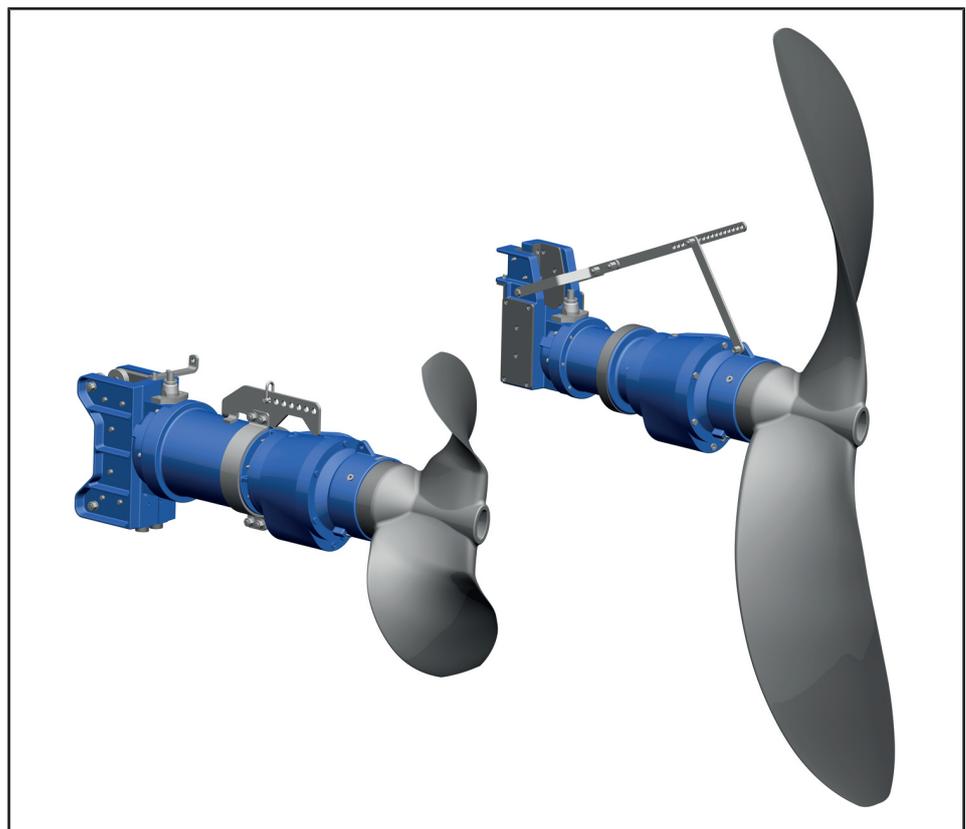


Submersible Mixer

# Amaprop

60 Hz

## Installation/Operating Manual



Mat. No.:

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Installation/Operating Manual Amaprop

Original operating manual

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## Glossary

### **Certificate of decontamination**

If a product is to be returned to the manufacturer, the customer declares in a certificate of decontamination 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 submersible motor.

## 1 General

### 1.1 Principles

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

The 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 uniquely identify the submersible mixer 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.

### 1.4 Other applicable documents

**Table 1:** Overview of other applicable documents

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

1) If agreed to be included in the scope of supply



## 2 Safety

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

### 2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

### 2.2 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 which are not taken into account.

### 2.3 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 fluids 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.

#### **2.4 Personnel qualification and personnel 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.

#### **2.5 Consequences and risks caused by non-compliance with these operating instructions**

- 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

#### **2.6 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

#### **2.7 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.

### 2.8 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 authorized 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 is performed by authorized, 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 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.

### 2.9 Unauthorized modes of operation

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

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.

### 2.10 Explosion protection

Special conditions apply to the operation of explosion-proof submersible mixers.

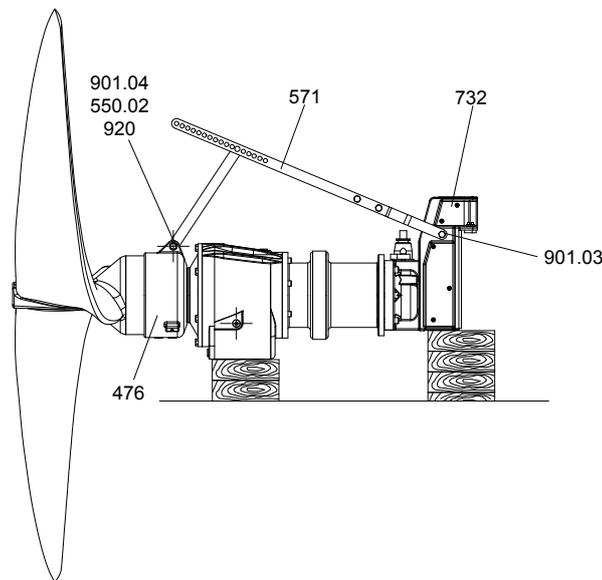
- The explosion-proof status of the product is only assured if the product is used in accordance with its intended use.
- The limits stated in the data sheet and on the name plate must not be exceeded under any circumstances.
- Correct monitoring of the motor temperature is imperative to ensure explosion protection.
- Observe the wiring diagrams.
- Never operate an explosion-proof submersible mixer without temperature monitoring equipment!
- Modifications or alterations of the submersible mixer can affect explosion protection and are only permitted after consultation with the manufacturer.
- Only original spare parts and accessories authorized by the manufacturer must be used for explosion-proof submersible mixers.

### 3 Transport/Temporary Storage/Disposal

#### 3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the distributor and the insurance company 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 center of gravity position.

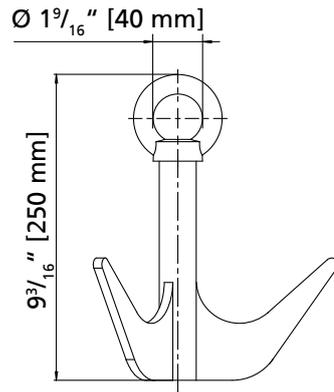
1. Position the submersible mixer as shown.
2. Fit the lifting bail to guide bracket 732 using hexagon head bolts 901.03.
3. Use hexagon head bolt 901.04, disc 550.02 and nuts 920 to fasten the lifting bail to mating ring carrier 476.

#### 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

	<b>NOTE</b>
	Lifting hooks can only be used in low-viscosity substrates.



**Fig. 2: Lifting hook**

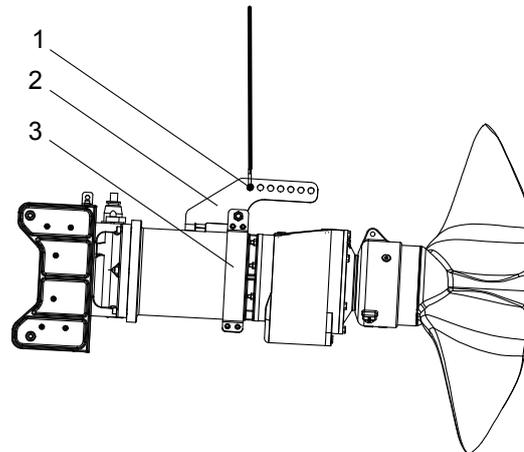
The lifting hook has a maximum load-carrying capacity of 1100 lbs [500 kg].

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 – Amaprop 1000**

1	Attachment point	2	Supporting strap
3	Supporting clamp		

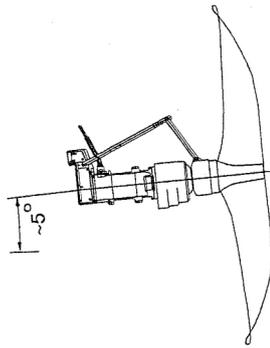
For trouble-free lifting and lowering, a slight inclination angle must be maintained (lower end = propeller end) when the mixer is suspended by the supporting strap. If the angle deviates from the requirements, the attachment point must be adjusted.

Adjusting 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 in the supporting strap, counted from the guide rail).

**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 adjusted.

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 bolted connection on the lifting bail.
3. Select the correct hole in the lifting bail, depending on the required inclination of the mixer.

	<b>CAUTION</b>
	<p><b>Loose or insufficiently tightened screwed connections</b>                  Damage to the installation parts during operation</p> <ul style="list-style-type: none"> <li>▸ Observe the tightening torques.</li> </ul>

4. Re-tighten all bolts. (⇒ Section 7.6, Page 52)
5. Repeat attachment procedure.

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

**3.6 Transport**

	<b>⚠ DANGER</b>
	<p><b>Improper transport</b>                  Danger to life from falling parts!                  Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Use the attachment point provided on the lifting bail for attaching lifting accessories.</li> <li>▸ Never suspend the submersible mixer by its power cable.</li> <li>▸ Never use the chains or lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied.</li> <li>▸ Safely attach lifting ropes or chains to the submersible mixer and crane.</li> </ul>

Transport the submersible mixer as shown.

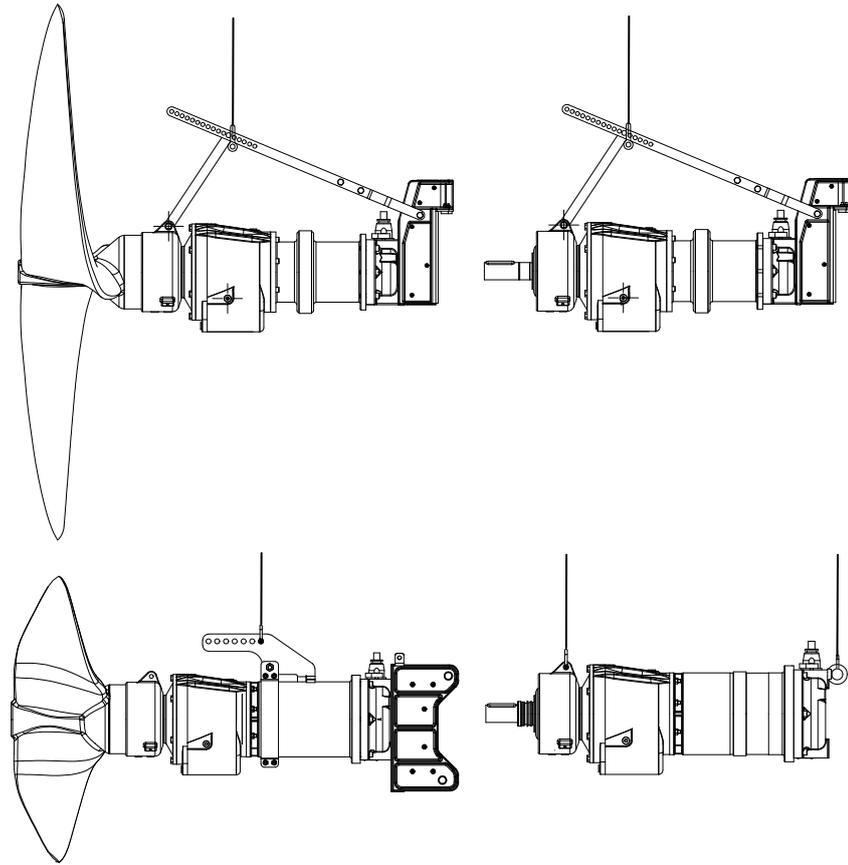


Fig. 5: Transporting the submersible mixer

### 3.7 Storage/Preservation

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

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

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

**Table 4:** Ambient conditions for storage

Ambient conditions	Value
Relative humidity	5 % to 85 % (non-condensing)
Ambient temperature	- 4 °F [- 20 °C] to 158 °F [+ 70 °C]

### 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 when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the submersible mixer must also be neutralized and treated with anhydrous inert gas for drying purposes.
3. Always complete and enclose a certificate of decontamination when returning the submersible mixer stand.  
Always indicate any safety and decontamination measures taken.

	<b>NOTE</b>
	If required, a blank certificate of decontamination can be downloaded from the KSB web site at: <a href="http://www.ksb.com/certificate_of_decontamination">www.ksb.com/certificate_of_decontamination</a>

### 3.9 Disposal

	 <b>WARNING</b>
	<p><b>Fluids posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▸ Submersible mixers used in fluids posing a health hazard must be decontaminated.</li> <li>▸ Collect and properly dispose of flushing liquid and any residues of the fluid handled.</li> <li>▸ Wear safety clothing and a protective mask, if required.</li> <li>▸ Observe all legal regulations on the disposal of substances posing a health hazard.</li> </ul>

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 other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

## 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 applications.

### 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, 16, 23	Amaprop 1000
	1, 2, 3, 4, 5, 7	Amaprop 1200 to 2500
4	Number of motor poles	
UP	Motor variant	
	UR	Non-explosion-proof, for fluid temperatures of up to 40 °C
	UP <sup>2)</sup>	Non-explosion-proof, for fluid temperatures of up to 40 °C
	XR	Explosion-proof according to NEC 500, CECJ
	XP <sup>2)</sup>	Explosion-proof according to NEC 500, CECJ
G	Casing material	
	G	Gray cast iron
IE3	Motor efficiency classification	
	<sup>3)</sup>	No efficiency classification
	IE3	Premium Efficiency

2) Variant IE3

3) Blank

### 4.4 Name plate

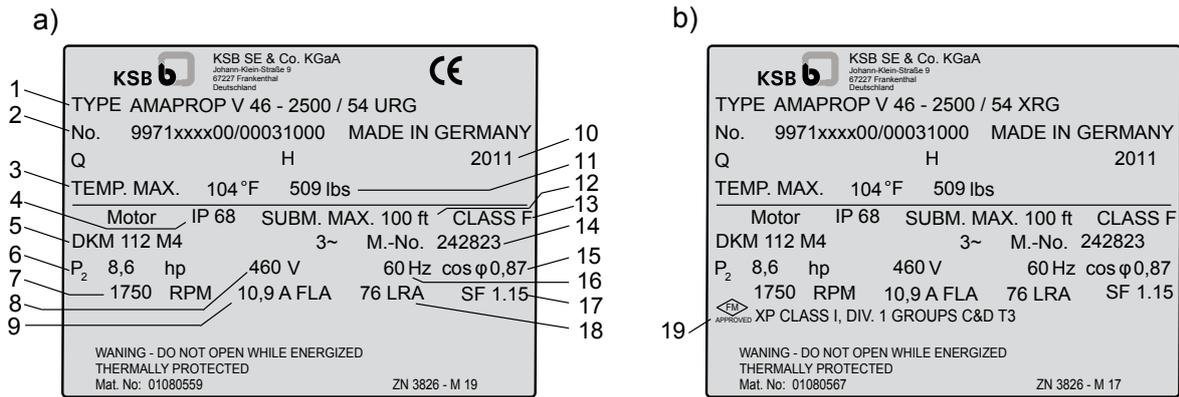


Fig. 6: Name plate (example) a) standard submersible mixer, b) explosion-proof submersible mixer

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	Mode of operation	18	Starting current
19	Marking for explosion-proof submersible mixers		

### 4.5 Design details

#### Design

- Fully floodable submersible mixer
- Horizontal installation

#### Axial propeller

- Self-cleaning (ECB) propeller

#### Shaft seal

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

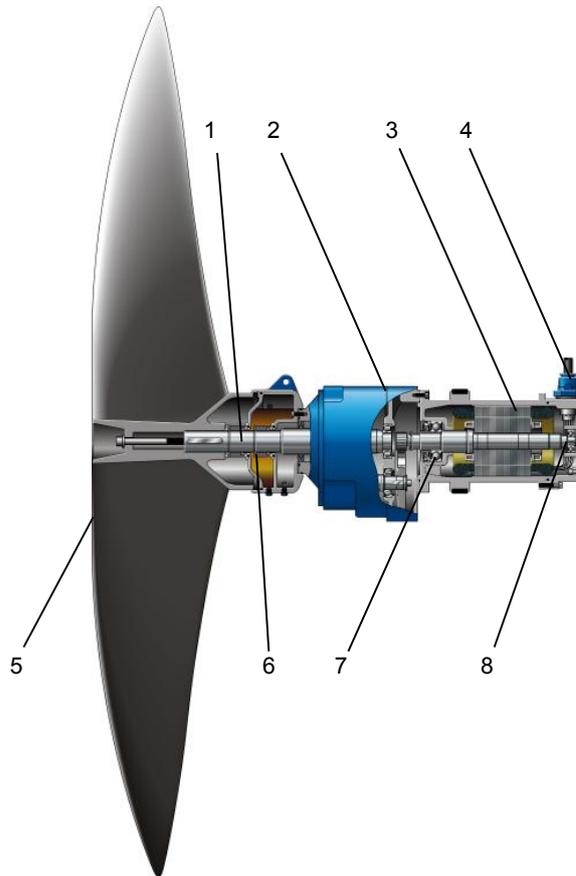
#### Bearings

- Grease-packed rolling elements bearings (sealed for life) in the motor
- Oil-lubricated rolling element bearings in the gear unit

#### Drive

- Three-phase asynchronous squirrel-cage motor
- Motors integrated in explosion-proof pump sets are supplied in Explosionproof Class I Division 1, Groups C&D, T3.

### 4.6 Configuration and function



**Fig. 7:** Sectional drawing

1	Gear shaft	2	Casing
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. This thrust induces 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 chamber between the mechanical seals ensures cooling and lubrication. The cable gland (4) for the power cable is absolutely 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

**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

	<p><b>⚠ DANGER</b></p> <p><b>Improper installation in potentially explosive atmospheres</b> Explosion hazard! Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Comply with the applicable local explosion protection regulations.</li> <li>▸ Observe the information given in the data sheet and on the name plate.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Persons entering the tank</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▸ Never start up the submersible mixer when there are persons inside the tank.</li> <li>▸ Disconnect or electrically disable the submersible mixer before entering the tank.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Hands, other body parts, or foreign objects in the propeller or propeller intake area</b> Risk of personal injury! Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.</li> </ul>

### 5.2 Checks to be carried out prior to installation

#### 5.2.1 Checking the operating data

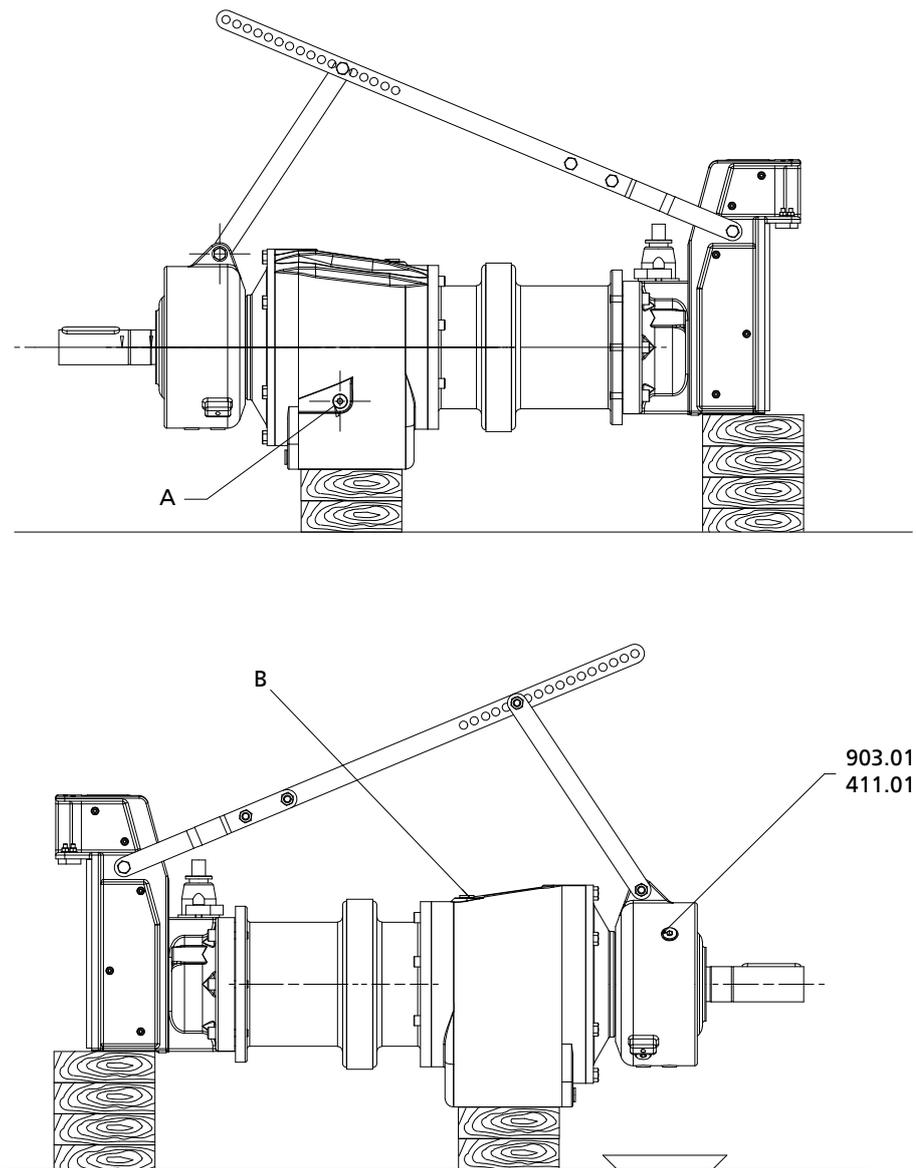
Before setting up the submersible mixer, verify that the name plate data matches the data given in the purchase order and the system data.

#### 5.2.2 Preparing the place of installation

	<p><b>⚠ WARNING</b></p> <p><b>Installation on foundations which are unsecured and cannot support the load</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▸ Make sure the foundation concrete is of sufficient strength (min. 3000 psi [class C25/30 to DIN 1045]).</li> <li>▸ Only place the submersible mixer on a foundation whose concrete has set firmly.</li> <li>▸ Refer to the weights given in the data sheet/on the name plate.</li> </ul>
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1. Check the structural requirements.  
All structural work required must have been prepared in accordance with the dimensions stated in the outline drawing/general arrangement drawing.

## 5.2.3 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 of mechanical seal**

1. Position the submersible mixer as shown.
2. Unscrew 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, if applicable, the lubricant filler plug.

**5.3 Setting up the submersible mixer**

	<b>CAUTION</b>
	<p><b>Incorrect installation position of submersible mixer</b>                  Damage by excessive stresses or strains!</p> <ul style="list-style-type: none"> <li>▷ Observe the information given in the general arrangement drawing.</li> <li>▷ Installation in other positions is only permitted after prior consultation with and approval by KSB.</li> </ul>

Mount the submersible mixer on the applicable submersible mixer stand as described in the separate "Submersible mixer stand" installation instructions.

**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.

	<b>NOTE</b>
	<p>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 cross-section of 1.5 mm<sup>2</sup> (AWG 15) is required.</p>

The motors can be connected to electrical low-voltage grids with rated 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.

**5.4.1.2 Level switch**

	<b>⚠ DANGER</b>
	<p><b>Dry-running of submersible mixer</b>                  Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never allow an explosion-proof submersible mixer to run dry.</li> </ul>

	<b>CAUTION</b>
	<p><b>Propeller not fully submerged</b>                  Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never allow the liquid level to drop below the submersible mixer during mixer operation (not even for short periods).</li> </ul>

Automatic mixer operation in a tank requires the use of level control equipment. Observe the specified minimum fluid level.

**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.

	<b>NOTE</b>
	For use in biogas installations, Amaprop 1000 mixers can be operated on 50 Hz mains power. Amaprop 2500 mixers installed in biogas installations must be operated on frequency inverters.
	<b>! DANGER</b>
	<b>Operation outside the permitted frequency range</b> Explosion hazard! ▷ Never operate an explosion-proof submersible mixer outside the specified range.
	<b>! DANGER</b>
	<b>Incorrect selection and setting of the frequency inverter</b> 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 intermediate-circuit 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.

**Operation** Observe the following limits when operating the pump set on a frequency inverter:

- Only utilize up to 95 % of the rated power  $P_2$  indicated on the name plate.
- Frequency range 30 to 60 Hz

**Electromagnetic compatibility** Frequency inverter operation produces RFI emissions of various extents, 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 cables.

**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 power cables. The power cable / control cable of the submersible mixer does not need to be replaced.

Select suitable analyzing 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

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

The submersible mixer features sensors that avoid hazards and damage to the submersible mixer.

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

All sensors are located inside the submersible mixer and are connected to the power cable.

For information on wiring and core identification please refer to the wiring diagrams.

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

5.4.1.4.1 Motor temperature

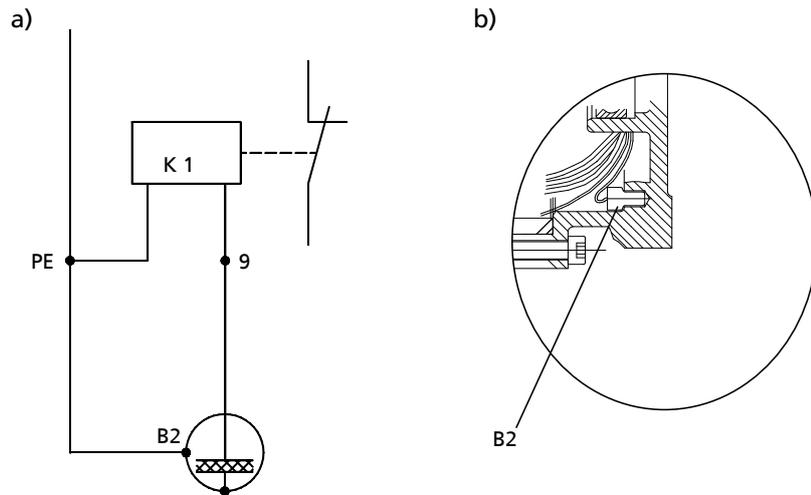
	 <b>DANGER</b>
	<p><b>Insufficient cooling</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never operate an explosion-proof submersible mixer without operational temperature monitoring equipment.</li> <li>▷ For explosion-proof submersible mixers use a thermistor tripping unit with manual reset.</li> </ul>

	<b>CAUTION</b>
	<p><b>Insufficient cooling</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never operate a submersible mixer without operational temperature monitoring equipment.</li> </ul>

The motor is monitored by three series-connected PTC thermistors with terminals 10 and 11. Tripping must result in the submersible mixer cutting out. Automatic re-start is not permitted.

5.4.1.4.2 Leakage inside the motor

	 <b>DANGER</b>
	<p><b>Incorrect monitoring of leakage electrode</b> Explosion hazard! Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▷ Voltages must be &lt; 30 V AC and tripping currents &lt; 0.5 mA.</li> </ul>



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

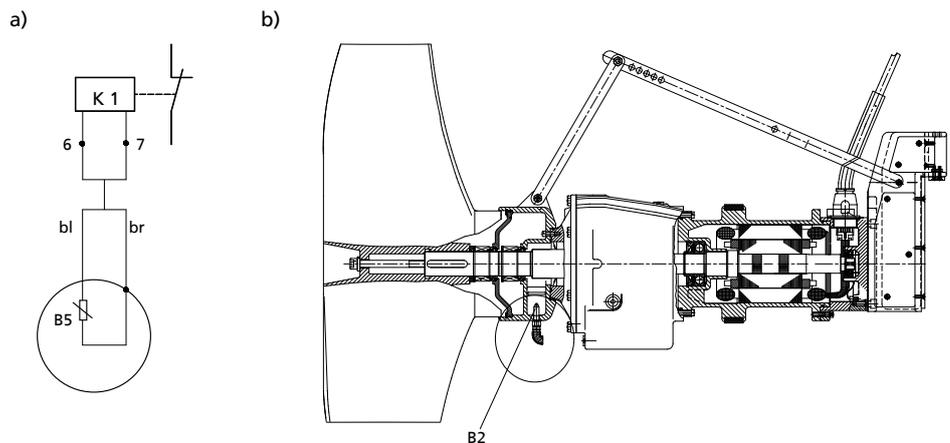
An electrode (B2) fitted inside the motor monitors the winding and connection space for leakage. This electrode must be connected to an electrode relay (core marked 9). Tripping of the electrode relay must result in the submersible mixer cutting out.

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

- Sensor circuit 10 to 30 V AC
- Tripping current  $\leq 0.5$  mA

**5.4.1.4.3 Optional monitoring of leakage at the mechanical seal**

	<p><b>! DANGER</b></p>
	<p><b>Incorrect connection</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never retrofit an explosion-proof submersible mixer with such a leakage sensor in the leakage chamber.</li> </ul>



**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 connection 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 meet 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

	<b>⚠ DANGER</b>
	<p><b>Electrical connection work by unqualified personnel</b>          Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▸ Always have the electrical connections installed by a trained electrician.</li> <li>▸ Observe IEC 60364 regulations as well as any locally applicable regulations.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Incorrect connection to the mains</b>          Damage to the mains network, short circuit!</p> <ul style="list-style-type: none"> <li>▸ Observe the technical specifications of the local energy supply companies.</li> </ul>
	<b>CAUTION</b>
	<p><b>Improper routing of power cable</b>          Damage to the power cables!</p> <ul style="list-style-type: none"> <li>▸ Never move the power cables at temperatures below -13 °F [-25 °C].</li> <li>▸ Never kink or crush the power cables.</li> <li>▸ Never lift the submersible mixer by its power cable.</li> </ul>
	<b>CAUTION</b>
	<p><b>Motor overload</b>          Damage to the motor!</p> <ul style="list-style-type: none"> <li>▸ Protect the motor by a thermal time-lag overload protection device in accordance with IEC 60947 and local regulations.</li> </ul>

For electrical connection observe the wiring diagrams and the information on planning the control system. (⇒ Section 5.4.1, Page 21)

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

	<b>⚠ DANGER</b>
	<p><b>Operating an incompletely connected submersible mixer</b>          Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ Never start up a submersible mixer with incompletely connected power cables or non-operational monitoring devices.</li> </ul>
	<b>⚠ DANGER</b>
	<p><b>Incorrect connection</b>          Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ The connection point of the cable ends must be located outside hazardous areas or in an area approved for electrical equipment.</li> </ul>

	<b>CAUTION</b>
	<p><b>Flow-induced motion</b> Damage to the power cable!</p> <ul style="list-style-type: none"> <li>▷ Run the power cable upwards without slack.</li> </ul>
	<b>NOTE</b>
	<p>We recommend using cable supports available as accessories for properly fastening the power cable at the tank edge.</p>

1. Run the power cable directly upwards without slack, and fasten it.
2. Remove the protective caps from the power cable immediately before connection.
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.

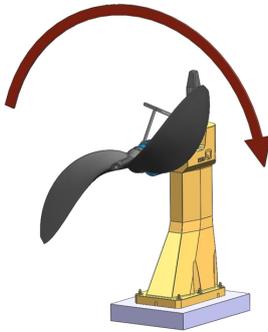
**Potential equalization** The submersible mixer does not have an external PE connection (risk of corrosion).

	<b>⚠ DANGER</b>
	<p><b>Incorrect wiring</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Explosion-proof submersible mixers installed in a tank must never be retrofitted with an external potential equalization connection!</li> </ul>
	<b>⚠ DANGER</b>
	<p><b>Touching the submersible mixer during operation</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Make sure that the submersible mixer cannot be touched during operation.</li> </ul>

### 5.5 Checking the direction of rotation

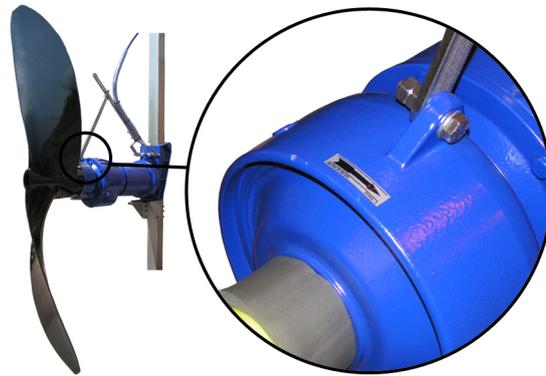
	<b>⚠ WARNING</b>
	<p><b>Hands, other body parts, or foreign objects in the propeller or propeller intake area</b> Risk of personal injury! Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.</li> </ul>
	<b>CAUTION</b>
	<p><b>Wrong direction of rotation</b> Damage to the submersible mixer and the submersible mixer stand!</p> <ul style="list-style-type: none"> <li>▷ Check the direction of rotation.</li> <li>▷ Observe the arrow indicating the direction of rotation.</li> <li>▷ Run the submersible mixer for a short period of time only (max. 1 minute) when checking the direction of rotation.</li> </ul>

	<p style="background-color: yellow; margin: 0;"><b>CAUTION</b></p> <p><b>Propeller not fully submerged</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never lower the submersible mixer into the fluid while checking the direction of rotation.</li> </ul>
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**Fig. 11:** Checking the direction of rotation

- ✓ The submersible mixer is mounted on the submersible mixer stand and positioned entirely 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 casing).



**Fig. 12:** Arrow indicating the direction of rotation

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

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/start-up

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

Before commissioning/start-up make sure that the following requirements are met:

- The submersible mixer has been correctly mounted on the submersible mixer stand.
- The submersible mixer has been properly connected to the power supply and is equipped with all protection devices.
- The operating data, the lubricant level and the direction of rotation have been checked.

#### 6.1.2 Start-up

	<p><b>⚠ DANGER</b></p>
	<p><b>Excessive temperatures due to dry running or excessive fluid temperature</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Never operate the submersible mixer outside the fluid.</li> <li>▷ Observe the minimum level of the fluid handled.</li> <li>▷ Never operate an explosion-proof submersible mixer at ambient and fluid temperatures exceeding those specified in the data sheet or on the name plate.</li> <li>▷ Always operate the submersible mixer within the permissible operating range.</li> </ul>
	<p><b>CAUTION</b></p>
	<p><b>Excessive temperatures due to dry running or excessive fluid temperature</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never operate the submersible mixer outside the fluid.</li> <li>▷ Observe the minimum level of the fluid handled.</li> <li>▷ Always operate the submersible mixer within the permissible operating range.</li> </ul>
	<p><b>CAUTION</b></p>
	<p><b>Re-starting while motor is still running down</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Do not re-start the submersible mixer before it has come to a standstill.</li> <li>▷ Never start up a submersible mixer running in reverse rotation.</li> </ul>

1. Start up the submersible mixer.

### 6.2 Operating limits

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

6.2.1 Frequency of starts

	<b>CAUTION</b>
	<p><b>Excessive frequency of starts</b> Damage to the motor!</p> <ul style="list-style-type: none"> <li>▸ Never exceed the specified frequency of starts.</li> </ul>

To prevent high temperature increases in the motor and excessive loads on the motor, sealing elements and bearings, the switching frequency shall 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). These limits do not apply to frequency inverter operation.

6.2.2 Fluid properties

	<b>CAUTION</b>
	<p><b>Layers of floating sludge in biogas installations</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Never use the Amaprop 2500 submersible mixer for mechanically breaking up layers of floating sludge in biogas installations.</li> </ul>

	<b>NOTE</b>
	<p>Deposits accumulating on the housing surface entail the risk of insufficient cooling of the submersible mixer. We recommend checking the housing surface regularly and removing severe dirt deposits.</p>

6.2.2.1 Minimum level of fluid handled

	<b>⚠ DANGER</b>
	<p><b>Excessive temperatures due to dry-running</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ Always operate the submersible mixer in fully submerged condition only (incl. propeller).</li> <li>▸ Observe the minimum level of the fluid handled.</li> </ul>

	<b>CAUTION</b>
	<p><b>Propeller not fully submerged</b> Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Never allow the liquid level to drop below the submersible mixer during mixer operation (not even for short periods).</li> </ul>

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

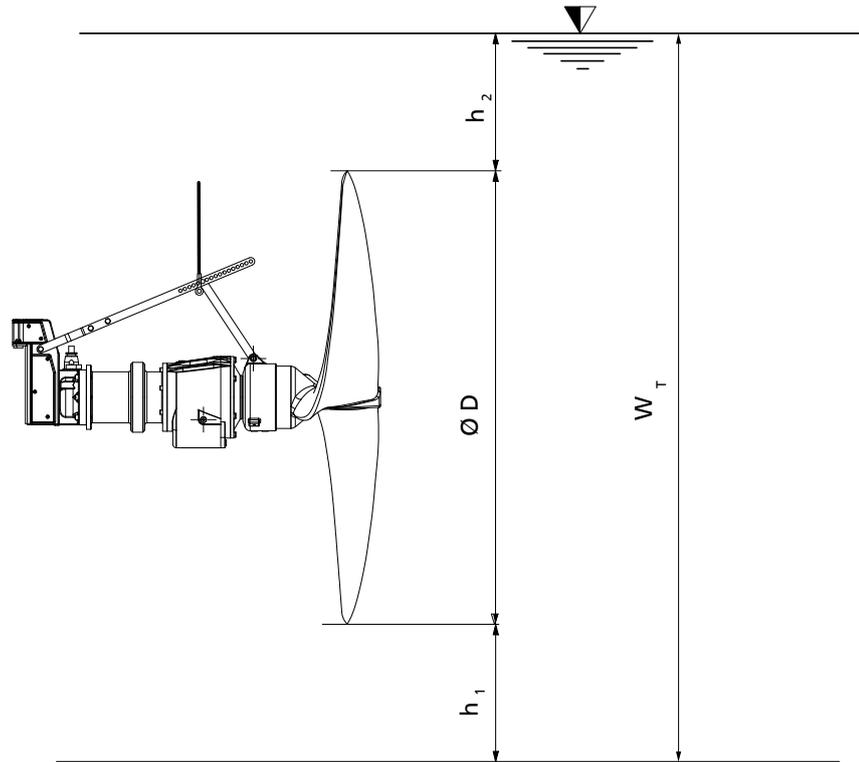


Fig. 13: Minimum level of fluid handled

Table 7: Minimum level of fluid handled

Ø D [mm]	h <sub>1</sub> <sup>4)</sup> [m]
All	0,20 <sup>5)</sup>

**Formula for calculating the minimum fluid level**

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

h<sub>2\*</sub> for sewage treatment plants / water = 1.00 m (0.75 m for Amaprop 1000)

$$W_t = \text{Ø D} + h_1 + h_2$$

**Calculation example**

**Given:**

- Amaprop U 42-2500/64
- n<sub>Submersible mixer</sub> = 42 rotations/minute
- n<sub>max</sub> = 46 rotations/minute

**Solution:**

$$h_2 = (42 / 46)^2 \times 0.50 \text{ m} = 0.42 \text{ m}$$

$$W_t = 2.50 \text{ m} + 0.30 \text{ m} + 0.42 \text{ m} = 3.22 \text{ m}$$

**6.2.2.2 Fluid temperature**

	<p><b>! DANGER</b></p>
	<p><b>Fluid temperature</b> Explosion hazard!</p> <p>▷ Never operate the submersible mixer at fluid temperatures exceeding those specified in the data sheet or on the name plate.</p>

4) Minimum  
5) For biogas applications: 0.30 m

	 <b>DANGER</b>
	<p><b>Fluid temperature</b>            Danger of frost/freezing!</p> <ul style="list-style-type: none"> <li>▷ The submersible mixer is designed for operation in liquids. The submersible mixer is not operational, and therefore must not be operated, under freezing conditions.</li> </ul>

**6.2.2.3 Density of fluid handled**

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

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

**6.2.2.4 Abrasive fluids**

Do not exceed the maximum permissible 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 behavior of fluid handled**

	<b>CAUTION</b>
	<p><b>Impermissibly high transverse flow</b>            Damage to submersible mixer and/or installation parts!</p> <ul style="list-style-type: none"> <li>▷ Match the rotational speed of the submersible mixer and/or the number of submersible mixers running to the predominantly low-viscosity fluid.</li> </ul>

**6.2.3 Supply voltage**

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

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

**6.2.4 Operation on a frequency inverter**

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

Frequency inverter operation of the submersible mixer is permitted in the frequency range from 25 to 60 Hz. In biogas applications, frequency inverter operation is permitted in the frequency range from 30 to 60 Hz.

### 6.3 Shutdown/storage/preservation

#### 6.3.1 Measures to be taken for shutdown

	<p><b>⚠ WARNING</b></p> <p><b>Fluids, consumables and supplies posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Submersible mixers used in fluids posing a health hazard must be decontaminated.</li> <li>▷ Wear safety clothing and a protective mask, if required.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Submersible mixer started up unintentionally</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.</li> <li>▷ Make sure that the submersible mixer cannot be started up unintentionally.</li> </ul>

#### The submersible mixer remains installed

	<p><b>⚠ DANGER</b></p> <p><b>Persons entering the tank</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▷ Never start up the submersible mixer when there are persons inside the tank.</li> <li>▷ Disconnect or electrically disable the submersible mixer before entering the tank.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Hands, other body parts, or foreign objects in the propeller or propeller intake area</b> Risk of personal injury! Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▷ Never place your hands, other body parts or foreign objects into the propeller or propeller intake area.</li> </ul>

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

#### The submersible mixer is removed from the tank and stored

- ✓ All safety regulations are observed.
- 1. Clean the submersible mixer.
- 2. Carry out maintenance work.  
Follow the maintenance instructions.

#### 6.4 Returning to service

For returning the submersible mixer to service adhere to the sections on commissioning/start-up and the operating limits.

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.

## 7 Servicing/Maintenance

### 7.1 Safety regulations

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

	<p><b>⚠ DANGER</b></p> <p><b>Sparks produced during maintenance work</b> Explosion hazard!</p> <ul style="list-style-type: none"> <li>▸ Always perform maintenance work on explosion-proof submersible mixers outside potentially explosive atmospheres only.</li> </ul>
	<p><b>⚠ DANGER</b></p> <p><b>Improper transport</b> Danger to life from falling parts! Damage to the submersible mixer!</p> <ul style="list-style-type: none"> <li>▸ Use the attachment point provided (lifting lug or bail) for attaching lifting accessories.</li> <li>▸ Never suspend the submersible mixer by its power cable.</li> <li>▸ Never use the lifting ropes included in KSB's scope of supply for lifting loads other than the KSB product supplied.</li> <li>▸ Safely attach lifting ropes to the submersible mixer and crane.</li> <li>▸ Protect the power cable against damage.</li> <li>▸ Maintain adequate safety distance during lifting operations.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Submersible mixer started up unintentionally</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▸ Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.</li> <li>▸ Make sure that the submersible mixer cannot be started up unintentionally.</li> </ul>
	<p><b>⚠ WARNING</b></p> <p><b>Fluids handled and supplies posing a health hazard or hot fluids handled and supplies</b> Risk of injury!</p> <ul style="list-style-type: none"> <li>▸ Observe all relevant laws.</li> <li>▸ Take appropriate measures to protect persons and the environment.</li> <li>▸ Decontaminate submersible mixers used in fluids posing a health hazard.</li> </ul>
	<p><b>NOTE</b></p> <p>Special regulations apply to repair work on explosion-proof submersible mixers. Modification or alteration of the submersible mixers can affect explosion protection and is only permitted after consulting the manufacturer.</p>

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

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

Never use force when dismantling and reassembling the submersible mixer.

### 7.2 Maintenance/inspection

KSB recommends the following regular maintenance schedule:

**Table 8:** Overview of maintenance work

Maintenance interval	Maintenance work
Every 8,000 operating hours <sup>6)</sup>	Insulation resistance measurement (⇒ Section 7.2.1.1, Page 35)
	Checking the power cables (⇒ Section 7.2.1.2, Page 36)
	Visual inspection of shackle/lifting rope (⇒ Section 7.2.1.3, Page 36)
Every 16000 operating hours <sup>7)</sup>	Checking the sensors (⇒ Section 7.2.1.4, Page 36)
	Lubricant change (⇒ Section 7.2.1.5, Page 37)
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 maximum measuring voltage is 1000 V.
  1. Measure winding to chassis ground.  
To do so, connect all winding ends together.
  2. Measure winding temperature sensor to chassis ground.  
To do so, connect all core ends of the winding temperature sensors together and connect all winding ends to chassis ground.
- ⇒ The insulation resistance of the core ends to chassis ground must not be lower than 1 MΩ.  
If the resistance measured is lower, cable and motor resistance must be measured separately. Disconnect the power cable from the motor for this purpose.

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

	<b>NOTE</b>
	If the motor insulation resistance measured is too low, the winding is defective. The submersible mixer must not be returned to service in this case.

6) At least once a year  
7) At least every three years

**7.2.1.2 Checking the power cables**

- Visual inspection**
  1. Inspect the power cable for visual damage.
  2. Replace any damaged components by original spare parts.
- Checking the ground conductor**
  1. Measure the resistance between ground conductor and chassis ground. The resistance must be lower than 1 Ω.
  2. Replace any damaged components by original spare parts.

	<p><b>⚠ DANGER</b></p>
	<p><b>Defective ground conductor</b> Electric shock!</p> <ul style="list-style-type: none"> <li>▸ Never switch on a submersible mixer with a defective ground conductor.</li> </ul>

**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**

	<p><b>CAUTION</b></p>
	<p><b>Excessive test voltage</b> Damage to the sensors!</p> <ul style="list-style-type: none"> <li>▸ Use a commercially available ohmmeter to measure the resistance.</li> </ul>

The tests described below measure the resistance at the core ends of the 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 ground conductor (PE)	> 60

Lower resistance values would 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 measurement of the leakage sensor at the mechanical seal

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

Lower values suggest liquid ingress into the leakage chamber. In this case the leakage chamber must be checked. (⇒ Section 7.2.1.5.3, Page 41)

7.2.1.5 Lubrication and lubricant change

7.2.1.5.1 Lubricant quality

**Recommended quality of mechanical seal lubricant**

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

Table 12: Oil quality

Description	Properties	
Paraffin oil or white oil Alternative: motor oils of classes SAE 10W to SAE 20W	Kinematic viscosity at 104 °F [40 °C]	<20 mm <sup>2</sup> /s
	Flash point (to Cleveland)	320 °F [160 °C]
	Solidification point (pour point)	2 °F [-15 °C]

**Recommended oil quality:**

- Merkur WOP 40 PB, made by SASOL
- Merkur white oil Pharma 40, made by DEA
- Thin-bodied paraffin oil No. 7174, made by Merck
- Equivalent brands of medical quality, non-toxic
- Water-glycol mixture
- Lubricant to ISO VG 320 (viscosity 320)

**Recommended quality of gear unit lubricant**

- Lubricant to ISO VG 320 (viscosity 320) for fluid temperatures ≤ 113 °F [≤ 45 °C]
- Fully synthetic gear oil CLP 320 PAO (based on polyalphaolefines) for fluid temperatures between 113 °F [45 °C] and 140 °F [60 °C]

	<p><b>! WARNING</b></p>
	<p><b>Contamination of fluid handled by lubricant</b> Hazard to persons and the environment!</p> <p>▸ Using machine oil is only permitted if the oil can be disposed of properly.</p>

7.2.1.5.2 Lubricant quantity

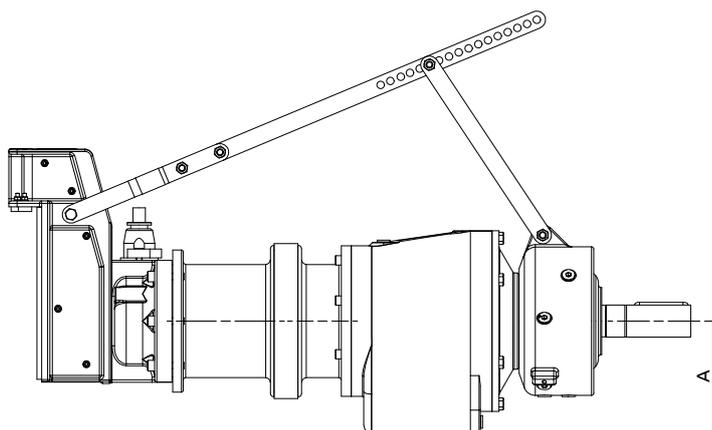
Mechanical seal Table 13: Quantity of mechanical seal lubricant

Size	Lubricant quantity	
	[oz]	[l]
All	64,25	1,9

Gear unit Table 14: Quantity of gear unit lubricant

Gear unit	Lubricant quantity	
	[oz]	[l]
SP 189	67,63	2,0
SP 190/SP 190 X	87,25 <sup>8)</sup>	2,6 <sup>9)</sup>

8) For Amaprop 1000 with pitch adapter (15° or 30° upward pitch) = 145.4 oz  
 9) For Amaprop 1000 with pitch adapter (15° or 30° upward pitch) = 4.3 liters


**Fig. 14:** Shaft centerline height - Gear unit

A	Shaft centerline height
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**Table 15:** Gear units and shaft centerline height by pump size

Amaprop	Gear unit	Shaft centerline height
...-1000/...	SP 190	87,92
V 59-1200/14	SP 189	67,63
V 64-1200/14	SP 190	87,92
V 69-1200/24	SP 189	67,63
V 72-1200/24	SP 190	87,92
V 75-1200/24	SP 189	67,63
V 78-1200/24	SP 190	87,92
V 82-1200/24	SP 189	67,63
V 84-1200/34	SP 189	67,63
V 88-1200/44	SP 190	87,92
V 96-1200/44	SP 190	87,92
V 102-1200/44	SP 190	87,92
V 109-1200/44	SP 190	87,92
V 110-1200/54	SP 190	87,92
V 48-1400/14	SP 189	67,63
V 56-1400/14	SP 189	67,63
V 63-1400/24	SP 189	67,63
V 67-1400/24	SP 189	67,63
V 72-1400/34	SP 190	87,92
V 79-1400/34	SP 190	87,92
V 85-1400/44	SP 190 X	87,92
V 87-1400/44	SP 190	87,92
V 95-1400/44	SP 190	87,92
V 102-1400/54	SP 190	87,92
V 39-1600/14	SP 189	67,63
V 43-1600/14	SP 189	67,63
V 47-1600/14	SP 189	67,63
V 52-1600/14	SP 189	67,63
V 53-1600/24	SP 189	67,63
V 57-1600/24	SP 189	67,63
V 62-1600/24	SP 189	67,63
V 65-1600/34	SP 190	87,92
V 72-1600/34	SP 189	67,63

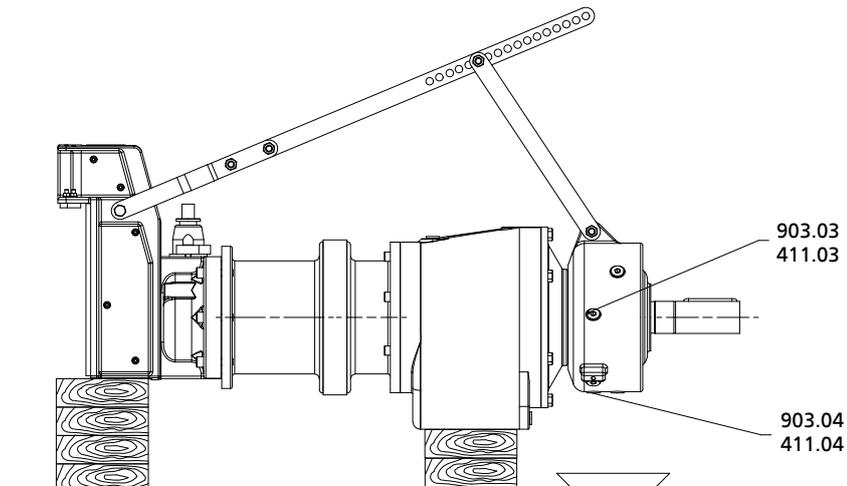
Amaprop	Gear unit	Shaft centerline height
V 80-1600/44	SP 190	87,92
V 84-1600/44	SP 190 X	87,92
V 86-1600/44	SP 190	87,92
V 87-1600/54	SP 190	87,92
V 35-1800/14	SP 189	67,63
V 39-1800/14	SP 189	67,63
V 43-1800/14	SP 189	67,63
V 47-1800/14	SP 189	67,63
V 52-1800/24	SP 189	67,63
V 56-1800/24	SP 189	67,63
V 60-1800/24	SP 190 X	87,92
V 61-1800/34	SP 190 X	87,92
V 62-1800/34	SP 189	67,63
V 64-1800/34	SP 190	87,92
V 67-1800/44	SP 190 X	87,92
V 71-1800/44	SP 190 X	87,92
V 78-1800/44	SP 190 X	87,92
V 79-1800/54	SP 190 X	87,92
V 84-1800/54	SP 190 X	87,92
V 30-1801/14	SP 189	67,63
V 35-1801/14	SP 189	67,63
V 39-1801/14	SP 189	67,63
V 42-1801/14	SP 189	67,63
V 44-1801/14	SP 190 X	87,92
V 48-1801/24	SP 189	67,63
V 49-1801/24	SP 190 X	87,92
V 52-1801/24	SP 189	67,63
V 56-1801/24	SP 189	67,63
V 61-1801/34	SP 190 X	87,92
V 62-1801/34	SP 189	67,63
V 67-1801/44	SP 190 X	87,92
V 71-1801/44	SP 190 X	87,92
V 71-1801/54	SP 190 X	87,92
V 79-1801/54	SP 190 X	87,92
V 27-2000/14	SP 189	67,63
V 29-2000/14	SP 189	67,63
V 30-2000/14	SP 189	67,63
V 30-2000/24	SP 189	67,63
V 33-2000/24	SP 190 X	87,92
V 35-2000/24	SP 189	67,63
V 37-2000/24	SP 190 X	87,92
V 39-2000/34	SP 189	67,63
V 41-2000/34	SP 190 X	87,92
V 42-2000/44	SP 190 X	87,92
V 45-2000/44	SP 190 X	87,92
V 46-2000/44	SP 190 X	87,92
V 47-2000/44	SP 190 X	87,92
V 48-2000/44	SP 190 X	87,92
V 49-2000/44	SP 190 X	87,92

Amaprop	Gear unit	Shaft centerline height
V 50-2000/54	SP 190 X	87,92
V 53-2000/54	SP 190 X	87,92
V 27-2001/14	SP 189	67,63
V 29-2001/14	SP 189	67,63
V 30-2001/14	SP 189	67,63
V 33-2001/24	SP 190 X	87,92
V 34-2001/24	SP 189	67,63
V 37-2001/24	SP 190 X	87,92
V 38-2001/24	SP 189	67,63
V 39-2001/34	SP 189	67,63
V 41-2001/34	SP 190 X	87,92
V 42-2001/44	SP 190 X	87,92
V 47-2001/44	SP 190 X	87,92
V 48-2001/44	SP 190 X	87,92
V 49-2001/44	SP 190 X	87,92
V 50-2001/54	SP 190 X	87,92
V 53-2001/54	SP 190 X	87,92
V 27-2200/14	SP 189	67,63
V 28-2200/14	SP 189	67,63
V 30-2200/24	SP 189	67,63
V 34-2200/24	SP 190 X	87,92
V 37-2200/24	SP 190 X	87,92
V 37-2200/34	SP 190 X	87,92
V 38-2200/34	SP 189	67,63
V 42-2200/44	SP 190 X	87,92
V 45-2200/44	SP 190 X	87,92
V 46-2200/44	SP 190 X	87,92
V 47-2200/44	SP 190 X	87,92
V 48-2200/44	SP 190 X	87,92
V 50-2200/54	SP 190 X	87,92
V 27-2500/14	SP 189	67,63
V 29-2500/24	SP 189	67,63
V 30-2500/24	SP 189	67,63
V 33-2500/24	SP 190 X	87,92
V 34-2500/24	SP 189	67,63
V 35-2500/34	SP 189	67,63
V 37-2500/34	SP 190 X	87,92
V 42-2500/44	SP 190 X	87,92
V 45-2500/44	SP 190 X	87,92
V 42-2500/54	SP 190 X	87,92
V 45-2500/44	SP 190 X	87,92
V 46-2500/44	SP 190 X	87,92

7.2.1.5.3 Checking the leakage chamber

	<b>WARNING</b>
	<p><b>Fluids posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Collect and properly dispose of flushing liquid and any residues of the fluid handled.</li> <li>▷ Wear safety clothing and a protective mask if required.</li> <li>▷ Observe all legal regulations on the disposal of harmful substances.</li> </ul>

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



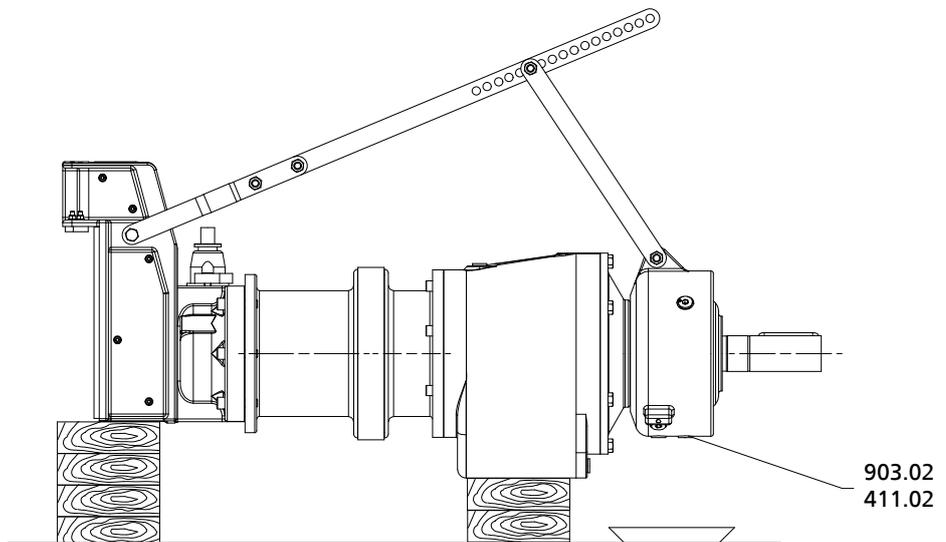
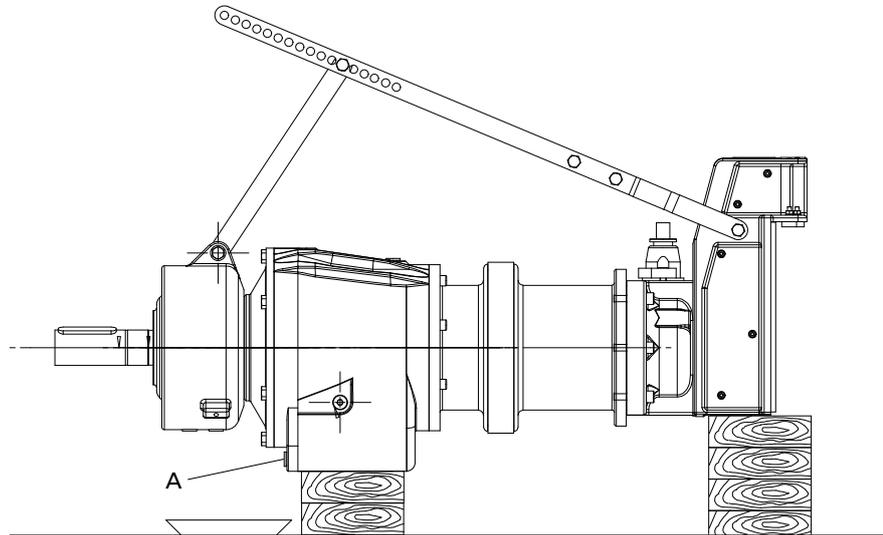
**Fig. 15:** Checking the leakage chamber

- ✓ A suitable container for the leakage is on hand.
  - ✓ The submersible mixer is positioned 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 only a small amount (less than 0.2 liters) after several years of operation, the mechanical seals are working properly. If the leakage exceeds 0.2 liters, the mechanical seals are defective and must be replaced.
  3. Re-insert and screw in screw plugs 903.03/04 with joint rings 411.03/04.

7.2.1.5.4 Draining the lubricant

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

	<p><b>! WARNING</b></p>
	<p><b>Excess pressure in the lubricant chamber</b>                  Liquid spurting out when the lubricant chamber is opened at operating temperature!</p> <p>▷ Open the screw plug of the lubricant chamber very carefully.</p>



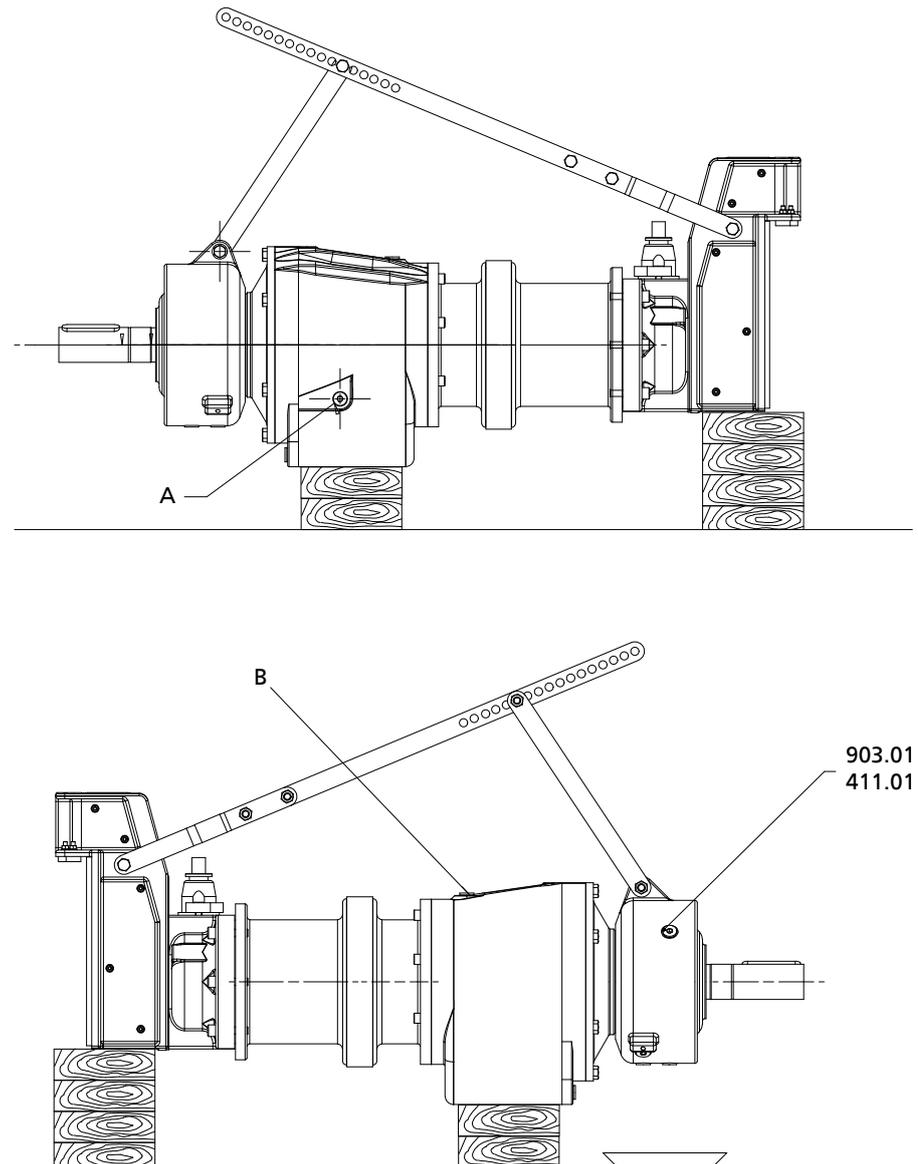
**Fig. 16:** Draining the lubricant – illustration without propeller

A	Lubricant drain plug
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1. Position the submersible mixer as shown.
2. Place a suitable container under the screw plugs.
3. Unscrew the lubricant drain plug of the gear unit. Drain off the lubricant.
4. Screw in the lubricant drain plug of the gear unit.
5. Undo and remove screw plug 903.02 with joint ring 411.02. Drain off the lubricant.
6. Fit screw plug 903.02 together with a new joint ring 411.02.

7.2.1.5.5 Filling in lubricant

	<p><b>WARNING</b></p> <p><b>Lubricants posing a health hazard</b>          Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ When refilling the lubricant take appropriate measures to protect persons and the environment.</li> </ul>
	<p><b>CAUTION</b></p> <p><b>Lubricant level too high</b>          Mechanical seal operation is impaired!</p> <ul style="list-style-type: none"> <li>▷ Always place the submersible mixer in horizontal position (as shown) for refilling the lubricant.</li> </ul>



**Fig. 17:** Filling in lubricant – illustration without propeller

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

- ✓ The submersible mixer has been positioned as shown.
- 1. Unscrew and remove screw plug 903.01 with joint ring 411.01.
- 2. Fill lubricant through the lubricant filler opening until the lubricant chamber overflows.
- 3. Fit screw plug 903.01 together with a new joint ring 411.01.
- 4. Unscrew the lubricant check plug at the gear unit.
- 5. Unscrew the lubricant filler plug at the gear unit.
- 6. Fill lubricant through the lubricant filler opening into the lubricant chamber until the lubricant flows out of the lubricant check opening.
- 7. Screw in the lubricant filler plug of the gear unit.
- 8. Screw in the lubricant check plug of the gear unit.

## 7.2.2 Spare parts stock

### 7.2.2.1 Ordering spare parts

Always quote the following data when ordering replacement parts 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 supply the following data:

- Part No. and description (⇒ Section 9.1, Page 54)
- Quantity of spare parts
- Shipping address
- Mode of dispatch (freight, mail, express freight, air freight)

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

**Table 16:** 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 <sup>10)</sup>
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 <sup>11)</sup>	-	-	-	1	1	2	3	E
99-2	Installation kit for gear unit <sup>12)</sup>	-	-	-	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 end	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

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

11) From installation kit (Amaprop 1200 to 2500 only)

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

### 7.3 Drainage/disposal

	 <b>WARNING</b>
	<p><b>Fluids posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Submersible mixers used in fluids posing a health hazard must be decontaminated.</li> <li>▷ Collect and properly dispose of flushing liquid and any residues of the fluid handled.</li> <li>▷ Wear safety clothing and a protective mask, if required.</li> <li>▷ Observe all legal regulations on the disposal of substances posing a health hazard.</li> </ul>

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

	 <b>WARNING</b>
	<p><b>Work on the submersible mixer by unqualified personnel</b> Risk of personal injury!</p> <ul style="list-style-type: none"> <li>▷ Always have repair and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	 <b>WARNING</b>
	<p><b>Submersible mixer started up unintentionally</b> Risk of injury by moving parts!</p> <ul style="list-style-type: none"> <li>▷ Always make sure the electrical connections are disconnected before carrying out work on the submersible mixer.</li> <li>▷ Make sure that the submersible mixer cannot be started up unintentionally.</li> </ul>
	 <b>WARNING</b>
	<p><b>Hot surface</b> Risk of personal injury!</p> <ul style="list-style-type: none"> <li>▷ Allow the submersible mixer to cool down to ambient temperature.</li> </ul>
	 <b>WARNING</b>
	<p><b>Improper lifting/moving of heavy assemblies or components</b> Personal injury and damage to property!</p> <ul style="list-style-type: none"> <li>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</li> </ul>

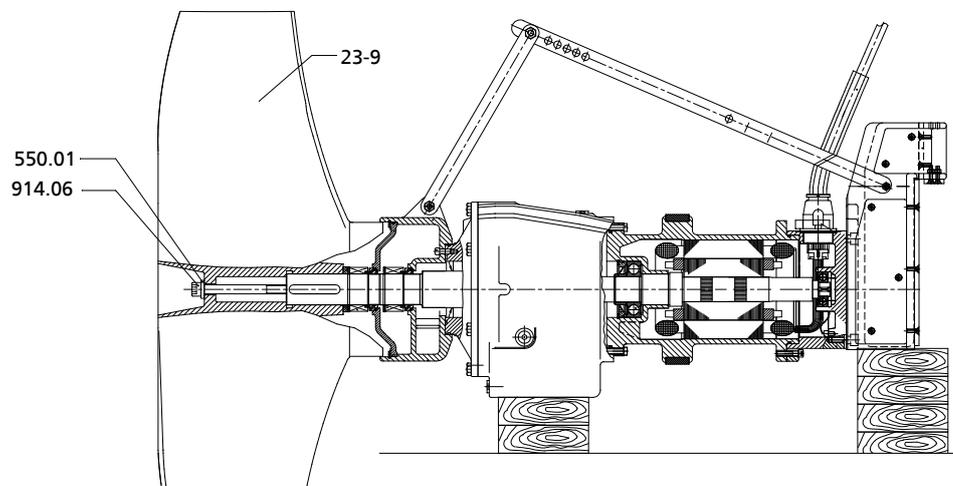
	<b>! WARNING</b>
	<p><b>Fluids, consumables and supplies posing a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"> <li>▷ Submersible mixers used in fluids posing a health hazard must be decontaminated.</li> <li>▷ Wear safety clothing and a protective mask, if required.</li> <li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li> </ul>

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

For dismantling and reassembly observe the general assembly drawing.  
(⇒ Section 9.1, Page 54)

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

#### 7.4.2 Removing the propeller

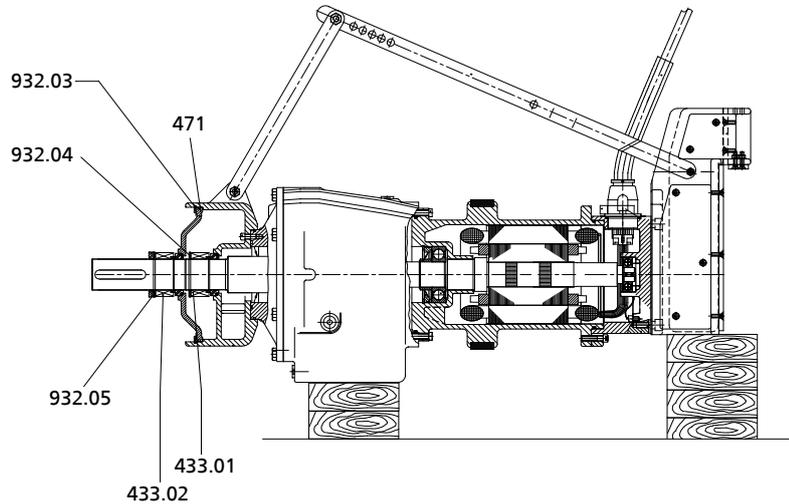


**Fig. 18:** Removing the propeller

- ✓ 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.

7.4.3 Removing the mechanical seal

	<b>CAUTION</b>
	<p><b>Improper removal of mechanical seal</b>                  Damage to the shaft!                  ▷ Carefully remove and dismantle the mechanical seal.</p>



**Fig. 19:** Removing the mechanical seal

- ✓ The propeller has been removed.
- 1. Undo circlip 932.05.
- 2. Remove mechanical seal 433.02.
- 3. Undo circlip 932.03.
- 4. Remove seal cover 471.
- 5. Undo circlip 932.04.
- 6. Remove mechanical seal 433.01.

7.4.4 Dismantling the motor section

	<b>NOTE</b>
	<p>Special regulations apply to repair work on explosion-proof submersible mixers. Modification or alteration of the submersible mixers can affect explosion protection and is only permitted after consulting the manufacturer.</p>
	<b>NOTE</b>
	<p>The motors of explosion-proof submersible mixers are supplied in "flameproof enclosure" type of protection. Any work on the motor section which could affect explosion protection, such as re-winding and machining repairs, must be inspected and approved by an approved expert or performed by the motor manufacturers. No modifications may be made to the internal configuration of the motor. Repair work at the joints relevant for explosion protection must only be performed in accordance with the manufacturer's instructions.</p>

When dismantling the motor section and the connection 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

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

**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 yard.
  - Assembly adhesives
    - Avoid the use of assembly adhesives if possible.

**Tightening torques** For reassembly, tighten all screws and bolts as indicated. In addition, secure all screwed connections closing off the flameproof enclosure with a thread-locking agent (Loctite type 243).

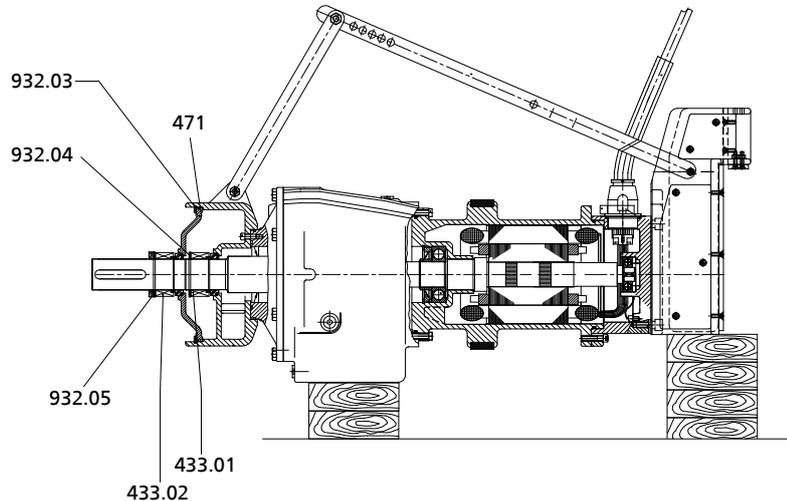
### 7.5.2 Reassembling the motor section

	<p><b>DANGER</b></p> <p><b>Wrong screws/bolts</b>          Explosion hazard!</p> <ul style="list-style-type: none"> <li>▷ Only use original screws/bolts on explosion-proof submersible mixers.</li> </ul>
	<p><b>NOTE</b></p> <p>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 56)          All screwed connections closing off the flameproof enclosure must be secured with a thread-locking agent (Loctite Type 243).</p>

### 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

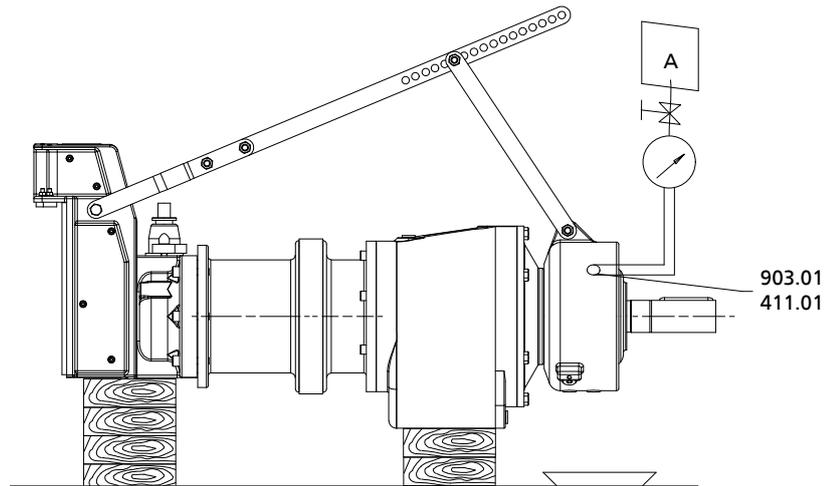
- ✓ The individual parts have been placed in a clean and level assembly area.
  - ✓ All disassembled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
  - ✓ The sealing surfaces have been cleaned.
1. Clean the shaft, and touch up 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 chamber 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.

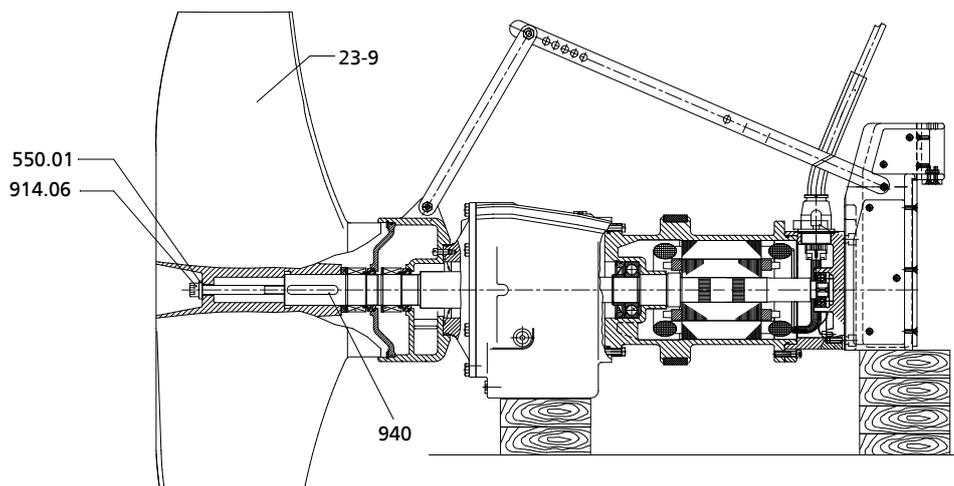


**NOTE**

The pressure must not drop during the test period.

4. Unscrew and remove the testing device.
5. Fit screw plug 903.01 and joint ring 411.01 again.

**7.5.5 Mounting the propeller**



**Fig. 22: Mounting the propeller**



**NOTE**

As a cast propeller is very heavy, we recommended suspending the submersible mixer vertically using a rope loop and threading it into the propeller, which has been placed in a horizontal position.

	 <b>WARNING</b>
	<p><b>Improper lifting/moving of heavy assemblies or components</b>            Personal injury and damage to property!</p> <p>▷ Use suitable transport devices, lifting equipment and lifting tackle to move heavy assemblies or components.</p>

- ✓ The submersible mixer has been placed down safely and secured against tipping 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.
  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. Fit screw 914.06 and disc 550.01.

### 7.6 Tightening torques

Table 17: Tightening torques

Thread	[ft lbs]	[Nm]
0.18 [M5]	4	4
0.24 [M6]	5	7
0.31 [M8]	12	17
0.39 [M10]	25	35
0.47 [M12]	45	60
0.63 [M16]	112	150

## 8 Trouble-shooting

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

If problems occur that are not described in the following table, consultation with KSB 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 18:** Trouble-shooting

A	B	C	D	Possible cause	Remedy
-	X	-	-	Unfavorable installation of submersible mixer	Check installation. Remove any obstacles from the flow passage.
-	-	X	X	Propeller covered in solids; density of fluid handled too high	Clean the propeller. Check power data. Check direction of rotation.
-	X	-	X	Propeller damaged	Replace the propeller.
-	X	X	X	Wrong direction of rotation	If the submersible mixer is running in the wrong direction of rotation, check its electrical connection and the control system if necessary.
-	-	X	-	Wrong supply voltage	Check mains voltage. Check power cable connections.
X	-	-	-	Motor is not running because of lack of supply voltage	Check electrical installation. Inform electric utility company.
X	-	-	-	Motor winding or power cable defective	Replace with original KSB parts or contact KSB.
-	-	-	X	Defective rolling element bearing(s)	Contact KSB.
-	X	X		In case of star-delta configuration: motor running in star configuration only	Check star-delta contactor.
-	X	-	X	Liquid level in the tank is too low.	Check level control equipment.
X	-	-	-	Temperature control device monitoring the winding has tripped as a result of excessive winding temperature.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	Motor has been tripped by leakage sensor.	Have cause determined and eliminated by qualified and trained personnel.
X	-	-	-	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

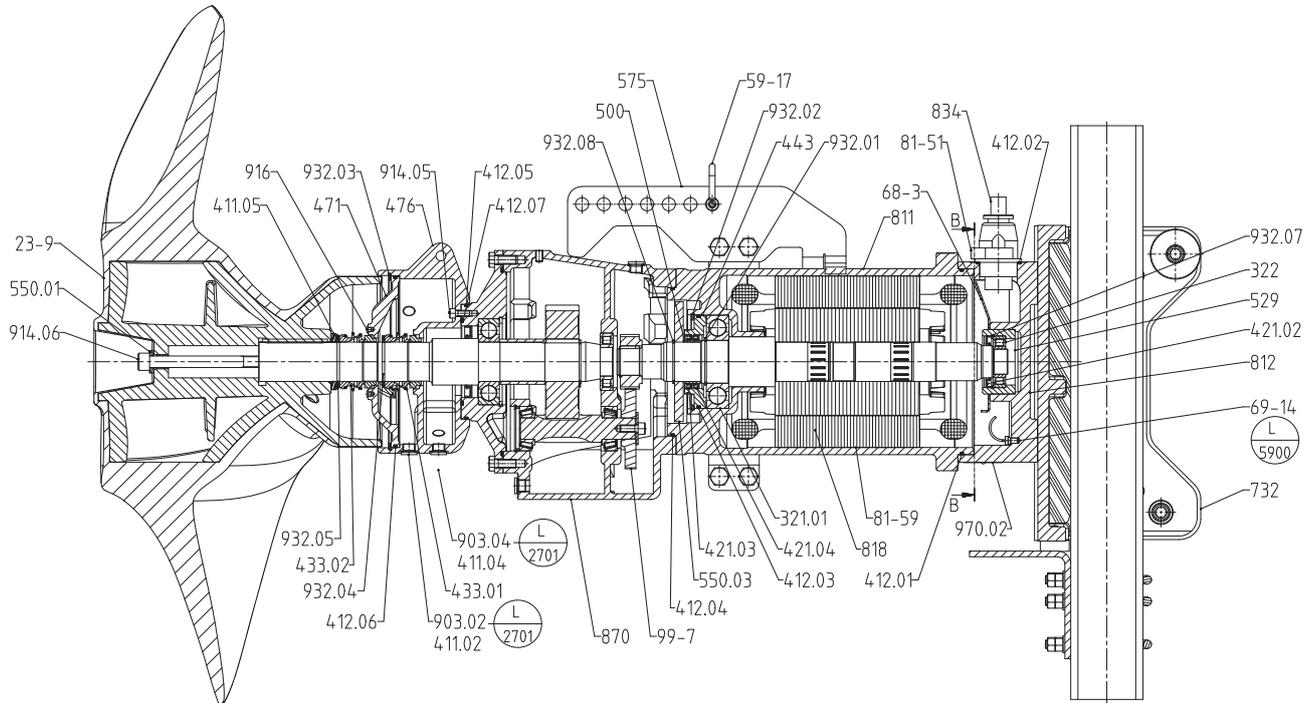


Fig. 23: General assembly drawing of Amaprop V 1000

Table 19: 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
575	Supporting strap	970.02	Label/plate
59-17	Shackle	99-7	Installation kit

9.1.2 Amaprop V 1200 - 2500

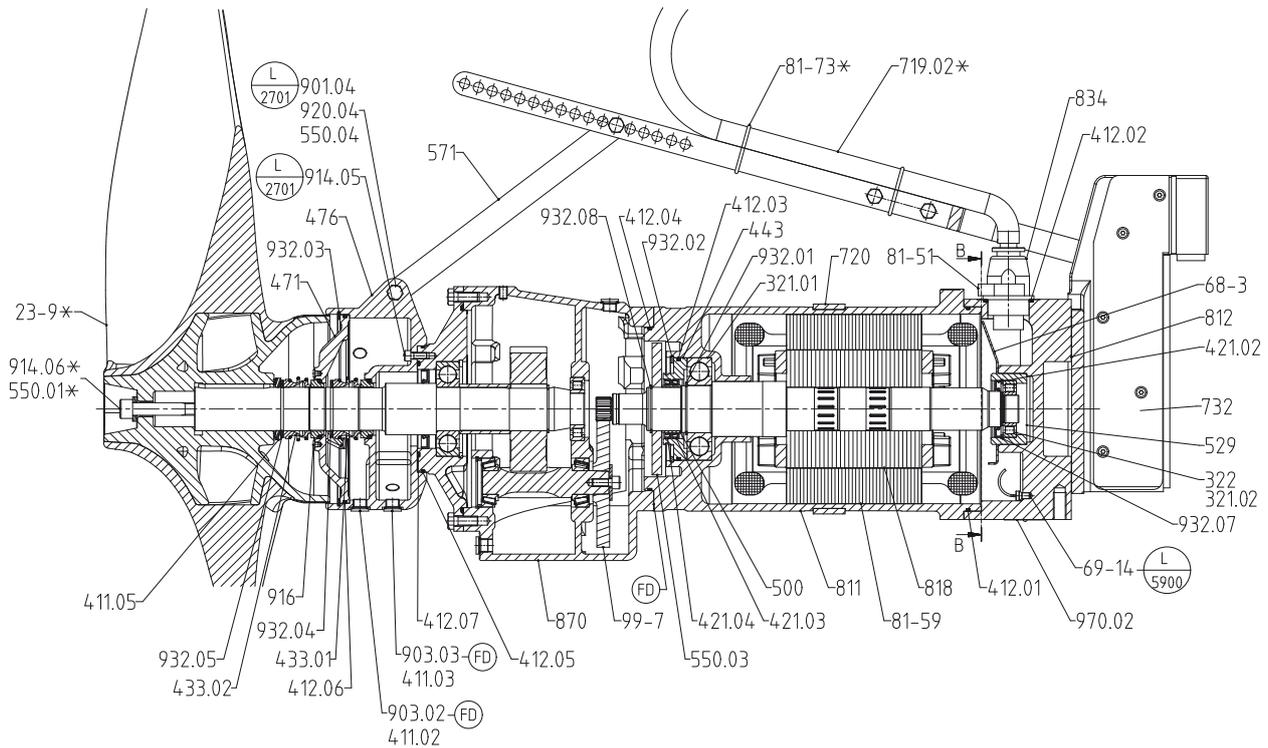


Fig. 24: General assembly drawing of Amaprop V 1200 - 2500

Table 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	Spacer
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
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 1000 and Amaprop 2500 / 6 4

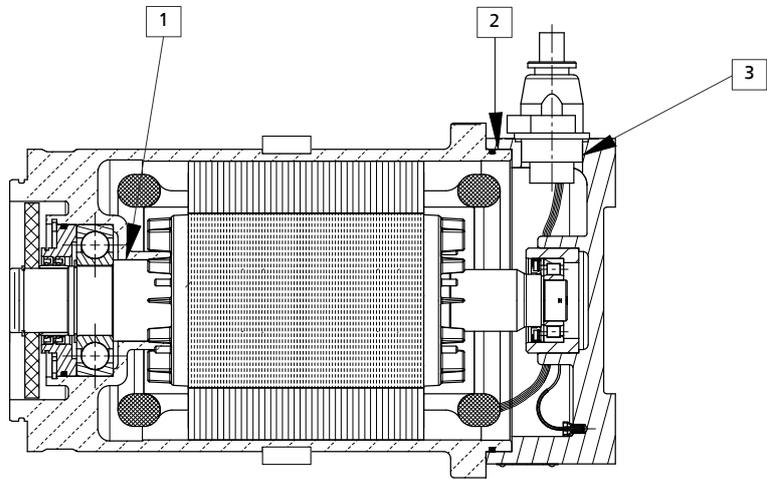


Fig. 25: Flamepaths on explosion-proof motors – Amaprop 1000 and Amaprop 2500 / 6 4

9.2.2 Amaprop 1200 - 2500; motors: 1 4, 2 4, 3 4, 4 4, 5 4

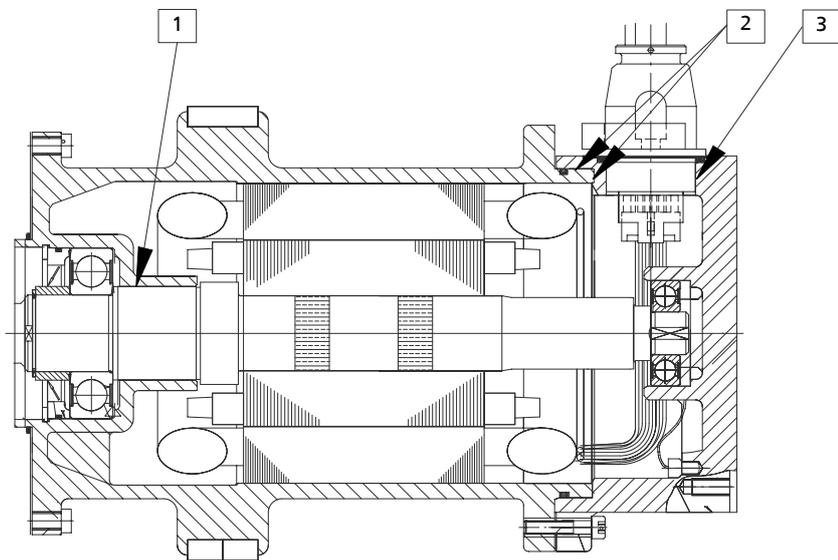


Fig. 26: Flamepaths on explosion-proof motors - Amaprop 1200 ... 2500; motors: 1 4, 2 4, 3 4, 4 4, 5 4

### 9.3 Wiring diagrams

	CAUTION
<p><b>Incorrect electrical installation</b> Winding damage!</p> <p>▷ Observe the wiring diagram and the direction of rotation. (⇒ Section 5.5, Page 26)</p>	

#### 9.3.1 Wiring diagram for one power cable 8G1.5

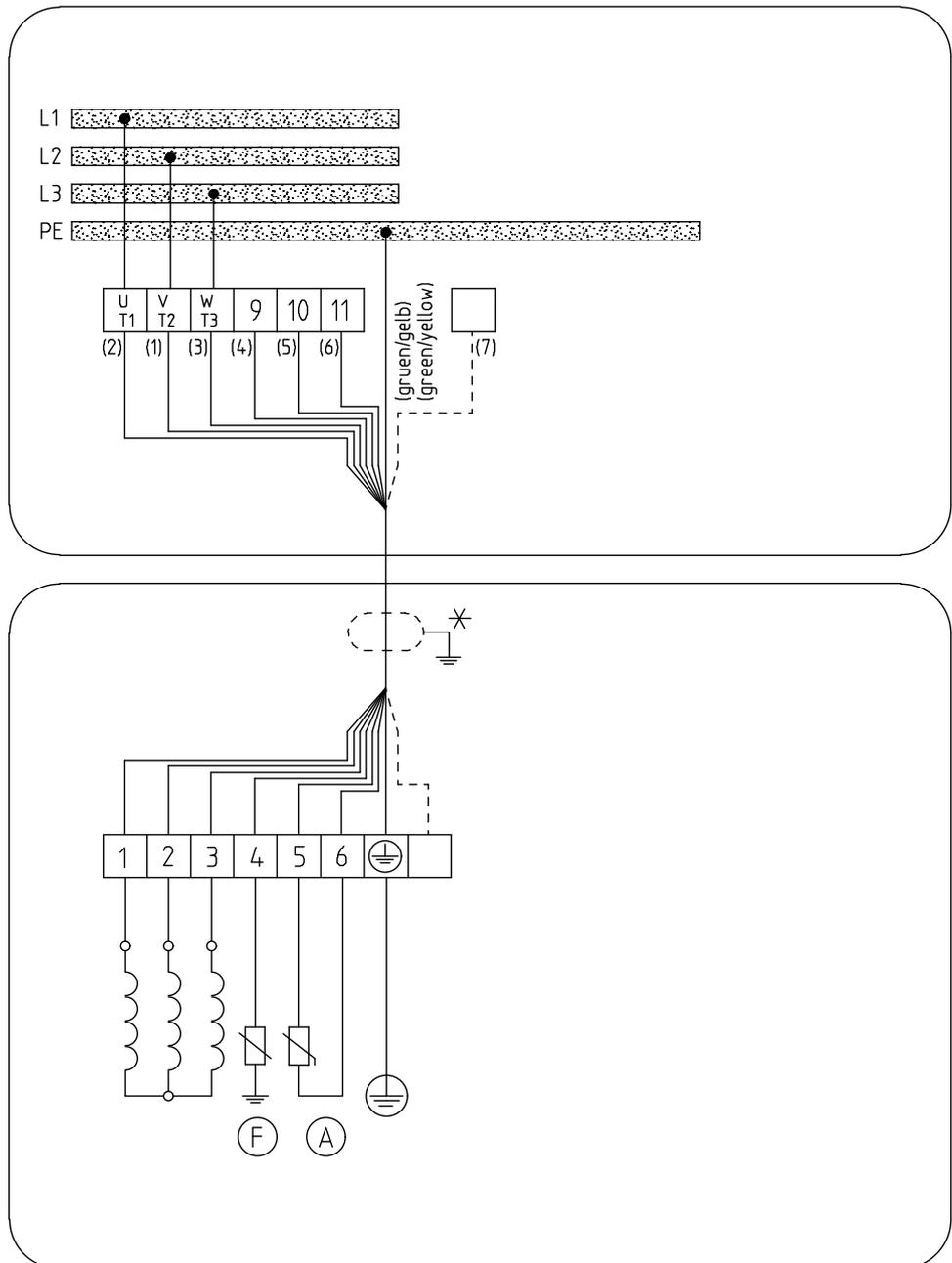


Fig. 27: Wiring diagram for one power cable 8G1.5

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

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

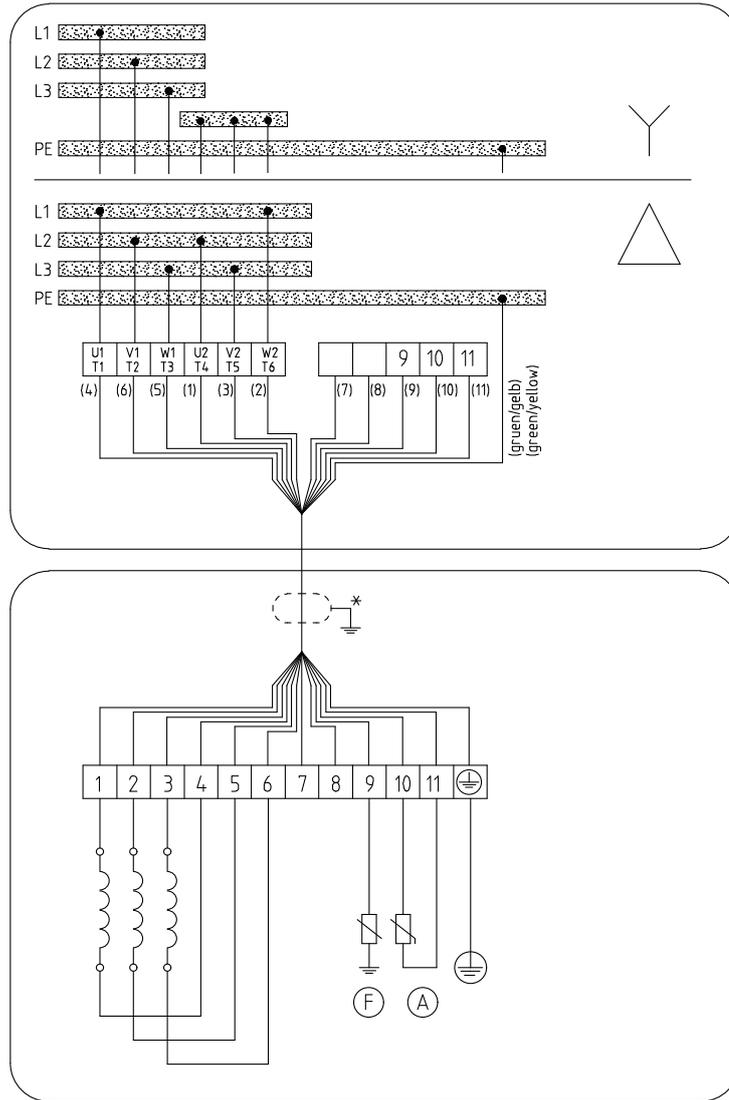


Fig. 28: Wiring diagram for one power cable 12G1.5 or 12G2.5

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

9.3.3 Wiring diagram for one power cable 7x6 + 5x1.5

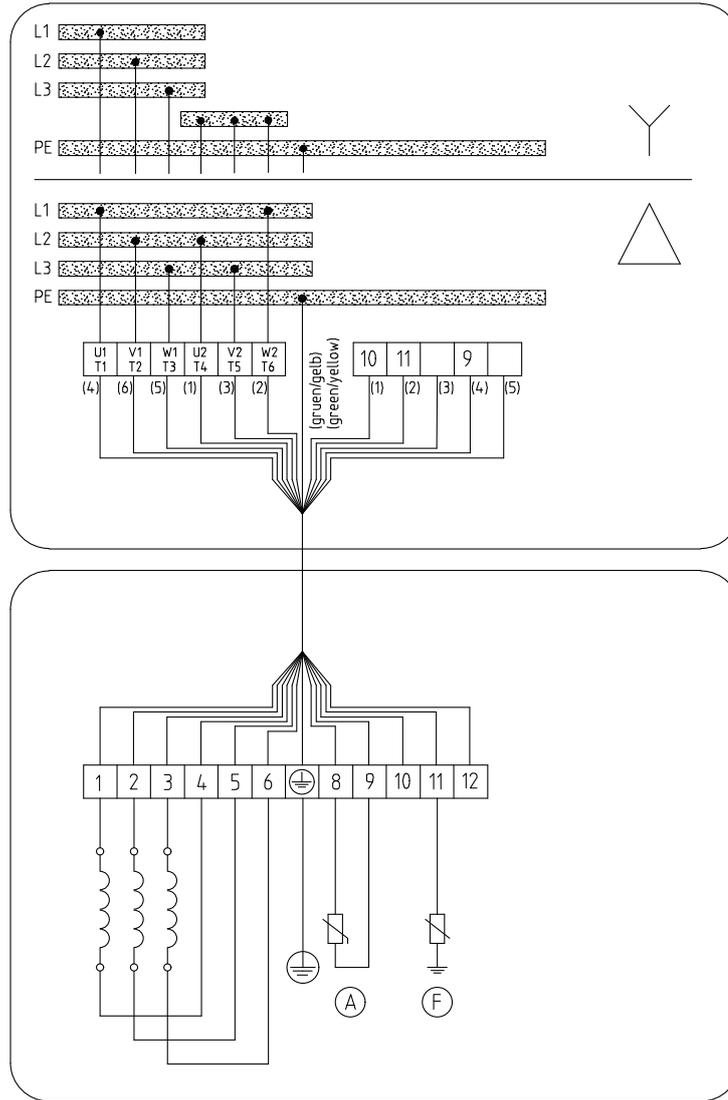
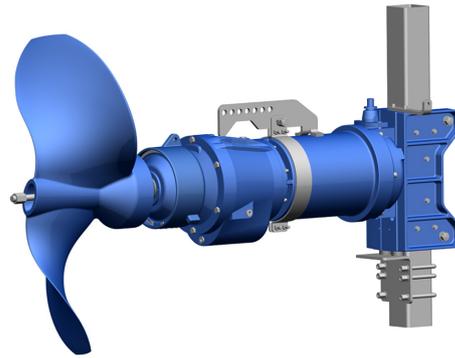
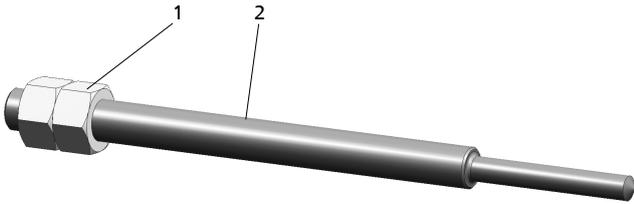


Fig. 29: Wiring diagram for one power cable 7x6 + 5x1.5

Ⓐ	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.

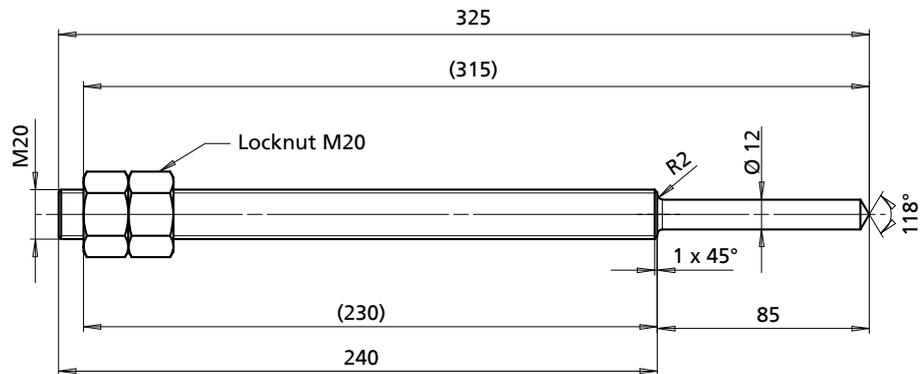


Fig. 30: Forcing screw M20 x 325

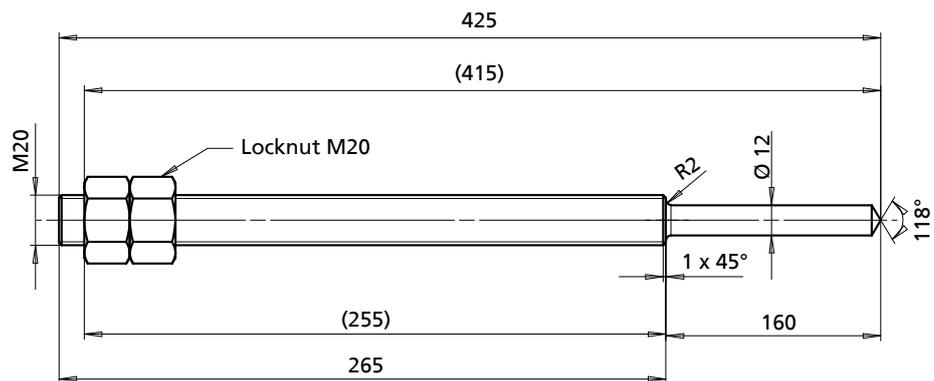
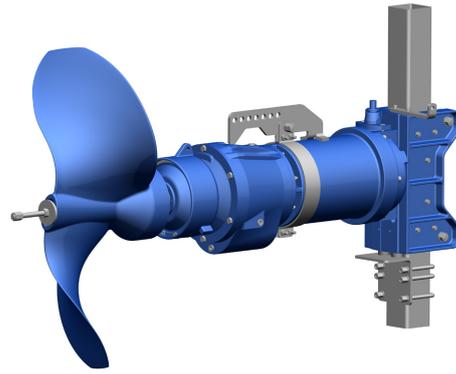
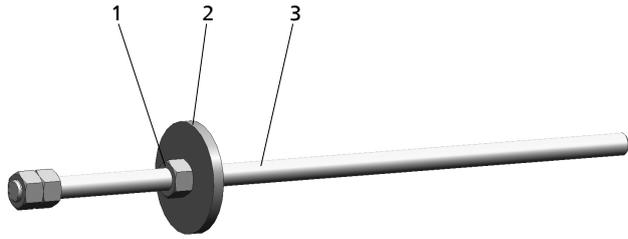


Fig. 31: Forcing screw M20 x 425

Table 21: Propeller forcing screws

Description		Amaprop									Material
		1000	1200	1400	1600	1800	1801	2000	2200	2500	
Forcing screw	M20 x 325	-	X	X	X	X	X	-	-	-	A 276 Type 316 Ti
Forcing screw	M20 x 425	X	-	-	-	-	-	X	X	X	A 276 Type 316 Ti

### 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.

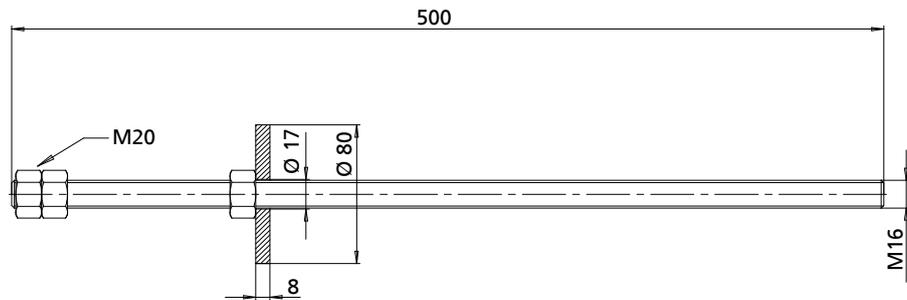


Fig. 32: Propeller fitting tool M16 x 500

Table 22: Propeller fitting tool

Description	M16 x 500	Amaprop									Material
		1000	1200	1400	1600	1800	1801	2000	2200	2500	
Propeller fitting tool	M16 x 500	X	X	X	X	X	X	X	X	X	A 276 type 316 Ti



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