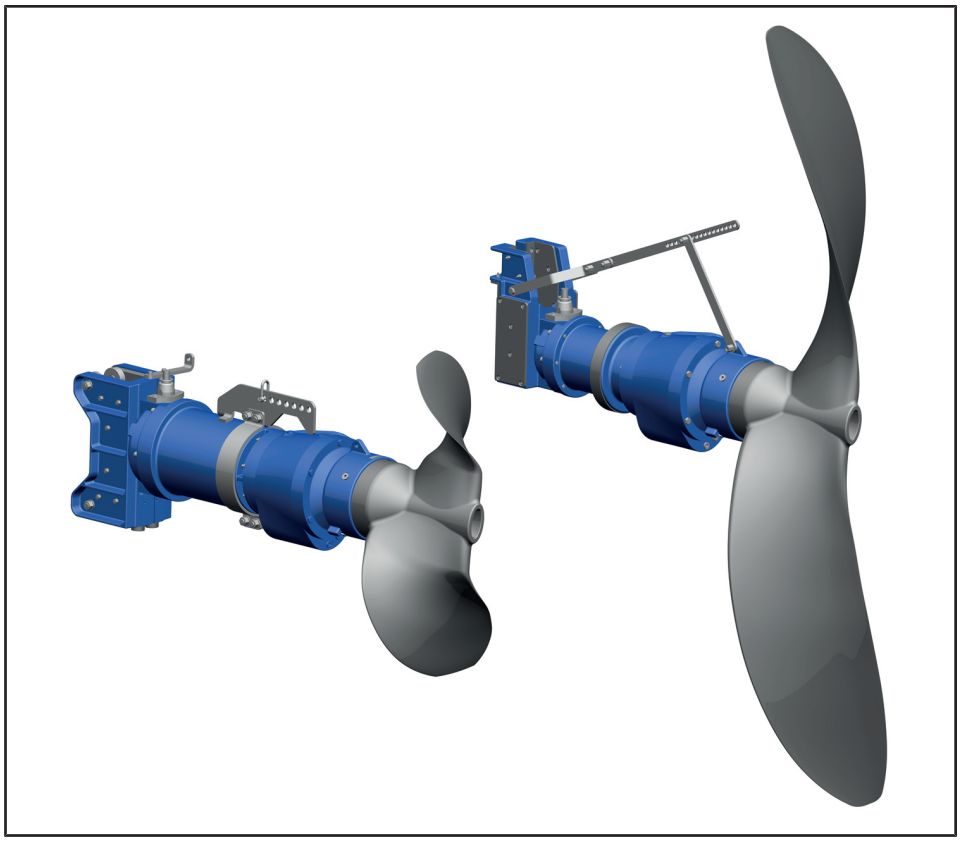
Submersible Mixer

Amaprop

Installation/Operating Manual



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Installation/Operating Manual Amaprop

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.

Fluid

In accordance with the intended use of the submersible mixer, the term "fluid" (also referred to as the fluid handled) refers to the fluid the mixer is operated in, i.e. generally municipal or industrial waste water and sludges. The fluid is described in greater detail by means of the gas and solids content, the content and length of fibrous substances, its chemical composition and temperature.

Submersible mixer

Submersible mixers are mixing units with open axial propeller hydraulics and an air-filled motor.

1 General

1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

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 submersible mixer and serve as identification for all further business processes.

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

1.2 Installation of partly completed machinery

To install partly completed machinery supplied by 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.

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Data sheet	Description of technical data
General arrangement drawing / outline drawing	Description of mating and installation dimensions
General assembly drawing[1)]	Sectional drawing
Sub-supplier product literature[1)]	Operating manuals and other product literature describing accessories and integrated machinery components
Spare parts lists[1)]	Description of spare parts
List of components[1)]	Description of components

1.5 Symbols

Table 2: 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

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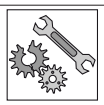
1 If agreed to be included in the scope of supply

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

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

2 Safety

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 submersible mixer must only be operated within the operating limits described in the other applicable documents.
- Only operate submersible mixers which are in perfect technical condition.
- Do not operate partially assembled submersible mixers.
- Only use the submersible mixer in the fluid described in the data sheet or product literature.
- Never operate the submersible mixer without fluid.
- Observe the minimum fluid levels indicated in the data sheet or product literature (to prevent overheating, bearing damage, cavitation damage, etc.).
- Consult the manufacturer about any use or mode of operation not described in the data sheet or product literature.

2.3 Personnel qualification and training

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

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

Deficits in knowledge must be rectified by sufficiently trained specialist personnel training and instructing the personnel who will carry out the respective tasks. If required, the operator can commission the manufacturer/supplier to train the personnel.

Training on the submersible mixer must always be supervised by technical specialist personnel.

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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

- 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.)
- Take suitable precautions to prevent persons from coming near the propeller when the submersible mixer is running.
- It is strictly prohibited for any person to enter the tank while the submersible mixer is running.

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the submersible mixer are only permitted with the manufacturer's prior consent.
- Use only original spare parts or parts authorised by the manufacturer. The use of other parts can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Carry out work on the submersible mixer during standstill only.
- The submersible mixer must have cooled down to ambient temperature.
- When taking the mixer out of service always adhere to the procedure described in the operating manual.
- Decontaminate submersible mixers used in fluids posing a health hazard.
- As soon as the work has been completed, re-install and/or re-activate any safety-relevant and protective devices. Before returning the product to service, observe all instructions on commissioning.

2.8 Unauthorised modes of operation

Never operate the submersible mixer outside the limits stated in the data sheet and in this manual.

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The warranty relating to the operating reliability and safety of the submersible mixer supplied is only valid if the mixer is used in accordance with its intended use.

2.9 Explosion protection

DANGER

Always observe the information on explosion protection given in this section when operating the product in potentially explosive atmospheres.

Sections of the manual marked by the Ex symbol apply to explosion-proof submersible mixers also when temporarily operated outside of potentially explosive atmospheres.

Only submersible mixers marked as explosion-proof **and** identified as such in the data sheet must be used in potentially explosive atmospheres.

Special conditions apply to the operation of explosion-proof submersible mixers to EU Directive 2014/34/EU (ATEX).
Especially adhere to the sections in this manual marked with the Ex symbol.
The explosion-proof status is only assured if the product is used in accordance with its intended use.
Never operate the product outside the limits stated in the data sheet and on the name plate.
Prevent impermissible modes of operation at all times.
Correct monitoring of the winding temperature is imperative.

2.9.1 Repair

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

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

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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 or the supplying dealer and the insurer about the damage in writing immediately.

3.2 Fitting the lifting bail

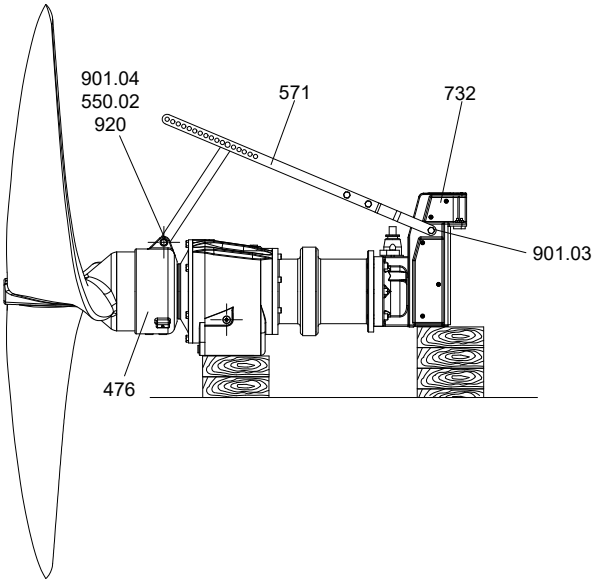

Fig. 1: Fitting the lifting bail

The mixer normally comes with the lifting bail 571 already fitted in centre of gravity position.

1. Position the submersible mixer as shown.
2. Fit the lifting bail to guide bracket 732 using hexagon head bolts 901.03.
3. Use hexagon head bolt 901.04, disc 550.02 and nuts 920 to fasten the lifting bail to mating ring holder 476.

3.3 Lifting rope

For lifting/lowering with lifting equipment, the lifting rope can also be attached directly at the attachment point. It can remain attached during operation.

3.4 Lifting hook

	NOTE
	Lifting hooks can only be used in low-viscosity substrates.

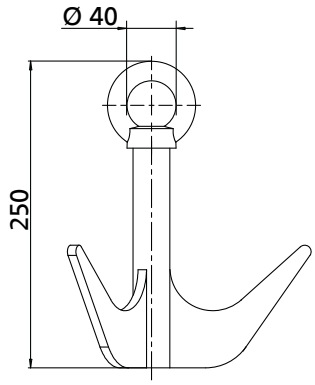

Fig. 2: Lifting hook

The lifting hook has a maximum load-carrying capacity of 500 kg.

For lifting/lowering with a lifting hook, the lifting hook is attached to the lifting rope of the lifting equipment (crane) with a shackle.

3.5 Adjusting the attachment point

The correct attachment point must be selected in order to ensure reliable installation and problem-free lifting and lowering of the submersible mixer on the submersible mixer stand.

Amaprop 1000

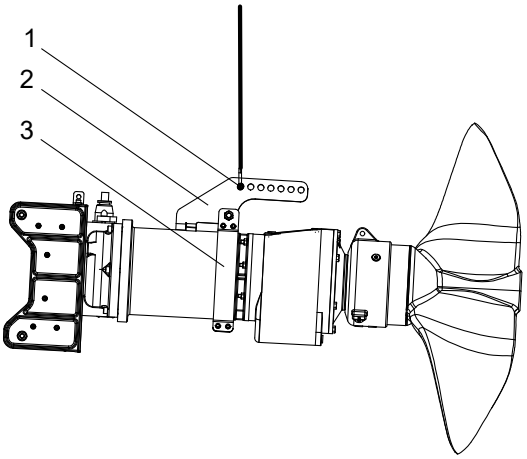

Fig. 3: Adjusting the attachment point for Amaprop 1000

1	Attachment point	2	Supporting strap
3	Supporting clamp		

To ensure problem-free lifting and lowering, the mixer must be slightly inclined when suspended by the supporting strap (lower end = propeller end). If the angle deviates from the requirements, the attachment point must be corrected.

Correcting the attachment point:

The supporting clamp is mounted at the factory as shown; its position must not be changed.
The correct attachment point is set by selecting the correct hole in the supporting strap (first hole of the supporting strap counted from the guide rail side).

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Amaprop 1200 - 2500

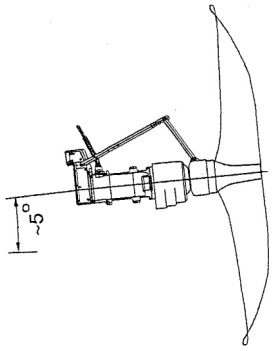

Fig. 4: Inclination angle approx. 5°

For trouble-free lifting and lowering, an inclination angle of approx. 5° must be maintained (higher end = propeller end) when the mixer is suspended by the lifting bail. If the angle deviates from the requirements, the attachment point must be corrected.

Correcting the attachment point:

1. Slightly loosen bolts 901.03 on guide bracket 732 and bolt 901.04 on mating ring carrier 476.
2. Undo the upper screwed connection on the lifting bail.
3. Select the correct hole in the lifting bail, depending on the required inclination of the mixer.

CAUTION

Loose or insufficiently tight screw connections

Damage to the installation parts during operation

- ▹ Observe the tightening torques.

4. Re-tighten all bolts. (⇨ Section 7.6, Page 49)
5. Perform attachment procedure again.

⇨ If the angle of inclination is approx. 5°, the correct centre of gravity position has been found.

3.6 Transport

DANGER

Improper transport

Danger to life from falling parts!

Damage to the submersible mixer!

- ▹ Use the attachment point provided on the lifting bail for attaching lifting accessories.
- ▹ Never suspend the submersible mixer by its power cable.
- ▹ Never use the chains or lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied.
- ▹ Securely attach the lifting ropes or chains to the submersible mixer and crane.

Transport the submersible mixer as shown.

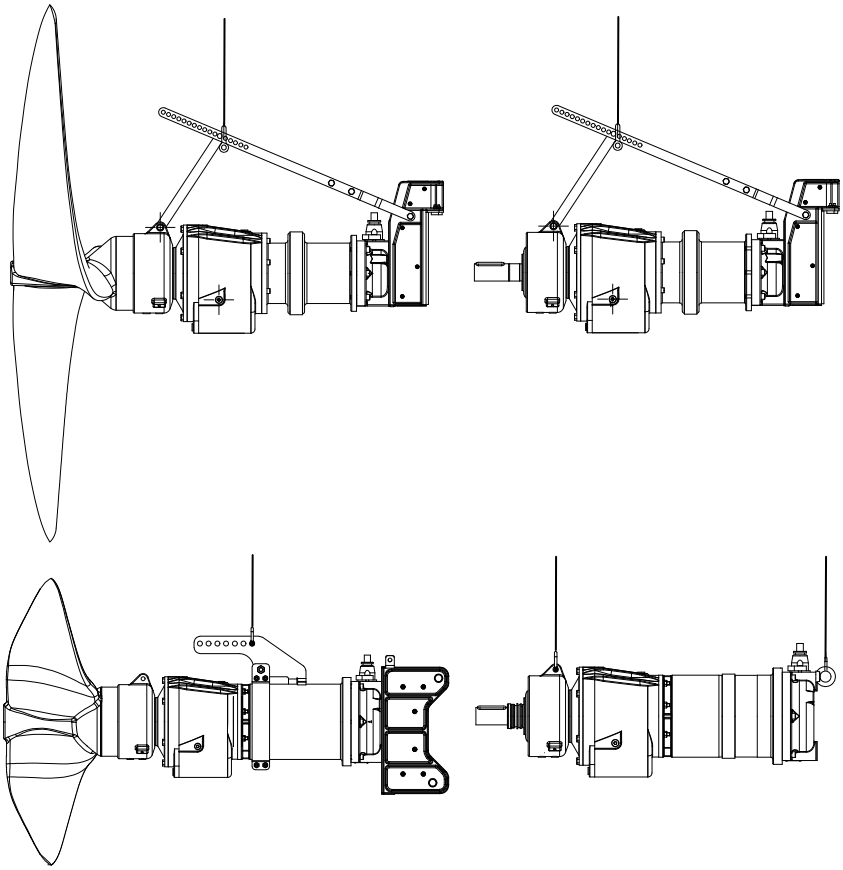

Fig. 5: Transporting the submersible mixer

3.7 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 power cable! ▷ Support the power cable at the cable entry to prevent permanent deformation. ▷ Only remove the protective caps from the power cable at the time of installation.

	**CAUTION** **Damage during storage by humidity, dirt or vermin** Corrosion/contamination of the submersible mixer! ▷ For outdoor storage cover the (packed or unpacked) submersible mixer and accessories with waterproof material.

- Store the submersible mixer under dry and vibration-free conditions and, if possible, in its original packaging.

Table 4: Ambient conditions for storage

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

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3.8 Return to supplier

1. Always flush and clean the submersible mixer, particularly if it has been used in noxious, explosive, hot or other hazardous fluids.
2. If the submersible mixer has been used in fluids leaving residues which might lead to corrosion damage when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the submersible mixer must also be neutralised and treated with anhydrous inert gas for drying purposes.
3. Always complete and enclose a certificate of decontamination when returning the submersible mixer.
   Always indicate any safety and decontamination measures taken.

NOTE

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

3.9 Disposal

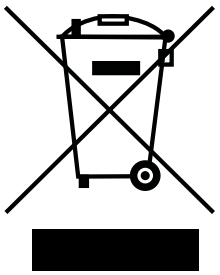
⚠ WARNING

Fluids posing a health hazard

Hazard to persons and the environment!

- ▷ Submersible mixers used in fluids posing a health hazard must be decontaminated.
- ▷ Collect and properly dispose of flushing liquid and any liquid residues.
- ▷ Wear safety clothing and a protective mask, if required.
- ▷ Observe all legal regulations on the disposal of harmful substances.

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



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

Contact your local waste disposal partner for returns.

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

4 Description

4.1 General description

- Submersible mixer

Submersible mixer with self-cleaning propeller for handling municipal or industrial waste water and sludges, as well as for use in biogas systems.

4.2 Product information

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

For information as per chemicals Regulation (EC) No 1907/2006 (REACH), see http://www.ksb.com/reach.

4.3 Designation

Example: Amaprop V 042 2500 / 5 4 UPG IE3

Table 5: Designation key

Code	Description	
Amaprop	Type series	
V	Axial propeller material	
	V	Composite material
42	Nominal speed of the axial propeller [rpm]	
2500	Size / nominal diameter of the axial propeller [mm]:	
	1000, 1200, 1400, 1600, 1800, 1801, 2000, 2200, 2500	
5	Motor size	
	11, 15, 22	Amaprop 1000
	1, 2, 3, 4, 5, 7	Amaprop 1200 to 2500
4	Number of motor poles	
UP	Motor variant	
	UP	Non-explosion-proof, for fluid temperatures of up to 40 °C
	YP	Explosion-proof ⟨Ex⟩ II2G Ex db h IIB T4 Gb, for fluid temperatures of up to 40 °C
G	Casing material	
	G	Grey cast iron
IE3	Motor efficiency classification[2)]	
	[3)]	No efficiency classification
	IE3	Premium Efficiency

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2 IEC 60034-30 standard not binding for submersible mixers. Efficiencies calculated/determined according to the measurement method specified in IEC 60034-2. The marking is used for submersible mixers that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.

3 Blank

4.4 Name plate

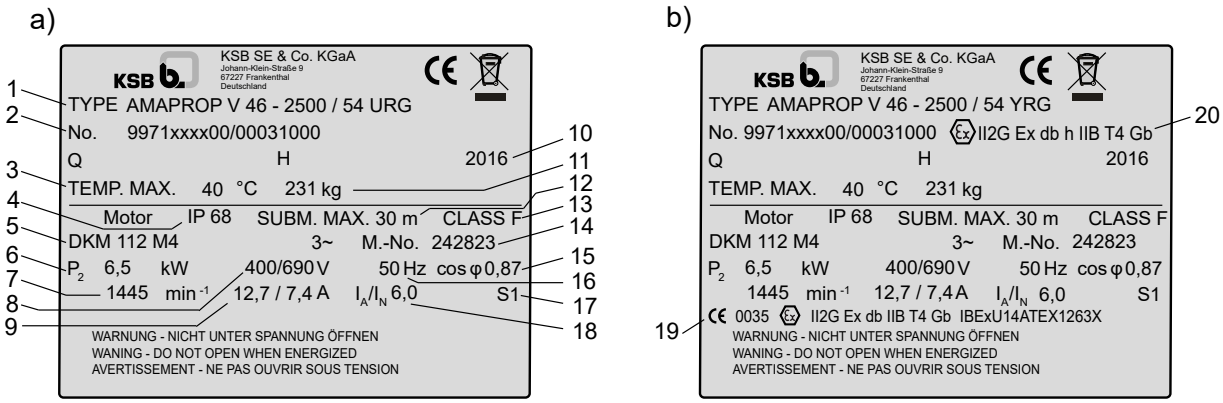

Fig. 6: Name plate (example) a) Standard submersible mixer, b) Explosion-proof submersible mixer

1	Designation	2	KSB order number,KSB order item number and consecutive number
3	Maximum fluid temperature and ambient temperature	4	Enclosure
5	Motor type	6	Rated power
7	Nominal propeller speed	8	Rated voltage
9	Rated current	10	Year of construction
11	Total weight	12	Maximum submergence
13	Thermal class of winding insulation	14	Motor number
15	Power factor at rated operating point	16	Rated frequency
17	Duty cycle	18	Starting current ratio
19	ATEX marking for the submersible motor	20	Marking for explosion-proof submersible mixers

4.5 Design details

Design

- Fully floodable submersible mixer
- Horizontal installation

Axial propeller

- Self-cleaning ECB propeller

Drive

- Three-phase asynchronous squirrel-cage motor
- Motors integrated in explosion-proof submersible mixers are supplied in Ex db IIB Gb type of protection.

Shaft seal

- Two bi-directional mechanical seals in tandem arrangement, with liquid reservoir
- Additional leakage chamber between the seat ring holder and the gear unit

Bearings

- Grease-packed rolling element bearings sealed for life in motor
- Oil-lubricated rolling element bearings in gear unit

4.6 Configuration and function

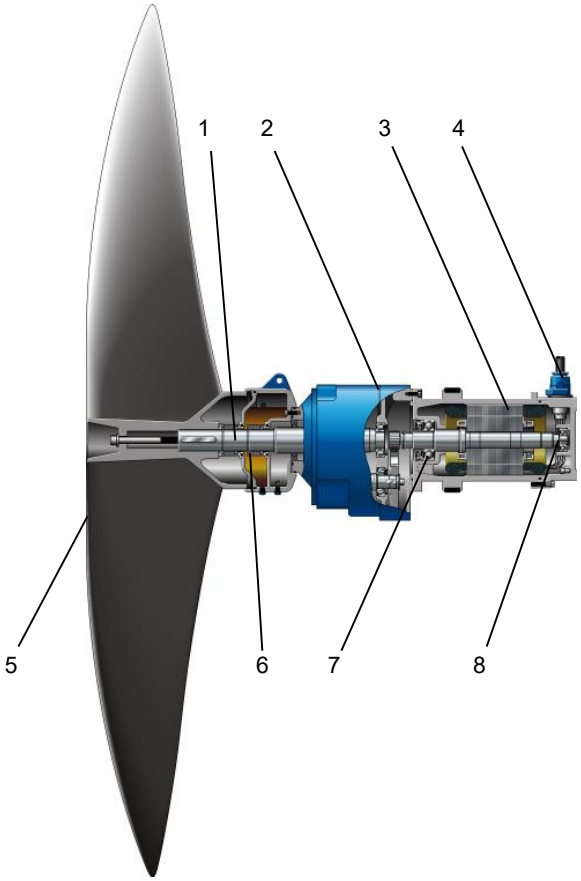

Fig. 7: Sectional drawing

1	Gear shaft	2	Housing
3	Stator	4	Cable gland
5	Propeller	6	Mechanical seal
7	Rolling element bearing	8	Rotor

Design Submersible mixer with gear unit and self-cleaning propeller (5) for mixing and keeping in suspension municipal or industrial waste water and sludges.

Function Driven by the motor, the propeller (5) generates thrust for inducing the required flow in the fluid handled.

Sealing The gear shaft (1) of the submersible mixer is equipped with two bi-rotational mechanical seals (6) in tandem arrangement. A lubricant reservoir between the two mechanical seals ensures cooling and lubrication.
The cable gland (4) is totally watertight.

4.7 Scope of supply

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

- Submersible mixer, complete with lifting bail or supporting strap and power cable
- Cable support for properly routing the power cable
- Two shackles (for lifting tackle and cable support)
- Separate name plate

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NOTE

A separate name plate is included in KSB's scope of supply.
Attach this name plate in a clearly visible location outside the place of installation, e.g. in the control cabinet or on the mounting bracket.

Accessories

- Submersible mixer stand
- Cable support for properly routing the power cables
- Forcing screw
- Propeller fitting tool
- Other accessories on request

4.8 Dimensions and weights

For dimensions and weights please refer to the general arrangement drawing/outline drawing and data sheet of the submersible mixer.

5 Installation at Site

5.1 Safety regulations

DANGER

Improper installation in potentially explosive atmospheres

Explosion hazard!

Damage to the submersible mixer!

- Comply with the applicable local explosion protection regulations.
- Observe the information given in the data sheet and on the name plate.

DANGER

Persons entering the tank

Electric shock!

- Never start up the submersible mixer when there are persons inside the tank.
- Disconnect or electrically disable the submersible mixer before entering the tank.

WARNING

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

Risk of personal injury! Damage to the submersible mixer!

- Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.

5.2 Checks to be carried out prior to installation

5.2.1 Checking the operating data

Before setting up the submersible mixer, verify that the name plate data matches the data given in the purchase order and the system data.

5.2.2 Preparing the place of installation

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 XC1 to EN 206-1.
- The mounting surface must have set and must be completely horizontal and even.
- Observe the weights indicated.

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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5.2.3 Checking the lubricant level

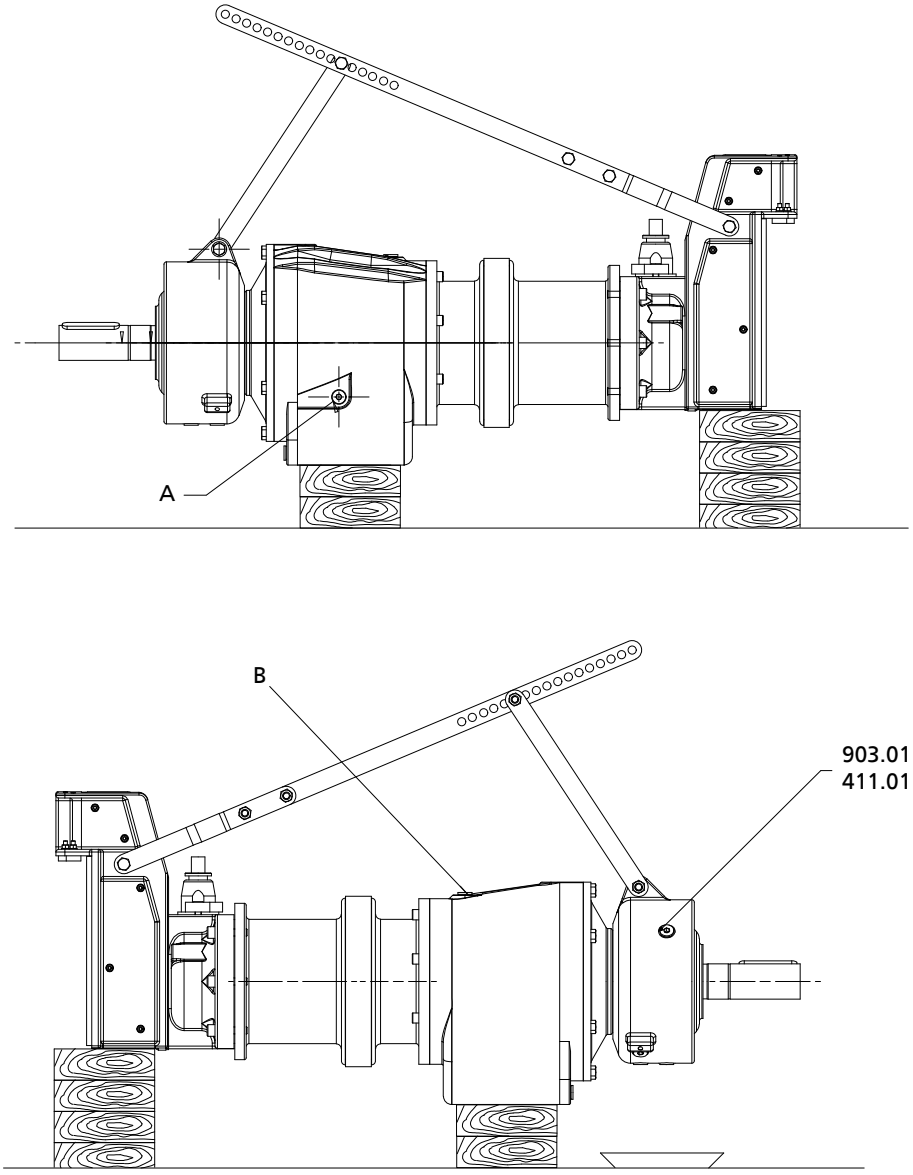

Fig. 8: Checking the lubricant, illustration without propeller

A	Lubricant check plug (gear unit)
B	Lubricant filler plug (gear unit)

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

Lubricant level for mechanical seal

1. Position the submersible mixer as shown.
2. Undo and remove screw plug 903.01 with joint ring 411.01.
   ⇨ The lubricant level must reach the filler opening.
3. If the lubricant level is lower, top up lubricant through the filler opening until the lubricant reservoir overflows.
4. Screw in screw plug 903.01 with joint ring 411.01.

Lubricant level of gear unit

1. Unscrew the lubricant check plug at the gear unit.

⇨ The lubricant level must reach the filler opening.

2. If the lubricant level is lower, unscrew the lubricant filler plug on the gear unit and top up lubricant through the filler opening until the lubricant reservoir overflows at the lubricant check opening.
3. Screw in the lubricant check plug of the gear unit and the lubricant filler plug if applicable.

5.3 Setting up the submersible mixer

CAUTION

Incorrect installation position of submersible mixer

Damage by excessive stresses or strains!

- ▹ Observe the data given in the general arrangement drawing.
- ▹ Installation in other positions is only permitted after prior consultation with and approval by KSB.

Mount the submersible mixer onto the applicable submersible mixer stand as described in the separate "Submersible Mixer Stand" installation/operating manual.

5.4 Electrical system

5.4.1 Information for planning the control system

For the electrical connection of the submersible mixer observe the wiring diagrams. The submersible mixer is supplied with a power cable and is wired for DOL starting. Star-delta starting is an option for motor ratings exceeding 4 kW.

NOTE

When laying a cable between the control system and the submersible mixer's connection point, make sure to have a sufficient number of cores for the sensors! A minimum cable cross-section of 1.5 mm^2 is required.

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

5.4.1.1 Overload protection

1. Protect the submersible mixer against overloading by a thermal time-lag overload protection device in accordance with IEC 947 and local regulations.
2. Set the overload protection device to the rated current specified on the name plate. (⇨ Section 4.4, Page 17)

5.4.1.2 Level control system

⚠ DANGER

Dry-running of submersible mixer

Explosion hazard!

- ▹ Never allow an explosion-proof submersible mixer to run dry!

CAUTION

Propeller not fully submerged

Damage to the submersible mixer!

- ▹ Never allow the liquid level to drop below the submersible mixer during mixer operation (not even for short periods).

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Automatic mixer operation in a tank requires the use of level control equipment. Observe the minimum fluid level. (⇨ Section 6.2.2.1, Page 30)

5.4.1.3 Operation on a frequency inverter

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

NOTE

For use in biogas systems, an Amaprop 1000 can be operated at 50 Hz mains power. Amaprop 2500 mixers installed in biogas systems must be operated on frequency inverters.

⚠ DANGER

Operation outside the permitted frequency range

Explosion hazard!

▹ Never operate an explosion-proof submersible mixer outside the specified range.

⚠ DANGER

Incorrect selection and setting of the frequency inverter

Explosion hazard!

▹ Observe the following information on selecting and setting a frequency inverter.

Selection

When selecting a frequency inverter, check the following details:

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

Setting

Observe the following instructions for setting a frequency inverter:

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

Start-up

Observe the following instructions for starting the frequency inverter:

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

Operation

Observe the following limits during operation on a frequency inverter:

- Only utilise up to 95 % of the rated power P_2 indicated on the name plate.
- Frequency range 25 to 50 Hz

Electromagnetic compatibility

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

Interference immunity

The submersible mixer sufficiently meets interference immunity requirements.

For monitoring the sensors installed, the operator must ensure sufficient interference immunity, e.g. by selecting and laying suitable electric cables. The power cable of the submersible mixer does not need to be replaced.

Select suitable analysing devices. To monitor the leakage sensor inside the motor we recommend using a special relay (available from KSB, not included in the scope of supply).

5.4.1.4 Sensors

DANGER

Operating an incompletely connected submersible mixer

Explosion hazard!

Damage to the submersible mixer!

- Never start up a submersible mixer with incompletely connected power cable or non-operational monitoring devices.

The submersible mixer features sensors designed to prevent hazards and damage to the submersible mixer.

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

NOTE

Reliable and safe operation of the submersible mixer within the scope of our warranty is only possible if the sensor signals are properly analysed as stipulated in this operating manual.

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

5.4.1.4.1 Motor temperature

DANGER

Insufficient cooling conditions

Explosion hazard!

Winding damage!

- Never operate a submersible mixer without operational temperature monitoring equipment.
- For explosion-proof submersible mixers use a thermistor tripping unit with manual reset and ATEX approval for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection.

CAUTION

Insufficient cooling

Damage to the submersible mixer!

- Never operate a submersible mixer without operational temperature monitoring equipment.

The motor is monitored by three series-connected PTC thermistors with terminals 10 and 11. They must be connected to a thermistor tripping unit with manual reset. Tripping must result in the submersible mixer cutting out.

For explosion-proof submersible mixers use a thermistor tripping unit which is ATEX-approved for monitoring the temperature of explosion-proof motors in "flameproof enclosure" Ex d type of protection.

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5.4.1.4.2 Leakage inside the motor

DANGER

Incorrect monitoring of leakage electrode

Explosion hazard!

Danger of death from electric shock!

- Voltages must be < 30 V AC and tripping currents < 0.5 mA.

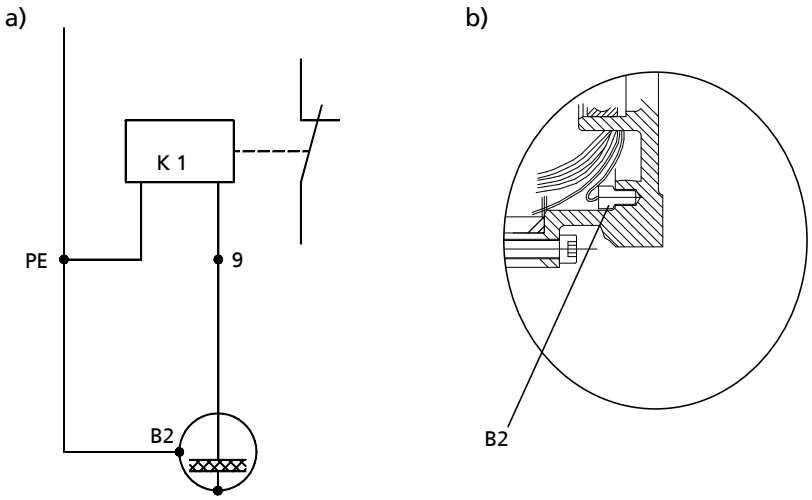

Fig. 9: a) Wiring of the electrode relay and b) Position of the electrode in the motor housing

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

The electrode relay (K1) must trip the motor at a tripping resistance between 3 and 60 kΩ.

5.4.1.4.3 Leakage at the mechanical seal (optional)

DANGER

Incorrect connection

Risk of explosion!

- Never retrofit an explosion-proof submersible mixer with such a leakage monitor in the leakage chamber.

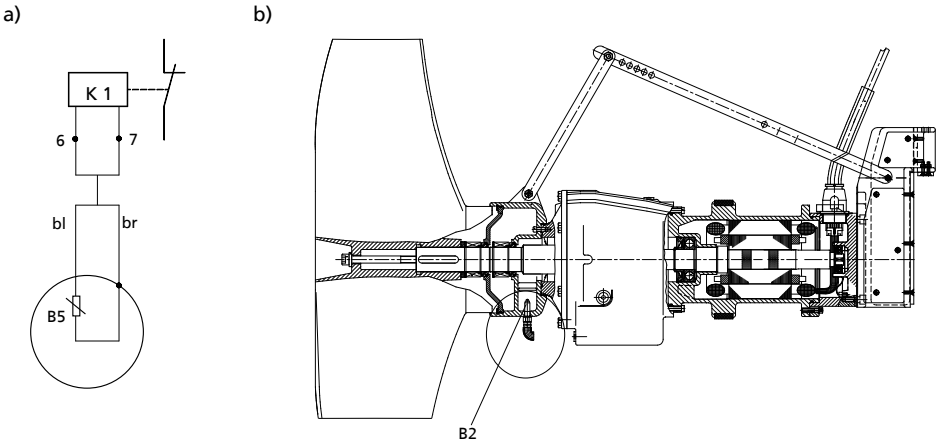

Fig. 10: a) Wiring of the electrode relay and b) Position of the leakage sensor

The submersible mixers have a leakage chamber between the oil chamber and the gear unit which can be equipped with a leakage sensor. A leakage sensor detects when the leakage chamber is filled due to defective mechanical seals. The leakage sensor has a separate electric cable and is intended for connection to an electrode relay. Tripping of the electrode relay must result in the submersible mixer cutting out.

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

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

5.4.2 Electrical connection

⚠ DANGER

Electrical connection work by unqualified personnel

Risk of fatal injury due to electric shock!

- ▷ Always have the electrical connections installed by a trained and qualified electrician.
- ▷ Observe regulations IEC 60364 and, for explosion-proof models, .

⚠ WARNING

Incorrect connection to the mains

Damage to the mains network, short circuit!

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

CAUTION

Improper routing of power cable

Damage to the power cable!

- ▷ Never lift the submersible mixer by its power cable.
- ▷ Never move the power cable at temperatures below -25 °C.
- ▷ Route the power cable in such a way that it will not chafe or catch when the submersible mixer is lowered or raised.
- ▷ Never kink or crush the power cable.

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CAUTION

Motor overload

Damage to the motor!

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

For electrical connection observe the wiring diagrams and the information for planning the control system. (⇨ Section 5.4.1, Page 22)

The submersible mixer is supplied with a power cable. Always connect all marked cores.

DANGER

Operating an incompletely connected submersible mixer

Explosion hazard!

Damage to the submersible mixer!

- ▷ Never start up a submersible mixer with incompletely connected power cable or non-operational monitoring devices.

DANGER

Incorrect wiring

Explosion hazard!

- ▷ The connection point of the cable ends must be located outside of the potentially explosive atmosphere or inside electrical equipment approved to equipment category II2G.

CAUTION

Flow-induced motion and layers of floating sludge in biogas installations

Damage to the power cable!

- ▷ Run the power cable upwards with as little slack as possible and protect, if necessary.

NOTE

We recommend using cable supports available as accessories for properly fastening the power cable at the tank edge.

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

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

DANGER

Incorrect wiring

Explosion hazard!

- ▷ Explosion-proof submersible mixers installed in a tank must never be retrofitted with an external potential equalisation connection!

	**DANGER** **Touching the submersible mixer during operation** Electric shock! ▷ Make sure that the submersible mixer cannot be touched during operation.

5.5 Checking the direction of rotation

	**WARNING** **Hands, other body parts, or foreign objects in the propeller or propeller intake area** Risk of personal injury! Damage to the submersible mixer! ▷ Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.

	**CAUTION** **Incorrect direction of rotation** Risk of damage to submersible mixer and submersible mixer stand! ▷ Check direction of rotation. ▷ Observe the arrow indicating the direction of rotation. ▷ Run the submersible mixer for a short period of time only (max. 1 minute) when checking the direction of rotation.

	**CAUTION** **Propeller not fully submerged** Damage to the submersible mixer! ▷ Never lower the submersible mixer into the fluid while checking the direction of rotation.

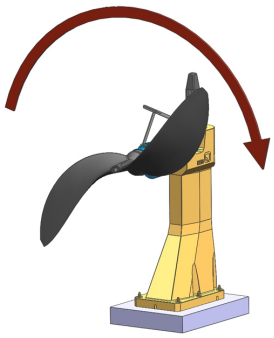

Fig. 11: Checking the direction of rotation

✓ The submersible mixer is mounted on the submersible mixer stand and is located completely outside the fluid handled.

✓ The submersible mixer is connected to the power supply.

1. Start the submersible mixer and stop it again immediately to determine the direction of rotation.
2. Check the direction of rotation.
   Propeller rotation must be clockwise
   (see rotation arrow on housing).

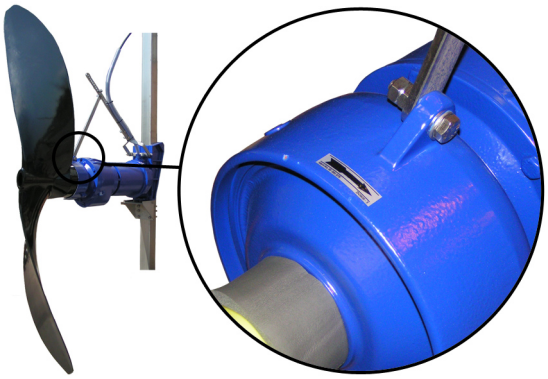

Fig. 12: Direction of rotation arrow

3. If the submersible mixer is running in the wrong direction of rotation, check the electrical connection and the control system, if necessary.
4. Lower submersible mixer to its operating position.

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6 Commissioning/Start-up/Shutdown

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up

Before commissioning, the following conditions must be ensured:

- The submersible mixer is correctly mounted to the submersible mixer stand.
- The submersible mixer is electrically connected to all protection devices in accordance with regulations.
- Operating data, lubricant level and direction of rotation have been checked.

6.1.2 Start-up

DANGER

Excessive temperatures due to dry running or excessive fluid temperature

Explosion hazard!

- ▷ Never operate the submersible mixer outside the fluid.
- ▷ Observe the minimum level of the fluid handled.
- ▷ Never operate an explosion-proof submersible mixer at ambient and fluid temperatures exceeding those specified in the data sheet or on the name plate.
- ▷ Always operate the submersible mixer within the permissible operating range only.

CAUTION

Excessive temperatures due to dry running or excessive fluid temperature

Damage to the submersible mixer!

- ▷ Never operate the submersible mixer outside the fluid.
- ▷ Observe the minimum level of the fluid handled.
- ▷ Always operate the submersible mixer within the permissible operating range only.

CAUTION

Re-starting while motor is still running down

Damage to the submersible mixer!

- ▷ Do not re-start the submersible mixer before it has come to a standstill.
- ▷ Never start up a submersible mixer running in reverse rotation.

1. Start up the submersible mixer.

6.2 Operating limits

DANGER

Non-compliance with operating limits

Damage to the submersible mixer!

- ▷ Comply with the operating data indicated in the data sheet.
- ▷ Never operate an explosion-proof submersible mixer at ambient and fluid temperatures exceeding those specified in the data sheet or on the name plate.

6.2.1 Frequency of starts

CAUTION

Excessive frequency of starts

Risk of damage to the motor!

- ▷ Never exceed the specified frequency of starts.

To prevent high temperature increases in the motor and excessive loads on the motor, sealing elements and bearings, do not exceed the following number of starts per hour.

Table 6: Frequency of starts

Interval	Maximum frequency of starts
	[Starts]
Per hour	10

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

6.2.2 Fluid properties

CAUTION

Layers of floating sludge in biogas plants

Damage to the submersible mixer!

- ▷ Never use the submersible mixer Amaprop 2500 for breaking up layers of floating sludge in biogas plants.

NOTE

Deposits accumulating on the housing surface entail the risk of insufficient cooling of the submersible mixer. We recommend to check the housing surface regularly and remove severe dirt deposits.

6.2.2.1 Minimum level of fluid handled

DANGER

Excessive temperatures due to dry-running

Explosion hazard!

- ▷ Always operate the submersible mixer in fully submerged condition only (incl. propeller).
- ▷ Observe the minimum level of the fluid handled.

CAUTION

Propeller not fully submerged

Damage to the submersible mixer!

- ▷ Never allow the liquid level to drop below the submersible mixer during mixer operation (not even for short periods).

The submersible mixer is operational when the fluid level is not lower than dimension W_T. This minimum level of the fluid handled must also be ensured during automatic operation.

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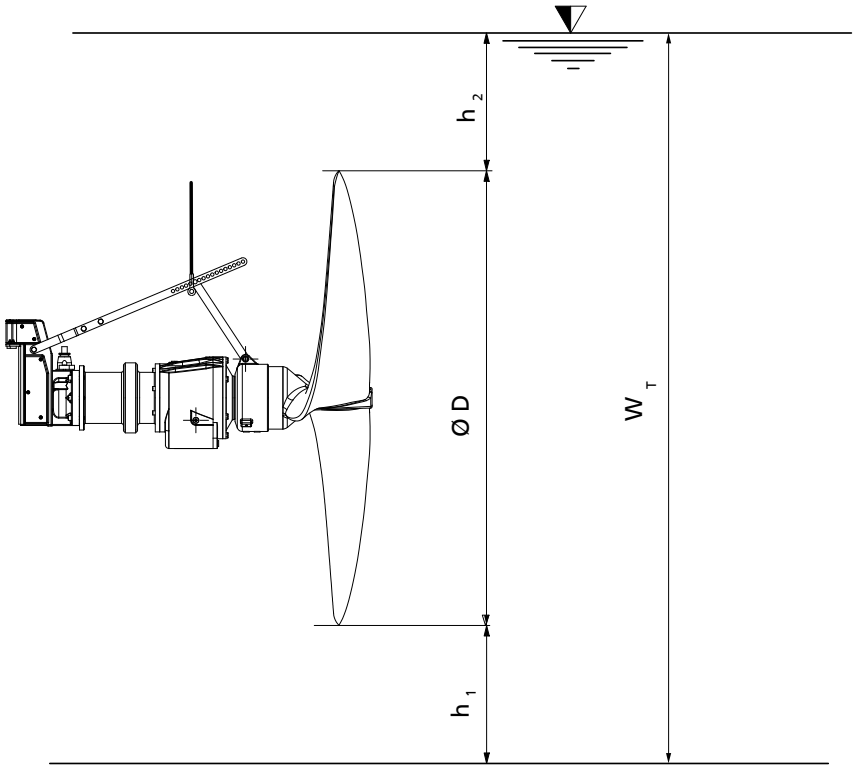

Fig. 13: Minimum level of fluid handled

Table 7: Minimum level of fluid handled

Ø D	h_1 [4]
[mm]	[m]
All	0,20[5]

Formula for calculating the minimum fluid level

$h_2 = (n_{Submersible\ mixer} / n_{max})^2 \times h_{2*}$

h_{2*} for sewage treatment plants / water= 1.00 m (0.75 m for Amaprop 1000)

$W_t = Ø\ D + h_1 + h_2$

Calculation example

Given:

- Amaprop V 40-2500/44
- $n_{Submersible\ mixer}$ = 40 rotations/minute
- n_{max} = 46 rotations/minute

Solution:

$h_2 = (40 / 46)^2 \times 0.50\ m = 0.38\ m$

$W_t = 2.50\ m + 0.30\ m + 0.38\ m = 3.18\ m$

6.2.2.2 Fluid temperature

DANGER

Fluid temperature

Explosion hazard!

▷ Never operate the submersible mixer at fluid temperatures exceeding those specified in the data sheet or on the name plate.

4 Minimum

5 For biogas applications: 0.30 m

CAUTION

Fluid temperature

Danger of freezing!

- ▷ The submersible mixer is designed for operation in liquids. The submersible mixer is not operational, and therefore must not be operated, under freezing conditions.

6.2.2.3 Density of fluid handled

The power input of the submersible mixer will increase in proportion to the density of the fluid handled.

CAUTION

Excessive density of the fluid handled

Motor overload!

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

6.2.2.4 Abrasive fluids

Do not exceed the maximum permissible solids content specified in the data sheet. When the mixer is operated in fluids containing abrasive substances, increased wear of the propeller and the shaft seal are to be expected. In this case, halve the intervals commonly recommended for servicing and maintenance.

6.2.2.5 Flow behaviour of fluid handled

CAUTION

Impermissibly high transverse flow

Damage to submersible mixer and/or installation parts!

- ▷ Match the rotational speed of the submersible mixer and/or the number of submersible mixers running to the predominantly low-viscosity fluid.

6.2.3 Supply voltage

DANGER

Non-compliance with permissible supply voltage tolerances

Explosion hazard!

- ▷ Never operate an explosion-proof submersible mixer outside the specified range.

The maximum permissible operating voltage deviation is ±10%, for explosion-proof mixers ±5% of the rated voltage. The voltage difference between the individual phases must not exceed 1%.

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6.2.4 Operation on a frequency inverter

DANGER

Operation outside the permitted frequency range

Explosion hazard!

- Never operate an explosion-proof submersible mixer outside the specified range.

Frequency inverter operation of the submersible mixer is permitted in the frequency range from 25 to 50 Hz. In biogas applications, frequency inverter operation is permitted in the frequency range from 30 to 50 Hz.

6.3 Shutdown/storage/preservation

6.3.1 Measures to be taken for shutdown

WARNING

Fluids, consumables and supplies posing a health hazard

Hazard to persons and the environment!

- Submersible mixers used in fluids posing a health hazard must be decontaminated.
- Wear safety clothing and a protective mask, if required.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

WARNING

Submersible mixer started up unintentionally

Risk of injury by moving parts!

- Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.
- Make sure that the submersible mixer cannot be started up unintentionally.

Submersible mixer remains installed

DANGER

Persons entering the tank

Electric shock!

- Never start up the submersible mixer when there are persons inside the tank.
- Disconnect or electrically disable the submersible mixer before entering the tank.

WARNING

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

Risk of personal injury! Damage to the submersible mixer!

- Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.

- Start up the submersible mixer regularly between once a month and once every three months for approximately one minute during prolonged shutdown periods.
  This will avoid the formation of deposits on the surface of the submersible mixer.

Submersible mixer is removed and stored

✓ Safety regulations are observed.

1. Clean the submersible mixer.
2. Carry out maintenance work.
   Follow the maintenance instructions. (⇨ Section 7.1, Page 35)

6.4 Returning to service

For returning the submersible mixer to service observe the sections on commissioning/start-up and the operating limits (⇨ Section 6.2, Page 29) .

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

NOTE

On submersible mixers older than 5 years we recommend replacing all elastomer seals.

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7 Servicing/Maintenance

7.1 Safety regulations

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

DANGER

Sparks produced during maintenance work

Explosion hazard!

- Always perform maintenance work on explosion-proof submersible mixers outside potentially explosive atmospheres only.

DANGER

Improper transport

Danger to life from falling parts!

Damage to the submersible mixer!

- Use the attachment point provided (lifting lug or bail) for attaching lifting accessories.
- Never suspend the submersible mixer by its power cable.
- Never use the lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied.
- Safely attach lifting ropes to the submersible mixer and crane.
- Protect the power cable against damage.
- Maintain adequate safety distance during lifting operations.

WARNING

Submersible mixer started up unintentionally

Risk of injury by moving parts!

- Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.
- Make sure that the submersible mixer cannot be started up unintentionally.

WARNING

Fluids handled and supplies posing a health hazard or hot fluids handled and supplies

Risk of injury!

- Observe all relevant laws.
- Take appropriate measures to protect persons and the environment.
- Decontaminate submersible mixers used in fluids posing a health hazard.

NOTE

Special regulations apply to repair work on explosion-proof submersible mixers. Modification or alteration of the submersible mixers could affect explosion protection and is only permitted after consulting the manufacturer.

NOTE

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

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

Never use force when dismantling and reassembling the submersible mixer.

7.2 Servicing/inspection

recommends the following regular servicing schedule:

Table 8: Overview of maintenance work

Maintenance interval	Maintenance work
Every 8000 operating hours[6)]	Insulation resistance measurement (⇨ Section 7.2.1.1, Page 36)
	Checking the power cable (⇨ Section 7.2.1.2, Page 37)
	Visual inspection of shackle/lifting rope (⇨ Section 7.2.1.3, Page 37)
Every 16,000 operating hours[7)]	Checking the sensors (⇨ Section 7.2.1.4, Page 37)
	Lubricant change (⇨ Section 7.2.1.5, Page 38)
Every five years	General overhaul

7.2.1 Inspection work

7.2.1.1 Measuring the insulation resistance

✓ The submersible mixer has been disconnected in the control cabinet.

✓ Use an insulation resistance measuring device.

✓ The max. measuring voltage is 1000 V.

1. Measure the winding to chassis ground.
   To do so, connect all winding ends together.
2. Measure the winding temperature sensors to chassis ground.
   To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to earth.

⇨ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.
If the resistance measured is lower, power cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

NOTE

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

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6 At least once a year

7 At least every three years

NOTE

If the insulation resistance values measured on the motor are too low, the winding insulation is defective. The submersible mixer must not be returned to service in this case.

7.2.1.2 Checking the power cable

Visual inspection

1. Inspect the power cable for visible damage.
2. Replace any damaged parts by original spare parts.

Checking the earth conductor

1. Measure the resistance between the earth conductor and chassis ground. The resistance must be lower than 1 Ω.
2. Replace any damaged parts by original spare parts.

DANGER

Defective earth conductor

Electric shock!

- ▷ Never switch on a submersible mixer with a defective earth conductor.

7.2.1.3 Checking the shackle/lifting rope

Visual inspection

✓ The submersible mixer has been lifted out of the fluid handled and cleaned.

1. Inspect the shackle/lifting rope and all fixing elements for visual damage.
2. Replace damaged components by original spare parts.

7.2.1.4 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. The actual function of the sensors is not tested.

Temperature sensors in the motor winding

Table 9: Resistance measurement of the temperature sensors in the motor winding

Measurement between terminals ...	Resistance
	[Ω]
10 and 11	100 to 1000

If the tolerances indicated are exceeded, disconnect the power cable at the submersible mixer and repeat the check inside the motor.
If tolerances are exceeded here, too, the winding will have to be replaced.

Leakage sensor in the motor

Table 10: Resistance measurement of the leakage sensor in the motor

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

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

Leakage sensor at mechanical seal (optional)

Table 11: Resistance of leakage sensor at mechanical seal

Measurement between terminals ...	Resistance
6 and 7	> 60 kΩ

Lower resistance values suggest liquid ingress into the leakage chamber. In this case the leakage chamber must be checked. (⇨ Section 7.2.1.5.3, Page 39)

7.2.1.5 Lubrication and lubricant change

7.2.1.5.1 Lubricant quality

Recommended lubricant quality

- Environmentally friendly, non-toxic white oil, of medical quality

Alternative

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

Recommended quality of gear unit lubricant

- Lubricant to ISO VG 320 (viscosity 320) for fluid temperatures ≤ 45 °C
- Fully synthetic gear oil CLP 320 PAO (based on polyalphaolefines) for fluid temperatures between 45 °C and 60 °C

⚠ WARNING

Contamination of fluid handled by lubricant

Hazard to persons and the environment!

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

7.2.1.5.2 Lubricant quantity

Mechanical seal

Table 12: Quantity of mechanical seal lubricant

Size	Lubricant quantity
	[l]
All	1,9

Gear unit

Table 13: Quantity of gear unit lubricant

Gear unit	Shaft centreline height	Lubricant quantity
	[mm]	[l]
SP 189	158	1,9
SP 190/SP 190 X	192	2,6 [8)]

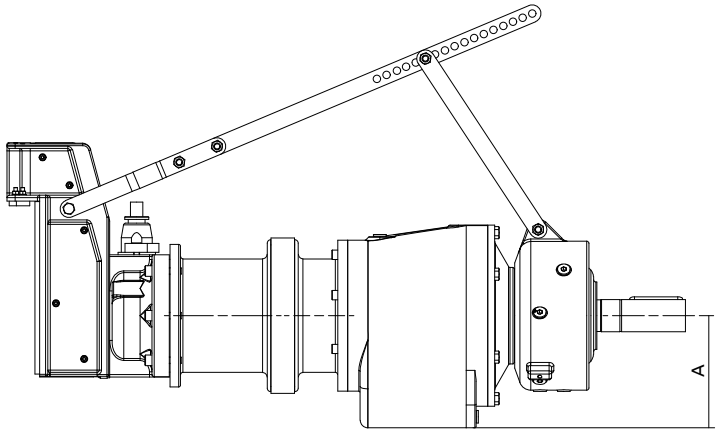

Fig. 14: Shaft centreline height - Gear unit

A	Shaft centreline height

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8 For Amaprop 1000 with pitch adapter (15° or 30° upward pitch) = 4.3 litres

7.2.1.5.3 Checking the leakage chamber

⚠ WARNING

Fluids posing a health hazard

Hazard to persons and the environment!

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

Checking the leakage chamber serves to assess the function of the drive-end mechanical seal.

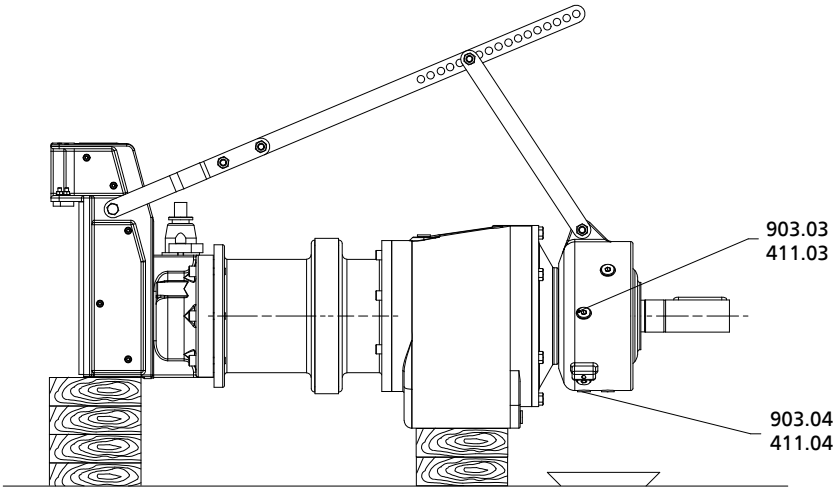

Fig. 15: Checking the leakage chamber

✓ A suitable container for the leakage is on hand.

✓ The submersible mixer is placed horizontally on a level surface.

1. Place the container underneath screw plug 903.04.
2. Remove screw plugs 903.03/04 with joint rings 411.03/04.
   ⇨ If there is no leakage or, after several years of operation, only a small amount (less than 0.2 litre), the mechanical seals are working properly. If the leakage exceeds 0.2 litres, the mechanical seals are defective and must be replaced.
3. Fit screw plugs 903.03/04 with joint rings 411.03/04 again.

7.2.1.5.4 Draining 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.

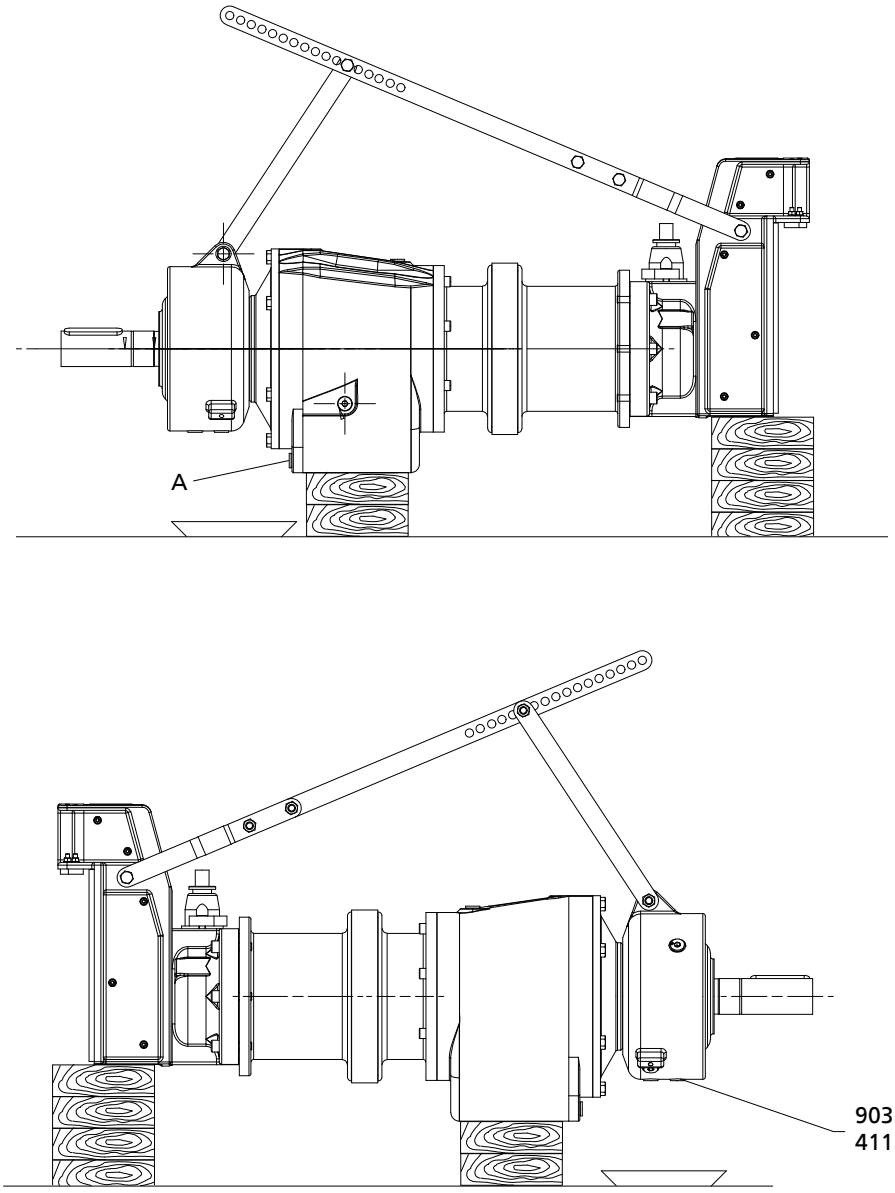

Fig. 16: Draining the lubricant (propeller not shown)

A	Lubricant drain plug

1. Position the submersible mixer as shown.
2. Place a suitable container under the screw plugs.
3. Unscrew the lubricant drain plug on the gear unit and drain off the lubricant.
4. Screw the lubricant drain plug of the gear unit back in.
5. Undo screw plug 903.02 with joint ring 411.02 and drain off the lubricant.
6. Close screw plug 903.02 again, fitting a new joint ring 411.02.

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7.2.1.5.5 Filling in the lubricant

⚠ WARNING

Lubricants posing a health hazard

Hazard to persons and the environment!

- ▹ When filling in the lubricant take appropriate measures to protect persons and the environment.

CAUTION

Lubricant level too high

Mechanical seal operation is impaired!

- ▹ Always place the submersible mixer in a horizontal position (as shown) for filling in the lubricant.

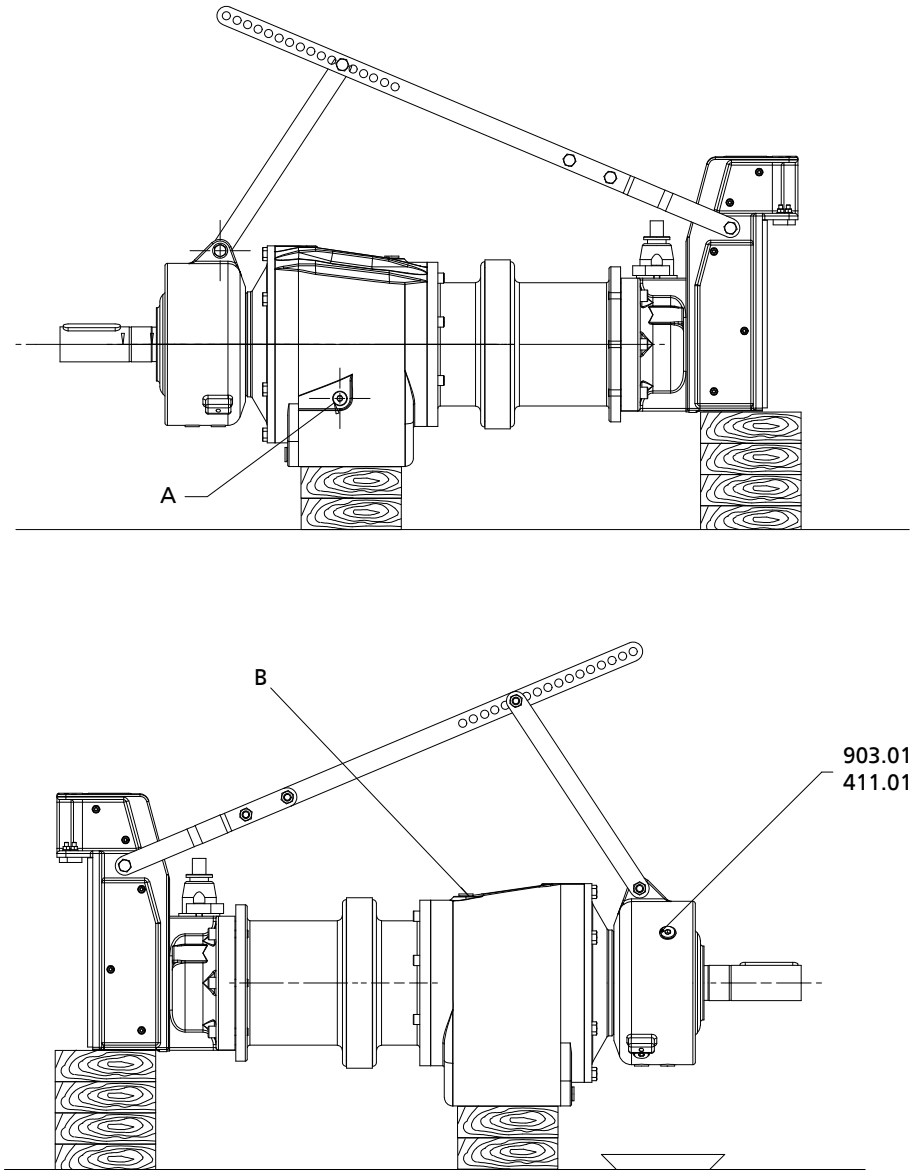

Fig. 17: Filling in lubricant (propeller not shown)

A	Lubricant check plug (gear unit)
B	Lubricant filler plug (gear unit)

✓ The submersible mixer has been positioned as shown.

1. Unscrew screw plug 903.01 with joint ring 411.01.
2. Fill the lubricant through the lubricant filler opening until the lubricant reservoir overflows.
3. Close screw plug 903.01 again, fitting a new joint ring 411.01.
4. Unscrew the lubricant check plug on the gear unit.
5. Unscrew the lubricant filler plug on the gear unit.
6. Fill the lubricant through the lubricant filler opening into the lubricant reservoir until the lubricant flows out of the lubricant check opening.
7. Screw the lubricant filler plug of the gear unit back in.
8. Screw the lubricant check plug of the gear unit back in.

7.3 Drainage/disposal

⚠ WARNING

Fluids posing a health hazard

Hazard to persons and the environment!

- ▷ Submersible mixers used in fluids posing a health hazard must be decontaminated.
- ▷ Collect and properly dispose of flushing liquid and any liquid residues.
- ▷ Wear safety clothing and a protective mask, if required.
- ▷ Observe all legal regulations on the disposal of harmful substances.

1. Always flush the submersible mixer if it has been used for handling noxious, explosive, hot or other hazardous fluids.
2. Always flush and clean the submersible mixer before sending it to the workshop.
   Make sure to add a certificate of decontamination.

7.4 Dismantling the submersible mixer

7.4.1 General information/Safety regulations

⚠ WARNING

Work on the submersible mixer by unqualified personnel

Risk of personal injury!

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

⚠ WARNING

Submersible mixer started up unintentionally

Risk of injury by moving parts!

- ▷ Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.
- ▷ Make sure that the submersible mixer cannot be started up unintentionally.

⚠ WARNING

Hot surface

Risk of personal injury!

- ▷ Allow the submersible mixer 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

Fluids, consumables and supplies posing a health hazard

Hazard to persons and the environment!

- Submersible mixers used in fluids posing a health hazard must be decontaminated.
- Wear safety clothing and a protective mask, if required.
- Observe all legal regulations on the disposal of fluids posing a health hazard.

⚠ WARNING

Components with sharp edges

Risk of cutting or shearing injuries!

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

For dismantling and reassembly observe the general assembly drawing.
(⇨ Section 9.1, Page 52)

NOTE

All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "www.ksb.com/contact" on the Internet.

7.4.2 Removing the propeller

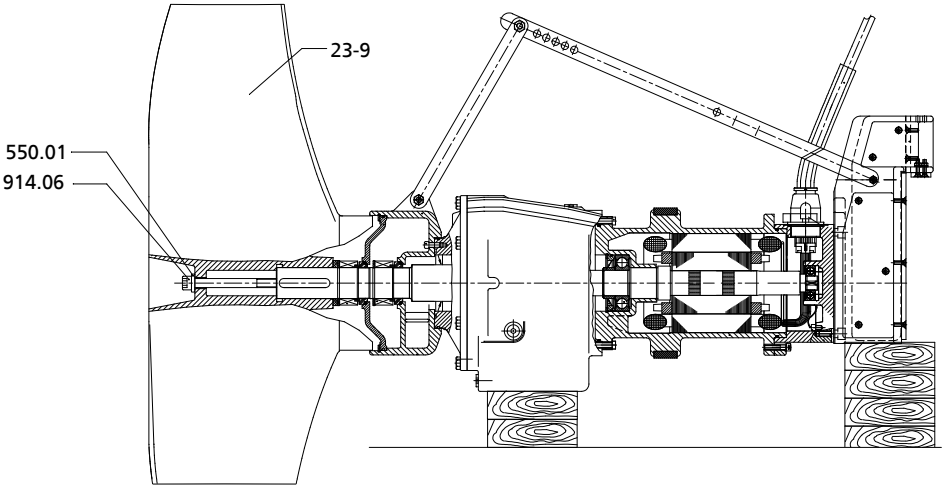

Fig. 18: Removing the propeller

✓ The submersible mixer has been lifted out of the tank, cleaned and placed outside the tank as per operating instructions.

1. Unscrew propeller screw 914.06 and disc 550.01.
2. Screw a forcing screw into propeller 23-9 and pull off the propeller.
(⇨ Section 9.4, Page 59)

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7.4.3 Removing the mechanical seal

CAUTION

Improper removal of mechanical seal

Damage to the shaft!

▷ Care must be taken when loosening and removing the mechanical seal.

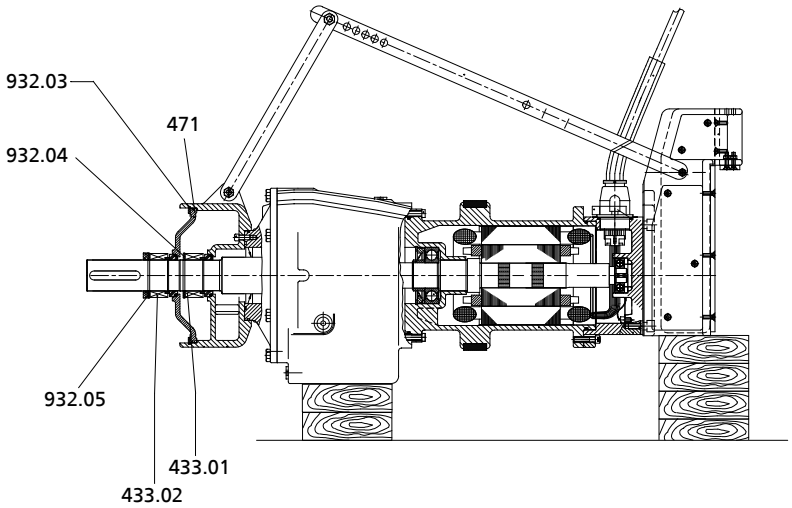

Fig. 19: Removing the mechanical seal

✓ The propeller has been removed.

1. Undo circlip 932.05.
2. Take out mechanical seal 433.02.
3. Undo circlip 932.03.
4. Take out seal cover 471.
5. Undo circlip 932.04.
6. Take out mechanical seal 433.01.

7.4.4 Dismantling the motor section

NOTE

Special regulations apply to repair work on explosion-proof submersible mixers. Modification or alteration of the submersible mixers could affect explosion protection and is only permitted after consulting the manufacturer.

NOTE

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

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

7.5 Reassembling the submersible mixer

7.5.1 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 submersible mixer!

- ▷ Reassemble the submersible mixer in accordance with the general rules of sound engineering practice.
- ▷ Use original spare parts only.

NOTE

Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Any components with damaged flamepaths must be replaced. Refer to the "Flamepaths" annex for the position of the flamepaths.

Sequence Always reassemble the submersible mixer in accordance with the corresponding general assembly drawing.

Sealing elements

- O-rings
  - Check O-rings for any damage and replace by new O-rings, if required.
  - Never use O-rings that have been glued together from material sold by the metre.
- Assembly adhesives
  - Avoid the use of assembly adhesives, if possible.

Tightening torques For reassembly, tighten all screws and bolts as specified in this manual.
(⇨ Section 7.6, Page 49)
In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite type 243).

7.5.2 Reassembling the motor section

⚠ DANGER

Wrong screws/bolts

Explosion hazard!

- ▷ Always use the original screws/bolts for assembling an explosion-proof submersible mixer.
- ▷ Never use screws/bolts of different dimensions or of a lower property class.

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NOTE

Before reassembling the motor section, check that all joints relevant to explosion protection (flamepaths) are undamaged. Components with damaged flamepaths must be replaced. Only use original spare parts made by KSB for explosion-proof submersible mixers. The flamepaths are shown in the relevant drawings.
(⇨ Section 9.2.2, Page 55)
All screwed connections closing off the flameproof enclosure must be secured with a thread-locking agent (Loctite Type 243).

7.5.3 Installing the mechanical seal

The following rules must be observed when installing the mechanical seal:

- Work cleanly and accurately.
- Only remove the protective wrapping of the contact faces immediately before installation takes place.
- Prevent any damage to the sealing surfaces or O-rings.

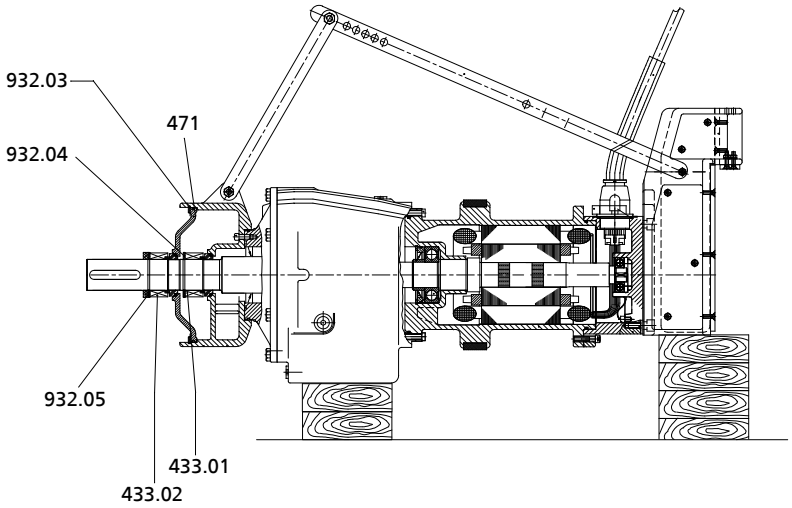

Fig. 20: Installing the mechanical seal

✓ The individual parts have been placed in a clean and level assembly area.
✓ All dismantled parts have been cleaned and checked for wear.
✓ Any damaged or worn parts have been replaced by original spare parts.
✓ The sealing surfaces have been cleaned.

1. Clean the shaft, and touch up any score marks or scratches with a polishing cloth, if necessary. If score marks or scratches are still visible, fit a new gear unit and shaft.
2. Fit mechanical seal 433.01.
3. Fit circlip 932.04.
4. Fit seal cover 471.
5. Fit circlip 932.03.
6. Fit mechanical seal 433.02.
7. Fit circlip 932.05.

7.5.4 Leak testing

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

Observe the following values for leak testing:

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

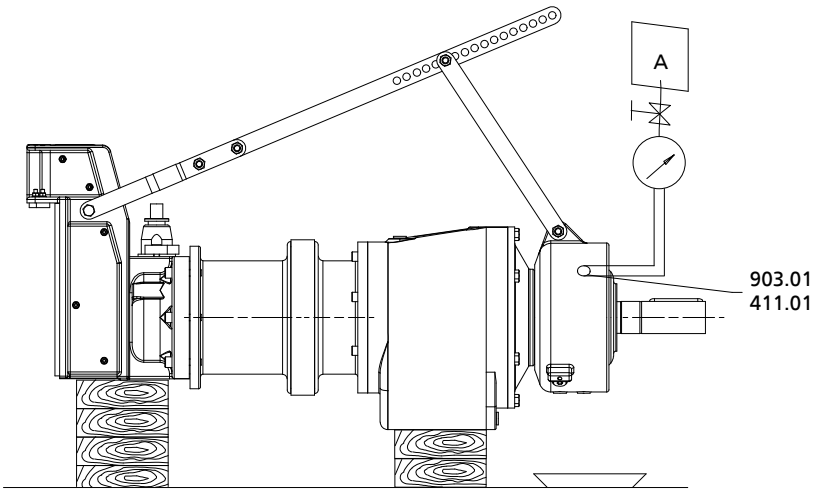

Fig. 21: Test pressure connection

A	Test pressure connection

1. Undo and remove screw plug 903.01 with joint ring 411.01.
2. Screw the testing device tightly into the lubricant filler opening.
3. Carry out the leak test with the values specified above.

NOTE

The pressure must not drop during the test period.

4. Unscrew and remove the testing device.
5. Screw in screw plug 903.01 with joint ring 411.01.

7.5.5 Fitting the propeller

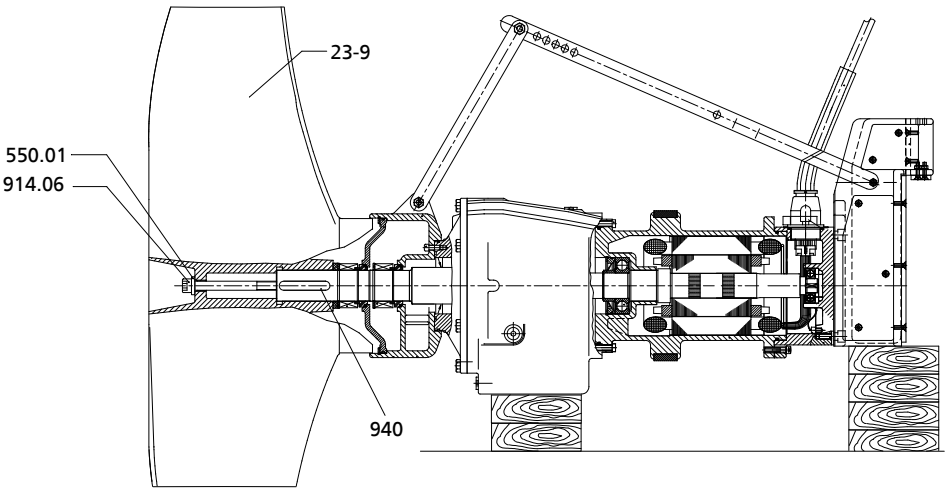

Fig. 22: Fitting the propeller

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NOTE

As a cast propeller is very heavy, it is recommended to suspend the unit vertically with a rope loop and to thread it into the propeller, which has been placed on the floor in a horizontal position.

⚠ 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.

- ✓ The submersible mixer has been set up safely and cannot tip over.
- ✓ The drive shaft of the gear unit is readily accessible.
- ✓ The protective caps have been removed from the shaft and the propeller-end mechanical seal.

1. Thoroughly clean the propeller, paying particular attention to the propeller hub seat.
2. Thread the propeller fitting tool into the drive shaft thread.
   (⇨ Section 9.5, Page 60)
3. Rotate the drive shaft so that key 940 points upwards.
4. Place propeller 23-9 on the propeller fitting tool so that the keyway in the hub aligns with key 940.
5. Screw the nut and washer onto the propeller fitting tool in order to slide the propeller onto the shaft up to the stop.
   ⇨ The propeller is slid onto the shaft up to the stop.
6. Screw two locknuts onto the threaded rod.
   (Do not use stainless steel nuts!)
7. Unscrew the propeller fitting tool from the drive shaft using the locknuts.
8. Apply thread-locking agent to the thread of screw 914.06 and to the contact face of disc 550.01 on the propeller.
9. Screw in screw 914.06 and disc 550.01. (⇨ Section 7.6, Page 49)

7.6 Tightening torques

Table 14: Tightening torques [Nm]
depending on thread, material and property class

Thread	Material
	A4-70
	Property class Rp 0.2 $^{N}/_{mm^2}$
	450
M5	4
M6	7
M8	17
M10	35
M12	60
M16	150

7.7 Spare parts stock

7.7.1 Ordering spare parts

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

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

Refer to the name plate for all data.

Also specify the following data:

- Part number and description (⇨ Section 9.1, Page 52)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

Table 15: Quantity of spare parts for recommended spare parts stock

Part No.	Description	Number of mixers (including stand-by mixers)							
		2	3	4	5	6	8	10 and more	Type[9)]
80-1	Motor unit (motor housing 811, stator 81-59)	-	-	-	1	1	2	3	E
834	Cable gland	1	1	2	2	2	3	40%	R
818	Rotor with plug-in pinion[10)]	-	-	-	1	1	2	3	E
99-2	Installation kit for gear unit[11)]	-	-	-	1	1	2	3	E
23-9	Propeller	1	1	1	2	2	3	30%	V
433.01	Mechanical seal, gear side	2	3	4	5	6	7	90%	V
433.02	Mechanical seal, propeller side	2	3	4	5	6	7	90%	V
321.01	Rolling element bearing, gear side	1	1	2	2	3	4	50%	R
321.02	Rolling element bearing, motor side	1	1	2	2	3	4	50%	R
322	Radial roller bearing	1	1	2	2	3	4	50%	R
	Set of sealing elements	4	6	8	8	9	10	100%	V

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9 E = spare part, R = replacement part, V = wear part; keeping a stock of wear and replacement parts is recommended

10 From installation kit (Amaprop 1200 to 2500 only)

11 Always in combination with rotor only (except for Amaprop 1000 with slip-on pinion; Amaprop 1200-2500: pinion pressed in at factory)

8 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 service is required.

A Submersible mixer does not generate flow

B Insufficient flow

C Excessive current/power input

D Vibrations and noise during mixer operation

Table 16: Trouble-shooting

A	B	C	D	Possible cause	Remedy
-	✗	-	-	Unfavourable installation of submersible mixer	Check installation – Check the flow area for obstacles and remove.
-	-	✗	✗	Propeller covered in solids; density of fluid handled is too high	Clean the propeller, check power data and direction of rotation.
-	✗	-	✗	Propeller damaged	Replace the propeller.
-	✗	✗	✗	Wrong direction of rotation	If the direction of rotation is incorrect, check the electrical connection of the submersible mixer and the control system if necessary.
-	-	✗	-	Wrong supply voltage	Check mains voltage; check electrical cable connections
✗	-	-	-	Motor is not running due to lack of power supply.	Check electrical installation, inform electric utility company.
✗	-	-	-	Motor winding or power cable are defective.	Replace by new original KSB parts or contact KSB.
-	-	-	✗	Defective rolling element bearing	Contact KSB.
-	✗	✗		In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.
-	✗	-	✗	Liquid level in the tank is too low.	Check level control equipment.
✗	-	-	-	Winding temperature monitor has tripped as a result of excessive winding temperature.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	Motor has been tripped by leakage monitor.	Have cause determined and eliminated by qualified and trained personnel.
✗	-	-	-	Mechanical seal monitor has tripped.	Have cause determined and eliminated by qualified and trained personnel.

9 Related Documents

9.1 General assembly drawing with list of components

9.1.1 Amaprop V 1000

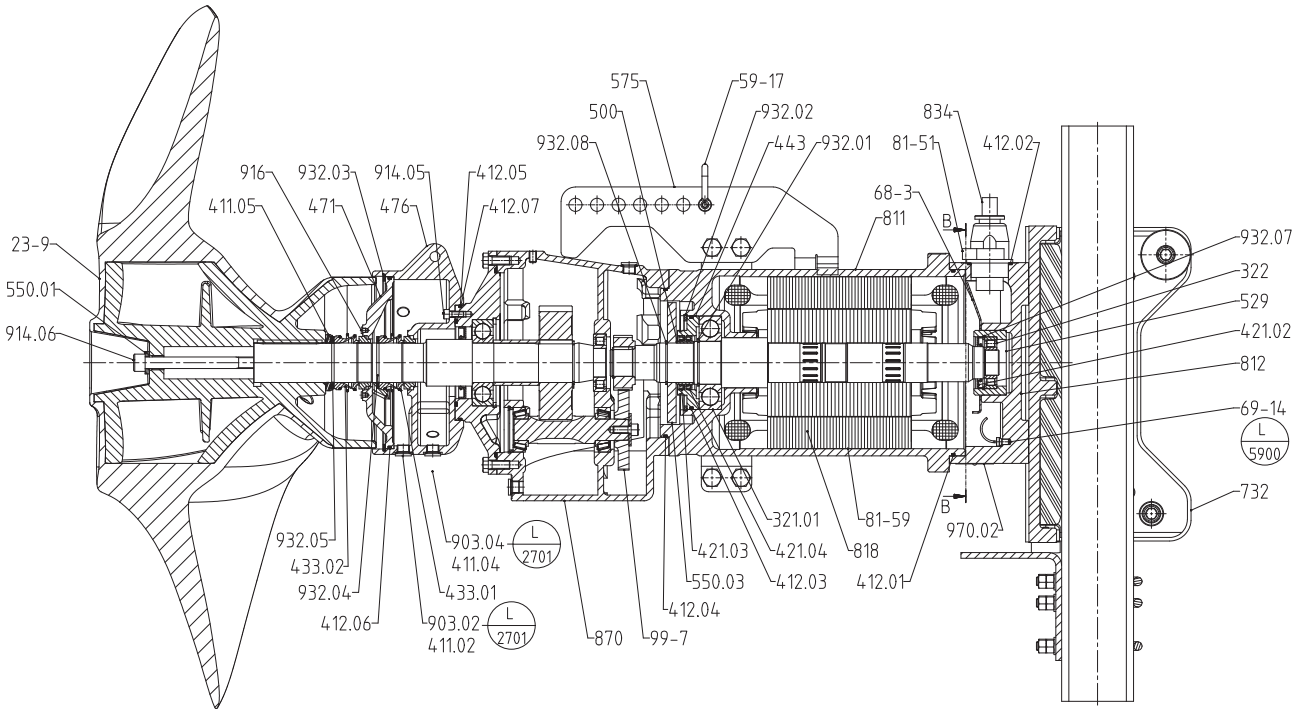

Fig. 23: General assembly drawing of Amaprop V 1000

Table 17: Symbols key

Symbol	Description
L 2701	Always secure screwed connections marked with this symbol with **Loctite 2701**.
L 5900	Always secure screwed connections marked with this symbol with **Loctite 5900**.

Table 18: List of components

Part No.	Description	Part No.	Description
23-9	Axial propeller	68-3	Cover plate
321.01	Radial ball bearing	69-14	Leakage sensor
322	Radial roller bearing	732	Guide bracket
411.02/.04/.05	Joint ring	81-51	Clamping element
412.01/.02/.03/ .04/.05/.06/.07	O-ring	81-59	Stator
421.02/.03/.04	Lip seal	811	Motor housing
433.01	Mechanical seal (gear side)	812	Motor housing cover
433.02	Mechanical seal (propeller side)	818	Rotor
443	Seal insert	834	Cable gland
471	Seal cover	870	Gear unit
476	Mating ring carrier	903.02/.04	Screw plug
500	Ring	914.05/.06	Hexagon socket head cap screw
529	Bearing sleeve	916	Plug
550.01/.03	Disc	932.01/.02/.03/ .04/.05/.07/.08	Circlip

Part No.	Description	Part No.	Description
575	Supporting strap	970.02	Label/plate
59-17	Shackle	99-7	Installation kit

9.1.2 Amaprop V 1200 - 2500

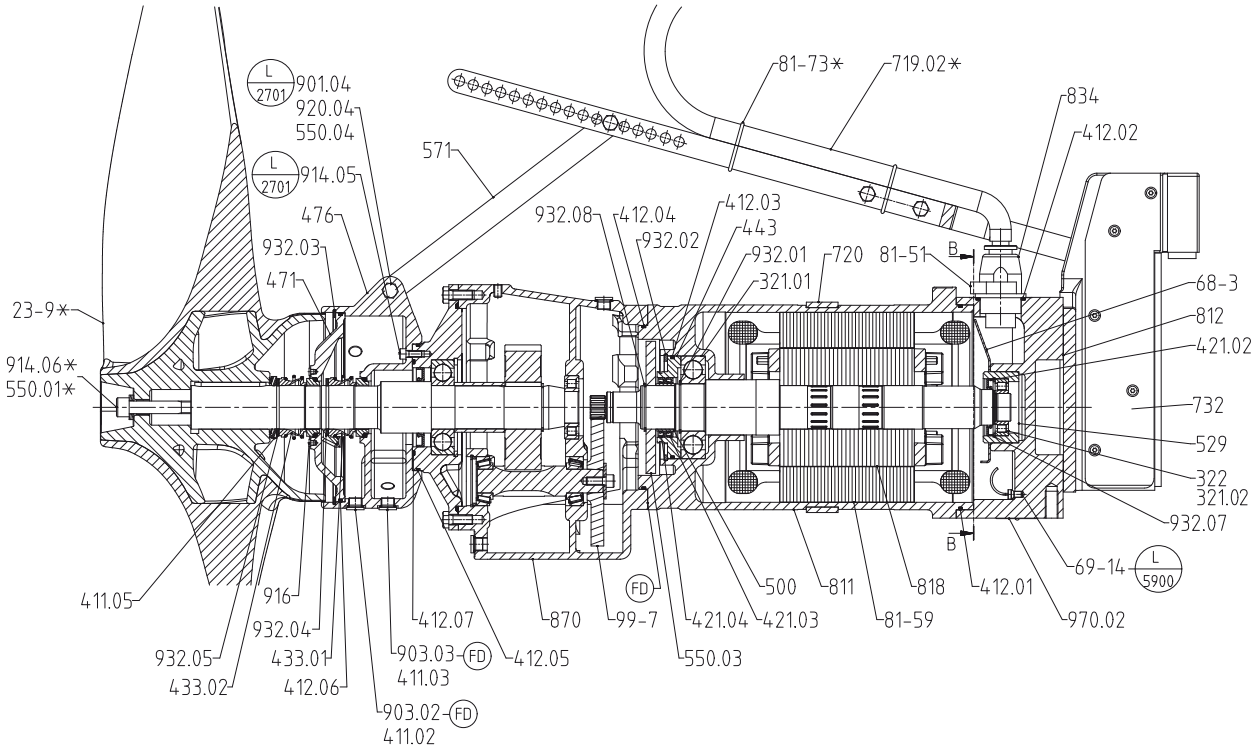

Fig. 24: General assembly drawing of Amaprop V 1200 - 2500

Table 19: Symbols key

Symbol	Description
L 2701	Always secure screwed connections marked with this symbol with **Loctite 2701**.
L 5900	Always secure screwed connections marked with this symbol with **Loctite 5900**.
*	To be assembled on site

Table 20: List of components

Part No.	Description	Part No.	Description
23-9	Axial propeller	719.02	Flexible tube
321.01/.02	Radial ball bearing	720	Fitting
322	Radial roller bearing	732	Guide bracket
411.02/.03/.05	Joint ring	81-51	Clamping element
412.01/.02/.03/ .04/.05/.06/.07	O-ring	81-59	Stator
421.02/.03/.04	Lip seal	81-73	Cable tie
433.01	Mechanical seal (gear side)	811	Motor housing
433.02	Mechanical seal (propeller side)	812	Motor housing cover
441	Shaft seal housing	818	Rotor
443	Seal insert	834	Cable gland
471	Seal cover	870	Gear unit
476	Mating ring carrier	901.03/.04	Hexagon head bolt
500	Ring	903.02/.03	Screw plug

Part No.	Description	Part No.	Description
540.04	Bush	914.05/.06	Hexagon socket head cap screw
550.01/.03/.04	Disc	920.04	Nut
571	Lifting bail	932.01/.02/.03/ .04/.05/.07/.08	Circlip
69-14	Leakage sensor	970.02	Label/plate

9.2 Flamepaths on explosion-proof motors

9.2.1 Amaprop motor types DKM161 and MA16

DKM motors: 11 4, 16 4, 23 4

MA motors: 5 4, 7 4, 11 4, 15 4, 22 4

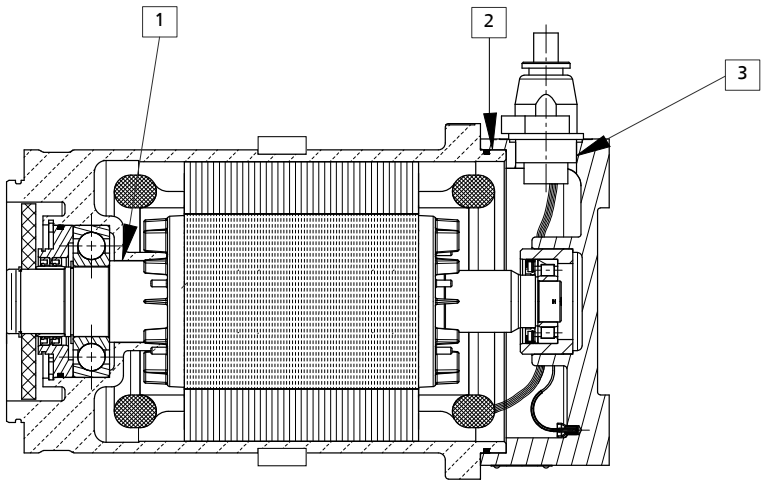

Fig. 25: Flamepaths on explosion-proof motors – motor types DKM161 / MA16

9.2.2 Amaprop motor types DKM90 / 112 and MA09 / 11

DKM motors: 1 4, 2 4, 3 4, 4 4, 5 4

MA motors: 1 4, 2 4, 3 4, 4 4

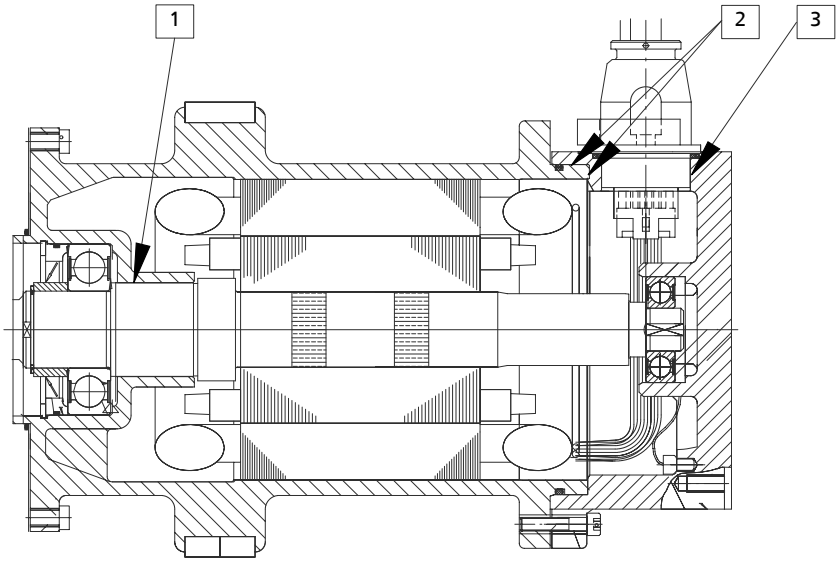

Fig. 26: Flamepaths on explosion-proof motors – motor types DKM90 / 112 and MA09 / 11

9.3 Wiring diagrams

CAUTION

Incorrect electrical connection

Winding damage!

- ▹ Observe the wiring diagram and the direction of rotation. (⇨ Section 5.5, Page 28)

9.3.1 Wiring diagram for one power cable 8G1.5

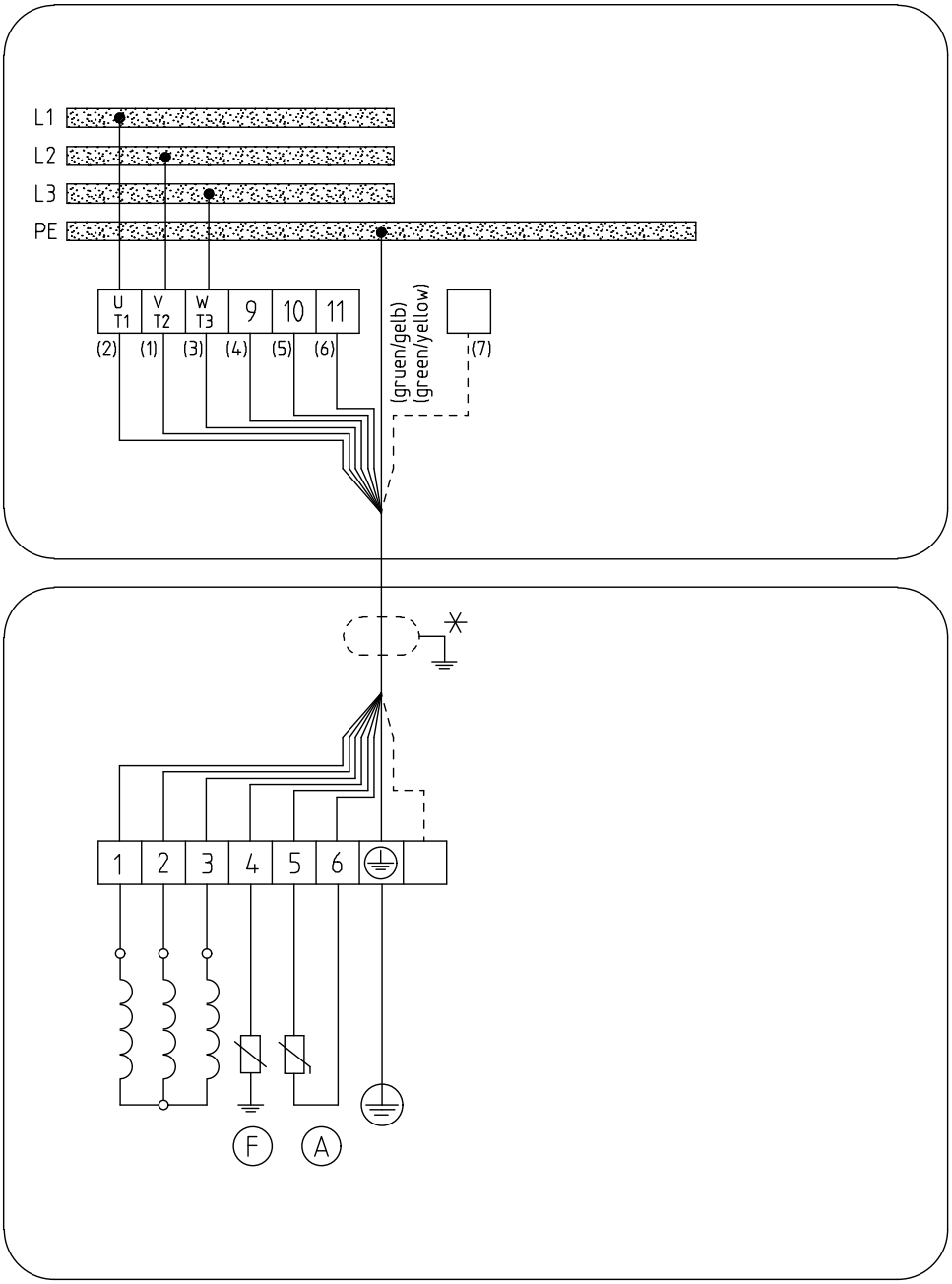

Fig. 27: Wiring diagram for one power cable 8G1.5

*	Shielded cable optional
Ⓐ	Motor temperature (PTC)
Ⓕ	Leakage inside the motor

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

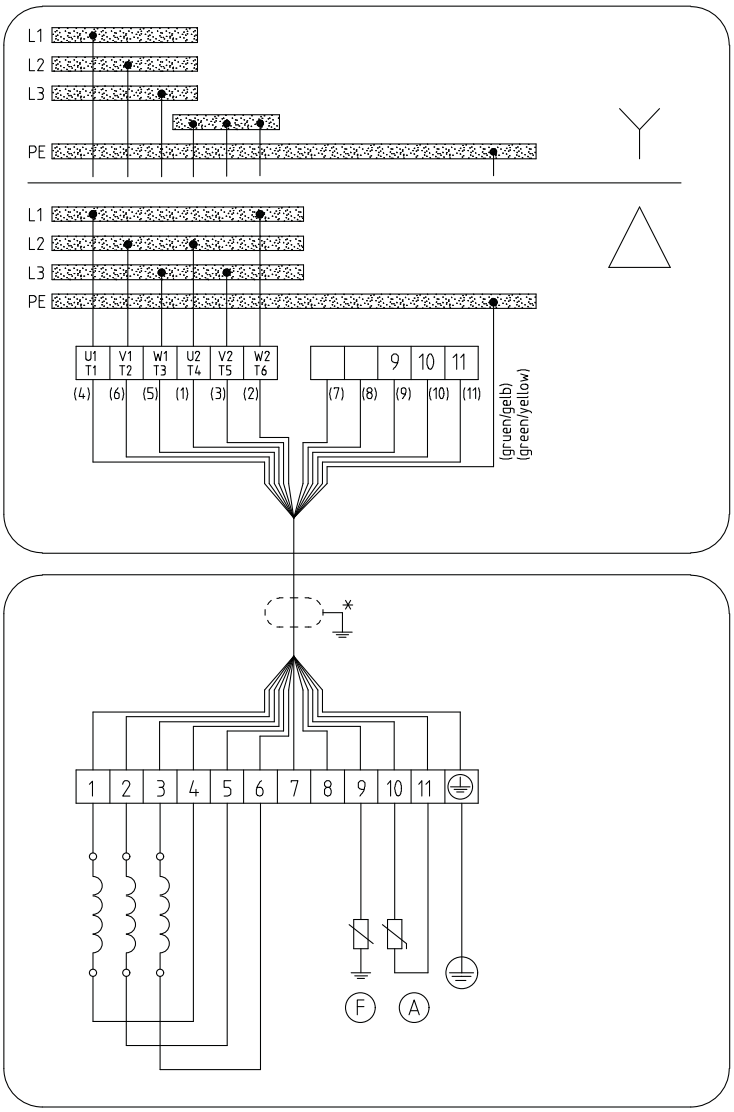


Fig. 28: Wiring diagram for one power cable 12G1.5 or 12G2.5

*	Shielded cable optional
Ⓐ	Motor temperature (PTC)
Ⓕ	Leakage inside the motor

9.3.3 Wiring diagram for one power cable 7x6 + 5×1.5

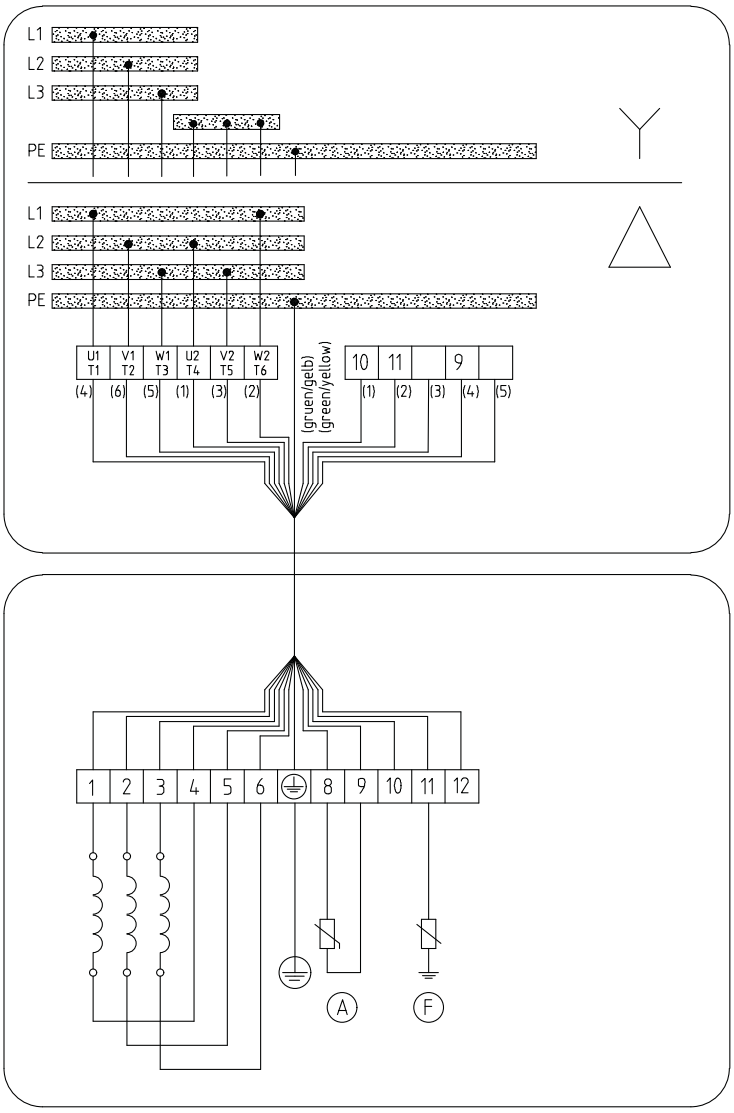
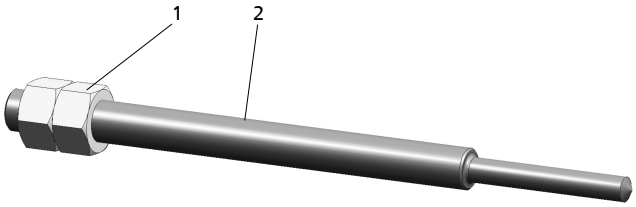


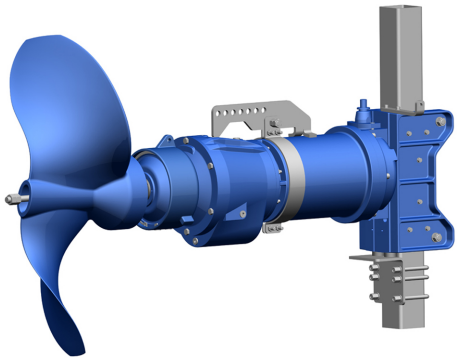
Fig. 29: Wiring diagram for one power cable 7x6 + 5×1.5

Ⓐ	Motor temperature (PTC)
Ⓕ	Leakage inside the motor

9.4 Forcing screw



Forcing screw



Propeller with forcing screw

1	Nut
2	Fully threaded stud

The forcing screw facilitates dismantling and pulling the propeller off the submersible mixer shaft. The hexagon socket head cap screw with washer is removed and the fully threaded stud (2) is screwed into the propeller's forcing thread up to the stop using the nut (1), pulling the propeller smoothly off the shaft.

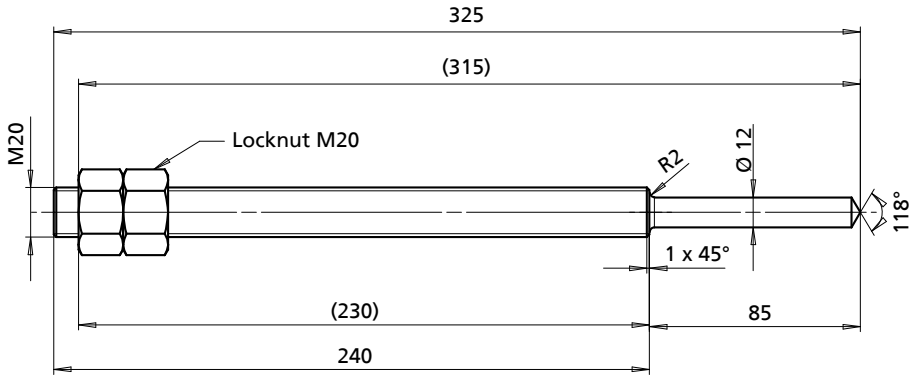


Fig. 30: Forcing screw M20 × 325

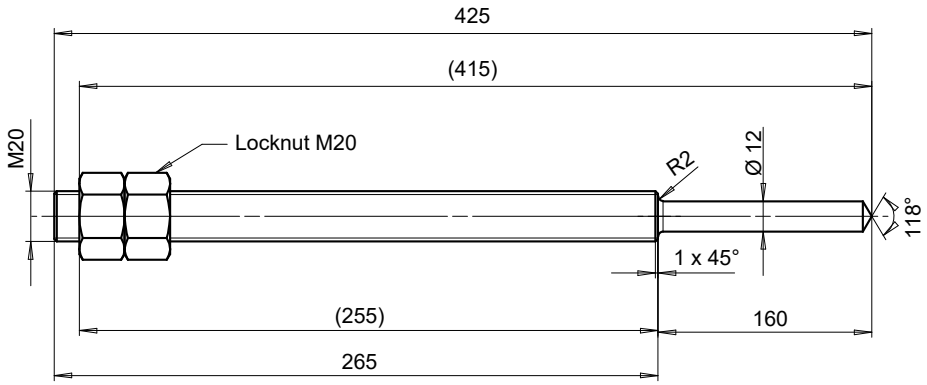
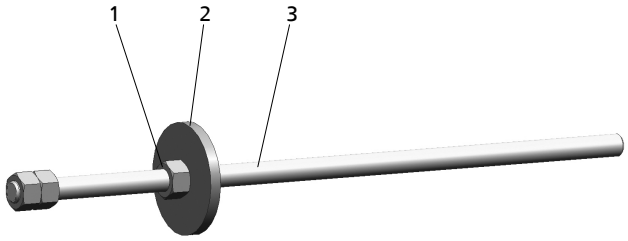


Fig. 31: Forcing screw M20 × 425

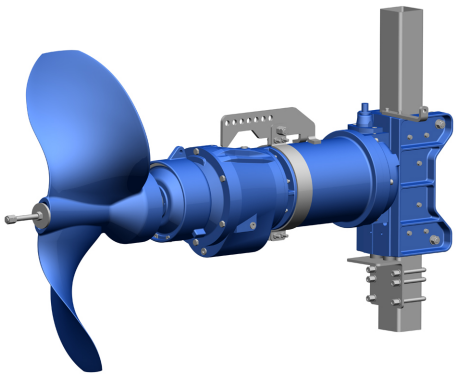
Table 21: Propeller forcing screws

Description		Amaprop									Material
		1000	1200	1400	1600	1800	1801	2000	2200	2500	
Forcing screw	M20 × 325	-	✘	✘	✘	✘	✘	-	-	-	A4-70
Forcing screw	M20 × 425	✘	-	-	-	-	-	✘	✘	✘	A4-70

9.5 Propeller fitting tool



Propeller fitting tool



Propeller with propeller fitting tool

1	Nut
2	Disc
3	Fully threaded stud

The propeller fitting tool facilitates fitting the propeller on the submersible mixer shaft. The fully threaded stud (3) is screwed into the shaft, and the propeller and the disc (2) are placed on the shaft. The nut (1) is tightened up to the stop, pulling the propeller onto the shaft.

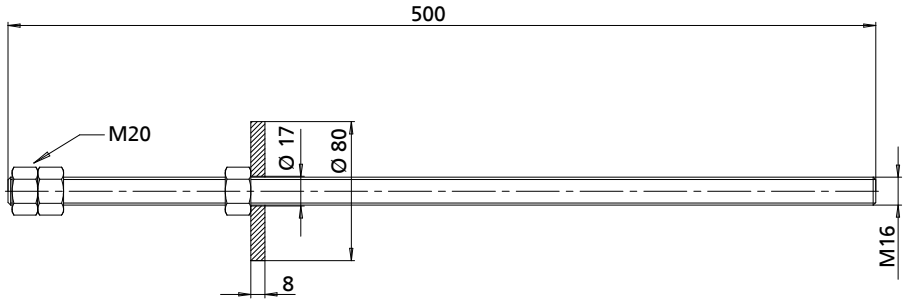


Fig. 32: Propeller fitting tool M16 × 500

Table 22: Propeller fitting tool

Description		Amaprop								Material
		1000	1200	1400	1600	1800	1801	2000	2200	2500	
Propeller fitting tool	M16 × 500	✗	✗	✗	✗	✗	✗	✗	✗	✗	A4-70

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10 EU Declaration of Conformity

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

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

Amamix direkt, Amaprop

KSB order number: .....

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

The manufacturer also declares that

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

Person authorised to compile the technical file:

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

.....[12)].....

Name

Function

Company
Address

1592.89/14-EN

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

11 Certificate of Decontamination

Type: .....

Order number /

Order item number[13]: .....

Delivery date: .....

Application: .....

Fluid handled[13]: .....

Please tick where applicable[13]:

☐ Corrosive

☐ Oxidising

☐ Flammable

☐ Explosive

☐ Hazardous to health

☐ Seriously hazardous to health

☐ Toxic

☐ Radioactive

☐ Bio-hazardous

☐ Safe

Reason for return:[13]: .....

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

1592.89/14-EN

13 Required field

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KSB SE & Co. KGaA
Johann-Klein-Straße 9 • 67227 Frankenthal (Germany)
Tel. +49 6233 86-0
www.ksb.com