

Submersible Motor Pump

## Amarex N S 32-160

Pump size DN 32

Motors:

2-pole: 02

Non-ATEX

## Installation/Operating Manual



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Installation/Operating Manual Amarex N S 32-160

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

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

Sizes	Impeller type	Material variant G
32-160	S	S

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

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

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

## 1.2 Installation of partly completed machinery

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

## 1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel. (⇒ Section 2.3, Page 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>1)</sup>	Sectional drawing of the pump
Spare parts lists <sup>1)</sup>	Description of spare parts
Supplementary operating manuals <sup>1)</sup>	e.g. for installation parts for stationary wet installation

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

## 1.5 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

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

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

### 1.6 Key to safety symbols/markings

Table 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>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 Safety

All the information contained in this section refers to hazardous situations. In addition to the present general safety information the action-related safety information given in the other sections must be observed.

### 2.1 General

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

### 2.2 Intended use

- The pump set must only be operated within the operating limits described in the other applicable documents.
- Only operate pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.
- Only use the pump 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  $1.2 \times Q_{BEP}$  to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ( $< 0.7 \times Q_{BEP}$ ).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- The pump set must only be used for the following applications:

	Impeller with cutter (impeller type S)	<b>Suitable for the following fluids:</b> faeces, domestic sewage and waste water containing long fibres
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### 2.3 Personnel qualification and training

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

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

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

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

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

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

### 2.5 Safety awareness

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

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

### 2.6 Safety information for the user/operator

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

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

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.

- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 32)
- Decontaminate pumps which handle fluids posing a health hazard.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇒ Section 6.1, Page 30)

### **2.8 Unauthorised modes of operation**

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

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

### 3 Transport/Storage/Disposal

#### 3.1 Checking the condition upon delivery

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

#### 3.2 Transport

	<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 for attaching the lifting accessory.</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 or lifting the pump set into/out of the pump sump.</li> <li>▷ Securely attach the lifting chain/rope to the pump and crane.</li> <li>▷ Use tested, marked and approved lifting accessories only.</li> <li>▷ Observe the regional transport regulations.</li> <li>▷ Observe the 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:

	<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 pump (set) or the packaged 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!</p> <ul style="list-style-type: none"> <li>▷ Clean and cover pump openings and connections as required prior to putting the pump into storage.</li> </ul>

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**Table 5:** Ambient conditions for storage

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

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

	<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 39)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the pump and blow through with anhydrous inert gas to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.  
Indicate any safety measures and decontamination measures taken.  
(⇒ Section 11, Page 53)

	<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 posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and dispose of any preservatives, flushing liquids and fluid residues.</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 product.  
Collect greases and other lubricants during dismantling.
2. Separate and sort the materials, e.g. by:
  - Metals
  - Plastics
  - Electronic waste
  - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.



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

Contact your local waste disposal partner for returns.

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

## 4 Description of the Pump (Set)

### 4.1 General description

Pump for handling domestic waste water, raw water and faeces in intermittent operation, with explosion protection.

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

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see <https://www.ksb.com/ksb-en/About-KSB/Corporate-responsibility/reach/>.

### 4.3 Designation

Example: Amarex N S 32-160 / 02 YLG 160

Table 6: Designation key

Code	Description	
Amarex N	Type series	
S	Impeller type	
	S	Impeller with cutter
32-160	Size	
	32	Nominal discharge nozzle diameter [mm]
	160	Hydraulic system size
0	Motor size	
2	Number of motor poles	
	2	2 poles
YL	Motor design	
	UL	Without explosion protection, fluid temperatures < 40 °C
	YL	With explosion protection, fluid temperatures < 40 °C
G	Material variant	
	G	Pump casing: grey cast iron EN-GJL-250
		Intermediate casing: grey cast iron EN-GJL-250
Impeller: grey cast iron EN-GJL-250		
160	Nominal impeller diameter [mm]	

### 4.4 Name plate

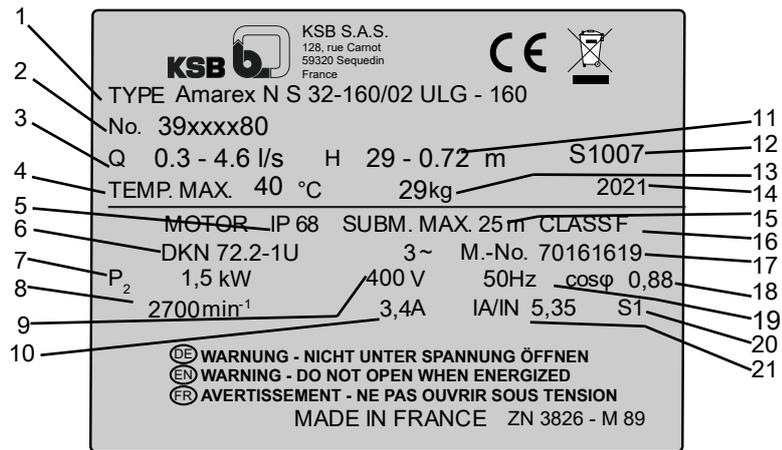


Fig. 1: Name plate (example)

1	Designation (⇒ Section 4.3, Page 14)	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	Serial number
13	Total weight	14	Year of construction
15	Maximum immersion depth	16	Thermal class of winding insulation
17	Motor number	18	Power factor at rated operating point
19	Rated frequency	20	Duty type
21	Starting current ratio		

### 4.5 Design details

#### Design

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

#### Drive

- Three-phase asynchronous squirrel-cage motor

#### Shaft seal

Drive end:

- Shaft seal ring

Pump-end:

- Uni-directional mechanical seal with liquid reservoir

#### Impeller type

- Application-oriented impeller type

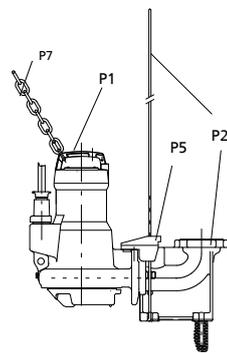
#### Bearings

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

4.6 Installation types

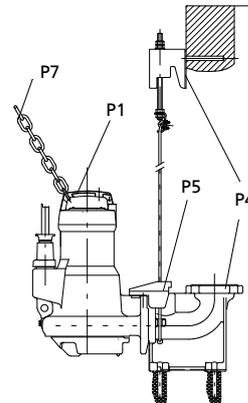
Table 7: Overview of installation types

Installation type S - stationary wet installation



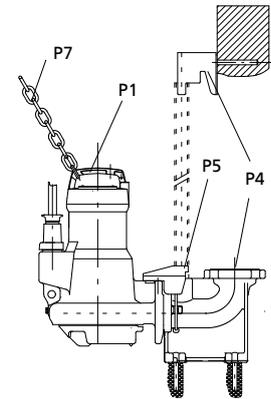
**Guide hoop arrangement**

P1: pump  
 P2: installation parts for guide hoop arrangement (ID<sup>2</sup>) = 1.5 m / 1.8 m / 2.1 m  
 P5: claw  
 P7: chain and shackle (length = 2 m)



**Guide wire arrangement**

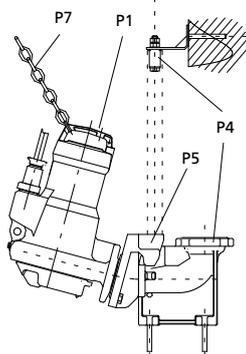
P1: pump  
 P4: installation parts for guide wire arrangement (ID<sup>2</sup>) = 4.5 m  
 P5: claw  
 P7: chain and shackle (length = 5 m)



**Single guide rail arrangement**

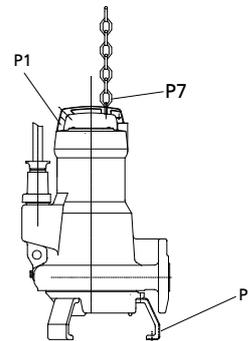
P1: pump  
 P4: installation parts for single guide rail arrangement  
 P5: claw  
 P7: chain and shackle (length = 5 m)

Installation type P - transportable wet installation



**Twin guide rail arrangement**

P1: pump  
 P4: installation parts for twin guide rail arrangement  
 P5: claw and adapter  
 P7: chain and shackle (length = 5 m)



P1: pump

P6: feet  
 P7: chain and shackle (length = 5 m)

<sup>2</sup> ID= installation depth from the lower edge of the access opening to the bottom of the pump sump

4.7 Configuration and function

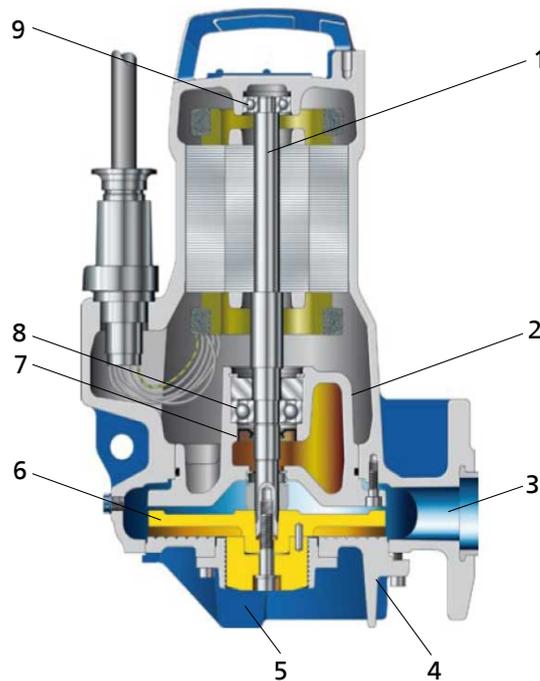


Fig. 2: Sectional drawing

1	Shaft	2	Bearing bracket
3	Discharge nozzle	4	Suction cover
5	Suction nozzle	6	Impeller
7	Shaft seal	8	Rolling element bearing, pump end
9	Rolling element 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 the suction nozzle (5) and is accelerated outward in a cylindrical flow by the rotating impeller (6). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (3), where it leaves the pump. At the rear side of the impeller, the shaft (1) enters the hydraulic system via a discharge cover. The shaft passage through the cover is sealed towards the atmosphere with a shaft seal (7). The shaft runs in rolling element bearings (8 and 9), which are supported by a bearing bracket (2) connected to the pump casing and/or discharge cover.

**Sealing** The pump is sealed by a bi-directional mechanical seal at the pump end and a shaft seal ring at the motor end. A lubricant reservoir between the shaft seal ring and the mechanical seal provides cooling and lubrication.

4.8 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
- Mounting bracket with fasteners
- Duckfoot bend with mounting elements
- Guiding equipment<sup>3)</sup>

<sup>3)</sup> The guide rails are not included in the scope of supply.

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

- Pump set complete with power cables
- 3 feet, or 3 feet and a pump stool, with fastening elements
- Lifting rope / lifting chain<sup>4)</sup>

**NOTE**

A separate name plate is included in the 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.

**4.9 Dimensions and weights**

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

---

<sup>4</sup> Optional

## 5 Installation at Site

### 5.1 Safety regulations

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

	<b>⚠ WARNING</b>
	<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>▷ Use a concrete of compressive strength class C25/30 which meets the requirements of 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, vane passing frequency) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

1. Check the structural requirements.

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

##### Place of installation for transportable models

	<b>⚠ WARNING</b>
	<p><b>Incorrect positioning / incorrect placing down</b>          Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Position the pump set vertically with the motor on top.</li> <li>▷ Use appropriate means to secure the pump set against tilting and tipping over.</li> <li>▷ Refer to the weights given in the data sheet/on the name plate.</li> <li>▷ Adjust the handle position.</li> </ul>

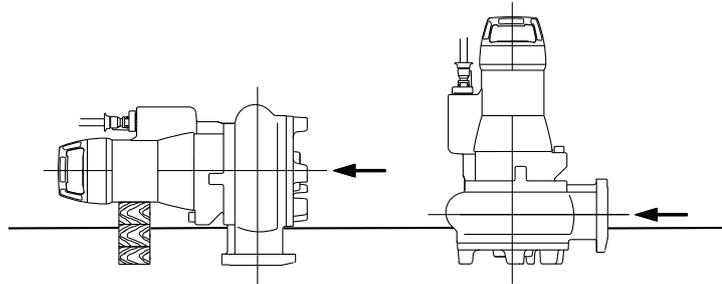
**Resonances** Any resonances at the usual excitation frequencies (1 x and 2 x rotational frequency, vane passing frequency) must be prevented both in the foundation and in the connected piping, as such frequencies may cause extreme vibrations.

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

### 5.2.2 Checking the direction of rotation

	<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>▷ Make sure that there is no foreign matter inside the pump.</li> <li>▷ Do not hold the pump while checking the direction of rotation.</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 in the control system.
4. Disconnect the pump set from the power supply and make sure it cannot be switched on unintentionally.

### 5.3 Installing the pump set

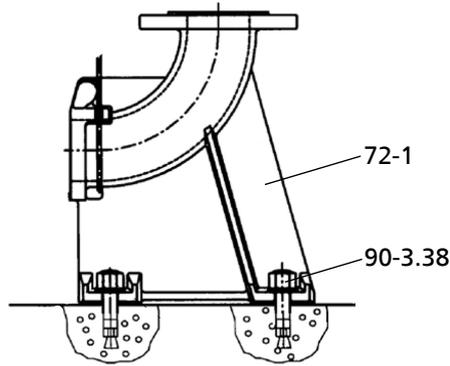
Always observe the general arrangement drawing/outline drawing when installing the pump set.

#### 5.3.1 Stationary wet installation

##### 5.3.1.1 Fastening the duckfoot bend

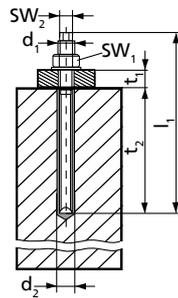
###### Fastening the duckfoot bend with chemical anchors

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



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

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



**Fig. 5:** Dimensions

**Table 8:** Chemical anchor dimensions

Size ( $d_1 \times l_1$ )	$d_2$ [mm]	$t_1$ [mm]	$t_2$ [mm]	$SW_1$ [mm]	$SW_2$ [mm]	$M_{d1}$ [Nm]
M10 x 130	12	20	90	17	7	20

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

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

**5.3.1.2 Connecting the piping**

	<p><b>⚠ DANGER</b></p>
<p><b>Impermissible loads acting on the flange of the duckfoot bend</b>                  Danger to life from escaping 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 pipes 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 for thermal expansion of the piping.</li> </ul>	

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	<b>NOTE</b>
	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.

	<b>CAUTION</b>
	<p><b>Critical speed of reverse rotation</b> Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> <li>▶ If long risers are used, fit a swing check valve to prevent excessive rotational speed of the pump running in reverse after it has been stopped. Watch the venting function when arranging the swing check valve.</li> <li>▶ Observe the maximum permissible speed (depending on the mechanical seal and bearings) in the event of reverse rotation.</li> </ul>

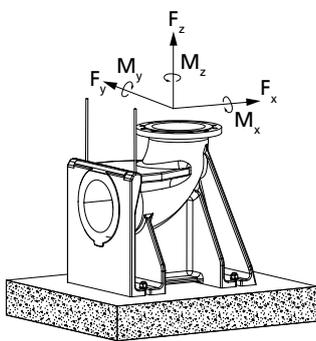


Fig. 6: Permissible flange loads

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	1350	1650	1500	2600	1000	1150	1400	2050

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

**Fitting the mounting bracket**

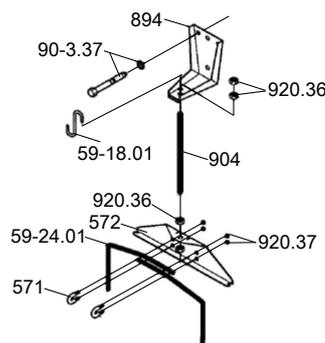


Fig. 7: Fitting the mounting bracket

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

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Inserting the guide wire

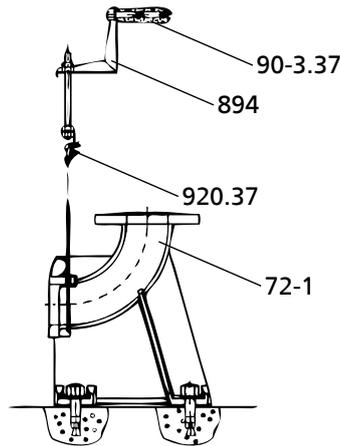


Fig. 8: Inserting the guide wire

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.
5. Secure the nuts with a second hexagon nut.
6. The loose wire ends at guide wire suspension bracket 572 can either be twisted into a ring or the end can be cut off.  
After length adjustment, tape the ends to avoid fraying.
7. Attach hook 59-18.01 to mounting bracket 894 for attaching the lifting chain / lifting rope at a later stage.

Table 11: Guide wire tension

Size	Tightening torque	Guide wire tension
	$M_A$ [Nm]	P [N]
32-160	7	3000

5.3.1.4 Fitting the guide rail (1 guide rail)

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

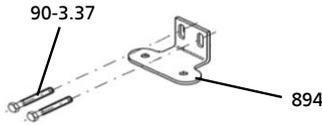
Observe the following dimensions for the guide rails:

Table 12: Guide rail dimensions

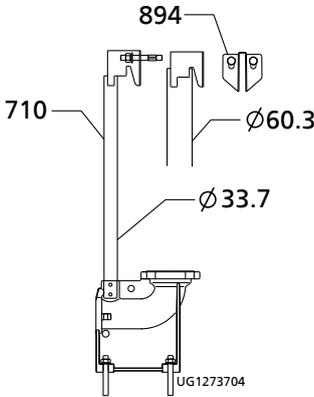
Hydraulic system size	Outside diameter [mm]	Wall thickness [mm] <sup>5)</sup>	
		Minimum	Maximum
32-160	33,7	2	5

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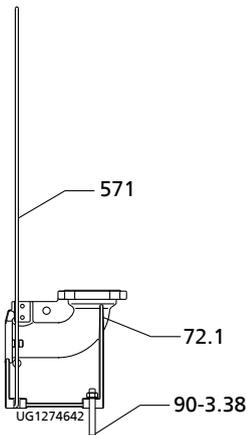
<sup>5)</sup> To DIN 2440/2442/2462 or equivalent standards



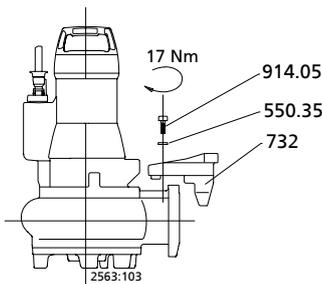
**Fig. 9: Fitting the mounting bracket**



**Fig. 10: Fitting 1 guide rail**



**Fig. 11: Fitting the guide hoop arrangement**



**Fig. 12: Fastening the claw for guide wire, single guide rail and guide hoop arrangement**

**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.)

**Fitting the guide rails (single guide rail arrangement)**

1. Position rail 710 in the recess of duckfoot bend 72.1. 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**

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 20)

**5.3.1.6 Preparing the pump set**

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

1. Fasten claw 732 with screw 914.05 and disc 550.35 to the discharge flange (see drawing). Tighten the screw to a torque of 17 Nm.



**Fig. 13:** Fastening the claw for twin guide rail arrangement

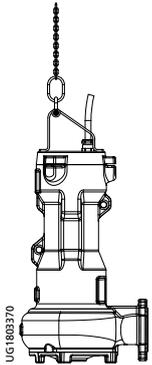
**Fastening the claw for twin guide rail arrangement**

1. Fasten claw 732 with screws 914, nuts 920 and discs 550 to the discharge flange (see illustration). Tighten the screws 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**

**Stationary wet installation**

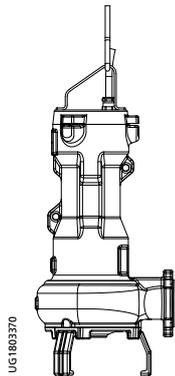
1. Attach the lifting chain or rope to the lug/eyebolt/bail at the pump set on the opposite side of the discharge nozzle.  
This attachment point achieves a forward inclination of the pump set towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.



Attaching the lifting chain/rope - stationary wet installation

**Transportable wet installation**

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



Attaching the lifting chain/rope – transportable wet-installed model

**Table 13:** Types of attachment

Illustration	Type of attachment	
	<b>Shackle with chain at the pump casing</b>	
	59-17	Shackle
	59-18	Hook
	885	Chain

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 and slowly lower it down along the guide wires / guide rails. The pump set attaches itself to duckfoot bend 72-1.
2. Attach the lifting chain/rope to hook 59-18.01 at the mounting bracket.

5.3.2 Transportable wet-installed model

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. Push pump feet 182 into the openings in the suction cover.
3. Tighten screws 914.03 again to the indicated tightening torque.

Fitting the foot plate

1. Fit the foot plate to the three pump feet with bolts/screws, discs and nuts. Observe the tightening torques.

Attaching the lifting chain/rope

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

Connecting the piping

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

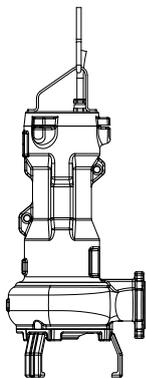


Fig. 14: Attaching the lifting chain/rope

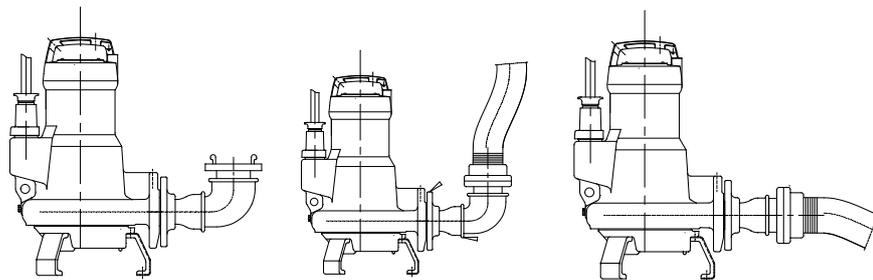


Fig. 15: Connection options

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" section. 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, verify that the number of cores is sufficient for the sensors. A minimum cross-section of 1.5 mm <sup>2</sup> is required.

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed.

**5.4.1.1 Setting the overload protection device**

1. Protect the pump set against overloading by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations. (⇒ Section 9.4, Page 51)
2. Set the overload protection device to the rated current specified on the name plate.

**5.4.1.2 Level control**

	<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>

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

**5.4.1.3 Sensors**

	<b>⚠ DANGER</b>
	<p><b>Operating a pump set that has not been fully connected</b>                  Explosion hazard!                  Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never start up a pump set with power cables that have not been fully connected or non-operational monitoring devices.</li> </ul>

	<b>CAUTION</b>
	<p><b>Incorrect wiring</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 features sensors designed to prevent hazards and damage to the pump set.

Measuring transducers are required for analysing the sensor signals supplied. Suitable devices for 230 V~ 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 this manual.</p>

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

**5.4.1.4 Motor temperature**

The pump set features 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.

Tripping must result in the pump set cutting out. Automatic re-starting is permitted.

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.

Tripping must result in the pump set cutting out. The pump set must not re-start automatically.

**5.4.2 Electrical connection**

	<p><b>⚠ DANGER</b></p> <p><b>Electrical connection work 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 EN 61557 regulations as well as any regional regulations.</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> <li>▷ Inspect the power cable for visible damage.</li> <li>▷ Never connect damaged power cables.</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 cable 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 60947 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 cores.

	<b>⚠ DANGER</b>
	<p><b>Operating an incompletely connected pump set</b>            Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Never start up a pump set with incompletely connected power cables or non-operational monitoring devices.</li> </ul>
	<b>⚠ DANGER</b>
	<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.</li> <li>▷ Never connect damaged power cables.</li> <li>▷ Replace 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>▷ If the pump is installed in a tank, run the power cables directly upwards without slack.</li> </ul>

1. If the pump is installed in a tank, run the power cables directly 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 of the individual cores at the cable ends.

**Potential equalisation** Potential equalisation shall be provided for in compliance with EN 60204. The pump casing is designed with a female thread for an M8x20 hexagon 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 connection and the pump set.</li> </ul>

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/Start-up

#### 6.1.1 Prerequisites for commissioning/start-up

	<p style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></p> <p><b>Fluid level too low</b> 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 enter the pump casing.</li> <li>▷ Never allow the fluid level to drop below the specified minimum (R3).</li> <li>▷ For continuous duty (S1) operate the pump set in fully submerged condition.</li> </ul>
	<p style="background-color: #FF4500; padding: 5px;"><b>! DANGER</b></p> <p><b>Persons in the tank during pump operation</b> Electric shock! Risk of injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> <li>▷ Never start up the pump set when there are persons in the tank.</li> </ul>

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

- The pump set has been properly connected to the power supply and is equipped with all protection devices.
- The pump has been primed with the fluid to be handled.
- The direction of rotation has been checked.
- After prolonged shutdown of the pump (set), the activities described in (⇒ Section 6.4, Page 33) have been carried out.

#### 6.1.2 Start-up

	<p style="background-color: #FF4500; padding: 5px;"><b>! DANGER</b></p> <p><b>Persons in the tank during pump operation</b> Electric shock! Risk of injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> <li>▷ Never start up the pump set when there are persons in the tank.</li> </ul>
	<p style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></p> <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>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 specified in the data sheet.</li> <li>▷ Never operate the pump set at ambient or 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 starts per hour.

**Table 14:** Frequency of starts

Interval	Maximum frequency of starts
	[Start-ups]
Per hour	30
Per year	5000

These values apply to mains start-up (DOL or with star-delta contactor, autotransformer, soft starter).

**6.2.2 Operation on the power supply mains**

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 Fluid handled**

**6.2.3.1 Fluid temperature**

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

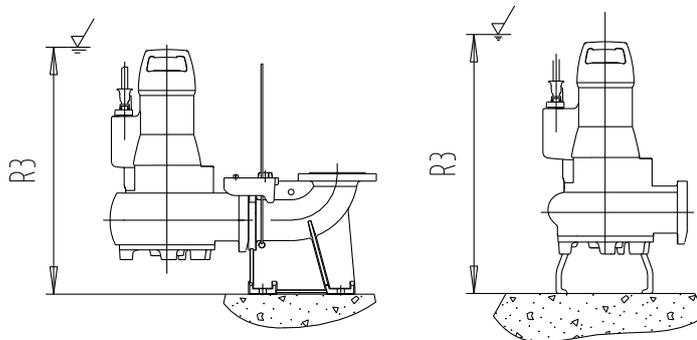
	<b>CAUTION</b>
	<p><b>Danger of freezing!</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Drain the pump set or protect it against freezing.</li> </ul>

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

**6.2.3.2 Minimum level of fluid handled**

	<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 general arrangement drawing/outline drawing).



**Fig. 16:** Minimum level of fluid handled

	<b>NOTE</b>
	<p>For pump sets with cutters it is recommended to continue pump operation for about 10 seconds after the minimum suction level (marked RS in the general arrangement drawing) has been reached.</p>

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

**6.3 Shutdown/storage/preservation**

**6.3.1 Measures to be taken for shutdown**

	<b>⚠ DANGER</b>
	<p><b>Electrical connection work 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 EN 61557 regulations as well as any regional regulations.</li> </ul>

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	<p><b>⚠ WARNING</b></p> <p><b>Unintentional starting of the pump set</b> Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</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><b>CAUTION</b></p> <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 functional 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.
- 1. Clean the pump set.
- 2. Preserve the pump set.
- 3. Observe the information for storage and preservation. (⇒ Section 3.3, Page 11)

**6.4 Returning to service**

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 30)

Refer to and comply with the operating limits. (⇒ Section 6.2, Page 31)

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

	<p><b>⚠ WARNING</b></p> <p><b>Failure to re-install or re-activate protective devices</b> Risk of injury from moving parts or escaping fluid!</p> <ul style="list-style-type: none"> <li>▷ As soon as the work is completed, properly re-install and re-activate any safety-relevant devices and protective devices.</li> </ul>
---	---



**NOTE**

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

## 7 Servicing/Maintenance

### 7.1 Safety regulations

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

	<p><b>⚠ WARNING</b></p> <p><b>Unintentional starting of the pump set</b> Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> <li>▷ Ensure that the pump set cannot be started unintentionally.</li> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</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><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><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>⚠ 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 tilting or tipping over.</li> </ul>

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

	<p><b>NOTE</b></p> <p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>" on the Internet.</p>
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Never use force when dismantling and reassembling the pump set.

## 7.2 Maintenance/inspection

KSB recommends the following regular servicing schedule:

**Table 15:** Overview of maintenance work

Maintenance interval	Maintenance work	For details see ...
Every 4000 operating hours; at least once a year	Insulation resistance measurement	(⇒ Section 7.2.1.3, Page 36)
	Checking the power cables	(⇒ Section 7.2.1.2, Page 36)
	Visual inspection of the lifting chain / lifting rope	(⇒ Section 7.2.1.1, Page 36)
	Checking the sensors	
	Changing the lubricant	
	Checking the bearings	
Every 5 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. (Applies to installation type K only.)
  1. Inspect the lifting chain/rope as well as their fasteners for any visible damage.
  2. Replace any damaged components by original spare parts.

#### 7.2.1.2 Checking the power cables

**Visual inspection**

- ✓ The pump set has been lifted out of the pump sump and cleaned.
  1. Inspect the power cables for visible damage.
  2. Replace any damaged components by original spare parts.

**Checking the earth conductor**

- ✓ The pump set has been lifted out of the pump sump and cleaned.
  1. Measure the resistance between the earth conductor and chassis ground. The electrical resistance must be lower than 1 Ω.
  2. Replace any damaged components by original spare parts.

	<b>⚠ DANGER</b>
	<p><b>Defective earth conductor</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Never switch on a pump set with a defective earth conductor.</li> </ul>

#### 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> <ul style="list-style-type: none"> <li>▸ Use a commercially available ohmmeter to measure the resistance.</li> </ul>

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 switches in the motor

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

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.

**7.2.2 Lubrication and lubricant change**

**7.2.2.1 Lubricating the mechanical seal**

The mechanical seal is supplied with lubricating liquid 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**

The lubricant reservoir is filled at the factory with 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:

**Recommended lubricant quality**

**Alternative**

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

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**Table 17: Lubricant quality**

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

	<b>WARNING</b>
	<p><b>Lubricant contaminating fluid handled</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Using machine oil is only permitted if the oil is disposed of properly.</li> </ul>

**7.2.2.1.3 Lubricant quantity**

Lubricant quantity: 0.18 l

**7.2.2.1.4 Changing the lubricant**

	<b>WARNING</b>
	<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>

	<b>WARNING</b>
	<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>▷ Allow the pump set to cool down to ambient temperature.</li> <li>▷ Carefully pull off the mechanical seal.</li> </ul>

	<b>NOTE</b>
	<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>

**Draining the lubricant**

- ✓ The suction cover and the impeller have been removed.  
(⇒ Section 7.4.3, Page 40)
- 1. Place a suitable container under the pump set.
- 2. Move mechanical seal 433.02 along the shaft.
- 3. Drain the oil.

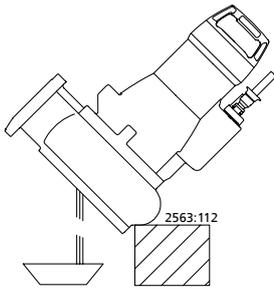


Fig. 17: Draining the lubricant

**Filling in the lubricant**

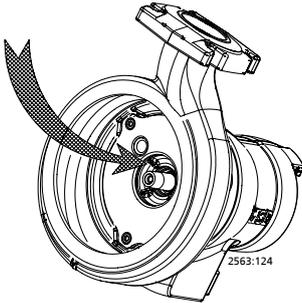


Fig. 18: Filling in the lubricant

1. Fill 0.18 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 44)

**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**

	<p><b>! WARNING</b></p>
	<p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b></p> <p>Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing fluid and any fluid residues.</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. Provide a certificate of decontamination for the pump set. (⇒ Section 11, Page 53)

**7.4 Dismantling the pump set**

**7.4.1 General information/Safety regulations**

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

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

	 <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 the suction line and discharge line.</li> <li>▷ Drain the pump and release the pump pressure.</li> <li>▷ Shut off any auxiliary connections.</li> <li>▷ Allow the pump set to cool down to ambient temperature.</li> </ul>

	 <b>WARNING</b>
	<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 39) have been observed/ carried out.
- 1. De-energise the pump set and secure it against unintentional start-up.

**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.

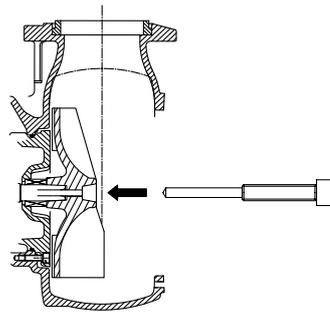


Fig. 19: Forcing screw

	<b>NOTE</b>
	<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 the motor part

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

- ✓ The oil has been drained. (⇒ Section 7.2.2.1.4, Page 38)
- 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 932.01.
- 7. Pull off rolling element bearing 321.02.
- 8. Remove baffle 17.5
- 9. Pull off rolling element bearing 321.01.
- 10. Take shaft seal ring 420 out of bearing bracket 330.

### 7.5 Reassembling the pump set

#### 7.5.1 General information/Safety regulations

	<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>
	<b>CAUTION</b>
	<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>

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	<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. Refer to the flamepath positions specified in the Annex.</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 44)

### 7.5.2 Reassembling the pump section

#### 7.5.2.1 Fitting 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 bellows-type mechanical seals, wet the inside diameter of the bellows with soapy water (not oil).
  - To prevent any damage to the rubber bellows, place a thin foil (of approximately 0.1 to 0.3 mm thickness) around the free shaft stub.  
Slip the rotating assembly over the foil into its installation position.  
Then remove the foil.
- ✓ Shaft 210, shaft seal ring 420, rolling element bearings 321.01/02 and baffle 17-5 have been properly fitted in bearing bracket 330.
1. Install the stationary part of mechanical seal 433.02 in bearing bracket 330 in accordance with the instructions.
  2. Press O-ring 412.03 into bearing bracket 330.
  3. Fill in oil.
  4. Slide the rotating assembly of mechanical seal 433.02 onto shaft 210.

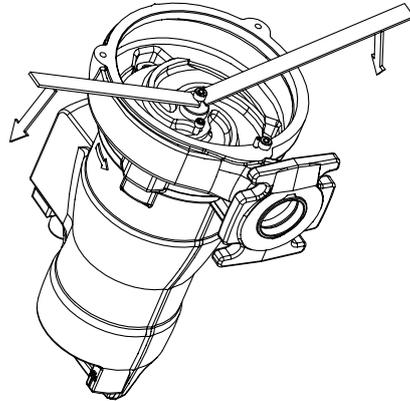
#### 7.5.2.2 Fitting the impeller

##### 7.5.2.2.1 Fitting impeller type S and cutter

	<b>NOTE</b>
	<p>Make sure that the conical impeller hub and the conical part of the shaft are undamaged and assembled free from grease.</p>

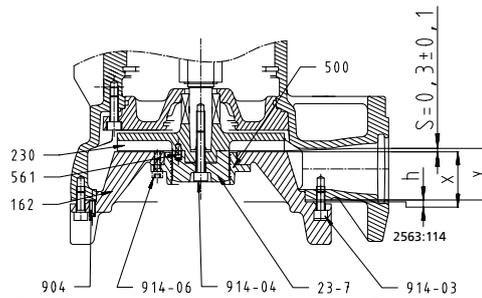
1. Slide impeller 230 onto the shaft end.
2. Insert grooved pin 561 into impeller 230.
3. Place impeller body 23-7 on the centring hub.
4. Insert impeller screw 914.04 and tighten it to a torque of 30 Nm.
5. Fasten ring 500 in the suction cover with screws 914.06.

	CAUTION
<p><b>Incorrect assembly</b> Clearance gap inaccurate!</p> <p>▷ 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.</p>	



**Fig. 20:** Pulling the rotor assembly up to the suction cover

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



**Fig. 21:** 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.

## 7.5.3 Reassembling the motor section

	<b>CAUTION</b>
	<p><b>Wrong screws/bolts</b> Damage to the pump set!</p> <ul style="list-style-type: none"> <li>▷ Always use the original bolts/screws for assembling a pump set.</li> <li>▷ Never use screws/bolts of different dimensions or of a lower property class.</li> </ul>

## 7.5.4 Checking the connection of motor/power supply

Check the power cables after reassembly. (⇒ Section 7.2.1, Page 36)

## 7.6 Tightening torques

Table 18: Tightening torques for metric screws/bolts

Thread	[Nm]
M6	7,3
M8	17

Table 19: Tightening torques for impeller screw

Part No.	Description	[Nm]
906	Impeller screw	30

## 7.7 Spare parts stock

## 7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇒ Section 9.1, Page 48)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

 Table 20: Quantity of spare parts for recommended spare parts stock<sup>6)</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 %
321.01	Rolling element bearing, motor end	1	1	2	2	3	4	50 %
321.02	Rolling element bearing, pump end	1	1	2	2	3	4	50 %

<sup>6)</sup> For two years of continuous operation or 4000 operating hours

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
420	Shaft seal ring, 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 sealing elements	4	6	8	8	9	10	100 %

### 7.7.3 Sets of spare parts

**Table 21:** Overview of spare parts set

Description	Part No.
Rolling element bearing, motor end	321.01
Rolling element bearing, pump end	321.02
Shaft seal ring, motor end	420
Mechanical seal, pump end	433.02
Set of sealing elements	99-9
Repair kit	99-20
1 set of circlips	-

## 8 Trouble-shooting

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

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

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

Table 22: 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 (part load/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 lift check valve.
-	X	-	X	X	Supply line or impeller clogged	Remove deposits in the pump and/or piping.
-	-	X	-	X	Dirt/fibres in the clearance between the casing wall and impeller Sluggish rotor.	Check whether the impeller can be easily rotated. Clean the impeller if required.
-	X	X	X	X	Wear of internal components	Replace worn components by new ones.
X	X	-	X	-	Defective riser (pipe and sealing element)	Replace defective riser pipes, replace sealing elements.
-	X	-	X	X	Impermissible air or gas content in the fluid handled	Contact the manufacturer.
-	-	-	-	X	System-induced vibrations	Contact the manufacturer.
-	X	X	X	X	Wrong direction of rotation	Check the electrical connection of motor and control system, if any.
-	-	X	-	-	Wrong supply voltage	Check the mains power supply. 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 the manufacturer.
-	-	-	-	X	Defective rolling element bearing	Contact the manufacturer.
-	X	-	-	-	Water level lowered too much during operation	Check level control equipment.

A	B	C	D	E	Possible cause	Remedy
X	-	-	-	-	Temperature control device monitoring the winding has tripped the pump as a result of excessive winding temperatures.	The motor will restart automatically once it has cooled down.
X	-	-	-	-	The temperature limiter (explosion protection) has tripped the pump as a result of excessive winding temperatures.	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 S 32 - variant YLG

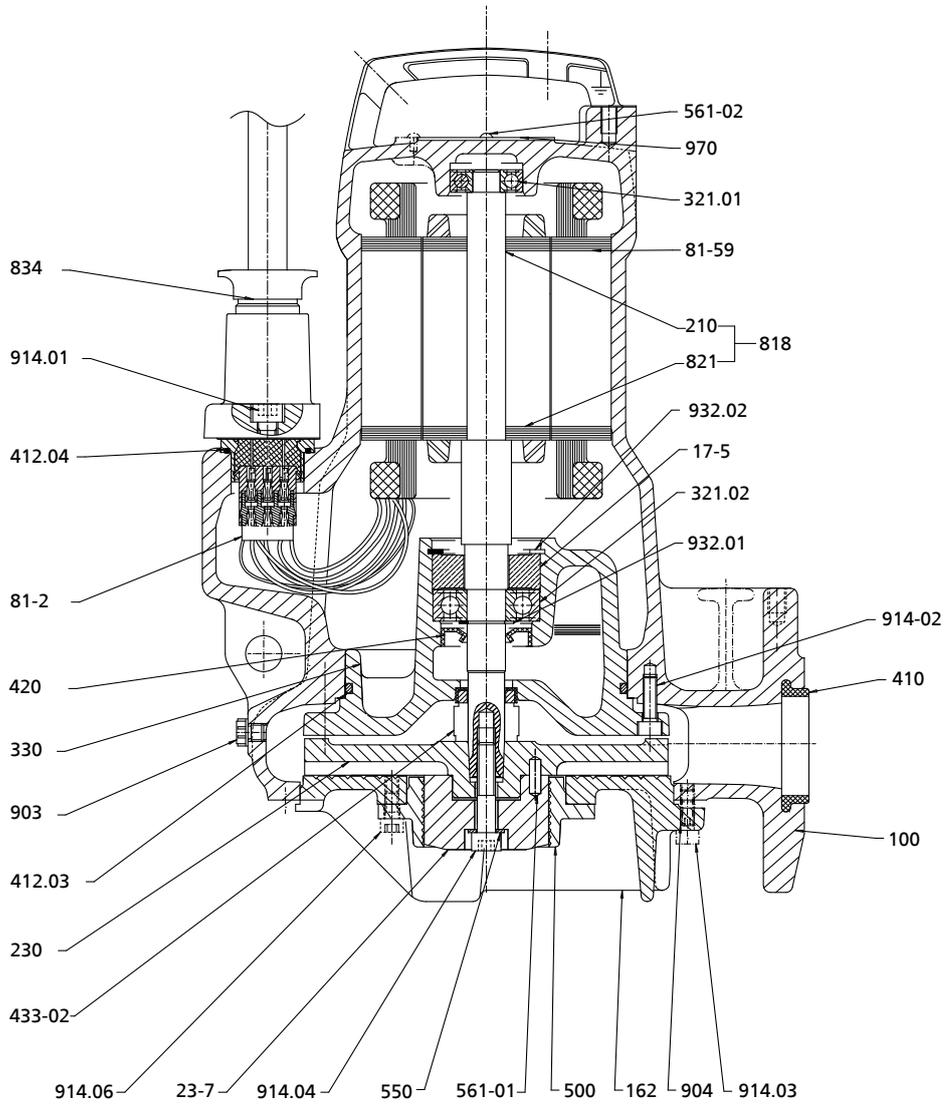


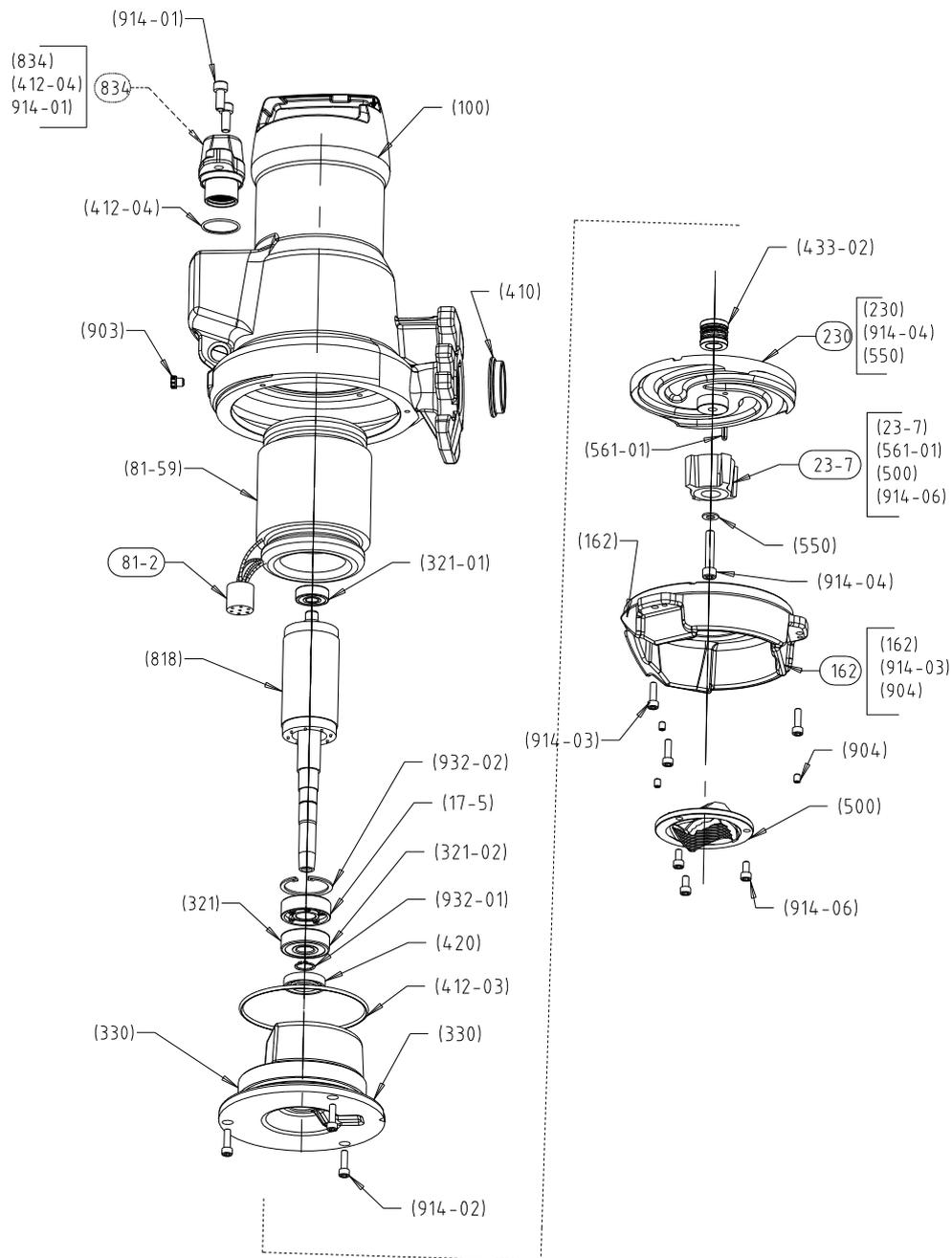
Fig. 22: General assembly drawing

Table 23: List of components

Part No.	Description	Part No.	Description
100	Casing	561.02	Grooved pin
162	Suction cover	81-2	Plug
210	Shaft	81-59	Stator
230	Impeller	818	Rotor
321.01/02	Radial ball bearing	821	Rotor core pack
330	Bearing bracket	834	Cable gland
410	Profile seal	914.01/02/03/04	Hexagon socket head cap screw
412.03/04	O-ring	932.01/02/06	Circlip
433.02	Mechanical seal	970	Label/plate

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9.2 Exploded view



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Fig. 23: Exploded views

9.3 Wiring diagram

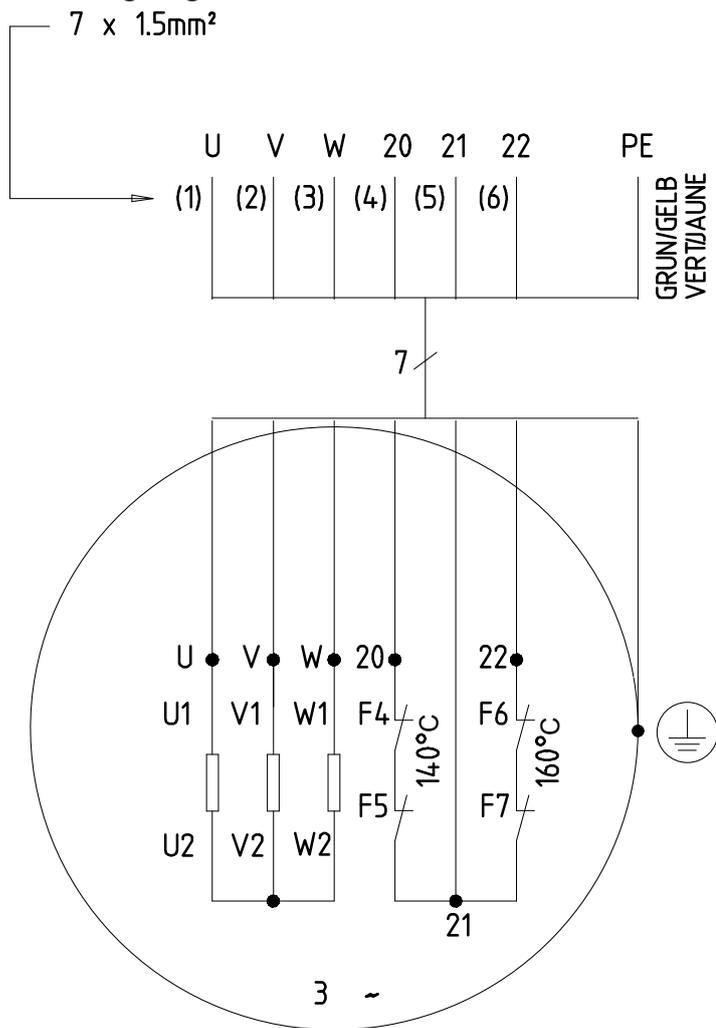


Fig. 24: Wiring diagram

### 9.4 Wiring diagrams overload protection

**Table 24:** 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>	

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## 10 EU Declaration of Conformity

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

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

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

### **Amarex N S 32 -160**

**From serial number: xxxxxxxx-A202116-00001**

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - Pump (set): 2006/42/EC Machinery Directive
  - Electrical components<sup>7)</sup>: 2011/65/EU Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

The manufacturer also declares that

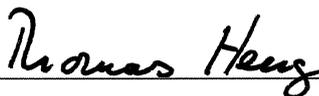
- the following harmonised international standards have been applied:
  - ISO 12100
  - EN 809
  - EN 60034-1, EN 60034-5/A1

Person authorised to compile the technical file:

Hugues Roland  
Head of Design/Engineering  
KSB S.A.S.  
128, rue Carnot,  
59320 Sequedin (France)

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 July 2021



---

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

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<sup>7</sup> Where applicable

### 11 Certificate of Decontamination

Type: .....

Order number /  
Order item number<sup>8)</sup>: .....

Delivery date: .....

Application: .....

Fluid handled<sup>8)</sup>: .....

Please tick where applicable<sup>8)</sup>:



Corrosive



Oxidising



Flammable



Explosive



Hazardous to health



Seriously hazardous to health



Toxic



Radioactive



Bio-hazardous



Safe

Reason for return<sup>8)</sup>: .....

Comments: .....

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

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

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

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

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

.....  
.....

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

.....  
Place, date and signature

.....  
Address

.....  
Company stamp

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<sup>8</sup> Required field

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