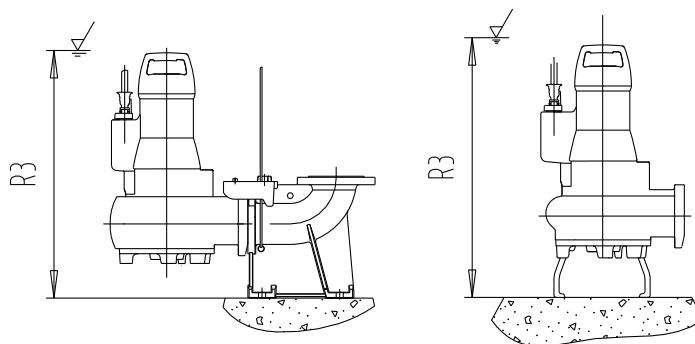
Refer to the maximum permissible fluid and ambient temperature on the name plate and in the data sheet.

**6.2.4.2 Minimum level of fluid handled**

	<b>⚠ DANGER</b>
	<p><b>Pump set running dry</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never allow an explosion-proof pump set to run dry!</li> </ul>

	<b>CAUTION</b>
	<p><b>Fluid level below the specified minimum</b> 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>

The pump set is ready for operation when the fluid level has reached dimension "R3" as a minimum (see outline drawing).




**Fig. 18:** Minimum fluid level

	<b>NOTE</b>
	<p>For pump sets with cutters we recommend continuing pump operation for about 10 seconds after the minimum suction level has been reached (see dimension R5 in the outline drawing).</p>

Operation with a dropping fluid level up to dimension R1 (see outline drawing) is permissible. Please note that during that time frequent starting and stopping of the pump set must be avoided.





### 6.2.4.3 Density of the fluid handled

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

	<b>CAUTION</b>
	<p><b>Impermissibly high density of the fluid handled</b> Motor overload!</p> <ul style="list-style-type: none"> <li>▷ Observe the information on fluid density indicated in the data sheet.</li> <li>▷ Make sure the motor has sufficient power reserves.</li> </ul>

## 6.3 Shutdown/storage/preservation

### 6.3.1 Measures to be taken for shutdown

	<b>⚠ DANGER</b>
	<p><b>Work on the pump set by unqualified personnel</b> Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Always have the electrical connections installed by a trained and qualified electrician.</li> <li>▷ Observe the IEC 60079 (DIN VDE 0100) regulation.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Unintentional starting of pump set</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started up unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Fluids handled and supplies posing a health hazard and/or hot fluids handled and supplies</b> 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>
	<b>CAUTION</b>
	<p><b>Danger of frost/freezing</b> 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>

**The pump set remains installed**

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



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

- ✓ All safety regulations are observed. (⇒ Section 7.1, Page 39)
- 1. Clean the pump set.
- 2. Preserve the pump set.
- 3. Observe the instructions given in (⇒ Section 3.3, Page 12) .

**6.4 Returning to service**

For returning the pump set to service observe the sections on commissioning/start-up and operating limits. (⇒ Section 6.2, Page 35)







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

	<p style="background-color: #f4a460; padding: 5px;"><b>! WARNING</b></p> <p><b>Failure to re-install or re-activate protective devices</b>          Risk of personal injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> <li>▷ As soon as the work is complete, re-install and/or re-activate any safety-relevant and protective devices.</li> </ul>
	<p style="background-color: #0070c0; color: white; padding: 5px;"><b>NOTE</b></p> <p>On pumps/pump sets older than 5 years we recommend replacing all elastomer seals.</p>

## 7 Servicing/Maintenance

### 7.1 Safety regulations

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

	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ DANGER</b></p> <p><b>Sparks produced during servicing work</b> 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>
	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Unintentional starting of pump set</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started up unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Fluids handled and supplies posing a health hazard and/or hot fluids handled and supplies</b> 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>
	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Hot surface</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>
	<p style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Improper lifting/moving of heavy assemblies or components</b> 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 style="background-color: #e67e22; color: white; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Insufficient stability</b> Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> <li>▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tipping or falling over.</li> </ul>

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

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

	<b>NOTE</b>
	All maintenance, service and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached "Addresses" booklet or on the Internet at " <a href="http://www.ksb.com/contact">www.ksb.com/contact</a> ".

Never use force when dismantling and reassembling the pump set.

## 7.2 Maintenance/inspection

**Table 15:** Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4,000 operating hours <sup>7)</sup>	Measure the insulation resistance	(⇒ Section 7.2.1.3, Page 41)
	Check the power cables	(⇒ Section 7.2.1.2, Page 40)
	Visually inspect the lifting chain/rope	(⇒ Section 7.2.1.1, Page 40)
	Check the sensors	(⇒ Section 7.2.1.4, Page 41)
	Change the lubricant	(⇒ Section 7.2.2.1.4, Page 43)
	Inspect the bearings	(⇒ Section 7.4.4, Page 46)
Every five years	General overhaul	

### 7.2.1 Inspection work

#### 7.2.1.1 Checking the lifting chain/rope

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

#### 7.2.1.2 Checking the power cables

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

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

	<b>⚠ DANGER</b>
	<p><b>Defective earth conductor</b> Electric shock!</p> <p>▷ Never switch on a pump set with a defective earth conductor.</p>

7) At least once a year



### 7.2.1.3 Measuring the insulation resistance

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

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

	<b>NOTE</b>
	If the insulation resistance of the power cable is lower than 1 MΩ, the power cable is defective and must be replaced.

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

### 7.2.1.4 Checking the sensors

	<b>CAUTION</b>
	<p><b>Excessive test voltage</b> Damage to the sensors!</p> <p>▶ Never test the sensors with voltages exceeding 30 V.</p>

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

**Bimetal switches in the motor**

**Table 16:** Resistance measurement of bimetal switch in the motor

Measurement between terminals ...	Resistance
20 and 21 and between 21 and 22	< 1 Ω

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

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

**Leakage sensor in the motor**

**Table 17:** Resistance measurement of the leakage sensor in the motor

Measurement between terminals ...	Resistance
9 and earth conductor (PE)	> 1 Ω

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

## 7.2.2 Lubrication and lubricant change

### 7.2.2.1 Lubricating the mechanical seal

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

#### 7.2.2.1.1 Intervals

Change the lubricant every 4000 operating hours but at least once a year.

#### 7.2.2.1.2 Lubricant quality

	<b>DANGER</b>
	<p><b>Incorrect lubricant quality</b> Explosion hazard!</p> <p>▸ For explosion-proof pump sets always use a lubricant whose ignition temperature exceeds 185 °C.</p>

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

**Table 18: Oil quality**

Description	Properties	
Paraffin oil or white oil	Kinematic viscosity at 40 °C	<20 mm <sup>2</sup> /s
Alternative: motor oils of grade SAE 10W to SAE 20W	Ignition temperature	>185 °C
	Flash point (to Cleveland)	+160 °C
	Solidification point (pour point)	-15 °C

**Recommended oil quality:**

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

	<b>WARNING</b>
	<p><b>Lubricant contaminating fluid handled</b> Hazard to persons and the environment!</p> <p>▸ Using machine oil is only permitted if the oil is disposed of properly.</p>

#### 7.2.2.1.3 Lubricant quantity

**Table 19: Lubricant quantity**

Motor version	Lubricant quantity [l]
YL and WL	0.74
UL	0.25

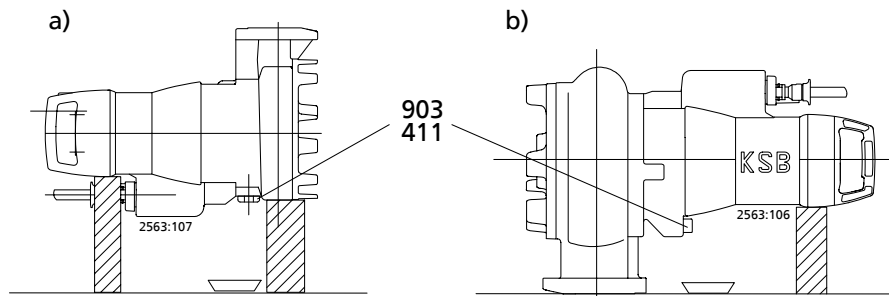
7.2.2.1.4 Changing the lubricant

7.2.2.1.4.1 Changing the lubricant — versions YL and WL

	<p><b>! WARNING</b></p>
	<p><b>Lubricants posing a health hazard and/or hot lubricants</b>  Hazard to persons and the environment!</p> <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>

**Draining the lubricant**

1. Position the pump set as shown.



**Fig. 19:** Draining the lubricant a) Versions YL and WL for pump size 50-170... and 65-220; b) Versions YL, WL

2. Place a suitable container under the screw plug.

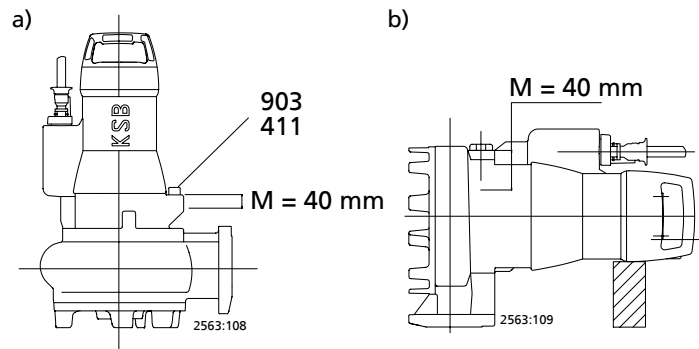
	<p><b>! WARNING</b></p>
	<p><b>Excess pressure in the lubricant reservoir</b>  Liquid spurting out when the lubricant reservoir is opened at operating temperature!</p> <ul style="list-style-type: none"> <li>▷ Open the screw plug of the lubricant reservoir very carefully.</li> </ul>

3. Undo screw plug 903 with joint ring 411 and drain off the lubricant.

	<p><b>NOTE</b></p>
	<p>Paraffin oil is bright and transparent in appearance. A slight discolouration, caused by the running-in process of new mechanical seals or small amounts of leakage from the fluid handled, has no detrimental effect. However, if the coolant is severely contaminated by the fluid handled, this suggests a defect at the mechanical seals.</p>

**Filling in the lubricant**

1. Position the pump set as shown.



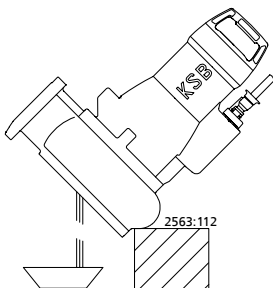
**Fig. 20:** Topping up the lubricant a) Versions YL and WL; b) Versions YL, WL for pump sizes 50-170... and 65-220

2. Fill lubricant through the lubricant filler opening until the lubricant in the lubricant reservoir reaches the required level M (see the following table).
3. Screw in screw plug 903 with new joint ring 411. Tighten to a torque of 23 Nm.

**Table 20:** Lubricant level

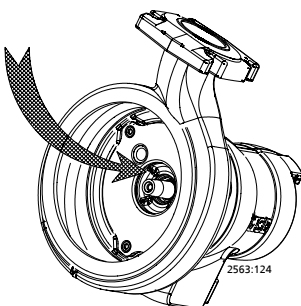
Motor sizes	M [mm]
50-22* 65-170 80-220 100-220 (versions YL and WL)	40
50-17* 65-220 (versions YL and WL)	40

#### Draining the lubricant



**Fig. 21:** Draining the lubricant

#### Filling in the lubricant



**Fig. 22:** Filling in the lubricant

#### 7.2.2.1.4.2 Changing the lubricant — version UL

- ✓ The suction cover and the impeller have been removed. (⇒ Section 7.4.3, Page 46)



  1. Place a suitable container under the pump set.
  2. Move mechanical seal 433.02 along the shaft.
  3. Drain the oil.

1. Fill 0.25 litres of oil through the opening between the stationary part of mechanical seal 433.02 and rotor 818.
2. Thoroughly clean rotor 818 and the contact face of the stationary part of mechanical seal 433.02. Remove any oil residues.
3. Fit the rotating part of mechanical seal 433.02.
4. Fit impeller 230 and suction cover 162. Observe the tightening torques. (⇒ Section 7.6, Page 52)

#### 7.2.2.2 Lubricating the rolling element bearings

The rolling element bearings of the pump sets are grease-packed and maintenance-free.



### 7.3 Drainage/cleaning



	 <b>WARNING</b>
	<p><b>Fluids, consumables and supplies which are hot and/or pose a health hazard</b> 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 safety 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. Always complete and enclose a certificate of decontamination when returning the pump set. (⇒ Section 11, Page 68)

### 7.4 Dismantling the pump set



#### 7.4.1 General information/Safety regulations

	 <b>WARNING</b>
	<p><b>Unqualified personnel performing work on the pump (set)</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair and maintenance work performed by specially trained, qualified personnel.</li> </ul>

	 <b>WARNING</b>
	<p><b>Hot surface</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>

	 <b>WARNING</b>
	<p><b>Improper lifting/moving of heavy assemblies or components</b> 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>

Observe the general safety instructions and information. (⇒ Section 7, Page 39)  
For dismantling and reassembly observe the general assembly drawing.  
In the event of damage you can always contact our service staff.

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

	<p><b>! WARNING</b></p>
	<p><b>Components with sharp edges</b> 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>

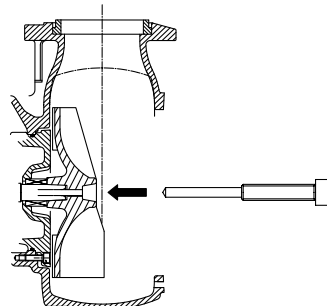
**7.4.2 Preparing the pump set**

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 45) have been observed/ carried out.
- 1. De-energise the pump set and secure it against unintentional start-up.
- 2. Drain the lubricant.
- 3. Drain the leakage chamber and leave it open for the duration of the disassembly.


**7.4.3 Dismantling the pump section**

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

1. Remove suction cover 162.
2. Undo and remove the M8 impeller fastening screw.  
The impeller/shaft connection is a tapered fit.
3. For removing the impeller, an M10 jacking thread is provided at the impeller hub.  
Screw in the jack as shown in the drawing below and remove the impeller.





**Fig. 23:** Forcing screw

	<p><b>NOTE</b></p>
	<p>The forcing screw is not included in the scope of supply. It can be ordered separately from KSB.</p>

**7.4.4 Removing the mechanical seal and motor section**

**7.4.4.1 Removing the mechanical seal and motor section (versions YLG and WLG)**

	<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>

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

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




1. Push primary ring 433.02 along the shaft.
2. Undo and remove screws 914.02.
3. Remove intermediate casing 113.
4. Push mating ring 433.02 out of intermediate casing 113.
5. Remove circlip 932.03.
6. Remove primary ring 433.01.
7. Pull off mating ring holder 476.
8. Take the mating ring out of mating ring holder 476.
9. Take O-ring 412.02 out of mating ring holder 476.
10. Take circlip 932.04 out of bearing bracket housing 355.
11. Remove bearing bracket housing 355.
12. Pull out rotor 818.
13. Remove circlip 932.01.
14. Remove circlip 932.02.
15. Pull off the two rolling element bearings 321.

#### 7.4.4.2 Removing the mechanical seal and motor part (version UL)

- ✓ The oil has been drained. (⇒ Section 7.2.2.1.4.2, Page 44)
1. Undo and remove screws 914.02 at bearing bracket 330.
  2. Remove rotor unit 818 from bearing bracket 330.
  3. Push mating ring 433.02 out of bearing bracket 330.
  4. Remove circlip 932.02.
  5. Take bearing bracket 330 off rotor 818.
  6. Remove circlip 932.03.
  7. Remove primary ring 433.01.
  8. Pull off mating ring holder 476.
  9. Take mating ring 433.01 out of mating ring holder 476.
  10. Remove circlip 932.01.
  11. Extract rolling element bearing 321.02.
  12. Extract rolling element bearing 321.01.

## 7.5 Reassembling the pump set

### 7.5.1 General information/Safety regulations

	<p><b>WARNING</b></p> <p><b>Improper lifting/moving of heavy assemblies or components</b>        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>CAUTION</b></p> <p><b>Improper reassembly</b>        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>
	<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. 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.
- Assembly adhesives
  - Avoid the use of assembly adhesives, if possible.

**Tightening torques** For reassembly, tighten all screws and bolts as specified in this manual. (⇒ Section 7.6, Page 52)

### 7.5.2 Reassembling the pump section

#### 7.5.2.1 Installing the mechanical seal

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

- The shaft surface must be absolutely clean and undamaged.
- Immediately before installing the mechanical seal, wet the contact faces with a drop of oil.
- For easier installation of the bellows-type mechanical seal, 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.  
 Slip 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 and secure it with taper lock ring 515 or circlip 932.03.
  2. Insert O-rings 412.04/412.35 and 412.15/412.11 into discharge cover 163, and press them into bearing bracket 330 as far as they will go.
  3. Slide pump-end mechanical seal 433.02 onto shaft 210.



For special mechanical seals with covered springs, tighten the socket head cap screw at the rotating assembly before fitting the impeller. Observe installation dimension "A".

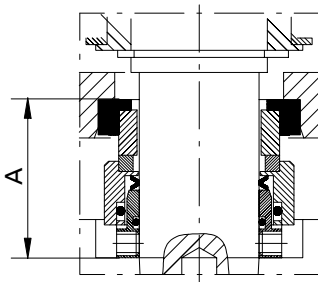


Fig. 24: Installation dimension "A"

Table 21: Installation dimension A

Pump size	Installation dimension "A" [mm]
All sizes	29

### 7.5.2.2 Fitting the impeller

#### 7.5.2.2.1 Fitting impeller type S and cutter

	<b>NOTE</b>
	For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and installed free from grease.

1. Slide impeller 230 onto the shaft end.
2. Insert grooved pin 561 into impeller 230.
3. Place impeller body 23-7 on the centring hub.
4. Insert impeller screw 914.04 and tighten it to a torque of 30 Nm.
5. Fasten ring 500 in the suction cover with screws 914.06.

	<b>CAUTION</b>
	<b>Incorrect assembly</b> Clearance gap inaccurate! <ul style="list-style-type: none"> <li>▸ Pull the rotor assembly right up to the suction cover until it will not go any further. Maintain this position until dimensions x and y have been measured.</li> </ul>

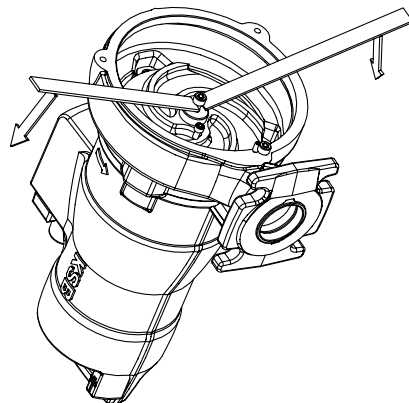
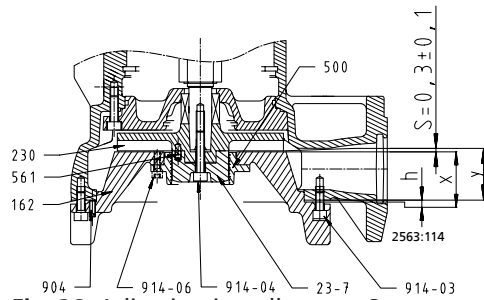


Fig. 25: Pulling the rotor assembly right up to the suction cover

6. Pull the rotor assembly right up to the suction cover until it will not go any further.


**Fig. 26: Adjusting impeller type S**

h	Distance between suction cover and pump casing
s	Clearance gap between suction cover and impeller vanes
x	Distance between the upper side of the suction cover and the mounting holes of the suction cover
y	Distance between the bottom of the pump casing and the impeller vanes

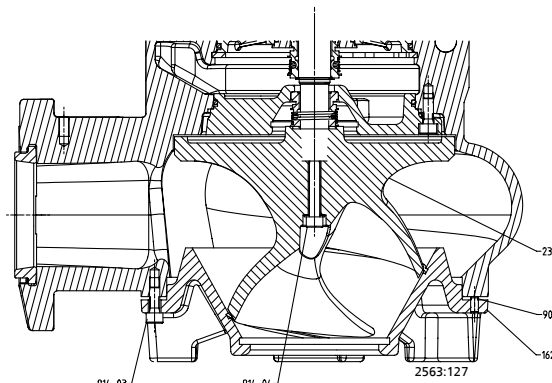
7. Measure dimension x on the suction cover  
Dimension x is the distance between the upper side of the suction cover and the mounting holes of the suction cover.
8. Measure dimension y between the pump casing and the impeller vanes.  
Dimension y is the distance between the bottom of the pump casing and the impeller vanes.
9. Use screws 904 to set dimension h ( $h = x + s - y$ ),  
where s ( $0.3 \pm 0.1$ ) is the clearance between the suction cover and the impeller vanes.
10. Tighten the suction cover with screws 914.03.
11. Rotate the impeller body to check that the impeller turns smoothly.  
Make sure that the suction cover and impeller do not touch each other.

#### 7.5.2.2.2 Fitting impeller type D



#### NOTE



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


**Fig. 27: Fitting impeller type D**

1. Slide impeller 230 onto the shaft end and fasten it with impeller screw 914.04.
2. Then, remove the impeller screw again.
3. Screw in an M8 x 100 eyebolt (not included in KSB's scope of supply) instead of the impeller screw.
4. Push on suction cover 162 until it rests against the impeller.
5. Suspend the pump set by the eyebolt (not included in KSB's scope of supply).
6. Screw in levelling screws 904 until they abut against the pump casing.
7. Carefully lower down the pump set again.

8. Remove the suction cover.
9. Measure the height of screws 904 up to suction cover 162 and add 0.8 +/- 0.1 mm to the height of every screw.
10. Re-insert the suction cover and fasten it with screws 914.03.
11. Suspend the pump set from the hoisting tackle and rotate the impeller by hand to check that it rotates easily.
12. Remove the eyebolt (not included in KSB's scope of supply).
13. Insert and tighten the impeller screw.

### 7.5.3 Reassembling the motor section

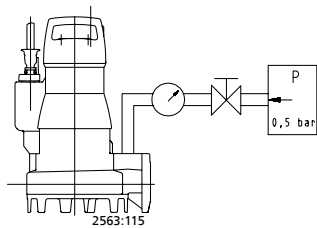
	<b>NOTE</b>
	<p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof pumps. Observe the flamepath positions specified in the Annex. Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite type 243).</p>
	<b>⚠ DANGER</b>
	<p><b>Wrong screws/bolts</b> 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>

### 7.5.4 Leak testing (versions YLG - WLG)

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

Observe the following values for leak testing:

- **Test medium:** compressed air
- **Test pressure:** 0.5 bar max.
- **Test duration:** 2 minutes



**Fig. 28:** Screwing in the testing device

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

### 7.5.5 Checking the connection of motor/power supply

Once reassembly has been completed, carry out the steps described in (⇒ Section 7.2.1, Page 40) .

## 7.6 Tightening torques

**Table 22:** Tightening torques

Thread	Torque [Nm]
M 8	17
Impeller screw M8	40
Screw plug 903	23

## 7.7 Spare parts stock



### NOTE

For explosion-proof pump sets only original spare parts or parts authorised by the manufacturer must be used.

### 7.7.1 Ordering spare parts

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

- Pump type
- KSB order number
- Motor number

Refer to the name plate for all data.

Also supply the following data:

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

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

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

**Table 23:** Quantity of spare parts for recommended spare parts stock<sup>8)</sup>

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
230	Impeller	1	1	2	2	3	4	50 %
320 / 321.02	Rolling element bearing, pump end	1	1	2	2	3	4	50 %
321.01 / 322	Rolling element bearing, motor end	1	1	2	2	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 %
99-9	Set of seal elements	4	6	8	8	9	10	100 %

8) For two years of continuous operation or 4000 operating hours

### 7.7.3 Sets of spare parts

**Table 24:** Overview of spare parts sets

Description	Part No.
Rolling element bearing, motor end	321.01
Rolling element bearing, pump end	3210.02
Mechanical seal, motor end	433.01
Mechanical seal, pump end	433.02
Set of seal elements	99-9
Repair kit	99-20
1 set of circlips	-

## 8 Trouble-shooting

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

Table 25: Trouble-shooting

A	B	C	D	E	Possible cause	Remedy
	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 is running in the off-design range (low flow/overload).	Check the pump's operating data.
X					Pump or piping are not completely vented.	Vent by lifting the pump off the duckfoot bend and lowering it again.
X					Pump intake clogged by deposits	Clean the intake, pump components and non-return valve.
	X		X	X	Suction 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 whether the impeller can be easily rotated. Clean the impeller, if required.
	X	X	X	X	Wear of internal parts	Replace worn parts by new ones.
X	X		X		Defective riser (pipe and sealing elements)	Replace defective riser pipes, replace sealing elements.
	X		X	X	Impermissible air or gas content in the fluid handled	Contact KSB.
				X	System-induced vibrations	Contact KSB.
	X	X	X	X	Wrong direction of rotation	Check the connection of the motor and switchgear, if any.
		X			Wrong supply voltage	Check the power cable. Check the cable connections.
X					Motor is not running because of lack of voltage.	Check the electrical installation. Contact the energy supplier.
X		X			Motor winding or power cable are defective.	Replace by new original KSB parts or contact KSB.
				X	Defective rolling element bearing	Contact KSB.
	X				Water level lowered too much during operation.	Check level control equipment.
X					The temperature control device for monitoring the winding has tripped due to excessive winding temperature.	The motor will restart automatically once it has cooled down.
X					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.
X					Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.

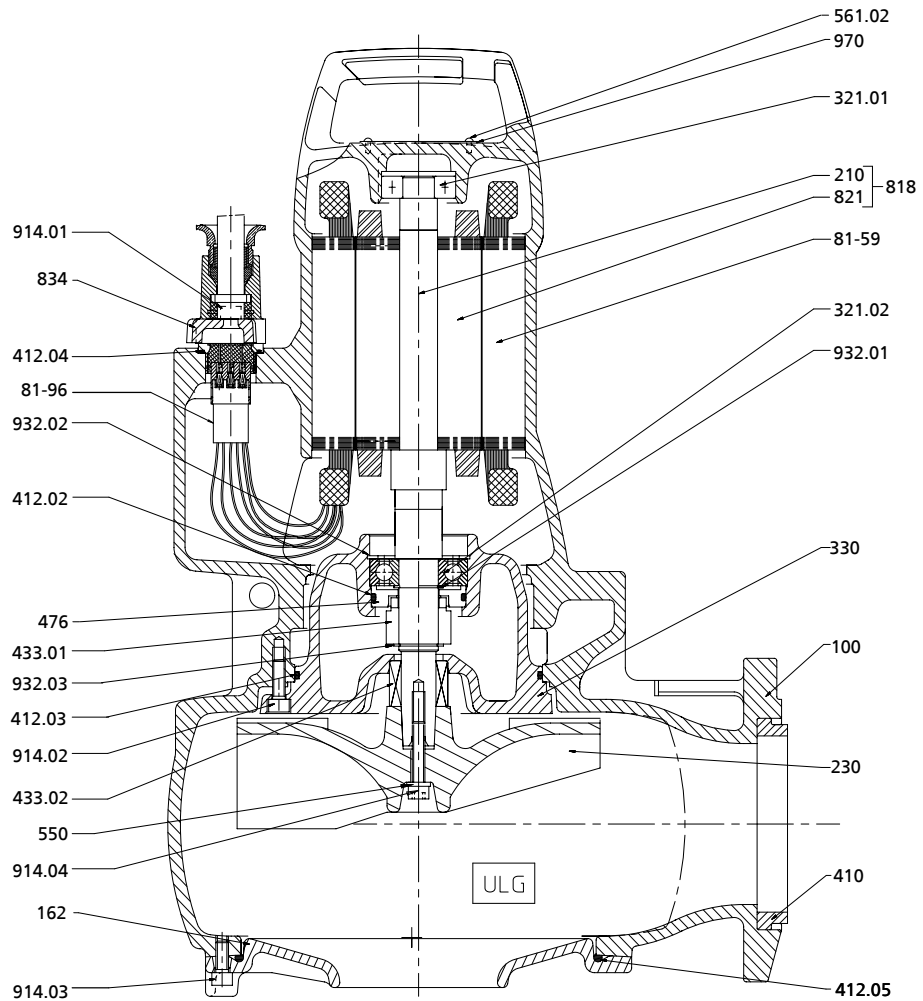
## 9 Related Documents

### 9.1 General assembly drawing with list of components

#### 9.1.1 Amarex N — version ULG

Sizes of hydraulic system  
DN 50 ... 100

Motor sizes  
002...042  
004...044



General assembly drawing of non-explosionproof pump set (ULG)

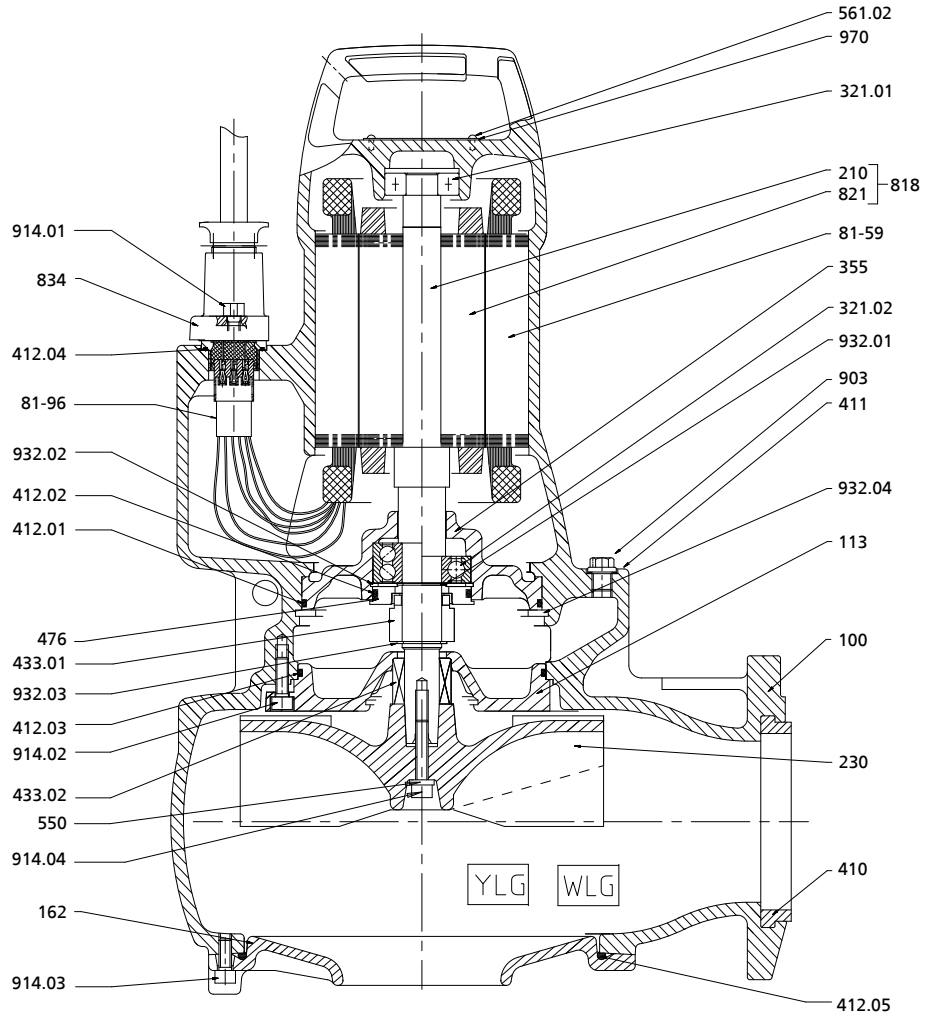
Table 26: List of components

Part No.	Description	Part No.	Description
100	Casing	550	Disc
162	Suction cover	561.02	Grooved pin
210	Shaft	81-2	Plug
230	Impeller	81-59	Stator
321.01/02	Radial ball bearing	818	Rotor
330	Bearing bracket	821	Rotor core pack
410	Profile seal	834	Cable gland
412.01/02/03/04/05	O-ring	914.01/02/03/04	Hexagon socket head cap screw
433.01/02	Mechanical seal	932.01/02/03	Circlip
476	Mating ring carrier	970	Label/plate

9.1.2 Amarex N — version YLG/WLG

Sizes of hydraulic system  
DN 50 ... 100

Motor sizes  
002...042  
004...044



General assembly drawing of explosion-proof pump set (YLG)/non-explosionproof pump set (WLG)

Table 27: List of components

Part No.	Description	Part No.	Description
100	Casing	476	Mating ring carrier
113	Intermediate casing	550	Disc
162	Suction cover	561.02	Grooved pin
210	Shaft	81-2	Plug
230	Impeller	81-59	Stator
321.01/02	Radial ball bearing	818	Rotor
330	Bearing bracket	821	Rotor core pack
355	Bearing bracket housing	834	Cable gland
410	Profile seal	903	Screw plug
411	Joint ring	914.01/02/03/04	Hexagon socket head cap screw
412.01/02/03/04/05	O-ring	932.01/02/03/04	Circlip
433.01/02	Mechanical seal	970	Label/plate



9.1.3 Exploded views

Amarex N - S 50

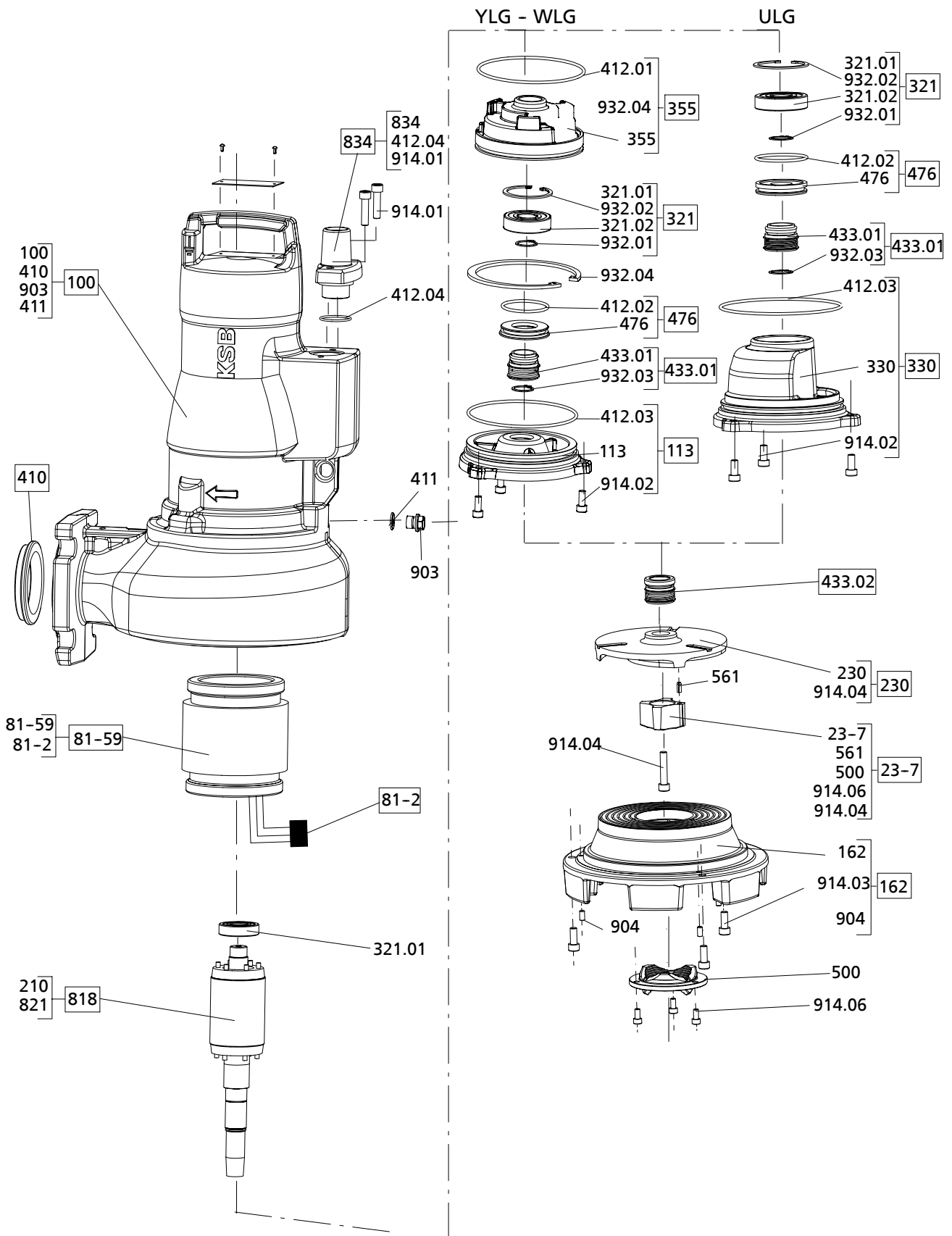


Fig. 29: Amarex N S50

Amarex N - F 50-100

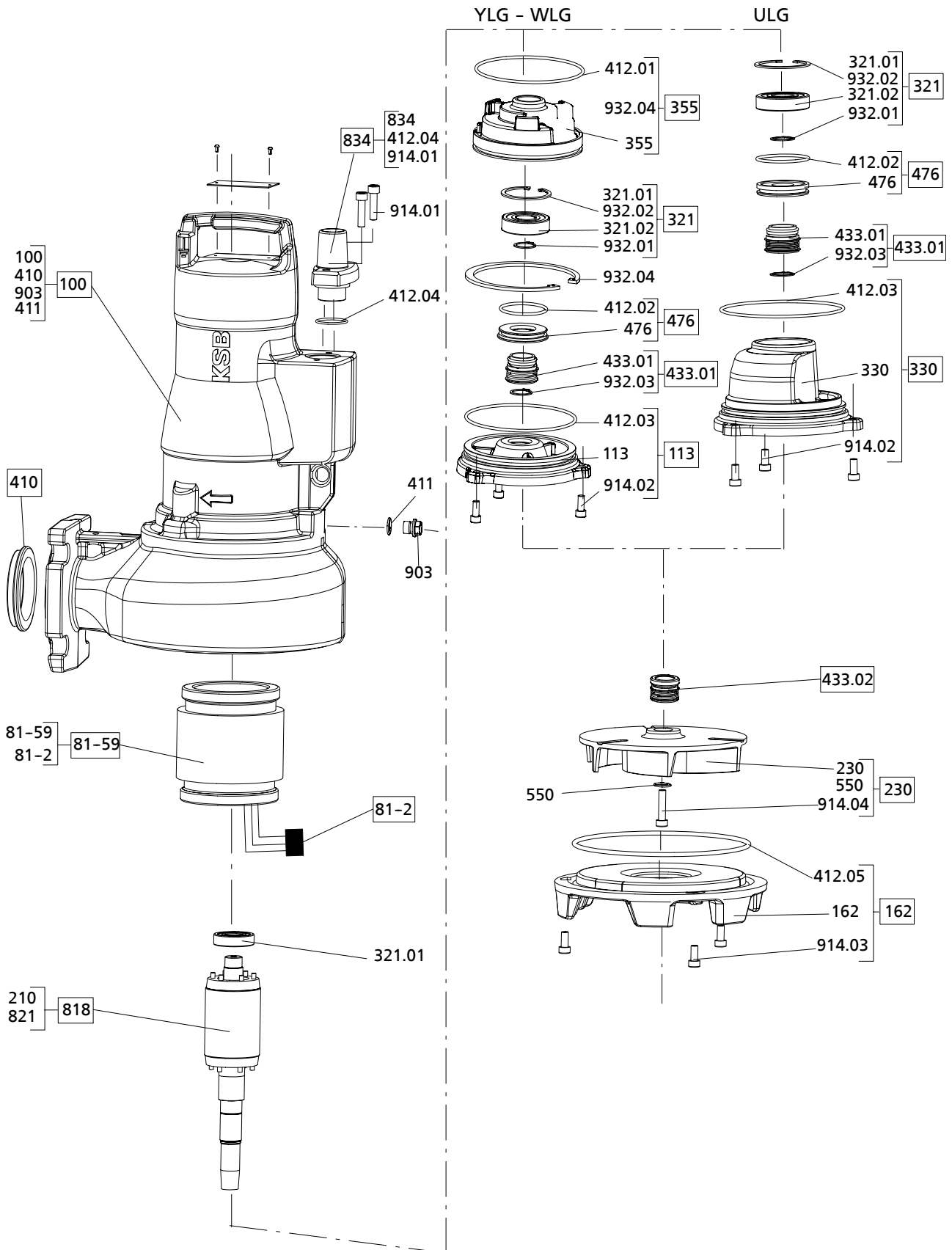


Fig. 30: Exploded view Amarex N with F 50 - 100

Amarex N - D 80-100

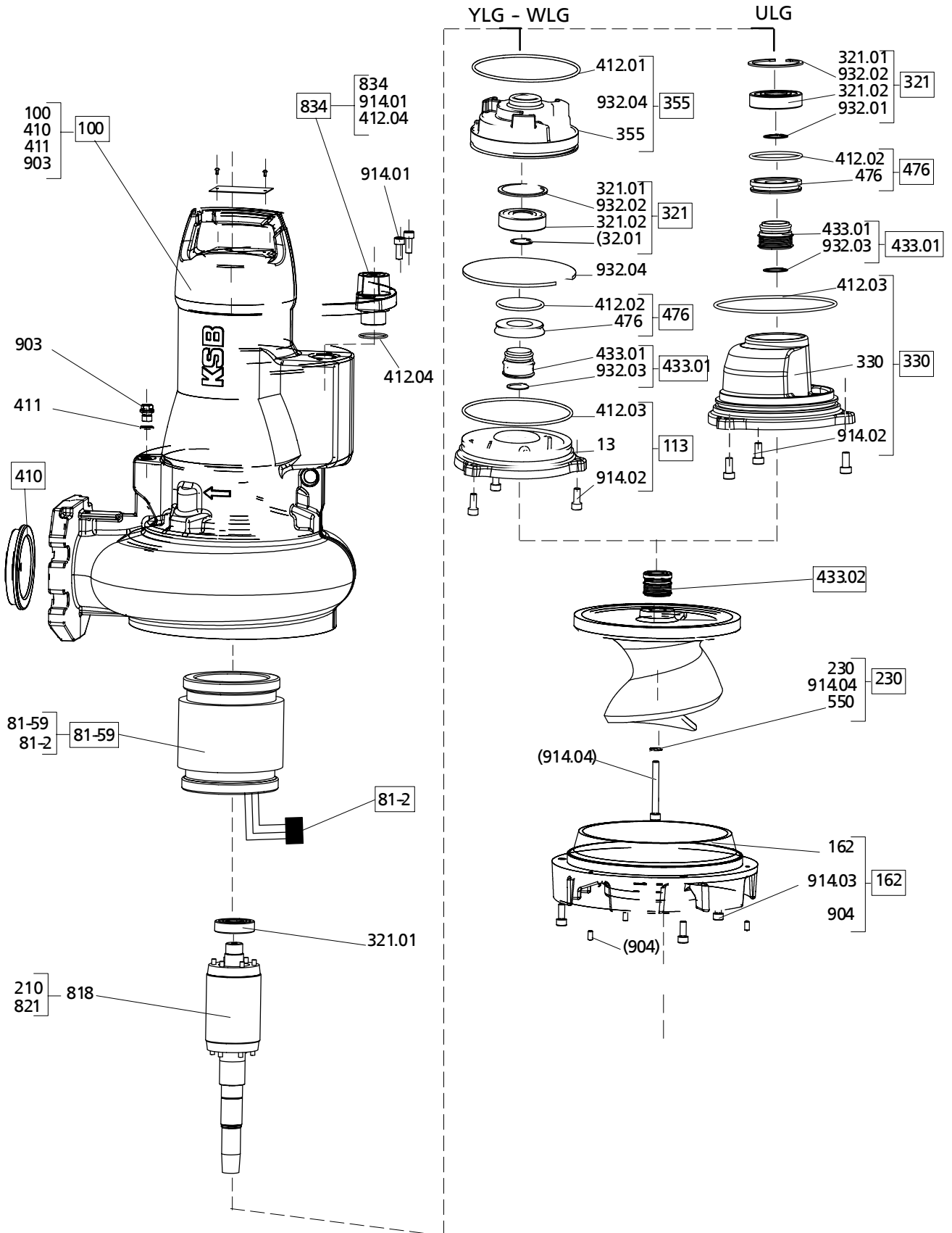


Fig. 31: Exploded view Amarex N with D 80-100

**Table 28:** List of components

Part No.	Description	Part No.	Description
100	Casing	500	Ring
113	Intermediate casing	550	Disc
162	Suction cover	561	Grooved pin
182	Feet	69-6	Temperature sensor
210	Shaft	69-16	Moisture sensor
23-7	Impeller body	81-2	Connector
230	Impeller	81-59	Stator
321.01/.02	Radial ball bearing	818	Rotor
330	Bearing bracket	821	Rotor core pack
355	Bearing bracket housing	834	Cable gland
410	Profile joint	99-9	Set of seal elements
411	Joint ring	903	Screw plug
412.01/.02/.03/.04/.05	O-ring	904	Grub screw
433.01/.02	Mechanical seal	914.01/.02/.03/.04/.06	Socket head cap screw
476	Mating ring holder	932.01/.02/.03/.04	Circlip
59-17	Shackle		

9.2 Wiring diagrams

9.2.1 Version WLG/YLG

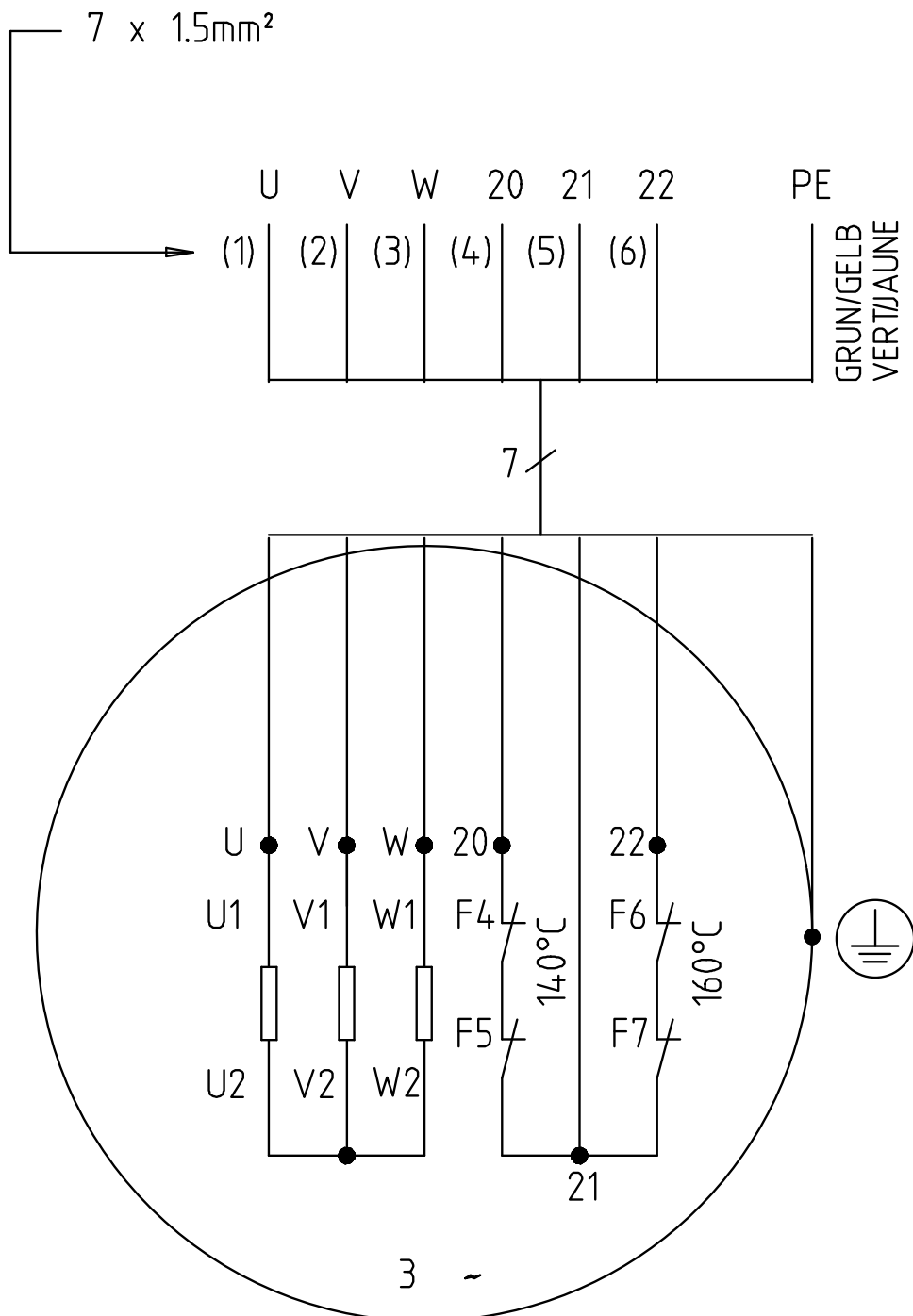


Fig. 32: Wiring diagram for version WLG/YLG

9.2.2 Version ULG

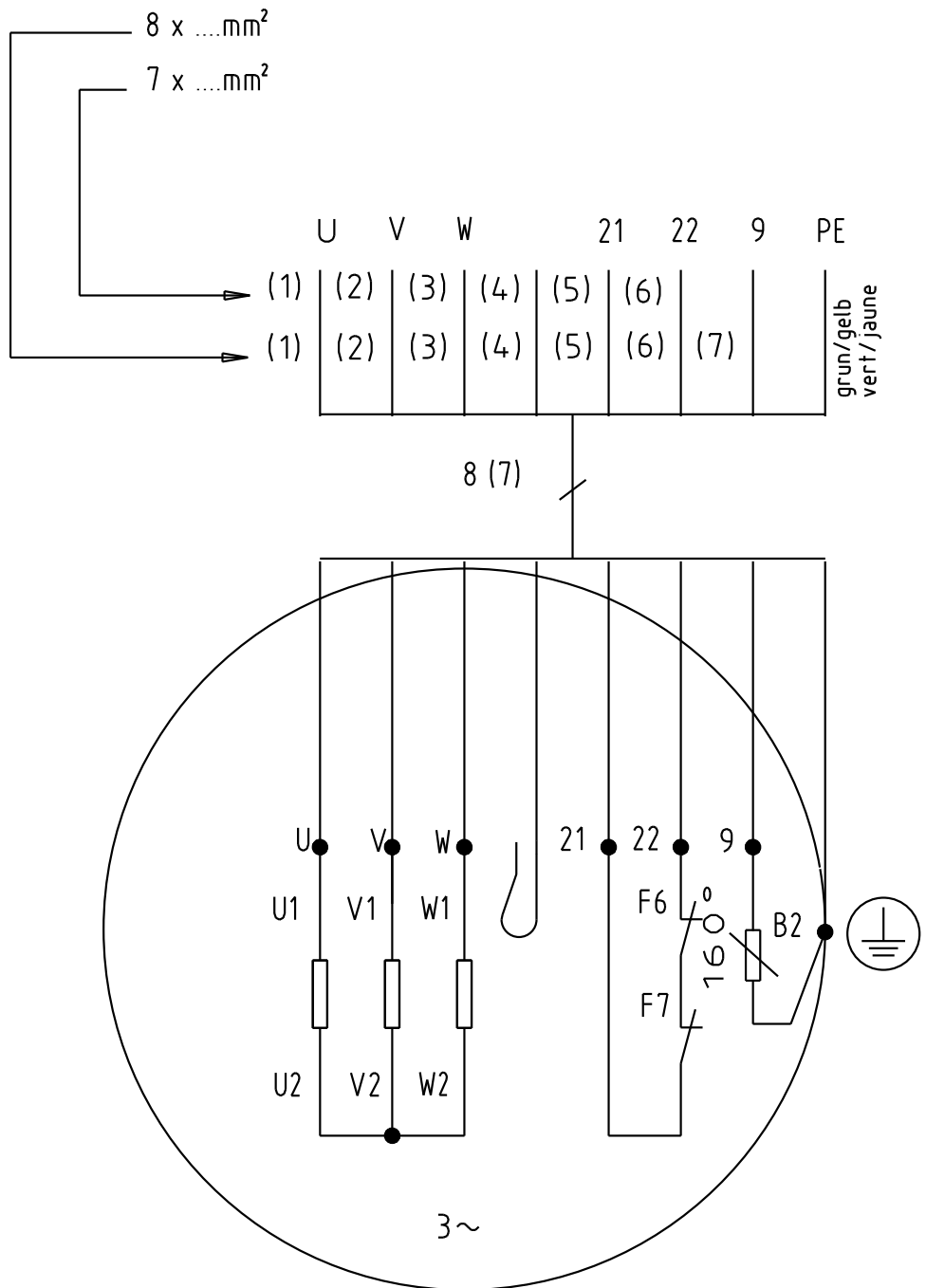


Fig. 33: Wiring diagram for version ULG

### 9.3 Wiring diagrams overload protection

**Table 29:** Examples of wiring diagrams for overload protection

Key	Circuit diagram
<p><b>Q:</b> residual current device 3~30 mA e.g. residual current device Merlin Guérin C60 L, trip characteristic K</p> <ul style="list-style-type: none"> <li>▪ Earth leakage module VIGI, instantaneous, 3~30 mA</li> <li>▪ Auxiliary contact (change-over contact)</li> </ul> <p><b>KM:</b> Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p><b>F:</b> Remote control</p>	
<p><b>Q:</b> Motor contactor e.g. Télémécanique GV2M + GV2 AN 11</p> <p><b>KM:</b> Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p><b>RH:</b> Earth leakage protection relay with separate toroid e.g. Vigirex RH 328 A Merlin Guérin + Tore</p> <p><b>F:</b> Remote control</p> <p><b>H:</b> Auxiliary supply</p>	
<p><b>Q:</b> Motor contactor e.g. Télémécanique GV2M + GV2 AN 11</p> <p><b>KM:</b> Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p><b>SM:</b> Insulation monitor, de-energised e.g. V12G1LOHM SM21 Merlin Guérin</p> <p><b>F:</b> Remote control</p> <p><b>H:</b> Auxiliary supply</p>	

### 9.4 Flamepaths on explosion-proof motors

**Table 30: Overview of flamepaths**

Motor sizes	Pump set		
DKN 82 F 50-170 S 50-17... F 65-220			
	Shaft	Pump casing	Cable gland
Flamepath number	1	2	3
Length of flamepath [mm]	$\geq 12.5$	$\geq 12.5$	$\geq 12.5$
Inside diameter (drilled hole) [mm]	30	142	32
Outside diameter (shaft) [mm]	29,9	142	32
Tolerance ISO inside diameter	F7	H8	H8
Tolerance ISO outside diameter	-	g6	-
Tolerance in $\mu\text{m}$ inside diameter to DIN ISO 286/2	Maximum	+41	+63
	Minimum	+20	0
Tolerance in $\mu\text{m}$ outside diameter to DIN ISO 286/2	Maximum	-	-14
	Minimum	-	-39
Tolerance in $\mu\text{m}$ inside diameter	Maximum	-	-
	Minimum	-	-
Tolerance in $\mu\text{m}$ outside diameter	Maximum	-40	-25
	Minimum	-60	-75



Motor sizes	Pump set		
DKN 92 F 50-220 S50-22... F65-170 F 80-220 D 80-220 F 100-220 D 100-220			
	Shaft	Pump casing	Cable gland
Flamepath number	1	2	3
Length of flamepath [mm]	$\geq 12.5$	$\geq 12.5$	$\geq 12.5$
Inside diameter (drilled hole) [mm]	30	$\geq 152$	32
Outside diameter (shaft) [mm]	29,9	152	32
Tolerance ISO inside diameter	F7	H8	H8
Tolerance ISO outside diameter	-	g6	-
Tolerance in $\mu\text{m}$ inside diameter to DIN ISO 286/2	Maximum	+41	+63
	Minimum	+20	0
Tolerance in $\mu\text{m}$ outside diameter to DIN ISO 286/2	Maximum	-	-14
	Minimum	-	-39
Tolerance in $\mu\text{m}$ inside diameter	Maximum	-	-
	Minimum	-	-
Tolerance in $\mu\text{m}$ outside diameter	Maximum	-40	-25
	Minimum	-60	-75

### 9.5 Installation drawings of the mechanical seal

**Table 31:** Sectional drawings of the mechanical seal

Part No.	Description	Sectional drawing
433.01	Mechanical seal (bellows-type mechanical seal)	
932.01	Circlip	
433.02	Mechanical seal (bellows-type mechanical seal)	
433	Mechanical seal (mechanical seal with covered springs - HJ)	

## 10 EU Declaration of Conformity

Manufacturer: **KSB S.A.S.**  
**128, rue Carnot,**  
**59320 Sequedin (France)**

The manufacturer herewith declares that the product:

### **Amarex N**

**Serial number range: S1501- S1952**

- is in conformity with the provisions of the following Directives as amended from time to time:
  - Pump set: Machinery Directive 2006/42/EC

The manufacturer also declares that

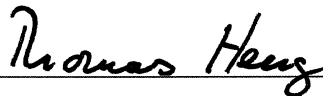
- the following harmonised international standards have been applied:
  - ISO 12100
  - EN 809
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

Hugues Roland  
Head of Design/Engineering  
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59320 Sequedin (France)

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 February 2018



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Thomas Heng  
Head of Product Development Series Pumps  
KSB SE & Co. KGaA  
Johann-Klein-Straße 9  
67227 Frankenthal

**11 Certificate of Decontamination**

Type: .....

Order number/ .....  
 Order item number<sup>9)</sup>: .....

Delivery date: .....

Field of application: .....

Fluid handled<sup>9)</sup>: .....

Please tick where applicable<sup>9)</sup>:

Radioactive



Explosive



Corrosive



Toxic



Harmful



Bio-hazardous



Highly flammable



Safe

Reason for return<sup>9)</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, 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 adapter 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

9) Required fields

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