

Submersible Motor Pump

Amarex N

Sizes DN 50 to DN 100

Motors:

2 poles: 002 to 042

4 poles: 004 to 044

ATEX-compliant

Installation/Operating Manual



CE

KSB 

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

Table 1: Variants covered by this operating manual

Sizes	Impeller types	Material variant			
		G	G1	G2	GH ¹⁾
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

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 dimensions and installation dimensions for the pump (set), weights
Hydraulic characteristic curve	Characteristic curves showing head, flow rate, efficiency and power input
General assembly drawing ²⁾	Sectional drawing of the pump
Spare parts lists ²⁾	Description of spare parts
Supplementary operating manual ²⁾	Installation/operating manual 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 included in agreed 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

1.6 Key to safety symbols/markings

Table 4: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



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 $1.2 \times Q_{\text{BEP}}$ to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates ($< 0.7 \times Q_{\text{BEP}}$).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

	<p>Impeller with cutter (impeller type S)</p>	<p>Suitable for the following fluids: faeces, domestic sewage and waste water containing long fibres</p>
	<p>Vortex impeller (impeller type F)</p>	<p>Suitable for the following fluids: fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas</p>
	<p>Open, diagonal single-vane impeller (impeller type D)</p>	<p>Suitable for the following fluids: fluids containing solid substances and long fibres</p>

2.3 Personnel qualification and training

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

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

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

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

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

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

2.5 Safety awareness

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

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

2.6 Safety information for the operator/user

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

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

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the pump (set) are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the pump (set) during standstill of the pump.
- Only perform work on the pump set when it has been disconnected from the power supply (de-energised).
- The pump (set) must have cooled down to ambient temperature.
- Pump pressure must have been released and the pump must have been drained.
- When taking the pump set out of service always adhere to the procedure described in the manual. (⇒ Section 6.3, Page 41)
- 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 38)

2.8 Unauthorised modes of operation

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

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

2.9 Explosion protection

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

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

Pumps / pump sets must not be used in potentially explosive atmospheres unless marked as explosion-proof **and** identified as such in the data sheet.

Special conditions apply to the operation of explosion-proof pump sets in accordance with EU Directive 2014/34/EU (ATEX).

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

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

Prevent impermissible modes of operation.



2.9.1 Repair

Special regulations apply to repair work on explosion-proof pumps. Modifications or alterations of the pump set can 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 Table 2 of EN 60079-1 is not permitted.

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

	⚠ DANGER
	<p>Improper transport Danger to life from falling parts! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Use the attachment point provided for attaching the lifting accessory. ▷ Never lift the pump set by the electric cables. ▷ Use the lifting chain/rope included in the scope of supply exclusively for lowering or lifting the pump set into/out of the pump sump. ▷ Securely attach the lifting chain/rope to the pump and crane. ▷ Use tested, marked and approved lifting accessories only. ▷ Observe the regional transport regulations. ▷ Observe the documentation of the lifting accessory manufacturer. ▷ The load-carrying capacity of the lifting accessory must be higher than the weight indicated on the name plate of the pump set to be lifted. Take into account any additional system components to be lifted.

3.3 Storage/preservation

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

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

2563.84/10-EN

Table 5: Ambient conditions for storage

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

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

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

3.4 Return to supplier

1. Drain the pump as per operating instructions. (⇒ Section 7.3, Page 53)
2. Flush and clean the pump, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the pump has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen, the pump must also be neutralised, and anhydrous inert gas must be blown through the pump to ensure drying.
4. Always complete and enclose a certificate of decontamination when returning the pump.
Indicate any safety measures and decontamination measures taken.
(⇒ Section 11, Page 80)

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

3.5 Disposal

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

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



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

Contact your local waste disposal partner for returns.

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

4 Description of the Pump (Set)

4.1 General description

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

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

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

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

4.3 Designation

Example: Amarex 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 variant, e.g. YL = with explosion protection T4 (40 °C)
G	Casing material, e.g. G = grey cast iron
120	Nominal impeller diameter [mm]

4.4 Name plate

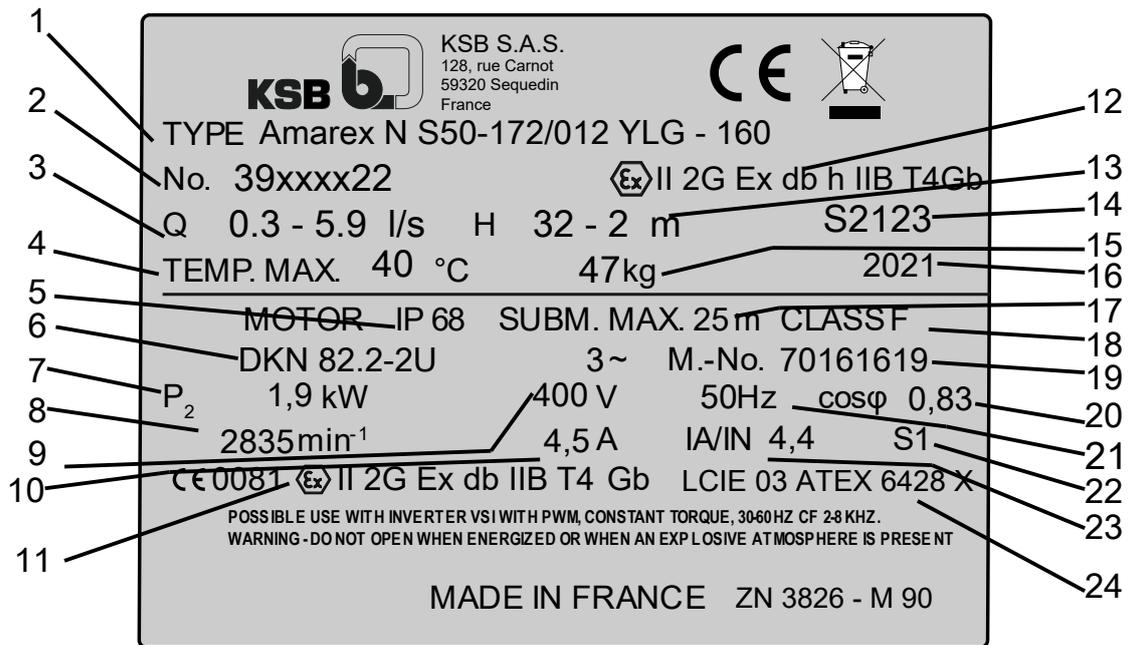


Fig. 1: Name plate (example)

1	Designation	2	KSB order number
3	Flow rate	4	Maximum fluid temperature and ambient temperature
5	Enclosure	6	Motor type
7	Rated power	8	Rated speed
9	Rated voltage	10	Rated current
11	ATEX marking for the submersible motor	12	ATEX marking for the pump set
13	Head	14	Serial number
15	Total weight	16	Year of construction
17	Maximum submergence	18	Thermal class of winding insulation
19	Motor number	20	Power factor at rated operating point
21	Rated frequency	22	Duty type
23	Starting current ratio	24	No. of type test certificate

4.5 Design details

Design

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

Drive

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

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)

- Size 50-172, motor version YL, motor size / no. of motor poles 002, 012, 022
- Size 50-222, motor version YL, motor size / no. of motor poles 032, 042

Pump-end bearings:

- Grease-packed bearings sealed for life

4.6 Installation types

Table 7: Installation type S – stationary wet installation

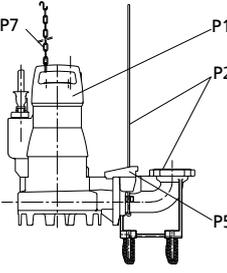
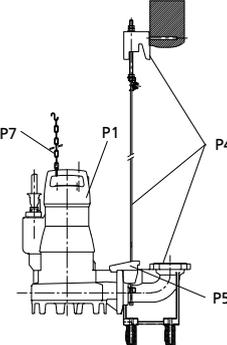
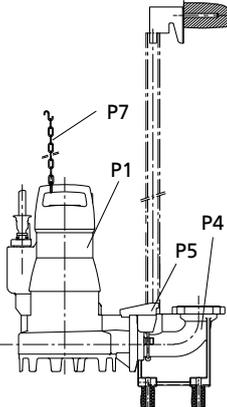
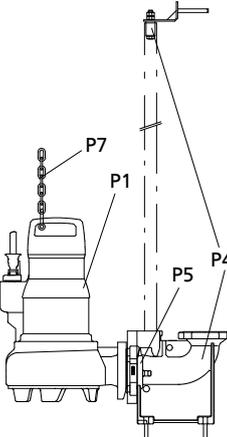
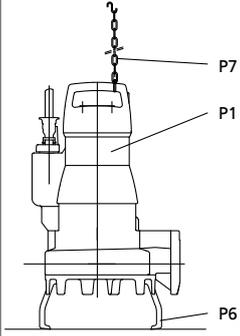
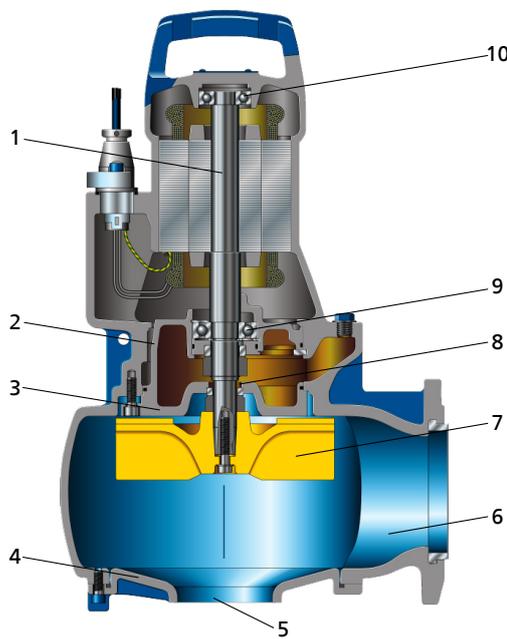
Installation type	Description	Comment
	<p>Guide hoop arrangement</p> <p>P1: pump P2: installation parts for guide hoop arrangement, installation depth = 1.5 m / 1.8 m / 2.1 m P5: claw P7: chain and shackle, length = 2 m</p>	<p>Only for the following sizes: 50-170 50-172 50-220 50-222 65-170 65-220</p>
	<p>Guide wire arrangement</p> <p>P1: pump P4: installation parts for guide wire arrangement, installation depth = 4.5 m P5: claw P7: chain and shackle, length = 5 m</p>	
	<p>Single guide rail arrangement</p> <p>P1: pump P4: installation parts for single guide rail arrangement P5: claw P7: chain and shackle, length = 5 m</p>	
	<p>Twin guide rail arrangement</p> <p>P1: pump P4: installation parts for twin guide rail arrangement P5: claw and adapter P7: chain and shackle, length = 5 m</p>	

Table 8: Installation type P – transportable wet installation

Installation type	Description
	<p>P1: pump P6: foot P7: chain and shackle, length = 5 m</p>

4.7 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.

4.8 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 electric cables
- Claw with sealing elements and fasteners
- Mounting bracket with fasteners
- Duckfoot bend with mounting elements
- Guiding equipment³⁾

Transportable wet-installed model (installation type P)

- Foot plate or pump stool with fasteners
- Lifting rope / lifting chain⁴⁾

	NOTE
<p>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.</p>	

4.9 Dimensions and weights

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

³⁾ The guide rails are not included in the scope of supply.

⁴⁾ Optional

5 Installation at Site

5.1 Safety regulations

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

5.2 Checks to be carried out prior to installation

5.2.1 Preparing the place of installation

Place of installation for stationary models

	 WARNING
	<p>Installation on mounting surfaces which are unsecured and cannot support the load Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class XS1 to EN 206 . ▷ The mounting surface must be set, even, and level. ▷ Observe the weights indicated.

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

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

Place of installation for transportable models

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

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 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.

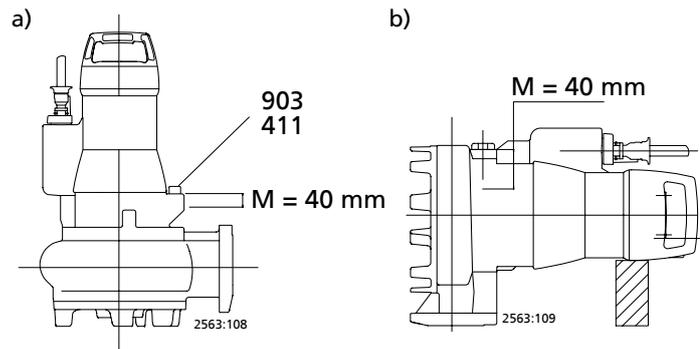


Fig. 2: Checking the lubricant level a) Version YL & WL; b) Version YL & WL for sizes 50-170, 50-172 and 65-220

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 60)

5.2.3 Checking the direction of rotation

	<p>⚠ DANGER</p>
	<p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Check the direction of rotation of explosion-proof pump sets outside potentially explosive atmospheres.
	<p>⚠ WARNING</p>
	<p>Hands and/or foreign objects in the pump casing Risk of injuries, damage to the pump!</p> <ul style="list-style-type: none"> ▸ Never insert your hands or any other objects into the pump. ▸ Before connecting the pump set, check that the inside of the pump is free from any foreign objects. ▸ Never hold the pump set in your hands while checking the direction of rotation.
	<p>CAUTION</p>
	<p>Pump set running dry Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▸ Never operate the pump set for more than 60 seconds without the fluid handled.

- ✓ The pump set is connected to the power supply.
1. Start the pump set and stop it again immediately to determine the motor's direction of rotation.
 2. 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.)

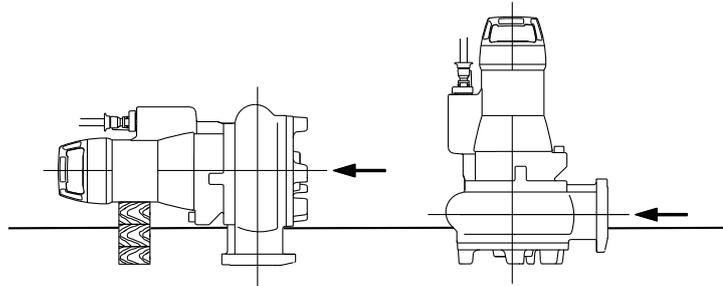


Fig. 3: Checking the direction of rotation

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

Fastening the duckfoot bend with chemical anchors

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

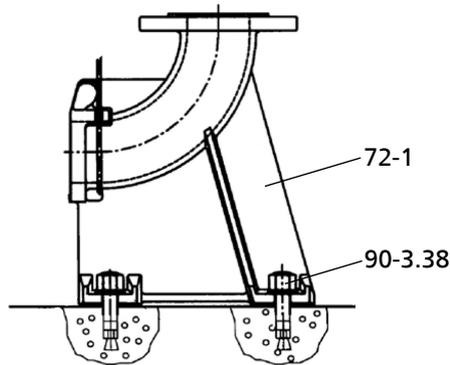


Fig. 4: Fastening the duckfoot bend

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.

Chemical anchor dimensions

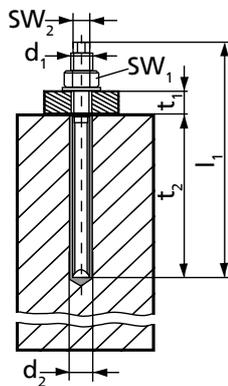


Fig. 5: Dimensions

Table 9: Chemical anchor dimensions

Size (d ₁ × l ₁)	d ₂	t ₁	t ₂	SW ₁ ⁵⁾	SW ₂ ⁵⁾	M _{d1}
	[mm]	[mm]	[mm]	[mm]	[mm]	[Nm]
M10 × 130	12	20	90	17	7	20
M16 × 190	18	35	125	24	12	60

Table 10: 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>⚠ DANGER</p>
	<p>Impermissible loads acting on the flange of the duckfoot bend Danger to life from escaping hot, toxic, corrosive or flammable fluids!</p> <ul style="list-style-type: none"> ▷ Do not use the pump as an anchorage point for the piping. ▷ Anchor the pipes in close proximity to the pump and connect them without transmitting any stresses or strains. ▷ Observe the permissible flange loads. ▷ Take appropriate measures to compensate for thermal expansion of the piping.
	<p>NOTE</p>
	<p>When the pump set is used for draining low-level building areas, install a swing check valve in the discharge line to avoid backflow from the sewer system.</p>
	<p>CAUTION</p>
	<p>Critical speed of reverse rotation Increased vibrations! Damage to mechanical seals and bearings!</p> <ul style="list-style-type: none"> ▷ 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. ▷ Observe the maximum permissible speed (depending on the mechanical seal and bearings) in the event of reverse rotation.

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⁵ SW = Width across flats

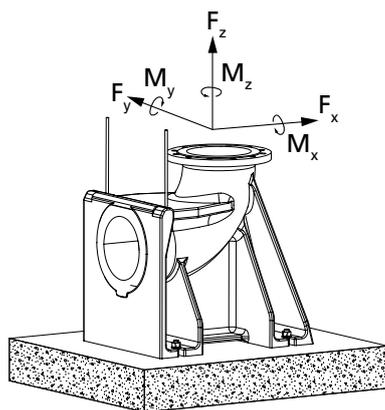


Fig. 6: Permissible flange loads

Table 11: Permissible flange loads

Nominal flange diameter	Forces [N]				Moments [Nm]			
	F _y	F _z	F _x	∑F	M _y	M _z	M _x	∑M
50	1350	1650	1500	2600	1000	1150	1400	2050
65	1700	2100	1850	3300	1100	1200	1500	2200
80	2050	2500	2250	3950	1150	1300	1600	2350
100	2700	3350	3000	5250	1250	1450	1750	2600
150	4050	5000	4500	7850	1750	2050	2500	3650

5.3.1.3 Fitting the guide wire arrangement

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

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

Fitting the mounting bracket

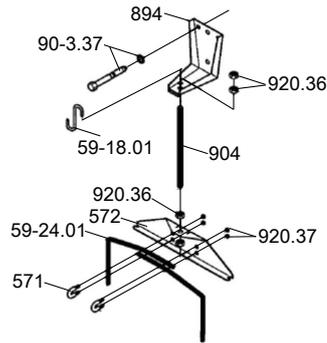


Fig. 7: Fitting the mounting bracket

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.

Inserting the guide wire

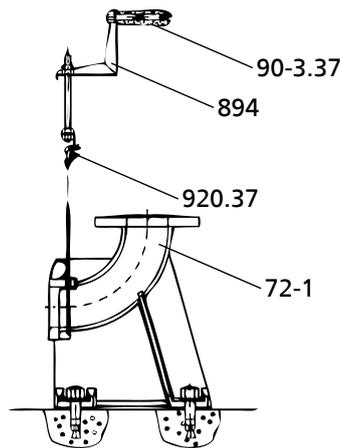


Fig. 8: Inserting the guide wire

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. (⇒ Table 12)
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 12: Guide wire tension

Size	Tightening torque	Guide wire tension
	M_A [Nm]	P [N]
50 - ...	9	6000
65 - ...	9	6000
80 - ...	14	6000
100 - ...	14	6000
150 - ...	14	6000

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

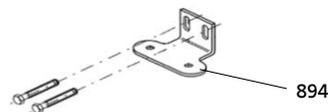
The pump set is guided into the sump or tank along one or two vertical guide rails. It attaches itself automatically to the duckfoot bend which has been fitted to the floor.

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

Table 13: Guide rail dimensions

Hydraulic system size	Outside diameter	Wall thickness [mm] ⁶⁾	
	[mm]	Minimum	Maximum
DN 50	33,7	2	5
DN 65	33,7	2	5
DN 80	60,3	2	5
DN 100	60,3	2	5

Fitting the mounting bracket


Fig. 9: 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.)

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

Fitting the guide rails (twin guide rail arrangement)

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

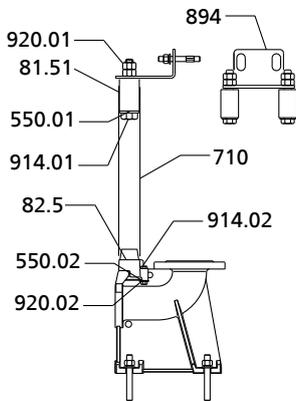


Fig. 10: Fitting two guide rails

1. Position adapter 82.5 on duckfoot bend 72.1 and fasten it with screws 914.02, 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)

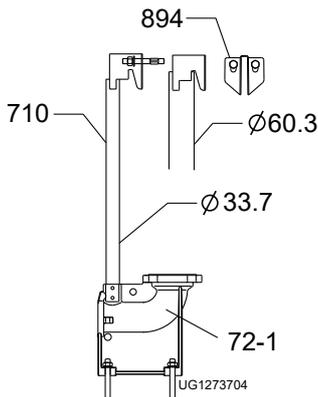


Fig. 11: Fitting 1 guide rail

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 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)

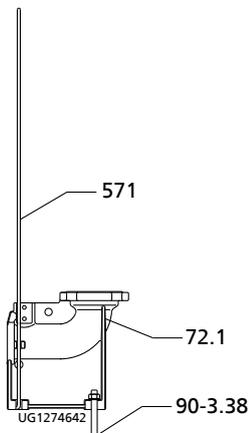


Fig. 12: Fitting the guide hoop arrangement

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 24)

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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.

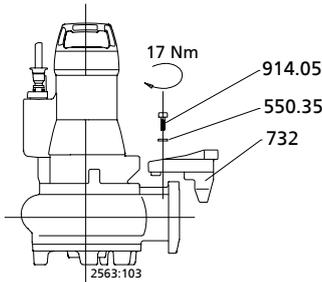


Fig. 13: Fastening the claw for guide wire, single guide rail and guide hoop arrangement

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 seal 410 in the groove of the claw. This will seal the duckfoot bend/pump connection.

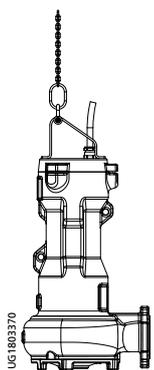


Fig. 14: Fastening the claw for twin guide rail arrangement

Attaching the lifting chain/lifting rope

Stationary wet installation

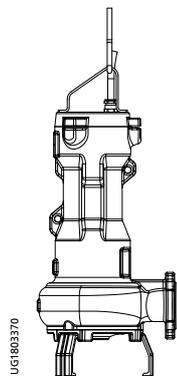
1. Attach the lifting chain with shackle or the lifting rope to the recess in the pump handle opposite the discharge nozzle. This attachment point achieves a forward inclination of the pump set towards the discharge nozzle, which allows the pump claw to hook onto the duckfoot bend.



Attaching the lifting chain/lifting rope for 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/lifting rope for transportable wet installation

Table 14: Types of attachment

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

5.3.1.7 Installing the pump set

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

1. Guide the pump set over the suspension bracket / mounting bracket 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 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 60)

Fitting the foot plate

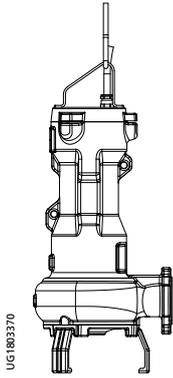
1. Fit the foot plate to the three pump feet with screws, discs and nuts. Observe the tightening torques. (⇒ Section 7.6, Page 60)

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.



UG 1803370
Fig. 15: Attaching the lifting chain/rope

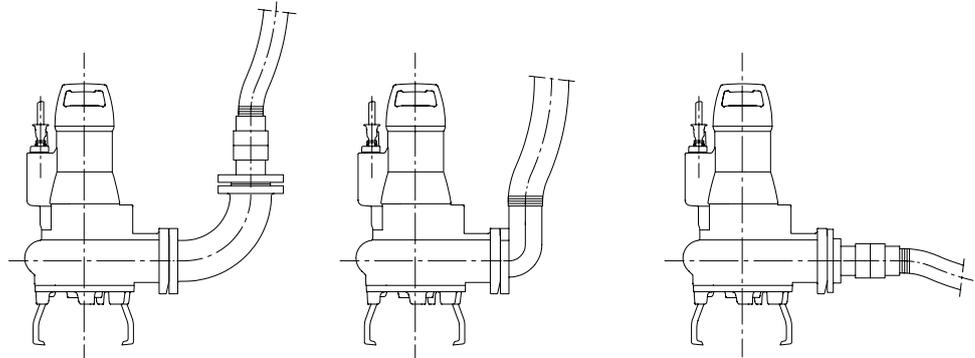


Fig. 16: Connection options

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" section. (⇒ Section 9.2, Page 73)

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

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

The motors can be connected to electrical low-voltage grids with mains voltages and voltage tolerances to IEC 60038. The permissible tolerances must be observed. (⇒ Section 6.2.2, Page 39)

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 9.3, Page 75)
2. Set the overload protection device to the rated current specified on the name plate.

5.4.1.2 Level control

	DANGER
	<p>Pump set running dry Explosion hazard!</p> <ul style="list-style-type: none"> ▶ Never allow an explosion-proof pump set to run dry!
	CAUTION
	<p>Fluid level below the specified minimum Damage to the pump set by cavitation!</p> <ul style="list-style-type: none"> ▶ Never allow the fluid level to drop below the specified minimum.

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Automatic operation of the pump set in a sump / tank requires the use of level control equipment.
Observe the minimum fluid level indicated. (⇒ Section 6.2.4.2, Page 40)

5.4.1.3 Operation on a frequency inverter

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

	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Never operate an explosion-proof pump set outside the specified range.
	NOTE
	<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 is observed.</p>
	⚠ DANGER
	<p>Incorrect selection and setting of the frequency inverter Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the following information on selecting and setting a frequency inverter.

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

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

Setting Observe the following instructions for setting a frequency inverter:

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

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

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

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

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

Electromagnetic compatibility Operation on a frequency inverter produces interference emissions whose level varies depending on the inverter used (type, interference suppression, make). To prevent the drive system, consisting of a submersible motor and a frequency inverter, from exceeding any given limits always observe the EMC information provided by the inverter manufacturer. If the inverter manufacturer recommends a shielded power cable, make sure to use a submersible motor pump with shielded power cables.

Interference immunity The submersible motor pump generally meets interference immunity requirements. For monitoring the sensors installed the operator must ensure sufficient interference immunity by appropriately selecting and laying the power cables in the plant. No

modifications are required on the power/control cable of the submersible motor pump. Suitable analysing devices must be selected. To monitor the leakage sensor inside the motor using a special relay available from KSB is recommended.

5.4.1.4 Sensors

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

	<p>CAUTION</p>
	<p>Incorrect wiring Damage to the sensors!</p> <ul style="list-style-type: none"> ▷ Observe the limits stated in the following sections of this manual when connecting the sensors.

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

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

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

All sensors are located inside the pump set and connected to the electric cables. For information on wiring and core identification please refer to the "Wiring diagrams" section.

The individual sensors and the limit values to be set are described in the following sections.

5.4.1.5 Motor temperature

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

Standard pump sets (versions UL & WL):

2 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.

	<p> WARNING</p>
	<p>Incorrect electrical installation Electric shock!</p> <ul style="list-style-type: none"> ▷ Adequately insulate conductor 22.

Conductor 22 has no function on standard pump sets. However, it can be live and must, therefore, be insulated or connected to a dummy terminal.

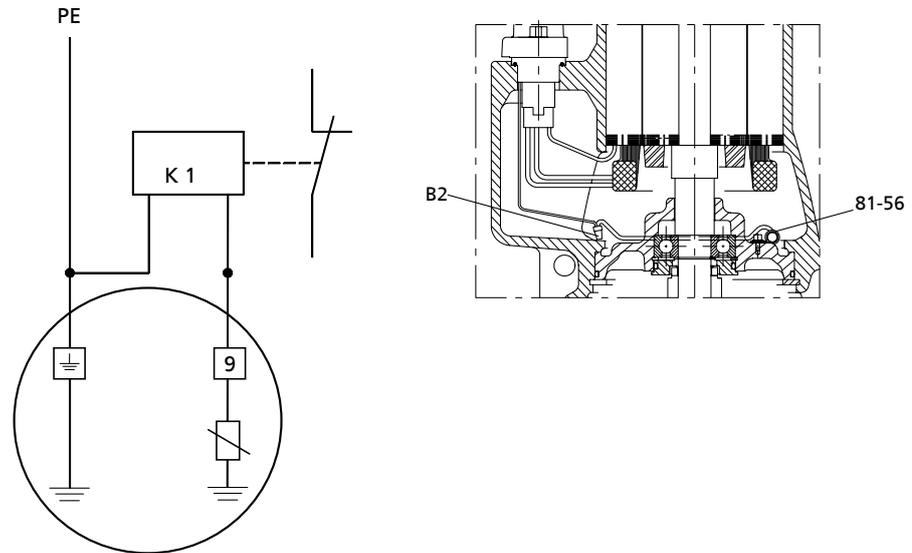
Explosion-proof pump sets (version YL)

Explosion-proof pump sets are equipped with double monitoring of the winding temperature. 2 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.

5.4.1.6 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 trip the motor at a tripping resistance between 3 and 60 kΩ.

Example device ▪ Télémécanique RM4-LG01

5.4.2 Electrical connection

	<p>⚠ DANGER</p>
	<p>Electrical connection work by unqualified personnel Danger of death from electric shock and explosion!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by an electrically qualified person. ▷ Observe regulations IEC 60364 and, for explosion-proof versions, EN 60079 .

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	<p>⚠ WARNING</p> <p>Incorrect connection to the mains Damage to the power supply network, short circuit!</p> <ul style="list-style-type: none"> ▸ Observe the technical specifications of the local energy supply companies.
	<p>CAUTION</p> <p>Improper routing of electric cables Damage to the electric cables!</p> <ul style="list-style-type: none"> ▸ Never move the electric cables at temperatures below -25 °C. ▸ Never kink or crush the electric cables. ▸ Never lift the pump set by the electric cables. ▸ Adjust the length of the electric cables to the site requirements.
	<p>CAUTION</p> <p>Motor overload Damage to the motor!</p> <ul style="list-style-type: none"> ▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.

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

	CAUTION
	<p>Flow-induced motion Damage to the cable!</p> <ul style="list-style-type: none"> ▷ If the pump is installed in a tank, run the electric cables directly upwards without slack.

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

5.4.2.1 Connecting potential equalisation

 	! DANGER
	<p>Chemically corrosive fluids Electric shock!</p> <ul style="list-style-type: none"> ▷ If the pump set is used in chemically corrosive fluids, never use the external terminal for potential equalisation. ▷ 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.

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

Potential equalisation shall be provided for in compliance with EN 60204.

On models YL and WL, the pump casing is designed with an internal thread for an M8 x 20 hexagon socket head cap screw (material: A2-70 or A4-70).

1. Connect the potential equalisation conductor to casing 100.
2. Fasten with hexagon head bolts.
3. Secure the hexagon head bolts to prevent them from working loose.

6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

	 DANGER
	<p>Fluid level too low Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Completely prime the pump set with the fluid to be handled to reliably prevent the formation of a potentially explosive atmosphere. ▷ Always operate the pump set in such a way that air cannot ingress into the pump casing. ▷ Never allow the fluid level to drop below the specified minimum (R3). (⇒ Section 6.2.4.2, Page 40) ▷ For continuous operation (S1) operate the pump in fully submerged condition.

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 filled with the fluid to be handled. The pump has been vented.
- The direction of rotation has been checked.
- The lubricants have been checked.
- After prolonged shutdown of the pump (set), the activities required for returning the equipment to service have been carried out. (⇒ Section 6.4, Page 42)

6.1.2 Start-up

	 DANGER
	<p>Persons in the tank during pump operation Electric shock! Risk of injury! Danger of death from drowning!</p> <ul style="list-style-type: none"> ▷ Never start up the pump set when there are persons in the tank.
	CAUTION
	<p>Re-starting while motor is still running down Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Do not re-start the pump set before it has come to a standstill. ▷ Never start up the pump set while the pump is running in reverse.

- ✓ The fluid level is sufficiently high.

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

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

6.2 Operating limits

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

6.2.1 Frequency of starts

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

To prevent high temperature increases in the motor, do not exceed the following number of start-ups per hour.

Table 15: Frequency of starts

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

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

6.2.2 Operation on the power supply mains

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

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

6.2.3 Operating on a frequency inverter

	⚠ DANGER
	<p>Operation outside the permitted frequency range Explosion hazard!</p> <p>▸ Never operate an explosion-proof pump set outside the specified range.</p>

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

	CAUTION
	<p>Pumping solids-laden fluids at reduced speed Increased wear and clogging!</p> <p>▸ Never operate the pump set with flow velocities below 0.7 m/s in horizontal pipes and 1.2 m/s in vertical pipes.</p>

6.2.4 Fluid handled

6.2.4.1 Fluid temperature

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

	CAUTION
	<p>Danger of freezing! Damage to the pump set!</p> <p>▸ Drain the pump set or protect it against freezing.</p>

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

6.2.4.2 Minimum level of fluid handled

	⚠ DANGER
	<p>Pump set running dry Explosion hazard!</p> <p>▸ Never allow an explosion-proof pump set to run dry!</p>

	CAUTION
	<p>Fluid level below the specified minimum Damage to the pump set by cavitation!</p> <p>▸ Never allow the fluid level to drop below the specified minimum.</p>

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

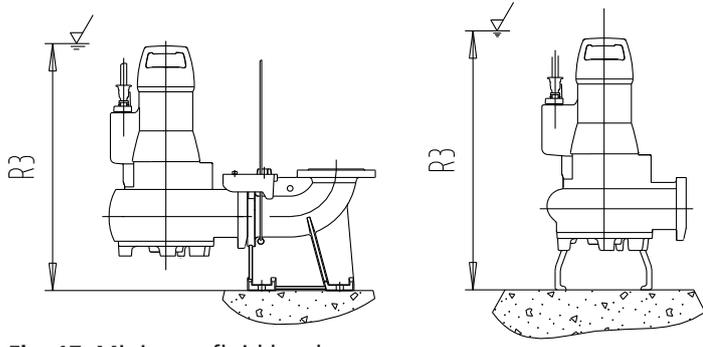


Fig. 17: Minimum fluid level

	NOTE
	<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 R3 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 set will change in proportion to the density of the fluid handled.

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

	⚠ DANGER
	<p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe the EN 61557 regulations as well as any regional regulations.

	⚠ WARNING
	<p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

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

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. (⇒ Section 7.1, Page 43)
1. Clean the pump set.
 2. Preserve the pump set.
 3. Observe the information for storage and preservation. (⇒ Section 3.3, Page 12)

6.4 Returning to service

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇒ Section 6.1, Page 38)

Refer to and comply with the operating limits. (⇒ Section 6.2, Page 39)

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

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

7 Servicing/Maintenance

7.1 Safety regulations

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

	<p>⚠ DANGER</p> <p>Sparks produced during servicing work Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Observe the safety regulations in force at the place of installation! ▷ Never open an energised pump set. ▷ Always perform maintenance work on explosion-proof pump sets outside potentially explosive atmospheres only.
	<p>⚠ DANGER</p> <p>Improperly serviced pump set Explosion hazard! Damage to the pump set!</p> <ul style="list-style-type: none"> ▷ Service the pump set regularly. ▷ Prepare a maintenance schedule with special emphasis on lubricants, electric cables, bearing assembly and shaft seal.
	<p>⚠ DANGER</p> <p>Electrical connection work by unqualified personnel Danger of death from electric shock!</p> <ul style="list-style-type: none"> ▷ Always have the electrical connections installed by a trained and qualified electrician. ▷ Observe the EN 61557 regulations as well as any regional regulations.
	<p>⚠ DANGER</p> <p>Risk of falling when working at a great height Danger to life by falling from a great height!</p> <ul style="list-style-type: none"> ▷ Do not step onto the pump (set) during installation work or dismantling work. ▷ Pay attention to safety equipment, such as railings, covers, barriers, etc. ▷ Observe the applicable local health and occupational safety regulations and accident prevention regulations.
	<p>⚠ WARNING</p> <p>Unintentional starting of the pump set Risk of injury by moving components and shock currents!</p> <ul style="list-style-type: none"> ▷ Ensure that the pump set cannot be started unintentionally. ▷ Always make sure the electrical connections are disconnected before carrying out work on the pump set.

	<p>⚠ WARNING</p>
	<p>Hands, other body parts or foreign objects in the impeller or intake area Risk of injury! Damage to the submersible motor pump!</p> <ul style="list-style-type: none"> ▷ Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area. ▷ Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.

	<p>⚠ WARNING</p>
	<p>Fluids handled, consumables and supplies which are hot and/or pose a health hazard Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe all relevant laws. ▷ When draining the fluid take appropriate measures to protect persons and the environment. ▷ Decontaminate pumps which handle fluids posing a health hazard.

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

	<p>⚠ WARNING</p>
	<p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

	<p>⚠ WARNING</p>
	<p>Insufficient stability Risk of crushing hands and feet!</p> <ul style="list-style-type: none"> ▷ During assembly/dismantling, secure the pump (set)/pump parts to prevent tilting or tipping over.

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

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

	<p>NOTE</p>
	<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details refer to the enclosed "Addresses" booklet or visit "https://www.ksb.com/en-global/contact" on the Internet.</p>

Never use force when dismantling and reassembling the pump set.

7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 16: 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 46)
	Checking the power cables	(⇒ Section 7.2.1.2, Page 45)
	Visual inspection of the lifting chain / lifting rope	(⇒ Section 7.2.1.1, Page 45)
	Checking the sensors	(⇒ Section 7.2.1.4, Page 46)
	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 (shackles) for any visible damage.
 2. Replace any damaged components by original spare parts.
 3. Assess the lifting chain/lifting rope/shackle in accordance with the locally applicable regulations for lifting tackle.
 4. In addition, observe the operating manual of the lifting accessories.

7.2.1.2 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.

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

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.

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

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

7.2.1.4 Checking the sensors

	CAUTION
	<p>Excessive test voltage Damage to the sensors!</p> <p>▷ Use a commercially available ohmmeter to measure the resistance.</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 17: 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.

Leakage sensor in the motor

Table 18: Resistance measurement of the leakage sensor in the motor

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

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

7.2.2 Lubrication and lubricant change

7.2.2.1 Lubricating the mechanical seal

	DANGER
	<p>Excessive temperatures at the shaft seal Damage to the pump set!</p> <ul style="list-style-type: none"> ▸ Regularly check the condition of the lubricant in the lubricant reservoir of the mechanical seal. Top it up if required.

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

	DANGER
	<p>Wrong quality of lubricating liquid Explosion hazard!</p> <ul style="list-style-type: none"> ▸ Always use a lubricating liquid whose ignition temperature is higher than 185 °C for explosion-proof pump sets.

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

Table 19: Oil quality

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

Recommended oil types:

- 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

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

7.2.2.1.3 Lubricant quantity

Table 20: Lubricant quantity depending on the motor

Motor version	Lubricant quantity
	[l]
YL & WL	0,74
UL	0,25

7.2.2.1.4 Changing the lubricant

Changing the lubricating liquid on versions YL & WL

	<p>⚠ WARNING</p>
	<p>Lubricants posing a health hazard and/or hot lubricants Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ When draining the lubricant take appropriate measures to protect persons and the environment. ▷ Wear safety clothing and a protective mask if required. ▷ Collect and dispose of any lubricants. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

Draining the lubricant

1. Position the pump set as shown.

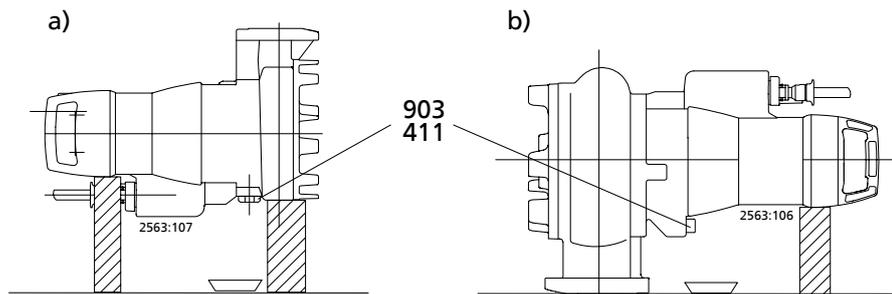


Fig. 18: Draining the lubricant a) Versions YL & WL for sizes 50-170, 50-172 and 65-220; b) Versions YL & WL

2. Place a suitable container under the screw plug.

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

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

	<p>NOTE</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.

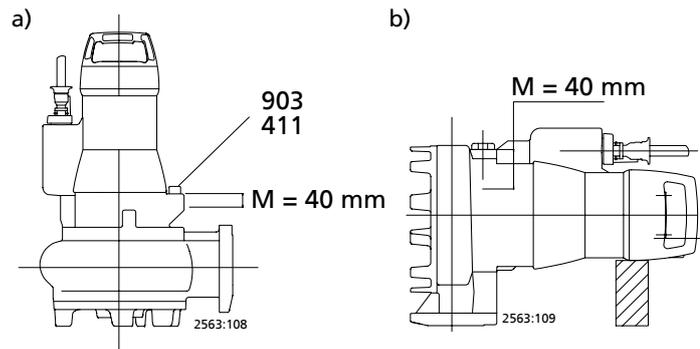


Fig. 19: Filling in the lubricant level a) Versions YL & WL; b) Versions YL & WL for size 50-170, 50-172 and 65-220

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 21: Lubricant level

Size	M [mm]
50-220	40
50-222	
65-170	
80-220	
100-220 (versions YL & WL)	
50-170	40
50-172	
65-220 (versions YL & WL)	

Changing the lubricating liquid on version UL

Draining the lubricant

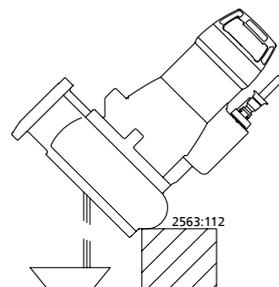


Fig. 20: Draining the lubricant

- ✓ The suction cover and the impeller have been removed.
(⇒ Section 7.4.3, Page 54)
1. Place a suitable container under the pump set.
 2. Slide mechanical seal 433.02 along the shaft.
 3. Drain the oil.

Filling in the lubricant

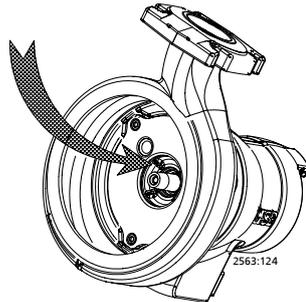


Fig. 21: Filling in the lubricant

1. Fill 0.25 litres of oil through the opening between the stationary assembly of mechanical seal 433.02 and rotor 818.
2. Thoroughly clean rotor 818 and the contact face of the stationary assembly of mechanical seal 433.02. Remove any oil residues.
3. Fit the rotating assembly of mechanical seal 433.02.
4. Fit impeller 230 and suction cover 162. Observe the tightening torques. (⇒ Section 7.6, Page 60)

7.2.2.1.4.1 Changing the lubricant — versions YL and WL

	<p>! WARNING</p>
	<p>Lubricants posing a health hazard and/or hot lubricants Hazard to persons and the environment!</p> <ul style="list-style-type: none"> ▷ When draining the lubricant take appropriate measures to protect persons and the environment. ▷ Wear safety clothing and a protective mask if required. ▷ Collect and dispose of any lubricants. ▷ Observe all legal regulations on the disposal of fluids posing a health hazard.

Draining the lubricant

1. Position the pump set as shown.

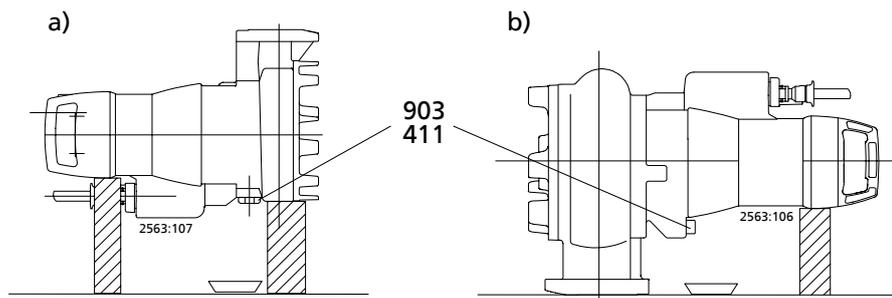


Fig. 22: Draining the lubricant a) Versions YL & WL for sizes 50-170, 50-172 and 65-220; b) Versions YL & WL

2. Place a suitable container under the screw plug.

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

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

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	NOTE
	<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.

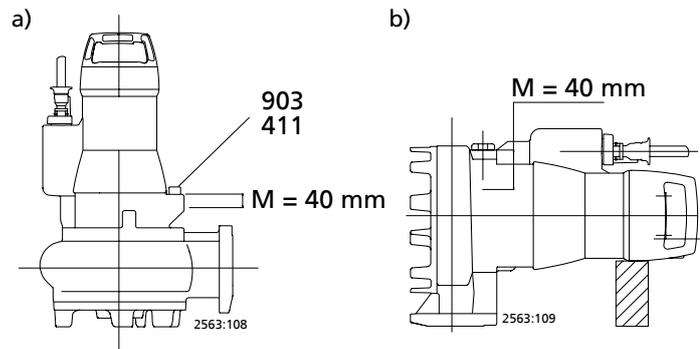


Fig. 23: Filling in the lubricant level a) Versions YL & WL; b) Versions YL & WL for size 50-170, 50-172 and 65-220

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 22: Lubricant level

Size	M [mm]
50-220	40
50-222	
65-170	
80-220	
100-220 (versions YL & WL)	
50-170	40
50-172	
65-220 (versions YL & WL)	

7.2.2.1.4.2 Changing the lubricant — version UL

Draining the lubricant

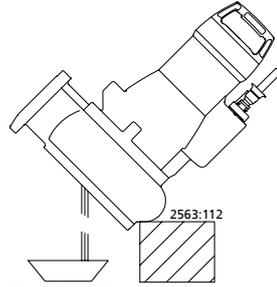


Fig. 24: Draining the lubricant

- ✓ The suction cover and the impeller have been removed.
(⇒ Section 7.4.3, Page 54)
- 1. Place a suitable container under the pump set.
- 2. Slide mechanical seal 433.02 along the shaft.
- 3. Drain the oil.

Filling in the lubricant

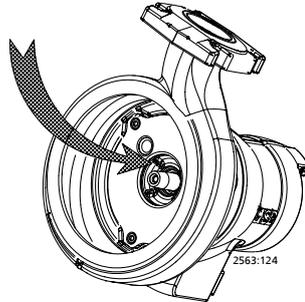


Fig. 25: Filling in the lubricant

1. Fill 0.25 litres of oil through the opening between the stationary assembly of mechanical seal 433.02 and rotor 818.
2. Thoroughly clean rotor 818 and the contact face of the stationary assembly of mechanical seal 433.02. Remove any oil residues.
3. Fit the rotating assembly of mechanical seal 433.02.
4. Fit impeller 230 and suction cover 162. Observe the tightening torques.
(⇒ Section 7.6, Page 60)

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

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set.
(⇒ Section 11, Page 80)

7.4 Dismantling the pump set

7.4.1 General information/Safety regulations

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

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

	WARNING
	<p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.

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

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

	<p>! WARNING</p>
	<p>Components with sharp edges Risk of cutting or shearing injuries!</p> <ul style="list-style-type: none"> ▷ Always use appropriate caution for installation and dismantling work. ▷ Wear work gloves.

7.4.2 Preparing the pump set

- ✓ The notes and steps stated in (⇒ Section 7.4.1, Page 53) 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.

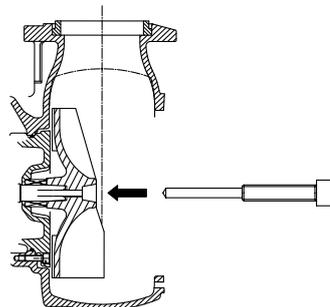


Fig. 26: Forcing screw

	<p>NOTE</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 part (versions YL and WL)

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

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

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

1. Slide primary ring 433.02 along the shaft.
2. Undo and remove screws 914.02.
3. Remove intermediate casing 113.
4. Press 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 carrier 476.
8. Take the mating ring out of mating ring carrier 476.
9. Take O-ring 412.02 out of mating ring carrier 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 52)
1. Undo and remove screws 914.02 at bearing bracket 330.
 2. Remove rotor unit 818 from bearing bracket 330.
 3. Press 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 carrier 476.
 9. Take mating ring 433.01 out of mating ring carrier 476.
 10. Remove circlip 932.01.
 11. Pull off rolling element bearing 321.02.
 12. Pull off rolling element bearing 321.01.

7.5 Reassembling the pump set

7.5.1 General information/Safety regulations

	<p>WARNING</p> <p>Improper lifting/moving of heavy assemblies or components Personal injury and damage to property!</p> <ul style="list-style-type: none"> ▶ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.
	<p>CAUTION</p> <p>Improper reassembly Damage to the pump!</p> <ul style="list-style-type: none"> ▶ Reassemble the pump (set) in accordance with the general rules of sound engineering practice. ▶ Use original spare parts only.
	<p>NOTE</p> <p>Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. 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 60)

7.5.2 Reassembling the pump section

7.5.2.1 Installing the mechanical seal

Observe the following 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 seal 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.
 Slide the rotating assembly over the foil into its installation position.
 Then remove the foil.
- ✓ The shaft and rolling element bearings have been properly fitted in the motor.
 1. Slide drive-end mechanical seal 433.01 onto shaft 210 and secure it with circlip 932.01.
 2. Insert O-rings 412.03 into intermediate casing 113 and push the intermediate casing into bearing bracket 330 up to the stop.
 3. Slide pump-end mechanical seal 433.02 onto shaft 210.

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

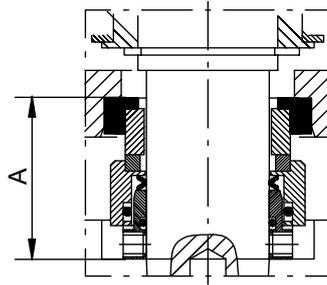


Fig. 27: Installation dimension "A"

Table 23: 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

	NOTE
	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.

	CAUTION
	<p>Incorrect assembly 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>

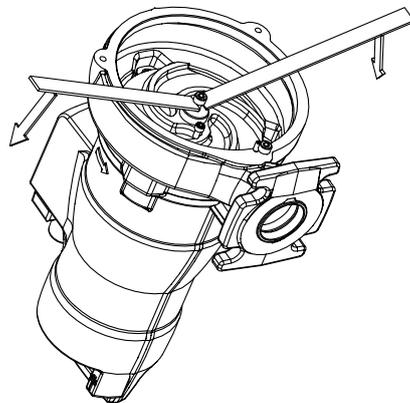


Fig. 28: Pulling the rotor assembly right up to the suction cover

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

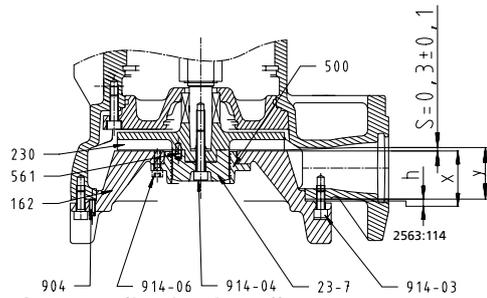


Fig. 29: Adjusting impeller type S

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 ($0.3 + -0.1$) 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
<p>For bearing brackets with tapered fit make sure that the tapered fit of impeller and shaft is undamaged and installed free from grease.</p>	

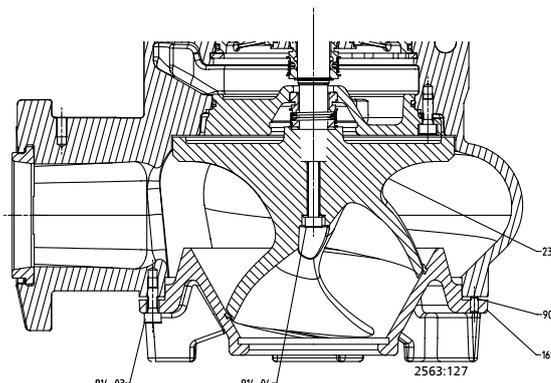


Fig. 30: Fitting impeller type D

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.

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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

	NOTE
	<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 (Flamepaths on explosion-proof motors). Secure all screwed/bolted connections closing off the flameproof enclosure with a thread-locking agent (Loctite Type 243).</p>
	⚠ DANGER
	<p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.

- Prior to assembly, slightly wet the flamepaths (⇒ Section 9.4, Page 76) with oil. Make sure to use the correct quality of lubricating liquid. (⇒ Section 7.2.2.1.2, Page 47)

7.5.4 Leak testing (versions YL and WL)

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

Observe the following values for leak testing:

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

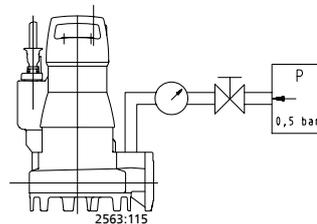


Fig. 31: Screwing in the testing device

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

7.5.5 Checking the connection of motor/power supply

Check the electric cables after reassembly. (⇒ Section 7.2.1, Page 45)

7.6 Tightening torques

	⚠ DANGER
	<p>Wrong screws/bolts Explosion hazard!</p> <ul style="list-style-type: none"> ▷ Always use the original screws/bolts for assembling an explosion-proof pump set. ▷ Never use screws/bolts of different dimensions or of a lower property class.

Table 24: Tightening torques

Thread	Material	[Nm]
M8	A2-70 or A4-70	17
Impeller screw M8	A4-80	40
Screw plug 903	A4	23

7.7 Spare parts

	NOTE
	<p>For explosion-proof pump sets only original spare parts or parts authorised by the manufacturer must be used.</p>

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 No. and description (⇒ Section 9.1, Page 64)
- 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 25: Quantity of spare parts for recommended spare parts stock⁷⁾

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 %

⁷⁾ 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
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 sealing elements	4	6	8	8	9	10	100 %

7.7.3 Sets of spare parts

Table 26: 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

	 WARNING
	<p>Improper work to remedy faults 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 27: 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 connection 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.
X	-	-	-	-	Temperature control device monitoring the winding has tripped the pump as a result of excessive winding temperatures.	The motor will restart automatically once it has cooled down.

A	B	C	D	E	Possible cause	Remedy
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.
X	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General arrangement drawings with list of components

9.1.1 General assembly drawing of Amarex N – version UL

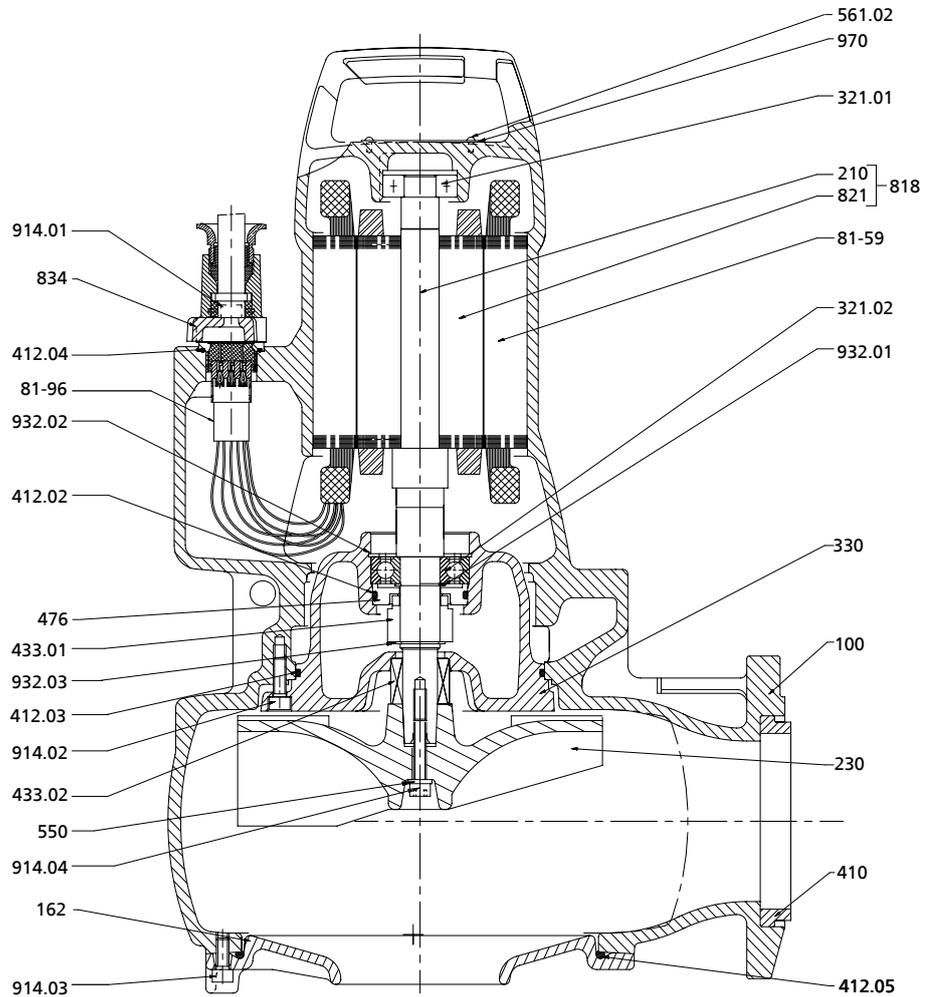
Sizes of hydraulic system

DN 50 ... 100

Motor sizes

002...042

004...044



General assembly drawing of the pump set, version UL

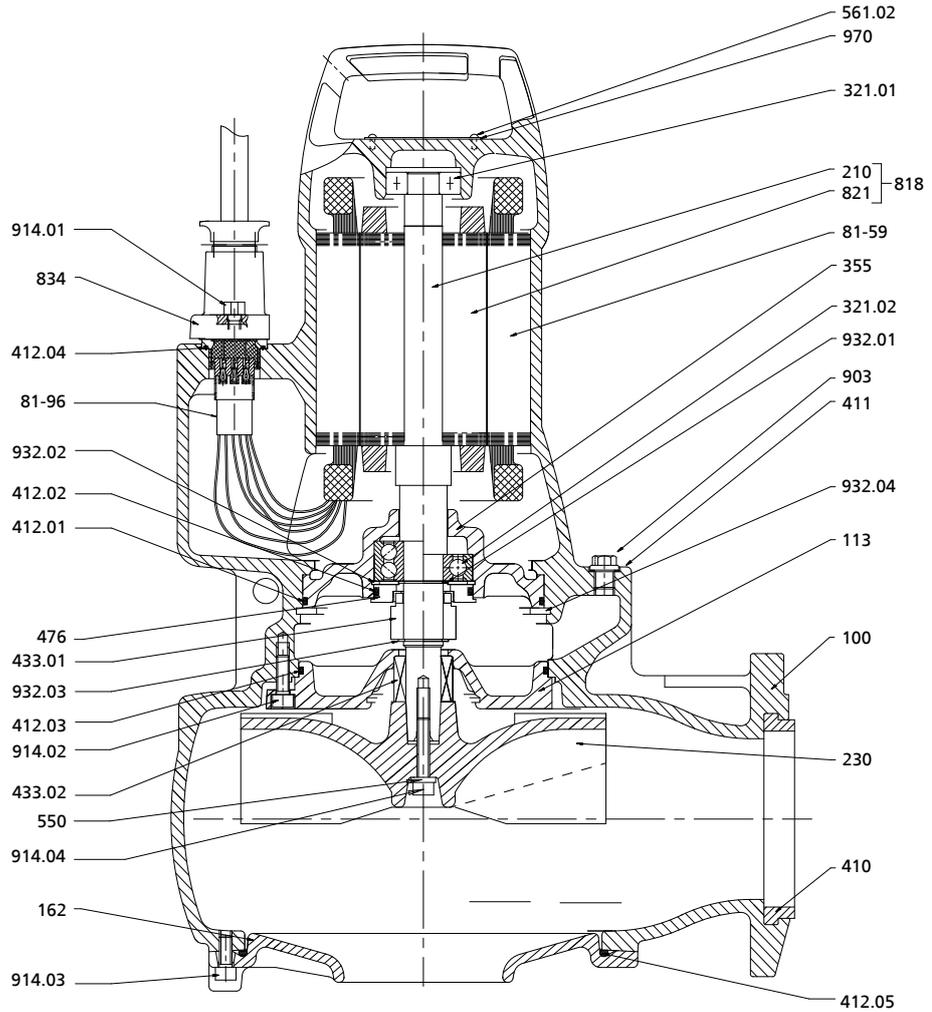
Table 28: List of components

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 General assembly drawing of Amarex N – versions YL and WL

Sizes of hydraulic system
DN 50...100

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



General assembly drawing of the pump set, versions YL & WL

Table 29: 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

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9.1.3 Exploded views with list of components

9.1.3.1 Exploded view of Amarex N - S 50, versions YL and WL

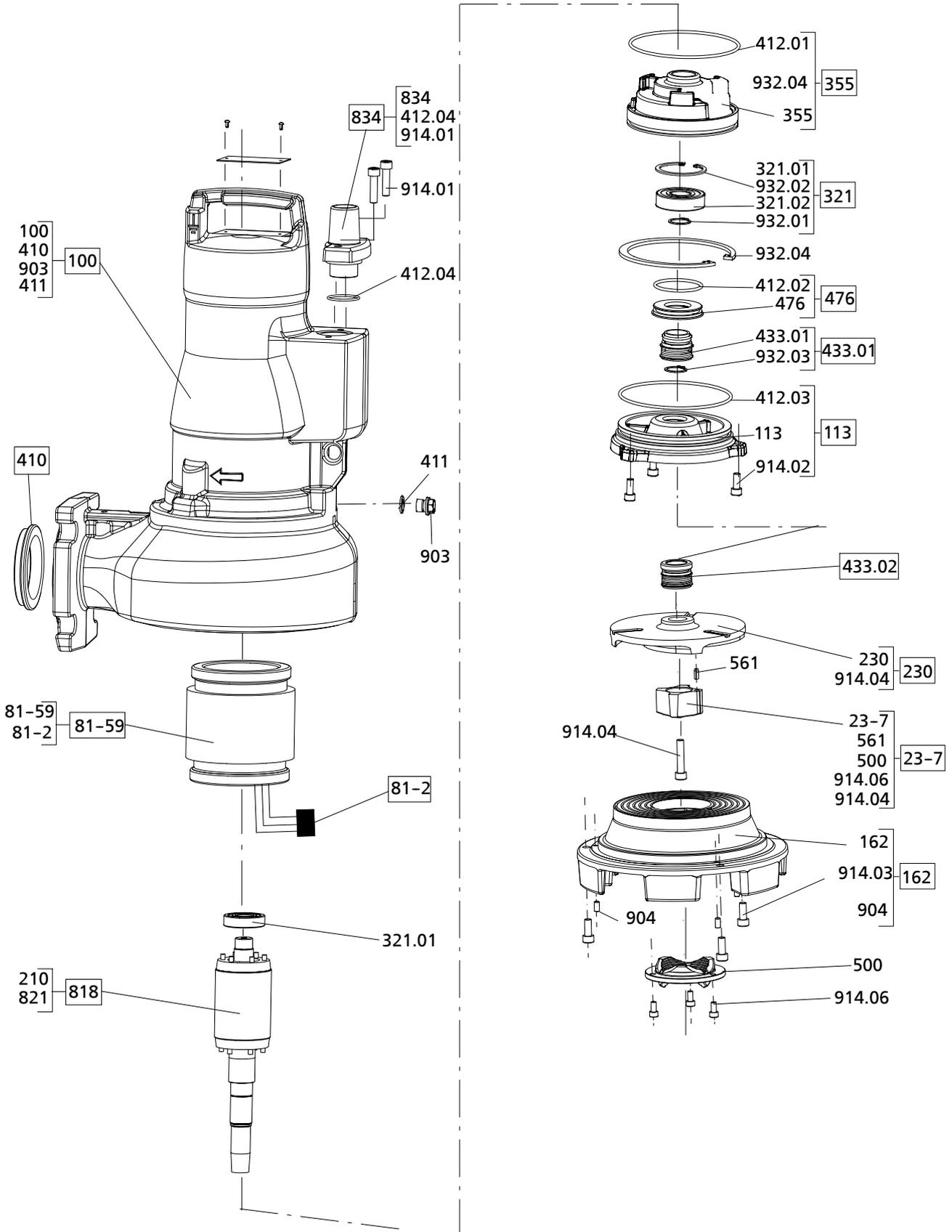
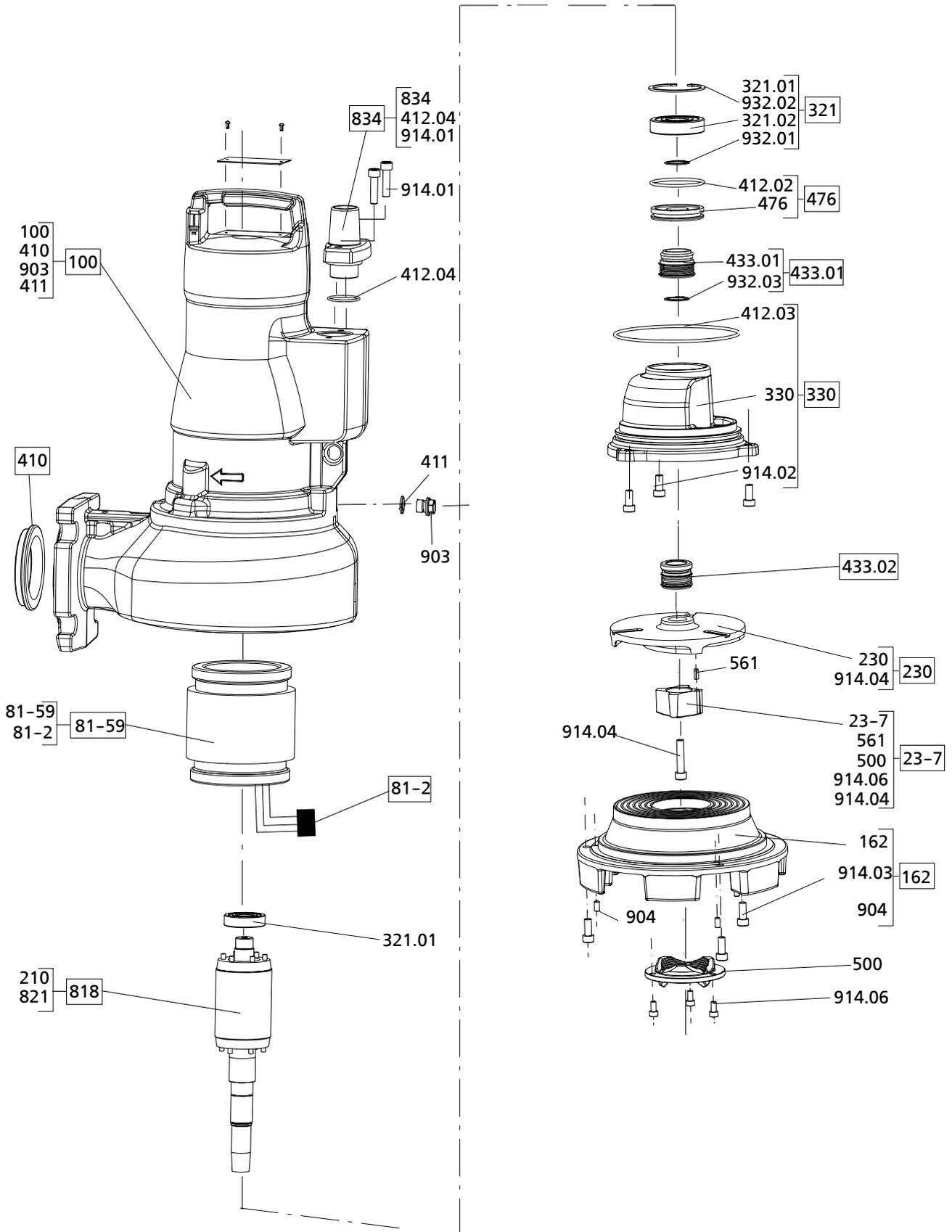


Fig. 32: Amarex N - S 50 version YL & WL

9.1.3.2 Exploded view of Amarex N - S 50, version UL



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Fig. 33: Amarex N - S 50 serie, design UL

9.1.3.3 Exploded view of Amarex N - F 50-100, versions YL and WL

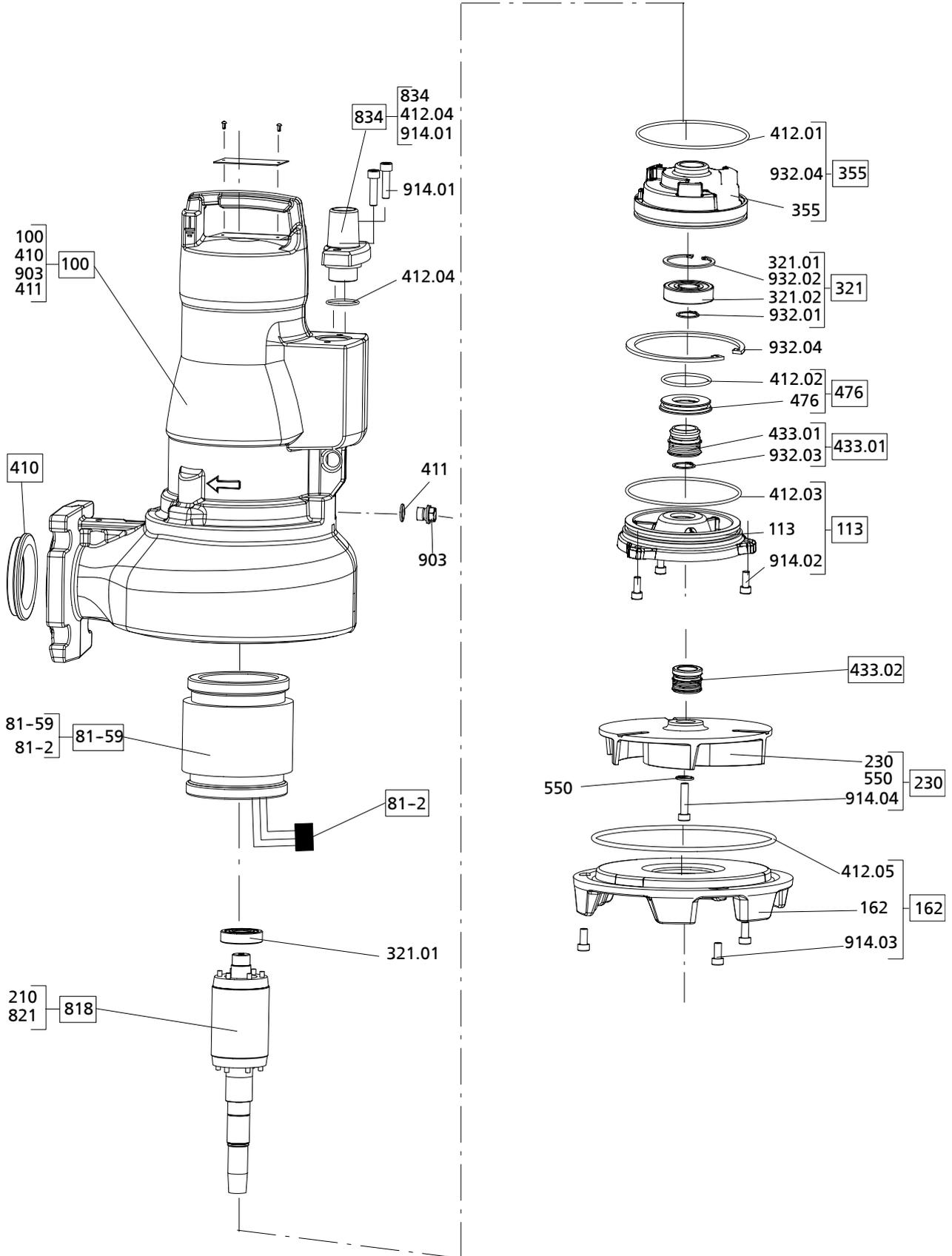
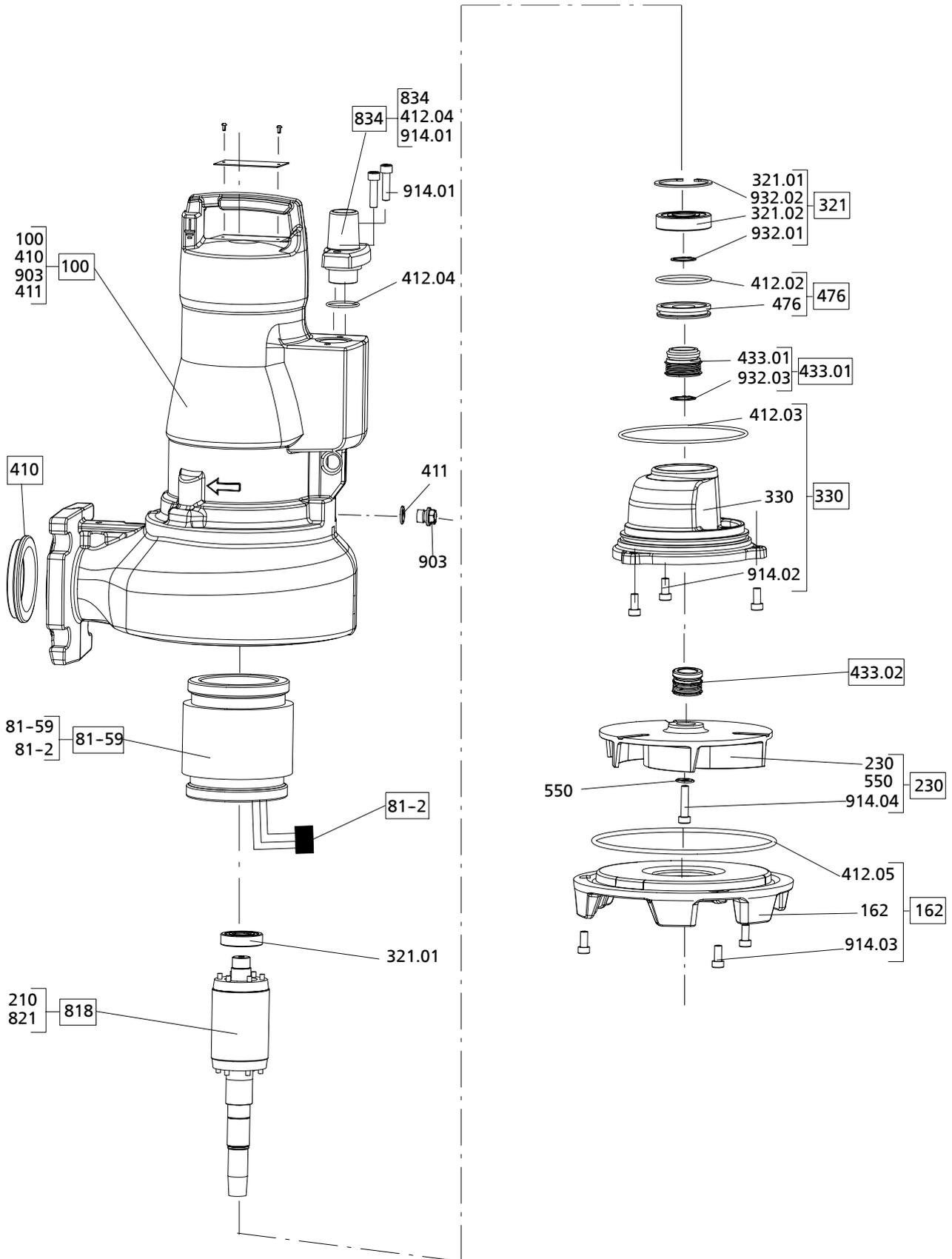


Fig. 34: Amarex N - F 50-100 version YL & WL

9.1.3.4 Exploded view of Amarex N - F 50-100, version UL



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Fig. 35: Amarex N - F 50-100, design UL

9.1.3.5 Exploded view of Amarex N - D 80-100, versions YL and WL

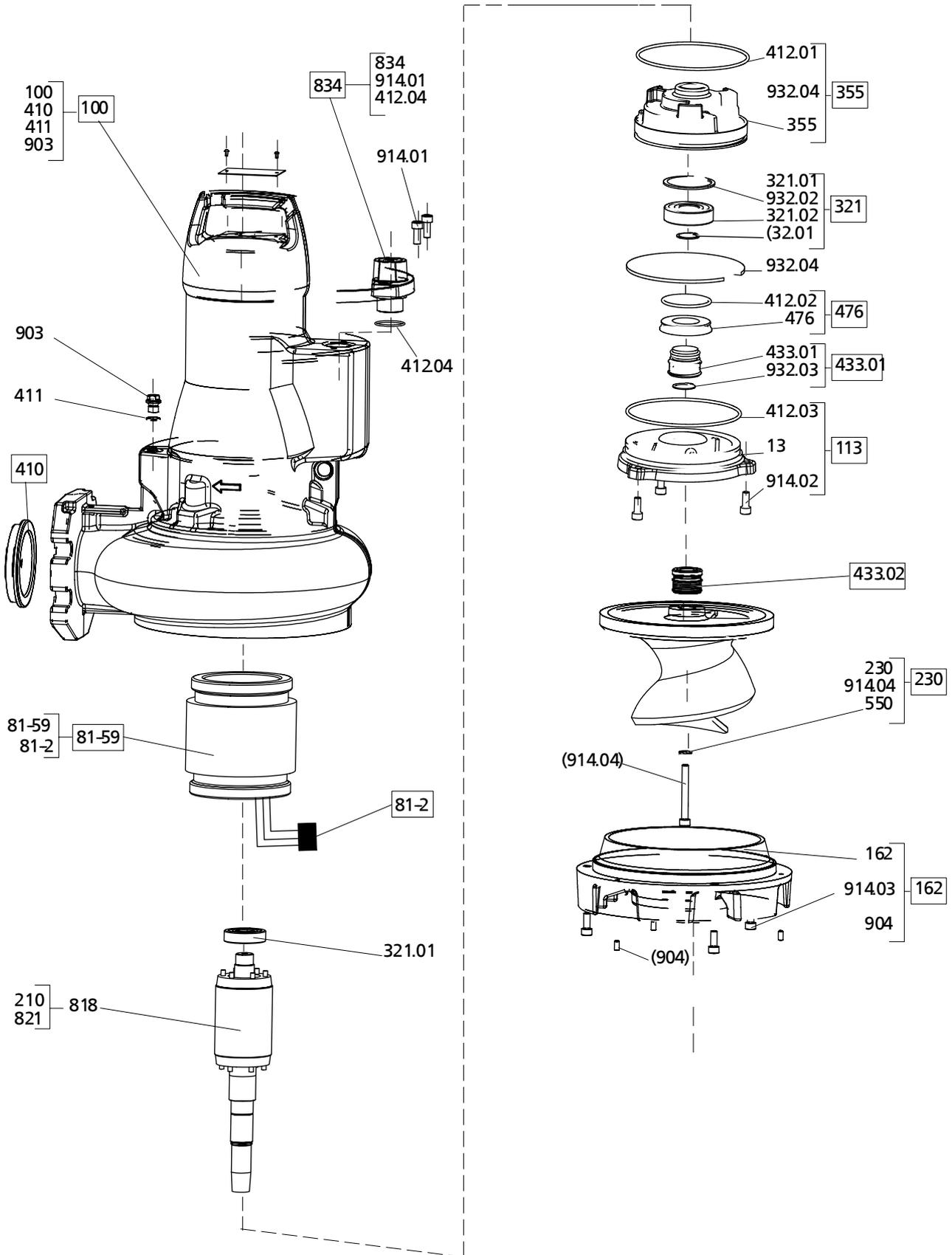


Fig. 36: Amarex N - D 80-100, versions YL and WL

9.1.3.6 Exploded view of Amarex N - D 80-100, version UL

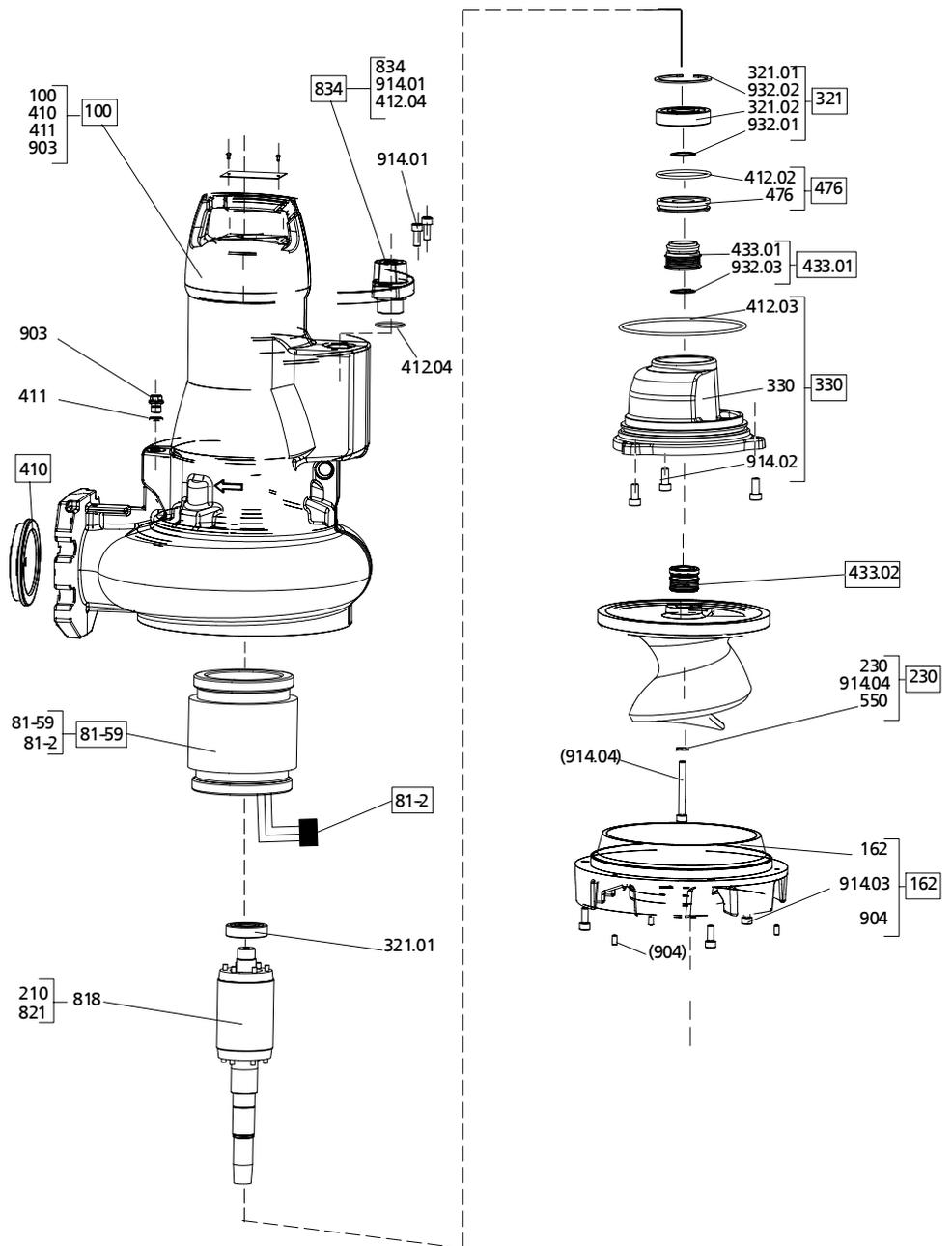


Fig. 37: Amarex N - D 80-100, version UL

9.1.3.7 List of components in the exploded views

Table 30: 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	Leakage sensor
23-7	Impeller body	81-2.01	Plug
230	Impeller	81-59	Stator
321.01/02	Radial ball bearing	82-14	Power cable conversion kit
330	Bearing bracket	818	Rotor
355	Bearing bracket housing	821	Rotor core pack
410	Profile seal	834	Cable gland
411	Joint ring	99-9	Set of sealing elements
412.01/02/03/04/05	O-ring	903	Screw plug
433.01/02	Mechanical seal	904	Grub screw
476	Mating ring carrier	914.01/02/03/04/06	Hexagon socket head cap screw
59-17	Shackle	932.01/02/03/04	Circlip

9.2 Wiring diagrams

9.2.1 Version YL

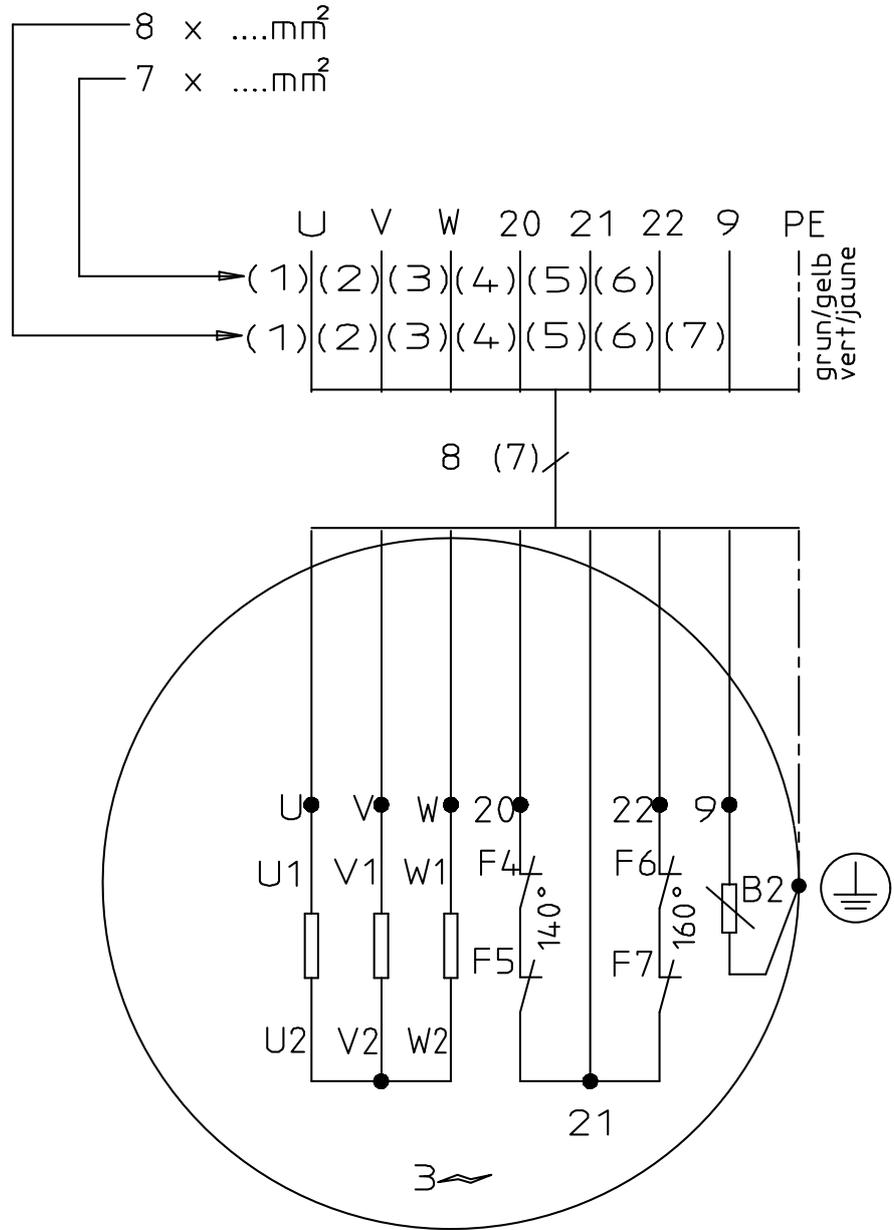


Fig. 38: Wiring diagram for version YL & WL

B2	Motor moisture protection
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9.2.2 Versions UL and WL

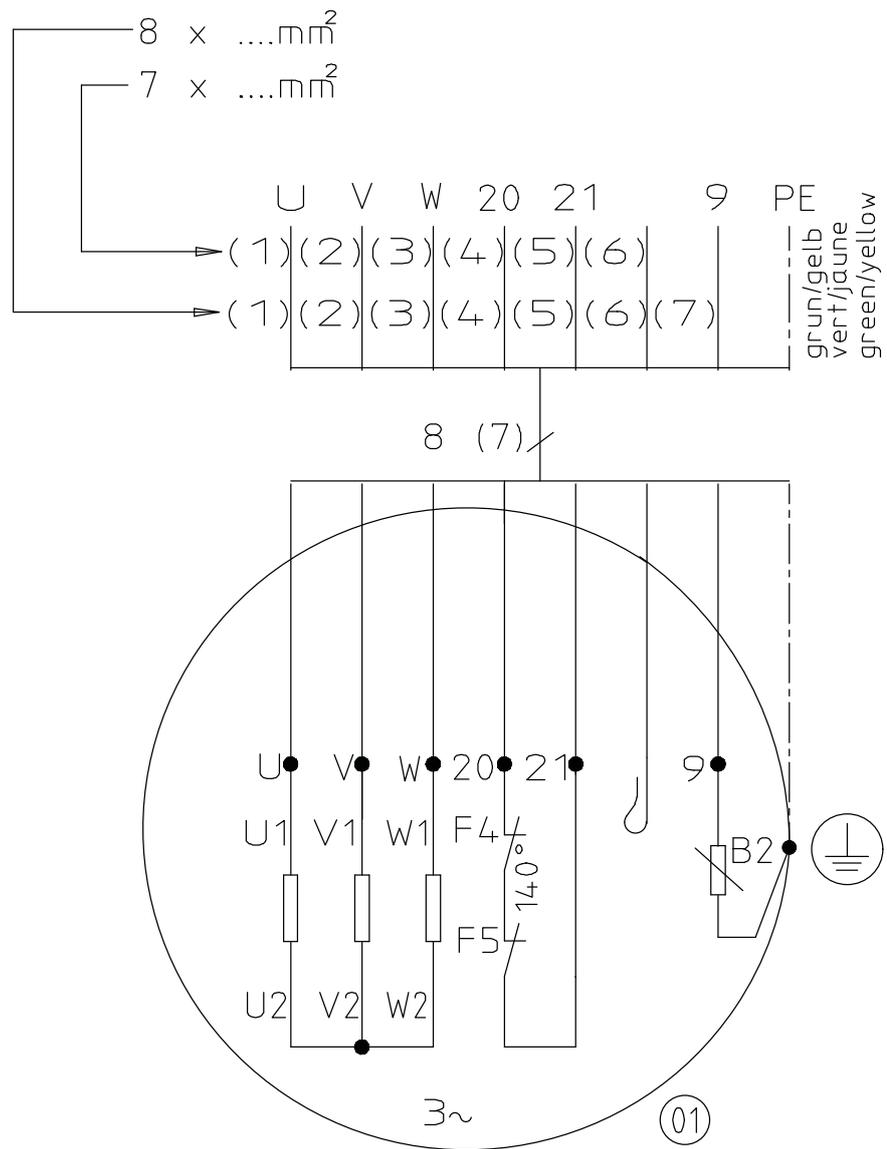


Fig. 39: Wiring diagram for version UL

B2	Motor moisture protection
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9.3 Wiring diagrams overload protection

Table 31: Examples of wiring diagrams for overload protection

Key	Circuit diagram
<p>Q: 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"> ▪ Earth leakage module VIGI, instantaneous, 3~30 mA ▪ Auxiliary contact (change-over contact) <p>KM: Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p>F: Remote control</p>	
<p>Q: Motor contactor e.g. Télémécanique GV2M + GV2 AN 11</p> <p>KM: Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p>RH: Earth leakage protection relay with separate toroid e.g. Vigirex RH 328 A Merlin Guérin + Tore</p> <p>F: Remote control</p> <p>H: Auxiliary supply</p>	
<p>Q: Motor contactor e.g. Télémécanique GV2M + GV2 AN 11</p> <p>KM: Motor contactor 3~ e.g. Télémécanique LC1 D0910</p> <p>SM: Insulation monitor, de-energised e.g. V12G1LOHM SM21 Merlin Guérin</p> <p>F: Remote control</p> <p>H: Auxiliary supply</p>	

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9.4 Flamepaths on explosion-proof motors

Table 32: Overview of flamepaths

Sizes	Pump set		
DKN 82 50-170 50-172 65-220			
	Shaft	Pump casing	Cable entry
Flamepath number	1	2	3
Length of flamepath [mm]	≥ 12.5	≥ 12.5	≥ 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 µm inside diameter to DIN ISO 286/2	Maximum	+41	+63
	Minimum	+20	0
Tolerance in µm outside diameter to DIN ISO 286/2	Maximum	-	-14
	Minimum	-	-39
Tolerance in µm inside diameter	Maximum	-	-
	Minimum	-	-
Tolerance in µm outside diameter	Maximum	-40	-25
	Minimum	-60	-75

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Table 33: Overview of flamepaths

Sizes	Pump set		
DKN 92			
50-220			
50-222			
65-170			
80-220			
100-220			
	Shaft	Pump casing	Cable entry
Flamepath number	1	2	3
Length of flamepath [mm]	≥ 12.5	≥ 12.5	≥ 12.5
Inside diameter (drilled hole) [mm]	30	≥ 152	32
Outside diameter (shaft) [mm]	29,9	152	32
Tolerance ISO inside diameter	F7	H8	H8
Tolerance ISO outside diameter	-	g6	-
Tolerance in µm inside diameter to DIN ISO 286/2	Maximum	+41	+63
	Minimum	+20	0
Tolerance in µm outside diameter to DIN ISO 286/2	Maximum	-	-14
	Minimum	-	-39
Tolerance in µm inside diameter	Maximum	-	-
	Minimum	-	-
Tolerance in µm outside diameter	Maximum	-40	-25
	Minimum	-60	-75

2563.84/10-EN

9.5 Installation drawings of the mechanical seal

Table 34: 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)

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

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

Amarex N

From serial number: xxxxxxxx-B202250-00001

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
 - Pump (set): 2006/42/EC Machinery Directive
 - Pump: 2014/34/EU Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX)
 - 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 1127-1
 - EN 60034-1:2010, EN 60034-5/A1:2007
 - EN IEC 60079-0:2018, EN 60079-1:2014
 - EN 80079-36:2016, EN 80079-37:2016

In compliance with Directive 2014/34/EU, the product is marked as follows: **Ⓜ II 2G Ex db h IIB T4 Gb**

The EC Type Test Certificate **LCIE 03 ATEX 6428X** is available for the integrated motor of type **DKN 82 or 92** with **Ⓜ II 2G Ex db IIB T4 Gb** type of protection.

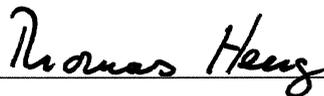
The manufacturer's quality assurance system is monitored by 0081 LCIE Fontenay-aux-Roses, France.

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 December 2022



Thomas Heng
Head of Product Development Series & Heavy Duty Pumps
KSB SE & Co. KGaA
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