Submersible Motor Pump

AmaRex Pro

Installation/Operating Manual



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Installation/Operating Manual AmaRex Pro

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.

Hydraulic system

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

IE5

Efficiency class for rotating electrical machinery to IEC TS 60034-30-2:2016 = Ultra Premium Efficiency (IE = International Efficiency)

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1 General

1.1 Principles

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

Table 1: Variants covered by this operating manual

Size	Impeller type	Material variant
80-180	D	G2
80-230	D	G2
100-180	D	G2
100-230	D	G2
150-230	D	G2

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 10)

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[1)]	Sectional drawing of the pump
Spare parts lists[1)]	Description of spare parts
Supplementary operating manual[1)]	Installation/operating manual Installation Parts for Stationary Wet Installation

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

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1 If included in agreed scope of supply

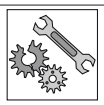
1.5 Symbols

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.
	**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.
	**Warning: Strong magnetic field** In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies information about protection against magnetic fields.
	**Warning for persons with pacemaker** In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies special information for persons with a pacemaker.

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2 Safety

DANGER

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

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

2.1 General

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

2.2 Intended use

- The pump set must only be operated within the operating limits described in the other applicable documents.
- Only operate pump sets which are in perfect technical condition.
- Do not operate partially assembled pump sets.
- Only use the pump to handle the fluids described in the data sheet or product literature of the pump model.
- Never operate the system without the fluid to be handled.
- Observe the limits for continuous duty specified in the data sheet or product literature (Q_{min} and Q_{max}) (to prevent damage such as shaft fracture, bearing failure, mechanical seal damage, etc).
- When untreated waste water is handled, the duty points in continuous operation lie within 0.7 to 1.2 × Q_{BEP} to minimise the risk of clogging/hardening.
- Avoid duty points for continuous operation at very low speeds and small flow rates (< 0.7 × Q_{BEP}).
- Observe the minimum flow rate and maximum flow rate indicated in the data sheet or product literature (to prevent overheating, mechanical seal damage, cavitation damage, bearing damage, etc).
- Do not throttle the flow rate on the suction side of the system (prevention of cavitation damage).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.
- Only use the respective impeller types in combination with the fluids described below.

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Table 5: Overview of impeller types

Illustration	Description	Use
	Open two-vane impeller (impeller type D-max)	**Suitable for the following fluids:** waste water containing wet wipes and long fibres

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.

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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 48)
- Decontaminate pumps which handle fluids posing a health hazard. (⇨ Section 8.3, Page 73)
- 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 43)

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 Software changes

The software has been specially created for this product and thoroughly tested. Making changes or additions to the software or parts of the software is prohibited. This does not, however, apply to software updates by KSB.

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2.10 Electromagnetic compatibility (EMC)

2.10.1 Interference emission requirements

The EN 61800-3 EMC product standard is relevant for electric variable speed drives/ control systems. The EMC product standard specifies all pertinent requirements and refers to the relevant generic standards for complying with the EMC Directive.

Frequency inverters are commonly used by operators as a part of a system, plant or machine assembly. The operator bears all responsibility for the final EMC properties of the equipment, plant or installation.

A prerequisite or requirement for complying with the relevant standards or the limit values and inspection/test levels referenced by them is that all information and descriptions regarding **EMC-compliant installation** be observed and followed.

In accordance with the EMC product standard, the EMC requirements to be met depend on the purpose or intended use of the frequency inverter. Four categories are defined in the EMC product standard:

Table 6: Categories of intended use

Category	Definition	Limits to EN 55011
C1	Frequency inverters with a supply voltage under 1000 V installed in the first environment (residential and office areas).	Class B
C2	Frequency inverters with a supply voltage under 1000 V installed in the first environment (residential and office areas) that are neither ready to be plugged in/connected nor are mobile and must be installed and commissioned by specialist personnel.	Class A, Group 1
C3	Frequency inverters with a supply voltage under 1000 V installed in the second environment (industrial environments).	Class A, Group 2
C4	Frequency inverters with a supply voltage over 1000 V and a nominal current over 400 A installed in the second environment (industrial environments) or that are intended for use in complex systems.	No borderline/boundary[2)]

The integrated frequency inverter meets the following requirements:

Table 7: EMC properties of the frequency inverter

Power	Power cable length	Category to EN 61800-3	Limits to EN 55011
[kW]	[m]		
≤ 7,5	≤ 20	C2	Class A, Group 1 or 2

The EN 61800-3 standard requires that the following warning be provided for drive systems that do not comply with category C1 specifications:
This product can produce high-frequency interference emissions that may necessitate targeted interference suppression measures in a residential or office environment.

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2 An EMC plan must be devised.

2.10.2 Line harmonics requirements

The product is a device for professional applications as defined by EN 61000-3-2. The following generic standards apply when establishing a connection to the public power grid:

- EN 61000-3-2 for symmetrical 3-phase devices

2.10.3 Interference immunity requirements

In general, the interference immunity requirements for a frequency inverter hinge on the specific environment in which the inverter is installed.

The requirements for industrial environments are therefore higher than those for residential and office environments.

The frequency inverter is designed such that the immunity requirements for industrial environments and, thus, the lower-level requirements for residential and office environments, are met and fulfilled.

The following relevant generic standards are used for the interference immunity test:

- EN 61000-4-2: Electromagnetic compatibility (EMC)
  - Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
- EN 61000-4-3: Electromagnetic compatibility (EMC)
  - Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
- EN 61000-4-4: Electromagnetic compatibility (EMC)
  - Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
- EN 61000-4-5: Electromagnetic compatibility (EMC)
  - Part 4-5: Testing and measurement techniques – Surge immunity test
- EN 61000-4-6: Electromagnetic compatibility (EMC)
  - Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields

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

Improper transport

Danger to life from falling parts!

Damage to the pump set!

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



WARNING

Insufficient stability

Risk of crushing hands and feet!

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

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3.3 Storage/preservation

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



CAUTION

Improper storage

Damage to the electric cables!

- ▷ 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

Damage during storage due to humidity, dirt or vermin

Corrosion/contamination of pump (set)!

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



CAUTION

Wet, contaminated or damaged openings and connections

Leakage or damage to the pump!

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

Table 8: Ambient conditions for storage

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

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

1. Spray-coat the inside wall of the pump casing and, in particular, the impeller clearance areas with a preservative.
2. Spray the preservative through the suction nozzle and discharge nozzle.
   ⇨ It is advisable to then close the pump nozzles (e.g. with plastic caps or similar).



NOTE

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

3.4 Return to supplier

1. Drain the pump properly. (⇨ Section 8.3, Page 73)
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 12, Page 91)



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



⚠ DANGER

Strong magnetic field in the pump rotor area

Danger of death for persons with pacemaker!

Interference with magnetic data carriers, electronic devices, components and instruments!

Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- ▹ Keep a safety distance of at least 0.3 m.



⚠ WARNING

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

Hazard to persons and the environment!

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

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

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4 Description of the Pump (Set)

4.1 General description

Waste water transport, waste water management, drainage systems, waste water treatment plants, stormwater transport, recirculation, sludge treatment

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

Table 9: Designation example

Position																											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	R	X		P	R	O		D	0	8	0	-	1	8	0	/	0	7	5	A	4	U	S	G	2	-	2	3	0
See name plate and data sheet																													

Table 10: Designation key

Position	Code	Description
1-7	Pump type	
	ARX PRO	AmaRex Pro
9	Impeller type	
	D-max	Open two-vane impeller
10-16	Size	
	080	Nominal discharge nozzle diameter [mm]
	180	Size of hydraulic system
18-20	Rated power P_2 [kW]	
	022	2,20
	...	...
	075	7,50
21	Efficiency class[3)]	
	A	IE5
22	Number of motor poles	
	4	4 poles
23	Motor version	
	U	Non-explosion-proof, standard
24	Motor construction type	
	S	Wet installation
25-26	Material variant	
	G2	Standard variant grey cast iron, impeller made of white cast iron
28-30	Nominal impeller diameter [mm]	
	090	90
	...	...
	230	230

3 The IEC 60034-30-2 standard is not binding for submersible motor pumps. Efficiencies are determined according to the measurement method described in IEC 60034-2. For motors that achieve efficiency levels similar to those of standardised motors according to the IEC 60034-30-2 standard this marking is used.

4.4 Name plate

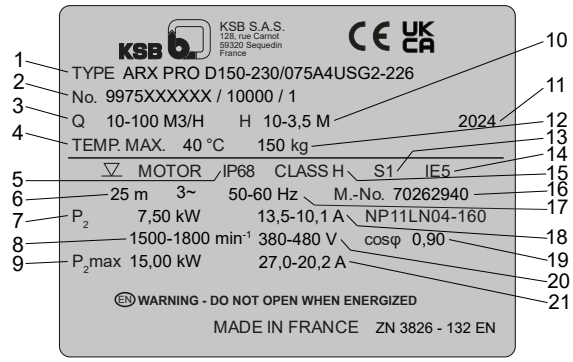


Fig. 1: Name plate (example)

1	Designation	12	Total weight
2	Order number	13	Duty type
3	Flow rate	14	Efficiency class
4	Maximum fluid temperature and ambient temperature	15	Thermal class of winding insulation
5	Enclosure	16	Motor number
6	Maximum immersion depth	17	Rated frequency
7	Rated power	18	Rated current
8	Rated speed	19	Power factor at rated operating point
9	Rated power in deragging process	20	Rated voltage
10	Head	21	Rated current in deragging process
11	Year of production		

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4.5 Design details

Design

- Vertical single-stage submersible motor pump for wet installation, with open two-vane impeller (D-max), stationary or transportable version.
- Single-stage, single-entry, close-coupled non-self-priming pump set

Drive

- Permanent magnet synchronous motor to thermal class H
- Enclosure: IP68 to EN 60529/IEC529

Shaft seal

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

Impeller type

- Open two-vane impeller (impeller type D-max)

Bearings

Motor-end bearings:

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

Pump-end bearings:

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

4.6 Technical data

Table 11: Technical data of frequency inverter

Characteristic	Value
Mains supply	
Mains voltage	3~ 380 V AC - 5 % to 3~ 480 V AC + 5 %
Voltage difference between the three phases	±2 % of the supply voltage
Mains frequency	50 - 60 Hz ± 2 %
Mains types	TN-S, TN-CS, TN-C, TT and IT mains (to IEC/EN 60364)
Frequency inverter data	
Efficiency	97 %
Environment	
Enclosure	IP68 (to EN 60529)
In-service ambient temperature	-10 °C to +50 °C
In-storage ambient temperature	-10 °C to +70 °C
Relative humidity	Storage: 5 % to 95 % Transport: ≤ 95 %
Installation altitude	< 1000 m above MSL, or 1 % power derating per additional 100 m
Fluid temperature[4)]	0 °C to +40 °C
EMC	
Frequency inverter ≤ 11 kW	EN 61800-3 C2 / EN 55011 Class A / cable length ≤ 20 m
Inputs and outputs	
Internal power supply unit	24 V ± 10 %
Maximum load	5 mA DC max., short-circuit-proof and overload-proof. Only for activating the digital input
Digital inputs	
Number of digital inputs	1, parameterisable
ON level	15 - 30 V
OFF level	0 - 3 V
Input impedance	Approx. 5 kΩ
Electrical isolation	Provided, isolation voltage: 500 V AC
Delay	< 10 ms
Reverse polarity protection	Provided
Relay outputs	
Number of parameterisable relay outputs	1 × NC contact
Maximum contact rating	Alternating current: maximum 250 V AC / 3 A (resistive) Direct current: maximum 30 V DC / 3 A (resistive)
Interfaces	
Quantity and type	2× RS-485
Galvanic isolation	Provided, isolation voltage: 500 V AC
Terminating resistor, internal	120 Ω, permanently installed
Power cable	
Type	Up to 5.5 kW: 4G2.5 + 2× (2×1)C + (2×2×0.5+0.5)C 7.5 kW: 4G4 + 2× (2×1)C + (2×2×0.5+0.5)C
Nominal voltage V_0/V	AC 0.6/1 kV (control conductors 300 V)
Nominal voltage VL	1000 V
AC test voltage	3.5 kV (control conductors 1 kV)
Duration of voltage test	5 minutes

4 Provided the specified ambient temperature limits are complied with.

Characteristic	Value
Flame-retardant	DIN EN 60332-1-2
Oil-resistant	DIN EN 60811-404
UV-resistant	ISO 4892-2
Ozone-resistant	DIN EN 60811-403
Maximum operating temperature at the conductor	90 °C
Maximum short circuit temperature at the conductor	250 °C
Ambient temperature, flexible use	≥ -40 °C to ≤ +60 °C
Outside diameter	≥ 22.5 mm to ≤ 24.5 mm
Maximum tensile strength of main conductors	15 N/mm^2
Bending radii to DIN VDE 0298-3	Fixed wiring: ≤ 115 mm Wiring subject to flexing: ≤ 230 mm

4.7 Available software/apps

KSB ServiceTool

This software can be used to change the settings for the pump set and carry out a firmware update.

https://www.ksb.com/en-gb/software-and-know-how/operational-tools/ksb-servicetool

4.8 Installation types

Table 12: Installation type S, stationary wet installation

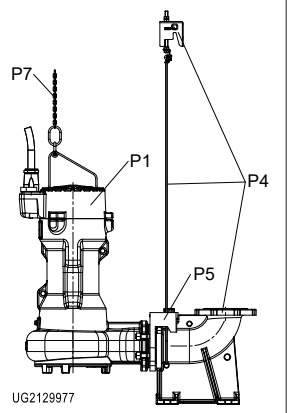
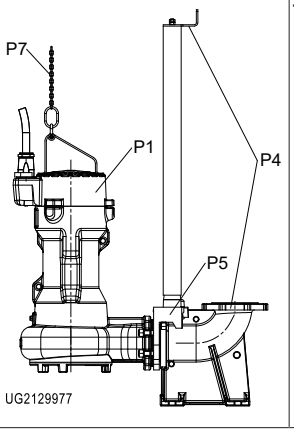
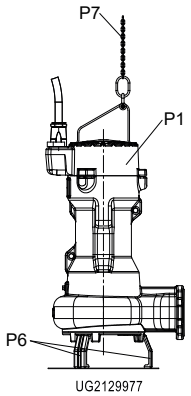
Installation type	Description	Comment
	**Guide wire arrangement** P1: pump P4: installation parts for guide wire arrangement, installation depth = 4.5 m / 9.5 m / 14.5 m P5: claw P7: chain and shackle	-
	**Twin guide rail arrangement** P1: pump P4: installation parts for twin guide rail arrangement P5: claw and adapter P7: chain and shackle	Only available for specific sizes, see selection configurator

Table 13: Installation type P, transportable wet-installed model

Installation type	Description	Note
	**Transportable wet-installed model** P1: pump P6: pump foot P7: chain and shackle	-

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4.9 Configuration and function

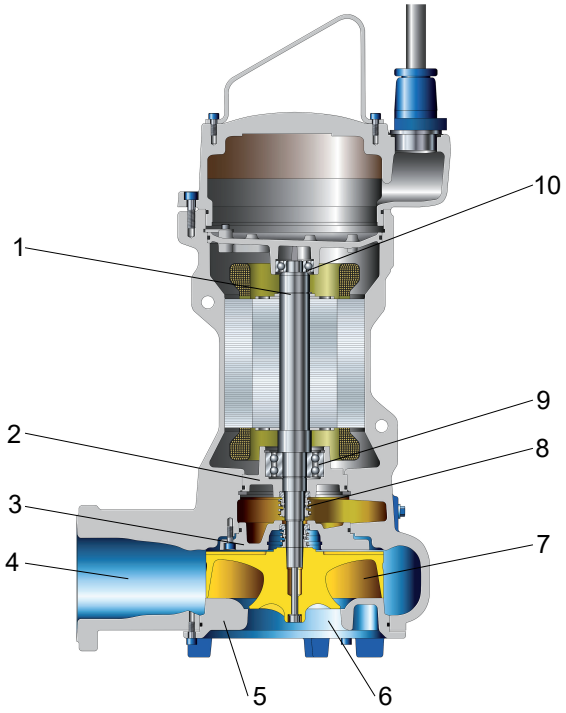


Fig. 2: Illustration of the pump set

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

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

Function The fluid enters the pump axially via the suction nozzle (6) and is accelerated outward in a cylindrical flow by the rotating impeller (7). In the flow passage of the pump casing the kinetic energy of the fluid is converted into pressure energy. The fluid is pumped to the discharge nozzle (4), where it leaves the pump. At the rear side of the impeller, the shaft (1) enters the casing via the discharge cover (3). The shaft passage through the cover is sealed to atmosphere with a shaft seal (8). The shaft runs in rolling element bearings (9 and 10), which are supported by a bearing bracket (2) joined to 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.

4.10 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
- Flanged bend with fastening elements
- Guiding equipment[5)]

Transportable wet-installed model (installation type P)

- Foot plate or pump stool with fasteners
- Lifting rope / lifting chain[6)]



NOTE

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

4.11 Dimensions and weights

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

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5 The guide rails are not included in the scope of supply.
6 Optional

5 Installation at Site

5.1 Safety regulations



DANGER

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the pump set!

- Comply with the applicable local explosion protection regulations.
- Observe the information given in the data sheet and on the pump/motor name plates.



DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

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



DANGER

Persons in the tank during pump set operation

Danger to life from electric shock!

- Never switch on the power supply of the pump set when persons are in the tank.



DANGER

Strong magnetic field in the pump rotor area

Danger of death for persons with pacemaker!

Interference with magnetic data carriers, electronic devices, components and instruments!

Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- Keep a safety distance of at least 0.3 m.



WARNING

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

Risk of injury! Damage to the submersible motor pump!

- Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area.
- Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.



⚠ WARNING

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

Personal injury and damage to property!

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

5.2 Checks to be carried out prior to installation

5.2.1 Preparing the place of installation

Place of installation for stationary models



⚠ WARNING

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

Personal injury and damage to property!

- ▷ Use a concrete of compressive strength class C25/30 which meets the requirements of exposure class 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

Incorrect positioning / incorrect placing down

Personal injury and damage to property!

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

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5.2.2 Checking the lubricant level

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

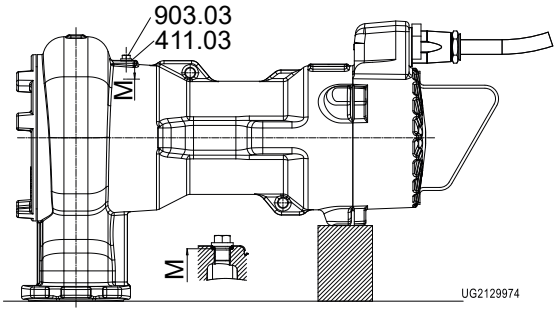


Fig. 3: Lubricant level

M	Optimum lubricant level

1. Position the pump set as shown.
2. Unscrew and remove screw plug 903.03 with joint ring 411.03.
3. Check the lubricant level.
   - ⇨ The lubricant level must be 38 mm below the filler opening.
   - ⇨ If the lubricant level is lower, top up the lubricant reservoir through the filler opening until the optimum lubricant level M is reached.
     (⇨ Section 8.2.2.1.4, Page 72)
4. Screw in screw plug 903.03 with new joint ring 411.03. Observe a tightening torque of 23 Nm.

5.2.3 Checking the direction of rotation



⚠ WARNING

Hands and/or foreign objects in the pump casing

Risk of injuries, damage to the pump!

- ▷ Never insert your hands or any other objects into the pump.
- ▷ 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.



CAUTION

Pump set running dry

Increased vibrations!

Damage to mechanical seals and bearings!

- ▷ Never operate the pump set for more than 60 seconds without the fluid handled.

✓ The pump set is connected to the power supply. (⇨ Section 5.5, Page 40)

✓ The power supply of the pump set has been switched on.

1. Connect the digital input and immediately disconnect it again. Observe the motor direction of rotation of the pump set during that time.
2. Check the direction of rotation.
   Impeller rotation must be anti-clockwise, seen from the pump mouth end. (The direction of rotation is marked by an arrow on the pump casing.)

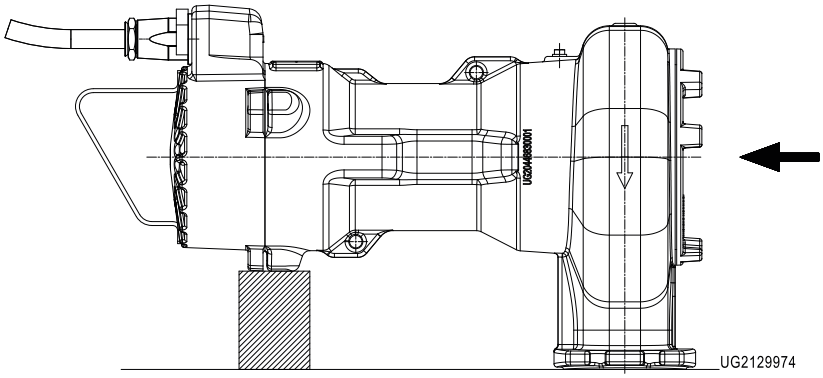


Fig. 4: Checking the direction of rotation

3. Disconnect the pump set from the power supply and make sure it cannot be switched on unintentionally.
4. If the direction of rotation is incorrect, check the motor connection in the terminal box of the pump.

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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 flanged bend

Fastening the flanged bend with chemical anchors

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

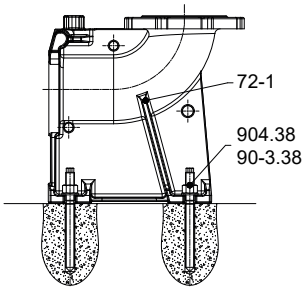


Fig. 5: Fastening the flanged bend

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

Chemical anchor dimensions

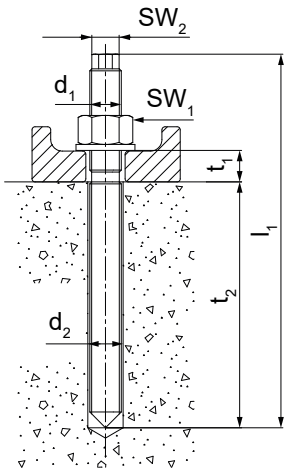


Fig. 6: Dimensions

Table 14: Chemical anchor dimensions

Size ($d_1 \times l_1$)	d_2 [mm]	t_1 [mm]	t_2 [mm]	SW_1 [7] [mm]	SW_2 [7] [mm]	M_{d1} [Nm]
M10 × 130	12	22	90	17	6	20
M16 × 190	18	35	125	24	12	80

Table 15: Curing times of mortar cartridge

Floor temperature	Minimum curing time	
	Dry concrete	Wet concrete
[°C]	[min]	
≥ +35	10	20
≥ +30	10	20

[7] SW = Width across flats

Floor temperature	Minimum curing time	
	Dry concrete	Wet concrete
[°C]	[min]	
≥ +20	20	40
≥ +10	60	120
≥ +5	60	120
≥ 0	300	600
≥ -5	300	600

5.3.1.2 Connecting the piping



DANGER

Impermissible loads acting on the flange of the flanged bend

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

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



CAUTION

Critical speed of reverse rotation

Increased vibrations!

- 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.



NOTE

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

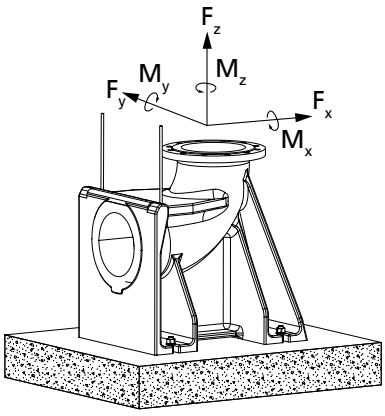


Fig. 7: Permissible flange loads

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Table 16: Permissible flange loads

Nominal flange diameter	Forces [N]				Moments [Nm]			
	F_y	F_z	F_x	$\sum F$	M_y	M_z	M_x	$\sum M$
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.

Fastening the mounting bracket

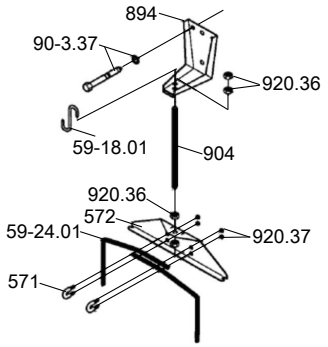


Fig. 8: Fitting the mounting bracket

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.
   Lightly tighten nut 920.36, allowing sufficient play for subsequently tensioning the guide wire.

Inserting the guide wire

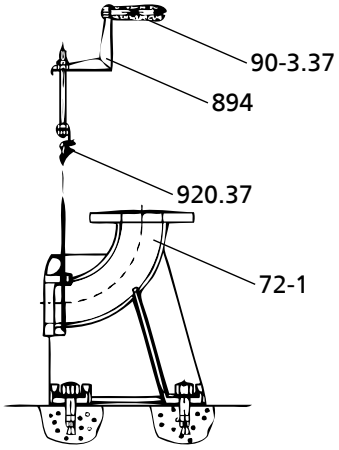


Fig. 9: Inserting the guide wire

1. Lift clamping piece 571 and insert one end of the guide wire.
2. Run wire 59-24.01 around flanged 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 nuts 920.37.
4. Pull the wire taut by tightening nuts 920.36 on the upper side of the mounting bracket. Observe the guide wire tension as specified in the table below.
5. Use a second nut to lock in position.
6. Either coil the excess wire at guide wire suspension bracket 572 or cut it off. Tape the wire ends to prevent them from fraying.
7. Attach hook 59-18.01 to mounting bracket 894 for attaching the lifting chain / lifting rope at a later stage.

Table 17: Guide wire tension

Size	Tightening torque M_A	Wire tension P
	[Nm]	[N]
80-...	14	6000
100-...	14	6000
150-...	14	6000

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5.3.1.4 Fitting the guide rail arrangement

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.

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

Table 18: Guide rail dimensions

Size	Outside diameter	Wall thickness[8]	
	[mm]	Minimum	Maximum
		[mm]	[mm]
80-...	60,3	2	5
100-...	60,3	2	5
150-...[9]	60,3	2	5

Fastening the mounting bracket

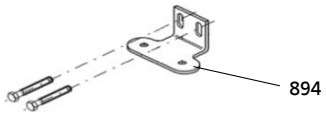


Fig. 10: Fastening the mounting bracket

✓ The hole pattern for the anchor bolts has been observed as illustrated above.

1. Fasten mounting bracket 894 to the edge of the sump opening with steel anchor bolts 90-3.37 and tighten the anchor bolts. Observe a tightening torque of 10 Nm.

Fitting the guide rails (twin guide rail arrangement)

CAUTION

Improper installation of the guide rails

Damage to the guide rail arrangement!

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

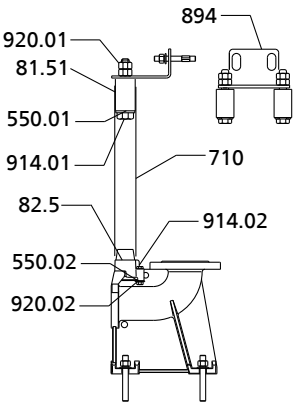


Fig. 11: Fitting two guide rails

1. Position adapter 82.5 on flanged bend 72.1 and fasten it with hexagon socket head cap screws 914.02, discs 550.02 and nuts 920.02.

8 To DIN 2440/2442/2462 or equivalent standards
9 Only with twin guide rail arrangement

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). Take 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 until the clamping sleeves expand so that they clamp the rails at the inside rail diameter.
7. Secure nut 920.01 with a second nut.

5.3.1.5 Preparing the pump set

Fastening the claw for twin guide rail arrangement

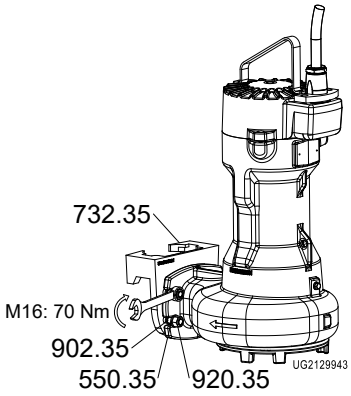


Fig. 12: Fastening the claw for twin guide rail arrangement

1. Fasten claw 732.35 to the discharge flange with studs 902.35, discs 550.35 and nuts 920.35. Observe a tightening torque of 70 Nm.
2. Insert profile seal 410 for sealing flanged bend 72-1 into the opening of claw 732.35.

Attaching the lifting chain / lifting rope

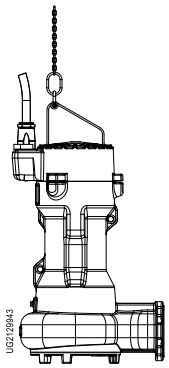


Fig. 13: Attaching the lifting chain / lifting rope for stationary wet installation

1. Attach the lifting chain with shackle or the lifting rope to the handle of the pump set.
   ⇨ This achieves a forward inclination of the pump set towards the discharge nozzle. This inclination allows the claw to hook onto flanged bend 72-1.

Transportable wet-installed model

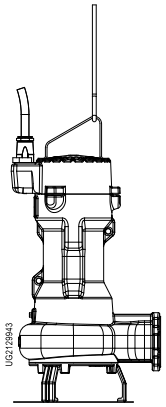
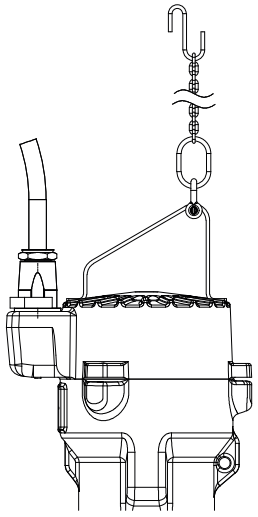


Fig. 14: Attaching the lifting chain / lifting rope for transportable wet installation

1. Remove hexagon socket head cap screws 914.26 at the handle.
2. Turn the handle around.
3. Fit the handle with hexagon socket head cap screws 914.26 and apply thread locking agent Loctite type 243.
4. Tighten hexagon socket head cap screws 914.26. Observe a tightening torque of 20 Nm.
5. Attach the lifting chain with shackle or the lifting rope to the handle of the pump set.
   ⇨ This achieves a vertical position of the pump set.

Table 19: Types of attachment

Drawing	Type of fastening	
 UG2129977	**Shackle with chain at the pump casing**	
	59-17	Shackle
	59-18.01	Hook
	885	Lifting chain / lifting rope

5.3.1.6 Installing the pump set

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 until the pump set attaches itself to flanged bend 72-1.
2. Attach the lifting chain / lifting rope to hook 59-18.01 at the mounting bracket.

5.3.2 Transportable wet-installed model

Fitting the pump feet

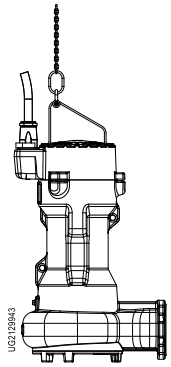


Fig. 15: Fitting the pump feet

1. Undo screws 914.03.
2. Push pump feet 182 into the openings in the suction cover.
3. Tighten screws 914.03 again. Observe the tightening torques. (⇨ Section 8.6, Page 79)

Fitting the foot plate

1. Fit the foot plate to the three pump feet with bolts/screws, discs and nuts. Observe the tightening torques. (⇨ Section 8.6, Page 79)

Attaching the lifting chain / lifting rope

1. Attach the lifting chain / lifting rope to the shackle on the discharge nozzle side of the pump set. See the above illustration and the **Types of attachment** table. (⇨ Section 5.3.1.5, Page 34)

Connecting the piping

The DIN connection is suitable for connecting rigid or flexible pipes.

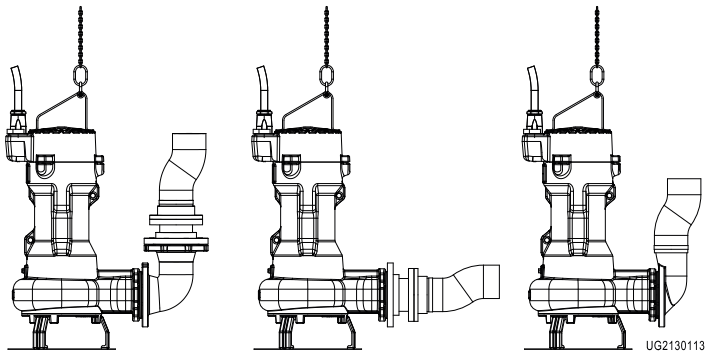


Fig. 16: Connection options

5.4 Information for planning the control system



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 mm² is required.

For the electrical connection of the pump set observe the wiring diagram.
(⇨ Section 10.4, Page 87)

The pump set can be connected to electrical low-voltage grids with rated voltages and voltage tolerances to IEC 60038. Observe the permissible tolerances.

5.4.1 Starting method

The pump set is intended for a continuous power supply and exclusively for direct starting.

The pump is started up by connecting the digital input connections. The digital input connections are guided out of the pump set in the power cable of the pump set.

5.4.2 Setting the overload protection device

1. Protect the pump set against short circuit with a suitable back-up fuse or a motor protection switch compliant with IEC 60947 and the local regulations.
2. Use an overload protection device with a suitable tripping current or set the motor protection switch to the rated current in deragging process. For the rated current in deragging process see the name plate. (⇨ Section 4.4, Page 18)

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5.4.3 Level control



CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

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

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

5.4.4 Operation on a frequency inverter



CAUTION

Operating the pump set on an upstream frequency inverter

Damage to the electronic system!

- ▷ Never operate the pump set on an upstream frequency inverter.

The pump set is fitted with an integrated electronic system and not suitable for operation on an upstream frequency inverter. Always connect the pump set directly to the power supply network.

5.4.5 Sensors



DANGER

Operating an incompletely connected pump set

Damage to the pump set!

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



CAUTION

Incorrect wiring

Damage to the sensors!

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

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

For information on wiring and conductor identification refer to the wiring diagram.
(⇨ Section 10.4, Page 87)

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5.4.6 Motor temperature

DANGER

Insufficient cooling

Explosion hazard!

Winding damage!

- ▷ Never operate a pump set without operational temperature monitoring equipment.

The temperature is monitored by an electric circuit with two series-connected bimetal switches and a configured alarm relay. The electric circuit is routed through cores 7 and 8 of the power cable (maximum 250 V AC / 0.25 A or 30 V DC / 2 A).

If a malfunction or excessive winding temperature occurs, the circuit opens. Tripping must result in the pump set cutting out. Automatic re-starting is permitted.

5.4.7 Leakage inside the motor

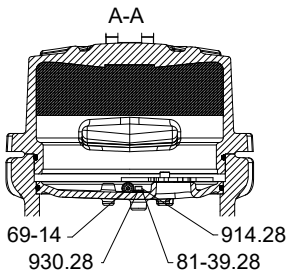


Fig. 17: Wiring of the electrode relay

An electrode (B2) fitted inside the motor monitors the winding space for leakage[10)]. The electrode is intended for connection to the integrated electronic system (terminal P1-10). If water ingress is detected, the alarm relay opens and the pump set stops.

Every time water ingress has tripped the alarm relay, the pump set must be checked:

- Check the power cable. (⇨ Section 8.2.1.2, Page 69)
- Measure the insulation resistance. (⇨ Section 8.2.1.3, Page 69)

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10 Optional

5.5 Connection to power supply



DANGER

Electrical connection work by unqualified personnel

Danger to life from electric shock

- Always have the electrical connections installed by a trained electrician.
- Observe regulation IEC 60364 as well as the applicable regional regulations.



DANGER

Unintentional start-up

Danger to life from electric shock!

- Disconnect the pump set from the mains before carrying out any maintenance and installation work.
- Prevent the pump set from being re-started unintentionally when carrying out any maintenance and installation work.



DANGER

Incorrect connection

Explosion hazard!

- The connection point of the cable ends must be located outside hazardous areas or in an area approved for electrical equipment.



DANGER

Operating an incompletely connected pump set

Damage to the pump set!

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



DANGER

Connection of damaged electric cables

Danger of death from electric shock!

- Check the electric cables for any damage before connecting them.
- Never connect damaged electric cables.
- Replace damaged electric cables.



WARNING

Incorrect connection to the mains

Damage to the power supply network, short circuit!

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

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CAUTION

Improper routing of electric cables

Damage to the electric cables!

- ▹ 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.

CAUTION

Overloading of the pump set

Damage to the pump set!

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

CAUTION

Flow-induced motion

Damage to the power cable!

- ▹ Run the power cable upwards without slack.

For electrical connection observe the wiring diagram (⇨ Section 10.4, Page 87) and the information for planning the control system (⇨ Section 5.4, Page 37).

The pump set is supplied with a power cable. Connect all marked cores.

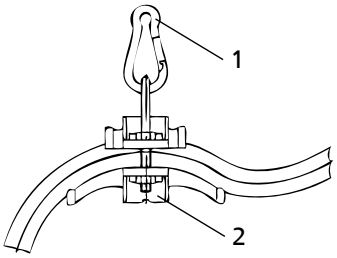


Fig. 18: Fastening the power cable

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

Potential equalisation

DANGER

Incorrect connection

Explosion hazard!

- ▹ The connection point of the cable ends must be located outside hazardous areas or in an area approved for electrical equipment.



DANGER

Touching the pump set during operation

Electric shock!

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

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

Setting for different mains types



NOTE

The pump set is generally supplied for connection to TN/TT systems. As an option, a pump set can be ordered to be pre-configured for IT systems.

If a pump set that has not been pre-configured for IT systems is to be used in an IT system, adjust the connection as follows:

1. Disconnect the pump set from the power supply.
2. Undo hexagon socket head cap screws 914.01.
3. Remove cover 160.
4. Remove the bridges from terminal blocks P10 and P12.
   (⇨ Section 10.4.2, Page 88)
5. Mount cover 160. Fit and tighten hexagon socket head cap screws 914.01. Observe the tightening torques. (⇨ Section 8.6, Page 79)

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning / start-up



DANGER

Fluid level too low

Explosion hazard!

Damage to the pump set!

- ▷ 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 enter the pump casing.
- ▷ For continuous duty S1 the minimum fluid level (R_3/R_4) must be observed. (⇨ Section 6.2.5.2, Page 47)
- ▷ For intermittent duty S3 the minimum fluid level (R_1/R_2) must be observed. (⇨ Section 6.2.5.2, Page 47)

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 49)

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6.1.2 Start-up



DANGER

Persons in the tank during pump set operation

Danger to life from electric shock!

- ▹ Never switch on the power supply of the pump set when persons are in the tank.



CAUTION

Re-starting while motor is still running down

Damage to the pump set!

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



CAUTION

Start-up against a closed shut-off element

Damage to the pump set!

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

✓ The minimum fluid level (R3/R4) has been met.

1. Fully open the shut-off element in discharge line.
2. Switch on the power supply / pump set.
3. If required, adjust the duty type and setpoint using the KSB ServiceTool.
4. Connect/close the digital input with 24 V auxiliary voltage of the pump set.
   ⇨ The pump set starts up.

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6.2 Operating limits



DANGER

Non-compliance with operating limits

Damage to the pump set!

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

6.2.1 Application limits

In submerged condition the pump set is suitable for S1 duty (continuous duty) without any restrictions.

In non-submerged condition the pump set is either suitable for S1 duty (continuous duty) or exclusively for S3 duty (intermittent duty), depending on its size. For operation outside the fluid observe the minimum water level.
(⇨ Section 6.2.5.2, Page 47)

The relative duty cycle in S3 duty (intermittent duty) is restricted, depending on the size.

Table 20: Relative duty cycle in S3 duty (intermittent duty)

Size	P_2 [kW]	Relative duty cycle
D080-180	2,2	-
D080-180	4,0	-
D080-230	5,5	40 %, 10 minutes
D080-230	7,5	30 %, 10 minutes
D100-180	2,2	-
D100-180	4,0	-
D100-230	5,5	50 %, 10 minutes
D100-230	7,5	30 %, 10 minutes
D150-230	2,2	-
D150-230	4,0	70 %, 10 minutes
D150-230	5,5	50 %, 10 minutes

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6.2.2 Frequency of starts



CAUTION

Excessively high frequency of starts

Damage to the motor!

- ▷ Check the cable entry and the check valve.

More than 60 starts per hour indicate a hydraulic error in the system. The control system of the pump set will emit a warning.

6.2.3 Operation on the power supply network



CAUTION

Non-compliance with permissible supply voltage tolerances

Damage to the pump set!

- ▷ Never operate a pump (set) outside the specified range.

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

6.2.4 Operation at reduced speed



CAUTION

Pumping solids-laden fluids at reduced speed

Increased wear and clogging!

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

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6.2.5 Fluid handled

6.2.5.1 Fluid temperature

CAUTION

Danger of freezing!

Damage to the pump set!

- ▷ Drain the pump set or protect it against freezing.

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

Refer to the maximum permissible fluid temperature and ambient temperature indicated on the name plate and/or in the data sheet. (⇨ Section 4.4, Page 18)

6.2.5.2 Minimum level of fluid handled

CAUTION

Fluid level below the specified minimum

Damage to the pump set by cavitation!

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

The pump set is ready for operation when the fluid level has reached dimension R_1, R_2, R_3 or R_4 (see outline drawing).

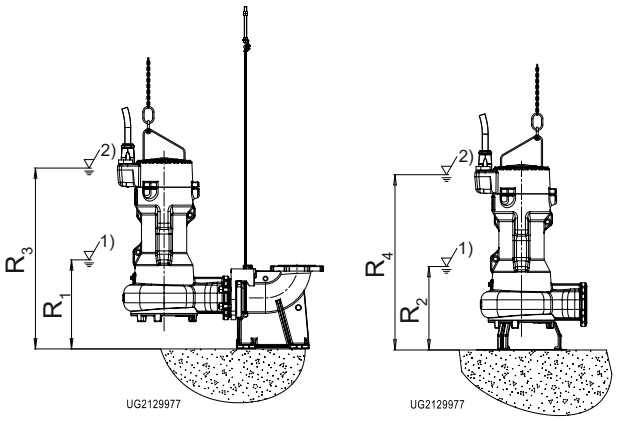


Fig. 19: Minimum fluid level

1)	Duty type S3 (maximum immersion depth 25 m / outside of fluid, minimum water level R_1 / R_2)
2)	Duty type S1 (maximum immersion depth 25 m / outside of fluid, minimum water level R_3 / R_4)

6.2.5.3 Density of the fluid handled

CAUTION

Impermissibly high density of the fluid handled

Motor overload!

- ▷ Observe the information about fluid density in the data sheet.
- ▷ Make sure the motor has sufficient power reserves.

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

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown



DANGER

Electrical connection work by unqualified personnel

Danger to life from electric shock

- Always have the electrical connections installed by an electrically qualified person.



WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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



WARNING

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

Risk of injury!

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



CAUTION

Danger of frost/freezing

Damage to the pump set!

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

The pump (set) remains installed.

✓ The minimum fluid level for the functional check run of the pump set has been met. (⇨ Section 6.2.5.2, Page 47)

1. During prolonged shutdown, start up the pump set manually or automatically via an adjustable cycle in the KSB ServiceTool once a month to once every three months and let it run for a short period of time. (⇨ Section 7.2.6, Page 58)

   ⇨ Deposits inside the pump and in its immediate intake area are prevented.

Removing and storing the pump (set)

✓ All safety regulations are observed. (⇨ Section 8.1, Page 66)

1. Clean the pump set.
2. Preserve and store the pump set. (⇨ Section 3.3, Page 15)

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6.4 Returning to service



⚠ WARNING

Failure to re-install or re-activate protective devices

Risk of injury from moving parts or escaping fluid!

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



NOTE

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

For returning the pump set to service, observe the instructions on commissioning/start-up. (⇨ Section 6.1, Page 43)

Refer to and comply with the operating limits. (⇨ Section 6.2, Page 45)

For returning the pump set to service after storage also follow the instructions for maintenance/inspection. (⇨ Section 8.2, Page 69)

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7 Operation

7.1 Information on settings



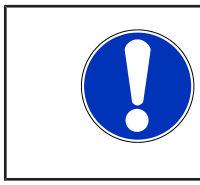
NOTE

The KSB ServiceTool is available for free from the corresponding web site.
(⇨ Section 4.7, Page 21)

The pump set is parameterised and monitored via the KSB ServiceTool. In addition, a parameterisation cable (see accessories) and a computer with USB interface are required.

7.2 Functions

7.2.1 Starting up/stopping the pump set



NOTE

The standard configuration the pump set is supplied in does not allow automatic operation of the pump set when it is connected to mains voltage. For starting up the pump set the digital input (DI) has to be correctly connected and closed.

Parameter 1-2-1 **Start - Stop** is factory-set to **On**. The pump set is started or stopped via the digital input (DI).

Settings

Starting up/stopping via digital input (DI)

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 1-2-1 **Start - Stop** to **On**.
2. Set parameter 3-3-1-1-1 **Digital input 1 function** to System start.
3. Close the digital input.[11)].
   ⇨ The pump set starts up.

Starting up/stopping via the KSB ServiceTool

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-3-1-1-1 **Digital input 1 function** to **Deactivated**.
   ⇨ The system now only starts up via parameter 1-2-1 **Start - Stop**.

Table 21: Parameter overview

Parameter	Description	Possible settings	Factory setting
1-2-1	Start - Stop	▪ Off ▪ On	On
3-3-1-1-1	Digital input 1 function	▪ Deactivated ▪ System start	System start

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11 The digital input (DI) can also be permanently activated. In this case the pump set will only be started/stopped via parameter 1-2-1.

7.2.2 Speed adjustment

NOTE

Standard pump sets are factory-set to maximum speed. In the case of pre-configured pump sets, the speed is pre-set to the speed specified in the purchase order.

The pump set runs at a pre-set speed.
The pre-set speed remains constant also in the event of load changes during operation. If the maximum permissible flow rate is exceeded, the speed falls.

The pump set speed can be set to a speed between the minimum speed n_{min} and maximum speed n_{max}.

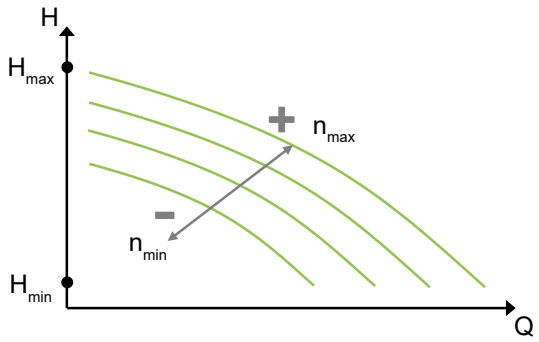


Fig. 20: Speed adjustment function

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set the required speed via parameter 1-2-2-1 **Speed setpoint**.
   ⇨ The HQ behaviour of the pump set changes.

Table 22: Parameter overview

Parameter	Description	Possible settings	Factory setting
1-2-2-1	Speed setpoint	Minimum speed to maximum speed	Maximum speed

7.2.3 Ramps

The pump sets has got 3 different ramps:

- Start ramp
- Stop ramp
- Operating ramp (parameterisable)

The control system autonomously manages the start ramp and stop ramp. The start ramp and stop ramp can not be parameterised.

To avoid spontaneous changes during normal operation the operating ramp limits the change velocity of the speed. During normal operation the motor responds to a setpoint change of the pump controller with maximum dynamic. When the pump set starts up/stops, the dynamic is limited. This limitation serves to prevent pressure surges during start-up, for example, or to enable a softer closing process of a check valve when stopping the pump set.

The operating ramp controls the pump set between the minimum and maximum permissible speed. The operating ramp can be set via parameters 3-2-1-1 and 3-2-1-2.

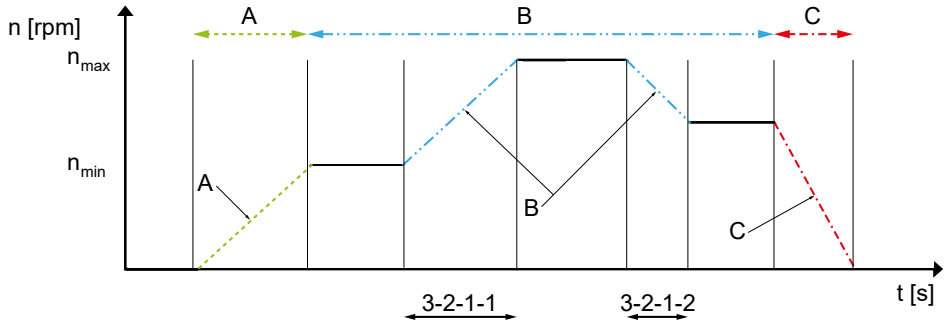


Fig. 21: Influence of the operating ramp on the speed

A	Start ramp
B	Operating ramp
C	Stop ramp

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set the **acceleration ramp** via parameter 3-2-1-1.
   ⇨ This determines the acceleration for reaching the required setpoint.
2. Set the **deceleration ramp** via parameter 3-2-1-2.
   ⇨ This determines the deceleration for reaching the required setpoint.

Table 23: Parameter overview

Parameter	Description	Possible settings	Factory setting
3-2-1-1	Acceleration ramp	20 - 500 rpm/s	500 rpm/s
3-2-1-2	Deceleration ramp	20 - 500 rpm/s	500 rpm/s

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7.2.4 Relay output

NOTE

Parameter 3-3-2-1-1 **Relay output function** is factory-set to **Alert**.

The volt-free relay (NC contact) of the pump set provides feedback on the current operating status of the pump set. The behaviour of the relay, trip delay (**Time delay On**) and re-set delay (**Time delay Off**) can be set.

The following illustration shows the behaviour of the relay with the following settings:

- Parameter 3-3-2-1-1 (Relay output function): Alert
- Parameter 3-3-2-1-2 (Time delay On): 5 seconds
- Parameter 3-3-2-1-3 (Time delay Off): 10 seconds

The NC contact of the relay opens 5 seconds after an alert has been detected (t0 + 5 seconds). If no alert is present any more, the NC contact closes after 10 seconds (t1 + 10 seconds).

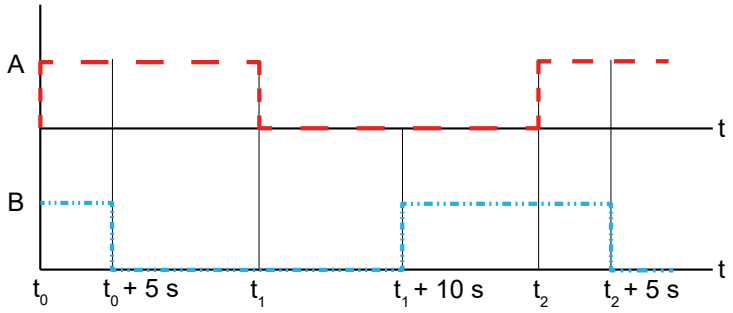


Fig. 22: Relay output function

A	Alert	B	NC contact

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-3-2-1-1 **Relay output function** to the required setting.
2. Set parameter 3-3-2-1-2 **Time delay On**.
   ⇨ This specifies the time until the relay trips after an alert state has occurred.
3. Set parameter 3-3-2-1-3 **Time delay Off**.
   ⇨ This specifies the time until the relay is reset after the alert state has been cleared.

Controlling the pump by switching the power supply on and off



NOTE

Standard pump sets are factory-set for continuous power supply. The pump is started up via the digital input (DI).

Using the power supply to start up the pump is not recommended.

Conditions on site may require the pump set to be started up/stopped via the power supply.
The relay output can be connected to the control circuit of upstream contactors. In the event of an alert, this will cause the power supply to be switched off.

When the power supply is off, the relay output will automatically return to its starting position. The power supply will start up again immediately.
To prevent continuous repetition of uncontrolled starting/stopping of the pump set the relay output can be set via parameter 3-3-2-1-1 **Relay output function** to **Interrupts power supply**.

If an alert is present, the pump will not be started up. In its settings the pump set recognises repeated interruptions of the power supply. When an alert is present, another opening of the alarm relay is prevented.
The time until the alarm relay trips again is delayed. The delay time doubles with each interruption of the power supply.
The delay time is between 10 seconds and 30 minutes. If no alert is present any more, the delay time is reset to 10 seconds.

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-3-2-1-1 **Relay output function** to **Interrupts power supply**.
   ⇨ The delay time for resetting the relay output is activated.

Table 24: Parameter overview

Parameter	Description	Possible settings	Factory setting
3-3-2-1-1	Relay output function	▪ Deactivated ▪ Alert ▪ No alert ▪ Interrupts power supply	Alert
3-3-2-1-2	Time delay On The time until the relay trips after an alert state has occurred	0.0 – 10.0 seconds	0.0 seconds
3-3-2-1-3	Time delay Off The time until the relay is reset after the alert state has been cleared.	0.0 – 10.0 seconds	1.0 second

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7.2.5 Deragging process



⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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



NOTE

Parameter 3-1-1-2 **Automatic deragging** is factory-set to **Automatic**.



NOTE

If parameter 3-1-1-1 **Manual deragging** is set to **On** or parameter 3-1-1-2 **Automatic deragging** is set to **Automatic and after idle period**, deragging is also activate when the pump has not started. Such settings may result in the starting up of the pump set.



NOTE

The deragging process can be stopped manually at any time via the KSB ServiceTool. To do so, go to the selected setting, parameter 3-1-1-1 **Manual deragging** or parameter 3-1-1-2 **Automatic deragging** and set it to **Off**. For pump sets that have been started up via the digital input, the digital input can be opened to stop **Automatic deragging** triggered by clogging.



NOTE

If deragging causes the pump set to heat up excessively, the deragging process is stopped. A higher-priority derating (power reduction) process is subsequently initiated. The speed is reduced until the operating temperature has fallen again.

Fluids with a high solids or fibre content may cause deposits in the hydraulic system of the pump set. Deposits/clogging influence the operation or prevent starting up of the pump set. The deragging process prevents deposits from forming, thus ensuring a reliable, low-maintenance operation.

The deragging process comprises 2 phases:

- 1st phase: The direction of rotation of the pump set is clockwise.
- 2nd phase: The direction of rotation of the pump set is anti-clockwise (normal operation).

At the start of each phase the pump set accelerates to a factory-set speed.
The pump set runs at this speed until the time set in parameter 3-1-1-4 **Deragging duration** has passed.
After this time, the pump set stops for the period set in parameter 3-1-1-5 **Stop time duration** until the 2nd phase begins.

The procedure keeps repeating. The number of repetitions depends on the type of deragging process selected.

Settings

Manual deragging

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set the required number of deragging cycles via parameter 3-1-1-9 **Deragging cycles**.
2. Set parameter 3-1-1-1 **Manual deragging** to **On**.
   ⇨ The pump set carries out the number of deragging cycles set in parameter 3-1-1-9 **Deragging cycles**.
   ⇨ Parameter 3-1-1-1 **Manual Deragging** is automatically set to **Off**.
   ⇨ The pump set keeps running in normal operation.

Automatic deragging

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-1-1-2 **Automatic deragging** to **Automatic**.
   ⇨ If deposits/clogging are detected, the pump set will start the deragging process as often as necessary to remove the deposits/clogging.
   ⇨ The pump set keeps running in normal operation.

Automatic deragging and after idle period

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set the idle period via parameter 3-1-1-3 **Idle period for deragging**.
2. Set the required number of deragging cycles via parameter 3-1-1-9 **Deragging cycles**.
3. Set parameter 3-1-1-2 **Automatic deragging** to **Automatic and after idle period**.
   ⇨ If deposits/clogging are detected, the pump set will start the deragging process as often as necessary to remove the deposits/clogging.
   ⇨ If the pump set has not been started up for the set idle period, the pump set carries out the number of deragging cycles set in parameter 3-1-1-9 **Deragging cycles**.
   ⇨ The pump set keeps running in normal operation.

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Limiting the current input for the deragging process



NOTE

To ensure an effective deragging process limiting the current input via the factory setting is not recommended.

To ensure an efficient deragging process the torque at the impeller of the pump set is increased (boosted deragging). The increased torque means that the current input $I_{deragging}$ (maximum rated current in deragging process) clearly exceeds the rated current I_n.
If the conditions on site require the current input during the deragging process to be limited, the current input can be limited via parameter 3-1-1-10 **Limit deragging current**.

Parameter 3-1-1-10 **Limit deragging current** is factory-set to 2.0. The factor 2.0 doubles the current input during the deragging process.

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-1-1-10 **Limit deragging current**.
   ⇨ The current input in the deragging process is limited.

Table 25: Parameter overview

Parameter	Description	Possible settings	Factory setting
3-1-1-1	Manual deragging Manual activation and deactivation of the deragging process	▪ Off ▪ On	Off
3-1-1-2	Automatic deragging Activation and deactivation of the deragging process	▪ Off ▪ Automatic ▪ Automatic and after idle period	Automatic
3-1-1-3	Idle period before deragging If the pump set has not been started up for the period specified, the deragging process starts.	0 - 168 hours	0 hours
3-1-1-4	Deragging duration Runtime of pump set during deragging process at the pre-set speed	0 - 60 seconds	5 seconds
3-1-1-5	Stop time duration Time until the pump set stops in deragging process	0 - 60 seconds	5 seconds
3-1-1-9	Number of deragging cycles Number of deragging cycles, if **Manual deragging** or **Automatic and after idle period** is activated	1 - 100	10
3-1-1-10	Limit deragging current Permissible overcurrent in deragging process	1,0 - 2,0	2,0

7.2.6 Functional check run



⚠ WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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



NOTE

The functional check run remains active, even when the digital input (DI) of the pump set is not connected. The pump set starts up automatically.

After prolonged shutdown, the pump set can be started up automatically via an adjustable cycle in the KSB ServiceTool. Short-time operation of the pump set prevents seizing of the impeller.
The functional check run is factory-set to Deactivated.

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 3-1-2-1 **Function** to **On**.
2. Set the idle time until the next automatic functional check run via parameter 3-1-2-2 **Waiting time**.
3. Set the runtime of the pump for the functional check run via parameter 3-1-2-3 **Runtime**.

Table 26: Parameter overview

Parameter	Description	Possible settings	Factory setting
3-1-2-1	Function Activating/deactivating the functional check run	▪ Off ▪ On	Off
3-1-2-2	Waiting time If the pump set has not been started up during the set time, a functional check run will be carried out.	0 - 168 hours	168 hours
3-1-2-3	Runtime Runtime of the pump set during functional check run at minimum speed	1 – 10 seconds	5 seconds

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7.2.7 Maintenance interval



NOTE

The maintenance interval is not factory-set.

The maintenance interval can be adjusted via the KSB ServiceTool.
When the operating hours of the pump set exceed the maintenance interval, information message I10 is output.

Parameter 1-4-1-1 shows the time remaining until the set maintenance interval.
When the message is acknowledged, it continues to appear in the list of pending messages. (⇨ Section 7.2.12, Page 62)

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 1-4-1-2 **Maintenance interval**.
2. To reset the maintenance interval, e.g. after maintenance has been completed, select parameter 1-4-1-3 **Resetting the maintenance interval**.

Table 27: Parameter overview

Parameter	Description	Possible settings	Factory setting
1-4-1-1	Time until pump set maintenance	Referenced to parameter 1-4-1-2	-
1-4-1-2	Maintenance interval pump set	0 – 168 months	0 months
1-4-1-3	Resetting the maintenance interval	Run	-

7.2.8 Monitoring

The monitoring parameters show the current status of the pump set, input interfaces / output interfaces, meters and general information on hardware and firmware. The parameters can be seen in the KSB ServiceTool, menu 1 **Operation** and menu 4 **Information**.

Table 28: Parameter overview: Pump set status

Parameter	Description	Possible settings
1-1-1-1	Speed	0 to maximum speed
1-1-1-2	Pump status	▪ Stopped ▪ Running ▪ Deragging
1-1-2-1	Motor current	-
1-1-2-2	Motor voltage	-
1-1-2-3	Motor temperature	-
1-1-2-4	Electronic system temperature	-
1-1-2-5	IGBT temperature	-
1-1-4-2	Cause of pump stop	▪ No system start ▪ No digital input ▪ Active alert

Table 29: Parameter overview: Input interfaces / output interfaces

Parameter	Description	Possible settings
1-1-3-1	Status digital input 1	▪ Open ▪ Closed
1-1-3-2	Status relay output 1	▪ Open ▪ Closed

Table 30: Parameter overview: Pump unit meters

Parameter	Description	Possible settings / Note
1-3-1	Operating hours of the pump set	Indicates the time the pump set has been supplied with power
1-3-3	Number of pump starts	Counts all pump starts via the KSB ServiceTool or the digital input and the KSB ServiceTool
1-3-5	Operating hours of the motor	Indicates the time the motor has been running
1-3-7	Number of deragging procedures	Counts the deragging procedures that have been carried out
1-4-1-1	Time until pump set maintenance	Referenced to parameter 1-4-1-2

Table 31: Parameter overview: Information on hardware and firmware

Parameter	Description	Note
4-1	Serial number	Indicates the serial number of the pump set
4-2	Order number	Indicates the order number of the pump set
4-3	Software version	Indicates the software version of the pump set
4-4	Software revision	Indicates the software revision of the pump set
4-5	Parameter revision	Indicates the parameter revision of the pump set
4-6	Device type	Indicates the device type of the pump set

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7.2.9 Protective functions

The pump set has got different protective functions. They can be set via the KSB ServiceTool.

Examples of available protective functions:

- Protection against overheating
- Voltage monitoring
- Current monitoring
- Blocked pump rotor
- Detection of clogging and deragging (adjustable)
- Maintenance interval (adjustable)
- Protection against externally forced flow

Any faults will result in error messages (warnings and alerts).
(⇨ Section 7.2.12, Page 62)

7.2.10 Saving data

Key parameters are saved and will remain set after the power supply has been switched off or interrupted. The other parameters will be reset to factory settings.

The following parameters are saved:

Table 32: Parameter overview

Parameter	Description	Note
1-2-1	Start - Stop	-
1-2-2-1	Speed setpoint	-
1-4-1-2	Maintenance interval pump set	-
3-1-1	Deragging	Incl. all of the corresponding parameters
3-2-1	Ramps	Incl. all of the corresponding parameters
3-3-1	Digital input (DI)	-
3-3-2	Relay	Incl. all of the corresponding parameters

7.2.11 Test alert

For checking the alert behaviour (relay function and system behaviour) an alert state (test alert) can be triggered.

Settings

✓ The power supply for the pump set has been switched on.

✓ The information on settings has been observed. (⇨ Section 7.1, Page 50)

1. Set parameter 1-1-4-1 **Test alert** to **On**.
   ⇨ An alert is triggered. The KSB ServiceTool shows error message A70. (⇨ Section 7.2.12, Page 62)
   ⇨ The running pump set stops until the alert state has been cleared.
2. Deactivate the test alert in the KSB ServiceTool or interrupt and then re-establish the power supply.
   ⇨ The alert state is cleared. No error message is shown in the KSB ServiceTool any more.
   ⇨ The pump set re-starts.

Table 33: Parameter overview

Parameter	Description	Possible settings	Factory setting
1-1-4-1	Test alert	▪ Off ▪ On	Off

7.2.12 Error messages



⚠ WARNING

Automatic re-start after a fault has been remedied/acknowledged

Risk of injury by moving parts!

▷ Never reach into the suction nozzle/impeller.



NOTE

The pump set acknowledges alerts and warnings automatically. The alert state has to be cleared before the pump re-starts its normal operation.

The pump set outputs warnings and alerts as a sequence of numbers.

- The error code is shown in the KSB ServiceTool.
- In the event of an alert, the pump set stops or the motor stops.
- If the parameters are set accordingly, the general fault message relay will output a message.
- If the pump control system cannot re-start the pump set automatically, the pump set continuously remains in fault status.

Table 34: Information messages

Error code	Cause	Response
I10	Set maintenance interval for the pump set expired	Perform maintenance. (⇨ Section 8.2, Page 69)
I43	Clogging detected	Perform deragging process. (⇨ Section 7.2.5, Page 55)
I44	Deragging process active	Deragging process is carried out. (⇨ Section 7.2.5, Page 55)

Table 35: Warnings

Error code	Cause	Response
W16	Excessive number of pump starts (> 60 starts per hour)	Check the pump set and on-site system for any hydraulic faults.
W40	Pump unit rotor blocked	Pump unit attempts to deblock automatically.
W41	Pump set rotation in the direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout).
W42	Pump set rotation in the reverse direction of flow is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required.
W43	Excessive number of deragging procedures (> 30 deragging procedures per hour)	Check the fluid composition.
W47	Pump set overheated, derating (power reduction) active	Pump set is running at reduced speed until the operating temperature has fallen again.
W52	The motor temperature limit has been reached. The pump set is running at reduced speed.	Let the pump set cool down until the warning is acknowledged automatically. If, instead, the temperature keeps rising, alert A52 is shown in the KSB ServiceTool. Check the fluid temperature and ambient temperature and verify them against the data on the name plate. (⇨ Section 4.4, Page 18)

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Error code	Cause	Response
W53 W54	The temperature limit inside the pump set has been reached. / The pump set is running at reduced speed.	Let the pump set cool down until the warning is acknowledged automatically. If, instead, the temperature keeps rising, alerts A53 and/or A54 are shown in the KSB ServiceTool. Check the fluid temperature and ambient temperature and verify them against the data on the name plate. (⇨ Section 4.4, Page 18)
W86	Excessive pump set input power	Check the hydraulics of the system (system schematic / head).

Table 36: Alerts

Error code	Cause	Response
A22 A23 A24 A25	Critical electronics fault	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. If the alert is still active, replace cover 160 incl. electronics or contact KSB Service. For removing and fitting cover 160 incl. electronics see (⇨ Section 5.5, Page 40) .
A30 A32	Internal fault/incorrect parameters in hardware/ firmware	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. If the alert is still active, replace cover 160 incl. electronics or contact KSB Service. For removing and fitting cover 160 incl. electronics see (⇨ Section 5.5, Page 40) .
A40	Pump unit rotor blocked	Deblock it by cleaning the pump unit and/or system. After the contamination has been removed, re-start the pump unit.
A41 A42	Pump set rotation is caused by an externally forced flow.	Check the hydraulics of the system (system schematic / piping layout). Fit a check valve if required.
A52 A53 A54 A55	Excessive temperature inside the pump set / Pump set has been stopped.	Interrupt the power supply and let the pump set cool down. Verify the permissible temperature ranges of the fluid temperature and the ambient temperature against the data on the name plate.
A56	Malfunction of Pt100 resistance thermometer in the motor	Check the Pt100 resistance thermometer. (⇨ Section 8.2.1.4, Page 70)
A61	Supply voltage below the permissible limit.	Check the supply voltage and verify it against the data on the name plate. (⇨ Section 4.4, Page 18)
A62	Supply voltage above the permissible limit.	Check the supply voltage and verify it against the data on the name plate. (⇨ Section 4.4, Page 18)
A63	Mains voltage phase failure	Check the power supply and fuse elements.
A64	Overvoltage in the intermediate circuit of the frequency inverter	Check the supply voltage and verify it against the data on the name plate. (⇨ Section 4.4, Page 18) Check the hydraulics of the system (system schematic/piping layout) (pump set may be driven by externally forced flow).
A70	Test alert	Interrupt and re-establish the power supply, or deactivate the test alert. (⇨ Section 7.2.11, Page 61)

Error code	Cause	Response
A72	Humidity in the terminal box of the pump	Remove cover 160 incl. electronics. Check cable gland 834 and O-ring 412.01 or contact KSB Service. For removing and fitting cover 160 incl. electronics see (⇨ Section 5.5, Page 40) .
A81 A82 A83 A85	Motor fault	Disconnect the power supply for 1 minute. After 1 minute, re-connect the power supply. If the alert is still active, replace the pump set or contact KSB Service.

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7.3 Resetting to factory settings

The pump set can be reset to the factory settings via parameter 3-4-1.

Any settings made for the speed setpoint, input interfaces / output interfaces, ramps and functions will be reset to the factory settings.

7.4 Carrying out a firmware update



NOTE

A firmware update can only be carried out with the pump set stopped.

1. Stop the pump set.
2. Open the KSB ServiceTool.
3. Click on the **KSB device wizard** button.
4. Click on the **Operation and monitoring** button.
   ⇨ The connected **KSB AmaRex Pro DTM** pump set and the **KSB Communication DTM** communication interface will be shown in the project tree.
5. In the project tree right-click on **KSB Communication DTM**.
   ⇨ The context menu will be displayed.
6. Under menu item **Further functions** click on **Firmware update**.
   ⇨ The **Firmware update** window opens, and the latest available firmware is automatically selected.
7. Click on the **Start update** button.
   ⇨ When the update has been completed, all updated components are marked with a green tick.
8. To re-connect the pump set to the KSB ServiceTool click on the **KSB device wizard** button.
9. Click on the **Operation and monitoring** button.
   ⇨ The parameter view is displayed again.
10. Re-start the pump set.

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8 Servicing/Maintenance

8.1 Safety regulations



DANGER

Sparks produced during servicing work

Explosion hazard!

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



DANGER

Improperly serviced pump set

Damage to the pump set!

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



DANGER

Electrical connection work by unqualified personnel

Danger to life from electric shock

- Always have the electrical connections installed by an electrically qualified person.



DANGER

Improper lifting/moving of heavy assemblies or components

Danger to life from falling parts!

Damage to the pump set!

- Use suitable transport equipment, lifting equipment and lifting tackle to move heavy assemblies or components.
- 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.
- Maintain a safe distance during lifting operations (load may swing when being lifted).

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DANGER

Risk of falling when working at a great height

Danger to life by falling from a great height!

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



DANGER

Strong magnetic field in the pump rotor area

Danger of death for persons with pacemaker!

Interference with magnetic data carriers, electronic devices, components and instruments!

Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- Keep a safety distance of at least 0.3 m.



WARNING

Strong magnetic field in the pump rotor area

Danger of crushing injuries when pulling out the pump rotor!

The strong magnetic field can suddenly pull the pump rotor back into its original position!

Uncontrolled magnetic attraction forces between magnet-equipped components, tools or similar!

- The pump rotor must only be removed from the electronic system housing by authorised specialist personnel.
- Remove any magnetic parts from the vicinity of the rotor.
- Use appropriate personal protective equipment.
- Keep a safety distance of at least 0.3 m from electronic components.



WARNING

Unintentional starting of the pump set

Risk of injury by moving components and shock currents!

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



WARNING

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

Risk of injury! Damage to the submersible motor pump!

- Never insert your hands, other body parts or foreign objects into the impeller or impeller intake area.
- Always make sure the electrical connections are disconnected before checking whether the impeller rotates freely.



⚠ WARNING

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

Risk of injury!

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



⚠ WARNING

Hot surface

Risk of injury!

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



⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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



⚠ WARNING

Insufficient stability

Risk of crushing hands and feet!

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



NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.

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

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.

Never use force when dismantling and reassembling the pump set.

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8.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

Table 37: Overview of maintenance work

Maintenance interval	Maintenance work	See
Every 4000 operating hours; at least once a year	Checking the power cables	(⇨ Section 8.2.1.2, Page 69)
	Measuring the insulation resistance	(⇨ Section 8.2.1.3, Page 69)
	Visual inspection of the lifting chain / lifting rope	(⇨ Section 8.2.1.1, Page 69)
	Checking the sensors	(⇨ Section 8.2.1.4, Page 70)
	Changing the lubricant	(⇨ Section 8.2.2.1.4, Page 72)
	Checking the bearings	(⇨ Section 8.4.4, Page 75)
Every five years	General overhaul	-

8.2.1 Inspection work

8.2.1.1 Checking the lifting chain/rope

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

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

8.2.1.2 Checking the power cable



DANGER

Defective earth conductor

Electric shock!

▹ Never switch on a pump set with a defective earth conductor.

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.

8.2.1.3 Measuring the insulation resistance



NOTE

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

As part of annual maintenance work or each time the alarm relay has tripped by ingress of water the insulation resistance has to be checked.

✓ The pump set has been de-energised.

✓ An insulation resistance measuring device is available. The recommended measuring voltage is 500 V DC.

1. Connect all winding ends together. Measure the winding against earth.
2. Connect the 3 phases of the power cable together. Measure them against earth.

⇨ The insulation resistance must not be less than 1 MΩ.

8.2.1.4 Checking the sensors



CAUTION

Excessive test voltage

Damage to the sensors!

▷ Use a commercially available ohmmeter to measure the resistance.

The tests described below measure the resistance at the core ends of the power cable (⇨ Section 10.4.1, Page 87) and in the terminal box of the pump (⇨ Section 10.4.2, Page 88) . The actual function of the sensors is not tested in this process.

Bimetal switch in the motor

Table 38: Resistance measurement of the bimetal switches at the power cable

Measurement between cores ...	Electrical resistance
	[Ω]
7 and 8	< 1

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

Table 39: Resistance measurement of the bimetal switches in the terminal box of the pump

Measurement between terminals ...	Electrical resistance
	[Ω]
P3-1 and P3-2	< 1

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

Pt100 resistance thermometer in the motor

Table 40: Resistance measurement of Pt100 resistance thermometer in the motor

Measurement between terminals ...	Electrical resistance
	[Ω]
P3-4 and P3-5	90 < R < 150

The electrical resistance depends on the temperature of the motor winding. If the tolerances are exceeded, the motor section must be opened and overhauled. The temperature sensors are fitted in the stator winding and cannot be replaced.

Leakage sensor in the terminal box of the pump

Table 41: Resistance measurement of the leakage sensor in the terminal box of the pump

Measurement between terminals ...	Electrical resistance
	[kΩ]
P1-10 and earth conductor (PE)	> 60

Lower resistance values suggest water ingress into the motor. In this case, open the motor section and perform service. Check the cable gland and power cable for any damage and for tightness.

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8.2.2 Lubrication and lubricant change

8.2.2.1 Lubricating the mechanical seal



DANGER

Excessive temperatures at the shaft seal

Explosion hazard!

Damage to the pump set!

- ▷ 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.

8.2.2.1.1 Intervals

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

8.2.2.1.2 Lubricant quality



WARNING

Lubricant contaminating fluid handled

Hazard to persons and the environment!

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

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 42: Oil quality

Description	Properties	
Paraffin oil or white oil Alternative: motor oil grades SAE 10W to SAE 20W	Kinematic viscosity at 40 °C	<20 mm^2/s
	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 Womac Special White 24 made by HAFA
- Equivalent brands of medical quality, non-toxic
- Water/glycol mixture

8.2.2.1.3 Lubricant quantity

Table 43: Lubricant quantity

Rated power	Efficiency class	Number of motor poles	Lubricant quantity
			[l]
022	A	4	1,05
040	A	4	1,05
055	A	4	1,05
075	A	4	1,05

8.2.2.1.4 Changing the lubricant



⚠ WARNING

Lubricants posing a health hazard and/or hot lubricants

Hazard to persons and the environment!

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



⚠ WARNING

Excess pressure in the lubricant reservoir

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

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



NOTE

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 lubricant is severely contaminated by the fluid handled, this suggests a defect at the mechanical seals.

Draining the lubricant

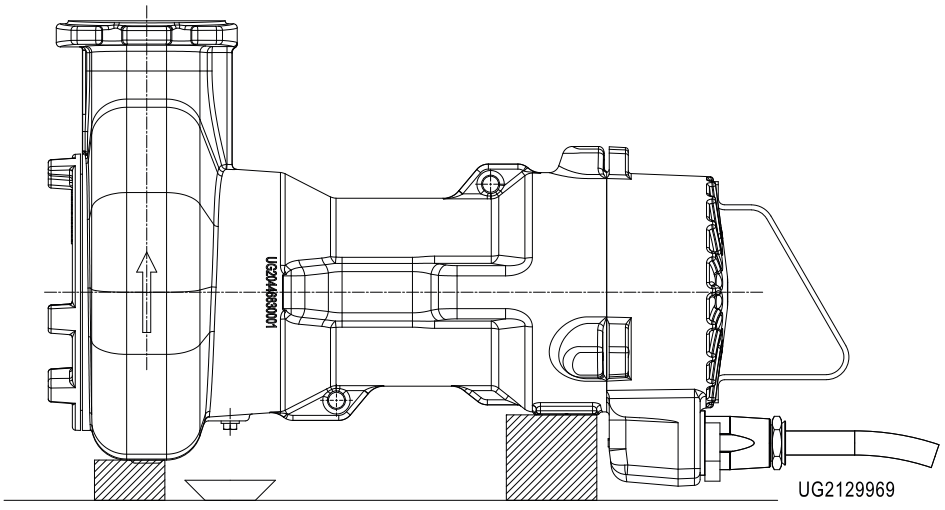


Fig. 23: Draining the lubricant

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1. Position the pump set as shown.
2. Place a suitable container for collecting the lubricant under the screw plug.
3. Undo screw plug 903 with joint ring 411 and drain off the lubricant.

Filling in the lubricant

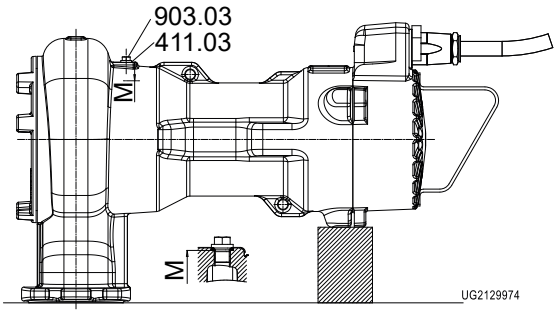


Fig. 24: Lubricant level

M	Optimum lubricant level

1. Position the pump set as shown.
2. Fill lubricant through the lubricant filler opening until the lubricant in the lubricant reservoir reaches the optimum lubricant level M (see the following table).
3. Screw in screw plug 903.03 with new joint ring 411.03. Observe a tightening torque of 23 Nm.

Table 44: Lubricant level

Rated power	Efficiency class	Number of motor poles	M
			[mm]
022	A	4	46
040	A	4	46
055	A	4	46
075	A	4	46

8.2.2.2 Lubricating the rolling element bearings

The pump set is equipped with grease-lubricated, maintenance-free rolling element bearings.

8.3 Drainage/cleaning



⚠ WARNING

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

Hazard to persons and the environment!

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

1. Always flush the pump if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the pump before transporting it to the workshop. Provide a certificate of decontamination for the pump set.
(⇨ Section 12, Page 91)

8.4 Dismantling the pump set

8.4.1 General information/Safety regulations



DANGER

Insufficient preparation of work on the pump (set)

Risk of injury!

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



WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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



WARNING

Unqualified personnel performing work on the pump (set)

Risk of injury!

- ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.



WARNING

Hot surface

Risk of injury!

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



WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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

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

8.4.2 Preparing the pump set

✓ The general information / safety regulations have been observed. (⇨ Section 8.4.1, Page 74)

1. De-energise the pump set and secure it against unintentional start-up.
2. Drain the lubricant. (⇨ Section 8.2.2.1.4, Page 72)
3. Drain the leakage chamber and leave it open for the duration of the disassembly.

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8.4.3 Dismantling the pump section

NOTE

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

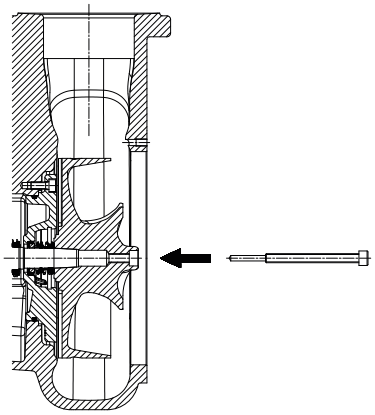


Fig. 25: Removing the impeller with a forcing screw

✓ The general assembly drawing is available and has been observed.

1. Remove suction cover 162.
2. Remove impeller fastening screw M8. The impeller/shaft connection is a tapered fit.
3. Screw the forcing screw into the M10 thread at the impeller hub as shown in the following illustration. Remove the impeller.

8.4.4 Removing the mechanical seal and motor section

✓ The oil has been drained. (⇨ Section 8.2.2.1.4, Page 72)

1. Slide primary ring 433.02 along the shaft.
2. Undo and remove screws 914.74.
3. Take off discharge cover 163.
4. Remove mating ring 433.02 from discharge cover 163.
5. Remove circlip 932.03.
6. Remove primary ring 433.01.
7. Remove circlip 932.08.
8. Remove the assembly consisting of bearing housing 350 and rotor 818.
9. Remove circlip 932.04.
10. Pull bearing housing 350 off the rolling element bearing.
11. Remove mating ring 433.01 from bearing housing 350.
12. Remove circlip 932.02.
13. Remove rolling element bearing 320.
14. Pull off rolling element bearing 321.01.

8.5 Reassembling the pump set

8.5.1 General information/Safety regulations



⚠ WARNING

Improper lifting/moving of heavy assemblies or components

Personal injury and damage to property!

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



CAUTION

Improper reassembly

Damage to the pump!

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

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.

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8.5.2 Reassembling the pump section

8.5.2.1 Installing 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+/-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. Push drive-end mechanical seal 433.01 on shaft 210 and secure it with circlip 932.03.
2. Insert O-ring 412.15 into discharge cover 163. Press the discharge cover into casing 100. Then fasten discharge cover 163 with screws 914.74.
3. Guide the 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.

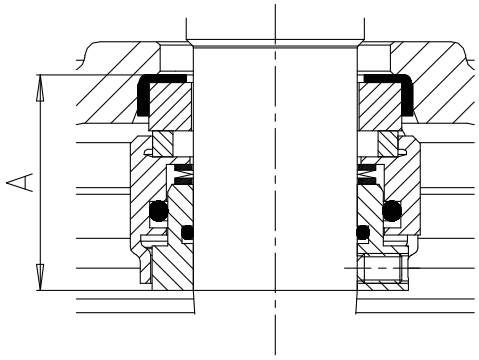


Fig. 26: Installation dimension A

Table 45: Installation dimension A

Size	Installation dimension A
	[mm]
All	29

8.5.2.2 Fitting the impeller

NOTE

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

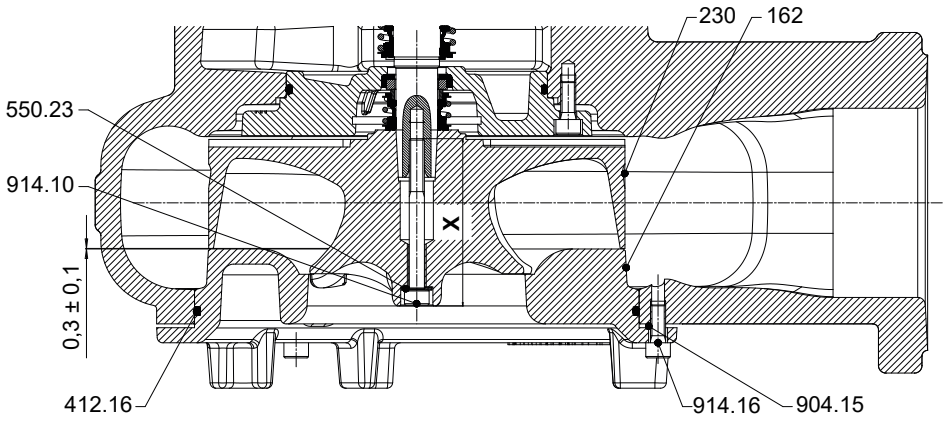


Fig. 27: Fitting the impeller, example impeller type D-max

✓ Transport equipment / lifting equipment are available.

1. Slide impeller 230 onto the shaft end and fasten it with impeller screw 914.10.
2. Remove hexagon socket head cap screws 914.10.
3. Screw in eyebolt M8[12)] instead of the hexagon socket head cap screw.
   ⇨ Observe the required minimum length of the eyebolt as indicated in the table below.
   ⇨ If a different bolt length is used, insert shims to establish contact with the impeller.
4. Tighten the eyebolt. Observe a tightening torque of 30 Nm maximum.
5. Push on suction cover 162 until it rests against impeller 230.
6. Suspend the pump set from eyebolt M8[12)] .
7. Screw in adjusting screws 904.15 until they abut against the pump casing.
8. Carefully place down the pump set.
9. Remove suction cover 162.
10. Measure the height adjusting screws 904.15 up to suction cover 162. Screw adjusting screws 904.15 in deeper by 0.3 +/- 0.1 mm.
11. Re-insert suction cover 162. Fasten it with hexagon socket head cap screws 914.16.
12. Suspend the pump set from the lifting equipment by the handle. Rotate impeller 230 by hand to check that it rotates easily.
13. Remove eyebolt M8[12)] .
14. Fit and tighten hexagon socket head cap screws 914.10. Observe a tightening torque of 30 Nm maximum.

Table 46: Required minimum length of the eyebolt depending on the suction nozzle

Suction nozzle DN	Required minimum length of eyebolt
	[mm]
80	100
100	90
150	130

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12 Not included in the scope of supply

8.5.3 Reassembling the motor section

NOTE

Before reassembling the motor section, verify that all parts are undamaged.

Replace damaged parts. Only original spare parts are permissible. Secure all screwed connections closing off the motor with a thread-locking agent (Loctite type 243).

8.5.4 Performing a leak test

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

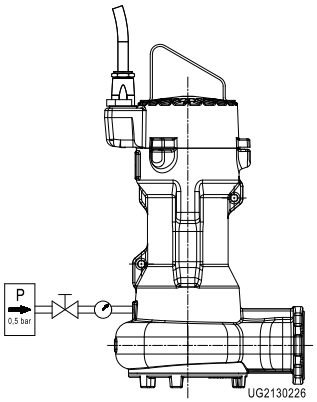


Fig. 28: Screwing in the testing device

1. Remove the screw plug incl. joint ring from 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 sealing elements and screwed connections.
   - ⇨ Repeat the leak test.
4. If the leak test has been successful, top up the lubricant.

8.5.5 Checking the connection of motor/power supply

Check the electric cables after reassembly. (⇨ Section 8.2.1, Page 69)

8.6 Tightening torques

Table 47: Tightening torques

Thread	[Nm]
M8	17
M10	35
Impeller screw M8	30
Screw plug 903.03	23

8.7 Spare parts stock

8.7.1 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 10.1, Page 84)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 48: Quantity of spare parts for recommended spare parts stock for 4000 operating hour or one year's continuous duty

Part No.	Description	Number of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
300	Bearings (set)	1	1	2	2	2	3	30 %
433	Mechanical seals (set)	1	1	2	2	2	3	30 %
412	O-rings (set)	1	1	2	2	2	3	30 %
900	Bolts/screws (set)	1	1	2	2	2	3	30 %

Table 49: Quantity of spare parts for recommended spare parts stock for 5 years' continuous duty

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	2	3	30 %
300	Bearings (set)	2	2	4	4	4	6	50 %
433	Mechanical seals (set)	2	2	4	4	4	6	50 %
412	O-rings (set)	2	2	4	4	4	6	50 %
834	Cable gland	1	1	2	2	2	3	30 %
900	Bolts/screws (set)	2	2	4	4	4	6	50 %

8.7.3 Spare parts sets

Table 50: Spare parts sets

Number of spare parts set		Part No.	Description
99-19	900	550.23	Disc
		592	Shim
		903.03	Screw plug
		904.15	Grub screw
		914.01/.04/.10/.16/.20/.26/.74/.83	Hexagon socket head cap screw
	412	411.03	Joint ring
		412.01/.02/.07/.15/.16/.47	O-ring
	433	433.01/.02	Mechanical seal
		932.03	Circlip
	300	320, 321.01/.02	Rolling element bearing
		932.02/.04	Circlip

9 Trouble-shooting



⚠ WARNING

Improper work to remedy faults

Risk of injury!

- ▷ 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.

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

F Error message in the KSB ServiceTool

Table 51: Trouble-shooting

A	B	C	D	E	F	Possible cause	Remedy
-	✗	-	-	-	-	Pump delivers against an excessively high pressure.	Re-adjust to duty point.
-	✗	-	-	-	-	Gate valve in the discharge line is not fully open.	Fully open the gate valve.
-	-	✗	-	✗	-	Pump running in off-design conditions (part load / overload)	Check the pump's operating data.
✗	-	-	-	-	-	Pump and/or piping not completely vented	Vent (lift the pump off the flanged bend and lower it again).
✗	-	-	-	-	-	Pump intake clogged by deposits	Clean the intake, pump components and lift check valve.
-	✗	-	✗	✗	-	Inlet line or impeller clogged	Remove deposits in the pump and/or piping.
-	-	✗	-	✗	-	Dirt/fibres in the clearance between the casing wall and impeller; sluggish pump rotor	Check whether the impeller can be easily rotated. Clean the impeller if required.
-	✗	✗	✗	✗	-	Wear of internal components	Replace worn parts by new ones.
✗	✗	-	✗	-	-	Defective riser (pipe and sealing elements)	Replace defective riser pipes. Replace sealing elements.
-	✗	-	✗	✗	-	Impermissible air or gas content in the fluid handled	Consult us.
-	-	-	-	✗	-	System-induced vibrations	Consult us.
-	✗	✗	✗	✗	-	Wrong direction of rotation	Check the electrical connection of the motor.
-	-	✗	-	-	-	Wrong supply voltage	Check the power cable and the cable connections. Check the voltage in the control cabinet.
✗	-	-	-	-	-	Motor is not running, no voltage.	Check the electrical installation and wiring of digital input 1. Contact the energy supplier.
✗	-	✗	-	-	-	Stator winding or power cable are defective.	Replace by new original spare parts or consult us.
-	-	-	-	✗	-	Defective rolling element bearing	Consult us.
-	✗	-	-	-	-	Water level lowered too much during operation	Check level control equipment.
✗	-	-	-	-	-	Temperature control device monitoring the winding has tripped the pump as a result of excessive winding temperatures.	The motor will restart automatically once it has cooled down.

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A	B	C	D	E	F	Possible cause	Remedy
✘	-	-	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
-	-	-	-	-	✘	See Error messages. (⇨ Section 7.2.12, Page 62)	See Error messages. (⇨ Section 7.2.12, Page 62)

10 Related Documents

10.1 General assembly drawings with list of components

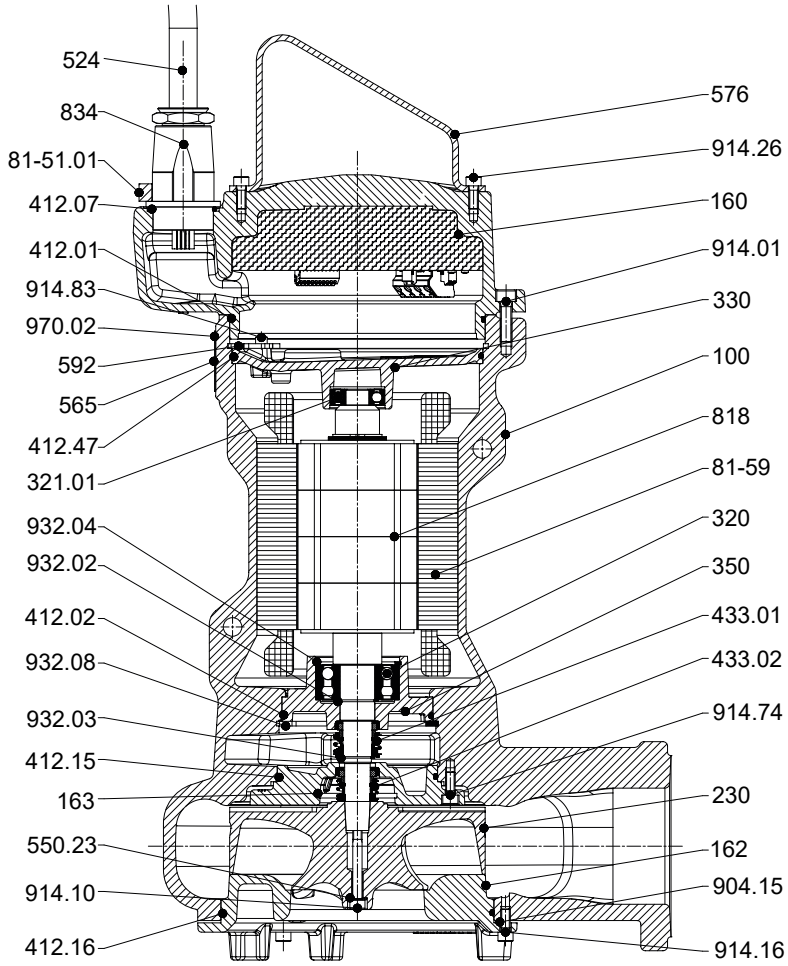


Fig. 29: General assembly drawing

Table 52: List of components

Part No.	Description	Part No.	Description
100	Casing	550.23	Disc
160	Cover	565	Rivet
162	Suction cover	576	Handle
163	Discharge cover	592	Plug
230	Impeller	81-51.01	Clamping element
320	Rolling element bearing	81-59	Stator
321.01	Radial ball bearing	818	Rotor
330	Bearing bracket	834	Cable gland
350	Bearing housing	904.15	Grub screw
412.01/.02/.07/.15/.16/.47	O-ring	914.01/.10/.16/.26/.74/.83	Hexagon socket head cap screw
433.01/.02	Mechanical seal	932.02/.03/.04/.08	Circlip
524	Shaft protecting sleeve	970.02	Label/plate

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10.2 Exploded view

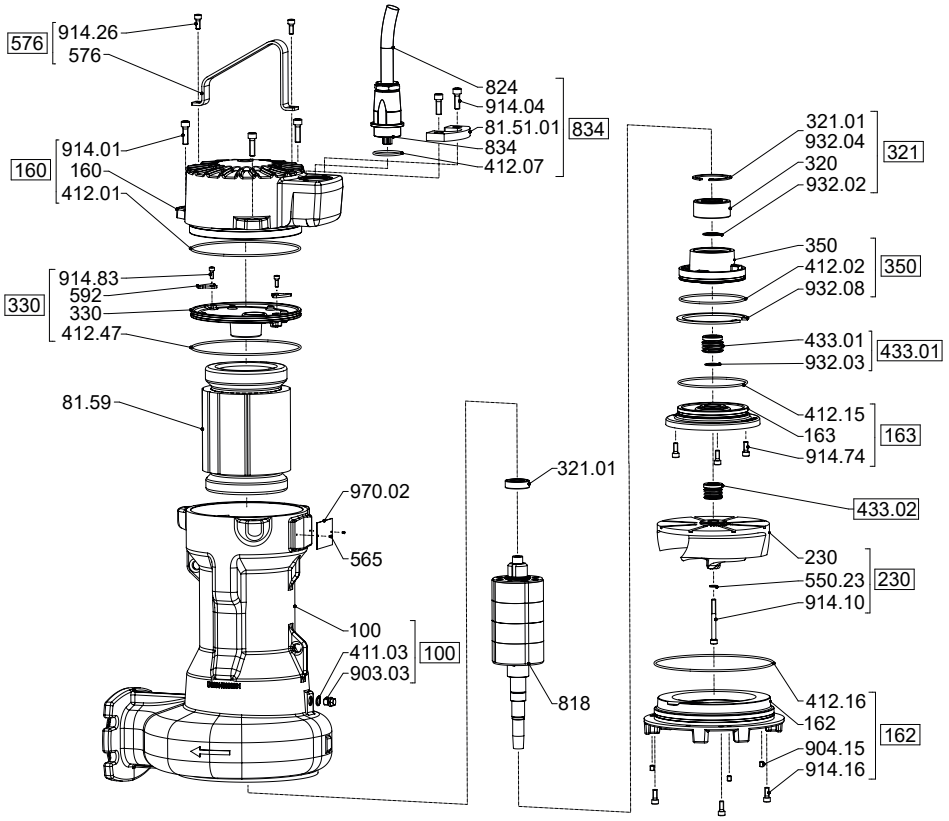
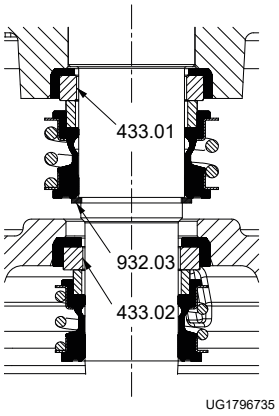
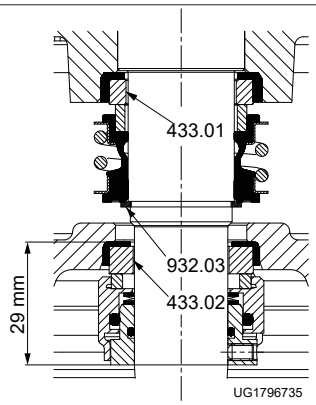


Fig. 30: Exploded view

10.3 Sectional drawings of the mechanical seal

Table 53: Sectional drawings of the mechanical seal

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

10.4 Wiring diagram

10.4.1 Power cable

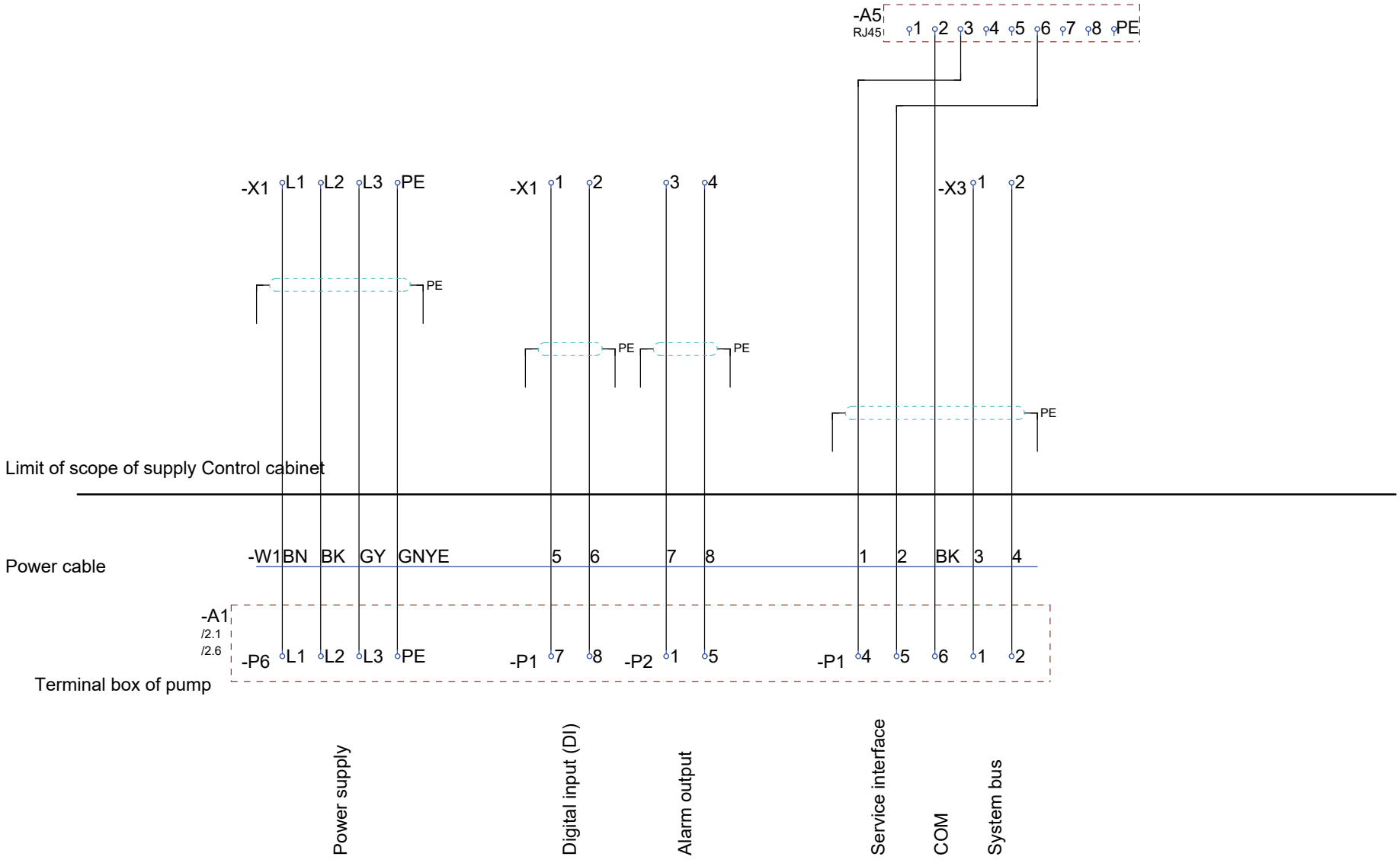


Fig. 31: Wiring diagram, power cable

10.4.2 Terminal board

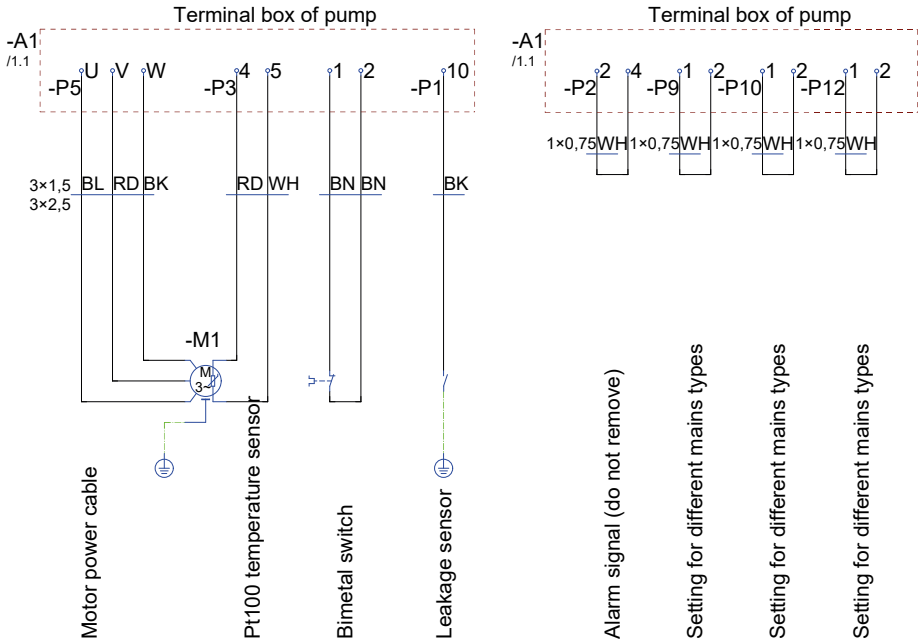


Fig. 32: Wiring diagram, terminal board

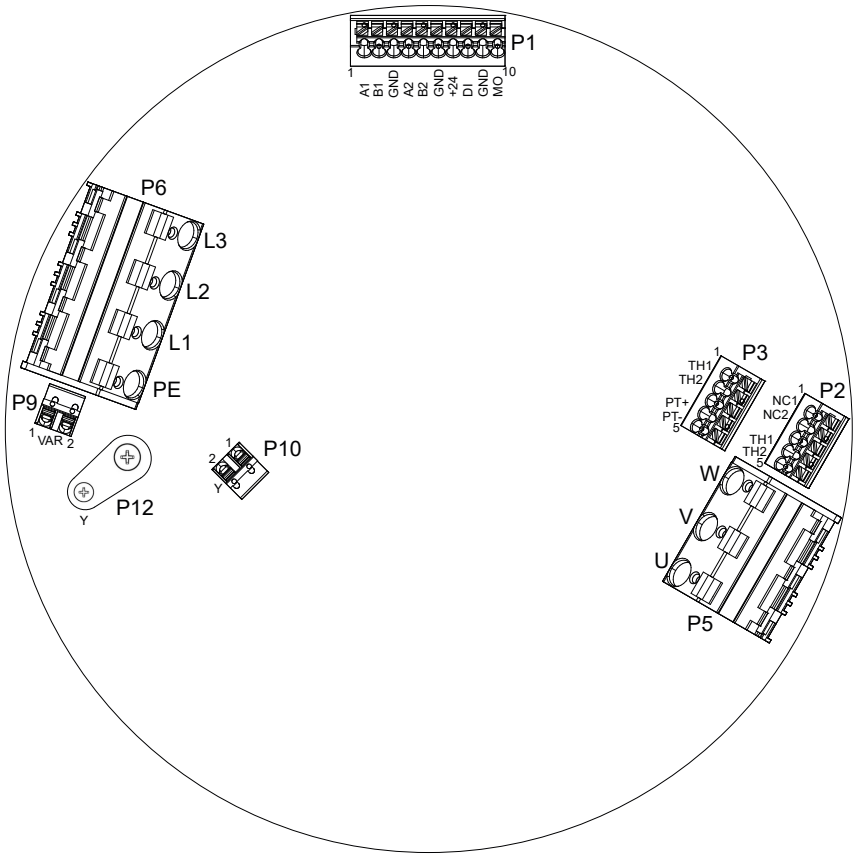


Fig. 33: Terminal board

Table 54: Connections on the terminal board

Terminal block	Connection number	Description of the connection	Function	Note
P1	1	A1	RS-485 A of system bus	For connection to a higher-level control system When the supplied power cable is used, the ground connection is not needed.
	2	B1	RS-485 B of system bus	
	3	GND	Ground of system bus	
	4	A2	RS-485 A of service interface	For parameterisation via service cable and PACTware
	5	B2	RS-485 A of service interface	
	6	GND	Ground of service interface	
	7	+24 V	Auxiliary voltage 24 V for activating the digital input (DI)	Always use a volt-free contact for the digital input.
	8	DI	Digital input 24 V	The function is parameterisable.
	9	GND	Ground	-
	10	MO	Internal connection for the leakage sensor	-
P2	1	NC1	Alarm relay output	If the software detects an error or if overheating occurs, the alarm output guided to the outside via the power cable emits an error message. The alarm relay and the bimetal switch have to be connected in series with a bridge between P2-2 and P2-4. The alarm output (NC contact) via the power cable is then effected via terminals P2-1 and P2-5
	2	NC2		
	3	-	-	
	4	TH1	Bimetal switch output	
	5	TH2		
P3	1	TH1	Internal connection of the bimetal switch	-
	2	TH2		
	3	-	-	-
	4	PT+	Internal connection of the Pt100 resistance thermometer	-
	5	PT-		
P5	-	U	Internal connection of the motor	-
	-	V		
	-	W		
P6	-	PE	Protective earthing	-
	-	L1	Connection for the power supply	-
	-	L2		
	-	L3		
P9	1	VAR	Setting for different mains types	TN/TT system: ▪ P9-1 and P9-2 bridged ▪ P10-1 and P10-2 bridged ▪ P12-1 and P12-2 bridged IT system: ▪ P9-1 and P9-2 bridged ▪ P10-1 and P10-2 not connected ▪ P12-1 and P12-2 not connected Test: ▪ P9-1 and P9-2 not connected ▪ P10-1 and P10-2 not connected ▪ P12-1 and P12-2 not connected
	2			
P10	1	Y		
	2			
P12	1	Y		
	2			

11 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 Pro
(ARX PRO)

KSB order number: KSB order number

- is in conformity with the provisions of the following directives / regulations as amended from time to time:
  - 2006/42/EC: Machinery Directive
  - 2014/30/EU: Electromagnetic Compatibility (EMC)

The manufacturer also declares that

- the following harmonised international standards have been applied:
  - EN ISO 12100:2010
  - EN 809:2012-10
  - EN 60529:1991/A1:2000-02
- the following international standards have been applied:
  - EN IEC 61800-3:2018
  - IEC 61800-5-1:2009
  - IEC TS 60034-30-2:2016

Person authorised to compile the technical file:

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

The EU Declaration of Conformity was issued in/on:

Place, date

.....[13)].....

Name

Function

Company
Address

13 A signed, legally binding EU Declaration of Conformity is supplied with the product.

12 Certificate of Decontamination

Type: .....

Order number /

Order item number[14]: .....

Delivery date: .....

Application: .....

Fluid handled[14]: .....

Please tick where applicable[14]:



☐ Corrosive



☐ Oxidising



☐ Flammable



☐ Explosive



☐ Hazardous to health



☐ Seriously hazardous to health



☐ Toxic



☐ Radioactive



☐ Bio-hazardous



☐ Safe

Reason for return:[14]: .....

Comments: .....

.....

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

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

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

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

☐ No special safety precautions are required for further handling.

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

.....

.....

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

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

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14 Required field

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