

## Wilo-EMU KPR... + T56...P

Installation and operating instructions

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TMPKPRXX

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# Table of Contents

<b>1</b>	<b>Introduction</b>	<b>1-1</b>
	Preface	1-1
	Structure of the manual	1-1
	Personnel qualification	1-1
	Illustrations	1-1
	Copyright	1-1
	Abbreviations and technical terms	1-1
	Manufacturer's address	1-3
	Rights of alteration	1-3
<b>2</b>	<b>Safety</b>	<b>2-1</b>
	Instructions and safety information	2-1
	Guidelines used and CE certification	2-2
	General safety	2-2
	Electrical work	2-2
	Electrical connection	2-3
	Ground connection	2-3
	Operating procedure	2-3
	Safety and control devices	2-3
	Operation in an explosive atmosphere	2-4
	Sound pressure	2-4
	Pumped fluids	2-4
	Warranty	2-5
<b>3</b>	<b>Product description</b>	<b>3-1</b>
	Proper use and fields of application	3-1
	Conditions of use	3-1
	Construction	3-1
	Type designation	3-4
	Cooling	3-4
	Name plate	3-4
	Technical data	3-5
<b>4</b>	<b>Transport and storage</b>	<b>4-1</b>
	Delivery	4-1
	Transport	4-1
	Storage	4-1
	Returning to the supplier	4-2
<b>5</b>	<b>Installation</b>	<b>5-1</b>
	General information	5-1

Installation types	5-1
The operating area	5-1
Assembly accessories	5-1
Installation	5-1
Dry-run protection	5-5
Removal	5-5
	5-5
<b>6    Startup</b>	<b>6-1</b>
Preparatory measures	6-1
Electrical system	6-1
Direction of rotation	6-2
Motor protection and activation types	6-2
After starting	6-3
<b>7    Maintenance</b>	<b>7-1</b>
Lubricants	7-2
Maintenance intervals	7-2
Maintenance tasks	7-3
Changing the lubricant	7-4
Sealing chamber	7-4
Repairs	7-5
Torque values	7-6
<b>8    Shutdown</b>	<b>8-1</b>
Temporary shutdown	8-1
Final shutdown / storage	8-1
Restarting after an extended period of storage	8-1
	8-2
<b>9    Troubleshooting and possible solutions</b>	<b>9-1</b>
Fault: The machine will not start	9-1
Fault: The motor starts, but the motor protection switch triggers shortly after start-up	9-1
Fault: Machine runs but does not pump	9-2
Fault: The machine runs, but not at the stated operating levels	9-2
Fault: The machine does not run smoothly and is noisy	9-3
Fault: Mechanical shaft seal leaks, moisture sensors report a fault or switch the machine off	9-3
Further steps for troubleshooting	9-4
<b>A    List of machine operators and maintenance</b>	<b>A-1</b>
List of machine operators	A-1
Maintenance and inspection log	A-2

<b>B</b>	<b>Key for the labelling of the screw plugs</b>	<b>B-1</b>
<b>C</b>	<b>Assembly Sheet For the Anchor Bolts</b>	<b>C-1</b>
	General product information	C-1
	Scope of proper use	C-1
	Transport and storage	C-1
	Setting the anchor bolts	C-1
<b>D</b>	<b>Operation with a static frequency converter</b>	<b>D-1</b>
	Selecting the motor and converter	D-1
	Minimum speed for submersible pumps (well pumps)	D-1
	Minimum speed for waste water and sewage pumps	D-1
	Operation	D-1
	Max. voltage peaks and rise speed	D-1
	EMC	D-2
	Motor protection	D-2
	Operation up to 60 Hz	D-2
	Efficiency	D-2
	Summary	D-2
<b>E</b>	<b>Ceram C0 data sheet</b>	<b>E-1</b>
	General information	E-1
	Description	E-1
	Composition	E-1
	Properties	E-1
	Technical data	E-1
	Resistance	E-2
	Surface preparation	E-3
	Material preparation	E-3
	Application instructions	E-3
	Coating layers and material requirements	E-3
	Repeat coating intervals / subsequent coating	E-3
	Hardening time	E-3
	Material needed	E-4
	Working steps	E-4
	Cleaning tools	E-4
	Storage	E-4
	Safety precautions	E-4
<b>F</b>	<b>Notes on unloading large units</b>	<b>F-1</b>
<b>G</b>	<b>Transport protection</b>	<b>G-1</b>
	Product description and proper use	G-1
	Instructions for the storage and transport of the machine	G-1

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Dismantling / assembling the transport protection	G-1
<b>H     Data Sheet – Electrical Connection</b>	<b>H-1</b>
Safety notes	H-1
Insulation resistance	H-1
Monitoring equipment	H-1
Wire designation of the connection lead	H-2
<b>I     EC declaration of conformity</b>	<b>I-1</b>

# 1 Introduction

Dear Customer,

Thank you for choosing one of our company's products. You have purchased a product which has been manufactured to the latest technical standards. Read this operating and maintenance manual carefully before you first use it. This is the only way to ensure that the product is safely and economically used.

The documentation contains all the necessary specifications for the product, allowing you to use it properly. In addition, you will also find information on how to recognize potential dangers, reduce repair costs and downtime, and increase the reliability and working life of the product.

All safety requirements and specific manufacturer's requirements must be fulfilled before the product is put into operation. This operating and maintenance manual supplements any existing national regulations on industrial safety and accident prevention. This manual must also be accessible to personnel at all times and also be made available where the product is used.

The manual is divided into several chapters. Each chapter has a clear heading which tells you what it describes.

The numbered chapters correspond to the standard chapters for a product. They contain all the detailed information on your product.

Chapters numbered alphabetically are added for specific customers. They contain information including the selected accessories, special coatings, connection diagrams and the declaration of conformity.

The table of contents also acts as a brief reference, because all the important sections are given headers. The header of each section is in the outside column, so that you can find everything, even when skimming through the manual.

All important operating and safety instructions are highlighted. You can find detailed information on the structure of these texts in chapter 2, "Safety".

All personnel who work on or with the product must be qualified for such work; electrical work, for example may only be carried out by a qualified electrician. The entire personnel must be of age.

Operating and maintenance staff must also work according to local accident prevention regulations.

It must be ensured that personnel have read and understood the instructions in this operating and maintenance handbook; if necessary this manual must be ordered from the manufacturer in the required language.

The illustrations used are of dummies and original drawings of the products. This is the only realistic solution for our wide range of products and the differing sizes enabled by the modular system. More exact drawings and specifications can be found on the dimension sheet, the planning information and/or the installation plan.

This operation and maintenance manual has been copyrighted by the manufacturer. The operation and maintenance handbook is intended for the use by assembly, operating and maintenance personnel. It contains technical specifications and diagrams which may not be reproduced or distributed, either completely or in part, or used for any other purpose without the expressed consent of the manufacturer.

Various abbreviations and technical terms are used in this operating and maintenance manual. Table 1 contains all the abbreviations, and Table 2 all the technical terms.

## *Preface*

## *Structure of the manual*

## *Personnel qualification*

## *Illustrations*

## *Copyright*

## *Abbreviations and technical terms*

Abbreviations	Explanation
<b>p.t.o.</b>	please turn over
<b>re.</b>	regarding
<b>approx.</b>	approximately
<b>i.e.</b>	that means
<b>pos.</b>	possible
<b>if nec.</b>	if necessary
<b>incl.</b>	including
<b>min.</b>	minimum
<b>max.</b>	maximum
<b>etc.</b>	and so on
<b>s.a.</b>	see also
<b>e.g.</b>	for example

Table 1-1: Abbreviations

Technical term	Explanation
<b>Dry run</b>	The product is running at full speed, however, there is no liquid to be pumped. A dry run is to be strictly avoided. If necessary, a safety device must be installed.
<b>“wet” installation type</b>	This installation type requires the product to be immersed in the pumped fluid. It is completely surrounded by the pumped fluid. Please observe the values for the maximum submersion depth and the minimum water coverage.
<b>“dry” installation type</b>	In this installation type, the product is installed dry, i.e. the pumped fluid is delivered to and discharged via a pipeline system. The product is not immersed in the pumped fluid. Please note that the surfaces of the product become very hot!
<b>“transportable” installation type</b>	With this installation type the product is equipped with a pedestal. It can be installed and operated at any location. Please observe the values for the maximum submersion depth and the minimum water coverage, and remember that the surfaces of the product become very hot.
<b>“S1” operating mode (continuous operation)</b>	At the rated load, a constant temperature is reached that does not increase even in prolonged operation. The operating equipment can operate uninterruptedly at the rated load without exceeding the maximum permissible temperature.

Table 1-2: Terms



Technical term	Explanation
<b>“S2” operating mode (short-term operation)</b>	The period of service at the rated load is short in comparison to the subsequent pause. The maximum operating period is indicated in minutes, for example, S2-15. The operating equipment can operate during this time uninterruptedly at the rated load without exceeding the maximum permissible temperature. The pauses must continue until the machine temperature no longer exceeds that of the coolant by more than 2 K.
<b>“Siphoning operation”</b>	Siphoning operation is similar to dry running. The product operates at full speed, but only small amounts of liquid are pumped. <b>Siphoning operation is only possible with certain types; see the “Product description” chapter.</b>
<b>Dry-run protection</b>	The dry-run protection is designed to automatically shut down the product if the water level falls below the minimum water coverage value of the product. This is made possible by installing a float switch.
<b>Level control</b>	The level control is designed to switch the product on or off depending on the filling level. This is made possible by installing a float switch.

Table 1-2: Terms

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*Manufacturer's address*

The manufacturer reserves the right to make technical alterations to systems or components. This operating and maintenance manual refers to the product indicated on the title page.

*Rights of alteration*



# 2 Safety

This chapter lists all the generally applicable safety instructions and technical information. Furthermore, every other chapter contains specific safety instructions and technical information. All instructions and information must be observed and followed during the various phases of the product's lifecycle (installation, operation, maintenance, transport etc.). The operator is responsible for ensuring that personnel follow these instructions and guidelines.

This manual uses instructions and safety information for preventing injury and damage to property. To make this clear for the personnel, the instructions and safety information are distinguished as follows:

*Instructions and safety information*

Instructions are indented by 10 mm and printed in 10pt bold script. Instructions contain text referring to previous text or particular sections of chapters, or highlight brief instructions. Example:





*Instructions*

**For machines approved for work in explosion zones, please refer to the “Explosion protection in accordance with the .... regulation” chapter.**

Safety information is indented by 5 mm and printed in 12pt bold script. Information only referring to damage to property is printed in gray.

*Safety information*

Information referring to personal injury is printed in black and always accompanied by a danger symbol. Danger, prohibition or instruction symbols are used as safety symbols. Example:

			
Danger symbol: general hazard	Danger symbol, e.g. electrical current	Prohibition symbol, e.g. keep out	Instruction symbol, e.g. wear protective clothing

The safety symbols conform to the generally valid guidelines and regulations, for example DIN and ANSI.

Each safety instruction begins with one of the following signal words:

Signal word	Meaning
<b>Danger</b>	Serious or fatal injuries can occur.
<b>Warning</b>	Serious injuries can occur.
<b>Caution</b>	Injuries can occur.
<b>Caution (Instruction without symbol)</b>	Serious damage to property can occur, including irreparable damage.

Table 2-1: Signal words and what they mean

Safety instructions begin with a signal word and description of the hazard, followed by the hazard source and potential consequences, and end with information on preventing it.

Example:

**Beware of rotating parts!**  
**The moving rotor can crush and sever limbs. Switch off the machine and let the rotor come to a rest.**

## *Guidelines used and CE certification*

Our products are subject to

- various EC directives
- various harmonized standards
- various national standards.

Please consult the EU Declaration of Conformity for the precise information and the guidelines and norms in effect. The EU Declaration of Conformity is issued in accordance with EU Directive 98/37/EC, Appendix II A.

Also, various national standards are also used as a basis for using, assembling and dismantling the product. These include the German accident prevention regulations, VDE regulations, German Equipment Safety Law etc.

The CE symbol is found either on the type plate or next to the type plate. The type plate is attached to the motor casing or to the frame.

## *General safety*

- Never work alone when installing or removing the product.
- The machine must always be switched off before any work is performed on it (assembly, dismantling, maintenance, installation). The product must be disconnected from the electrical system and secured against being switched on again. All rotating parts must be at a standstill.
- The operator should inform his/her superior immediately should any defects or irregularities occur.
- It is of vital importance that the system is shut down immediately by the operator if any problems arise which may endanger safety of personnel. Problems of this kind include:
  - Failure of the safety and/or control devices
  - Damage to critical parts
  - Damage to electric installations, cables and insulation
- Tools and other objects should be kept in a place reserved for them so that they can be found quickly.
- Sufficient ventilation must be provided in enclosed rooms.
- When welding or working with electronic devices, ensure that there is no danger of explosion.
- Only use fastening devices which are legally defined as such and officially approved.
- The fastening devices should be suitable for the conditions of use (weather, hooking system, load, etc). If these are separated from the machine after use, they should be expressly marked as fastening devices. Otherwise they should be carefully stored.
- Mobile working apparatus for lifting loads should be used in a manner that ensures the stability of the working apparatus during operation.
- When using mobile working apparatus for lifting non-guided loads, measures should be taken to avoid tipping and sliding etc.
- Measures should be taken that no person is ever directly beneath a suspended load. Furthermore, it is also prohibited to move suspended loads over workplaces where people are present.
- If mobile working equipment is used for lifting loads, a second person should be present to coordinate the procedure if needed (for example if the operator's field of vision is blocked).
- The load to be lifted must be transported in such a manner that nobody can be injured in the case of a power cut. Additionally, when working outdoors, such procedures must be interrupted immediately if weather conditions worsen.

**These instructions must be strictly observed. Non-observance can result in injury or serious damage to property.**

## *Electrical work*

Our electrical products are operated with alternating or industrial high-voltage current. The local regulations (e.g. VDE 0100) must be adhered to. The "Electrical connection" data sheet must be observed when connecting the product. The technical specifications must be strictly adhered to.

**If the machine has been switched off by a protective device, it must not be switched on again until the error has been corrected.**

**Beware of electrical current**

**Incorrectly performed electrical work can result in fatal injury!  
This work may only be carried out by a qualified electrician.**

**Beware of damp**

**Moisture penetrating cables can damage them and render them useless. Never immerse cable ends in the pumped fluid or other liquids. Any unused wires must be disconnected.**

The operator is required to know where the machine is supplied with current and how to cut off the supply.

When the machine is connected to the electrical control panel, especially when electronic devices such as soft startup control or frequency drives are used, the relay manufacturer's specifications must be followed in order to conform to EMC. Special separate shielding measures e.g. special cables may be necessary for the power supply and control cables.

**The connections may only be made if the relays meet the harmonized EU standards. Mobile radio equipment may cause malfunctions.**

*Electrical connection***Beware of electromagnetic radiation**

**Electromagnetic radiation can pose a fatal risk for people with pacemakers. Put up appropriate signs and make sure anyone affected is aware of the danger.**



Our products (machine including protective devices and operating position, auxiliary hoisting gear) must always be grounded. If there is a possibility that people can come into contact with the machine and the pumped liquid (e.g. at construction sites), the grounded connection must be additionally equipped with a fault current protection device.

**The electrical products conform to motor protection class IP 68 in accordance with the valid norms.**

*Ground connection*

When operating the product, always follow the locally applicable laws and regulations for work safety, accident prevention and handling electrical machinery. To help to ensure safe working practice, the responsibilities of employees should be clearly set out by the owner. All personnel are responsible for ensuring that regulations are observed.

Certain parts such as the rotor and propeller rotate during operation in order to pump the fluid. Certain materials can cause very sharp edges on these parts.

**Beware of rotating parts**

**The moving parts can crush and sever limbs. Never reach into the pump unit or the moving parts during operation. Switch off the machine and let the moving parts come to a rest before maintenance or repair work.**

*Operating procedure*

Our products are equipped with various safety and control devices. These include, for example suction strainers, thermo sensors, sealed room monitor etc. These devices must never be dismantled or disabled.

Equipment such as thermo sensors, float switches, etc. must be checked by an electrician for proper functioning before start-up (see the "Electrical Connection" data sheet). Please remember

*Safety and control devices*

that certain equipment requires a relay to function properly, e.g. posistor and PT100 sensor. This relay can be obtained from the manufacturer or a specialist electronics dealer.

**Staff must be informed of the installations used and how they work.**

### Caution

**Never operate the machine if the safety and monitoring devices have been removed or damaged, or if they do not work.**

### *Operation in an explosive atmosphere*

Products marked as explosion-proof are suitable for operation in an explosive atmosphere. The products must meet certain guidelines for this type of use. Certain rules of conduct and guidelines must be adhered to by the operator as well.

**Products that have been approved for operation in an explosive atmosphere are labeled as explosion-protected “Ex” (e.g. T...Ex...). In addition, an “Ex” symbol must be included on the type plate! When used in an explosive atmosphere, the chapter entitled “Explosion protection according to the ...standard” must be observed!**

### *Sound pressure*

Depending on the size and capacity (kW), the products produce a sound pressure of approximately 70 dB (A) and 110 dB (A).

The actual sound pressure, however, depends on several factors. These include, for example, the installation type (wet, dry, transportable), fastening of accessories (e.g. suspension unit) and pipe-line, operating site, immersion depth, etc.

Once the product has been installed, we recommend that the operator make additional measurements under all operating conditions.



### **Caution: Wear ear protectors**

**In accordance with the laws in effect, guidelines, standards and regulations, ear protection must be worn if the sound pressure is greater than 85 dB (A)! The operator is responsible for ensuring that this is observed!**

### *Pumped fluids*

Each pumped fluid differs in regard to composition, corrosiveness, abrasiveness, TS content and many other aspects. Generally, our products can be used for many applications. For more precise details, see chapter 3, the machine data sheet and the order confirmation. It should be remembered that if the density, viscosity or the general composition change, this can also alter many parameters of the product.

Different materials and impeller shapes are required for different pumped fluids. The more exact your specifications on your order, the more exactly we can modify our product to meet your requirements. If the area of application and/or the pumped fluid change, please inform us of this so that we can adapt the product to the new circumstances.

When switching the product into another pumped fluid, observe the following points:

- Products which have been operated in sewage or waste water must be thoroughly cleaned with pure water or drinking water before use.
- Products which have pumped fluids which are hazardous to health must always be decontaminated before changing to a new fluid. Also clarify whether the product may be used in a different pumped fluid.
- With products which have been operated with a lubricant or cooling fluid (such as oil), this can escape into the pumped fluid if the mechanical shaft seal is defective.



### **Danger – explosive fluids**

**It is absolutely prohibited to pump explosive liquids (e.g. gasoline, kerosene, etc.). The products are not designed for these liquids!**

This chapter contains the general information on the warranty. Contractual agreements have the highest priority and are not superseded by the information in this chapter!

## Warranty

The manufacturer is obliged to correct any defects found in the products it sells, provided that the following requirements have been fulfilled:

- The defects are caused by the materials used or the way the product was manufactured or designed.
- The defects were reported in writing to the manufacturer within the agreed warranty period.
- The product was used only as prescribed.
- All safety and control devices were connected and inspected by authorized personnel.

## General information

If no other provisions have been made, the warranty period applies to the first 12 months after initial start-up or to a max. of 18 months after the delivery date. Other agreements must be made in writing in the order confirmation. They will remain valid at least until the agreed warranty period of the product has expired.

## Warranty period

Only original spare parts as supplied by the manufacturer may be used for repairs, replacements, add-ons and conversions. Only these parts guarantee a long working life and the highest level of safety. These parts have been specially designed for our products. Self-made add-ons and conversions or the use of non-original spare parts can seriously damage the product and/or injure personnel.

## Spare parts, add-ons and conversions

The prescribed maintenance and inspection work should be carried out regularly. This work may only be carried out by qualified, trained and authorized personnel. **The maintenance and inspection log supplied must be properly updated.** This enables you to monitor the status of inspections and maintenance work. Quick repairs not listed in this operation and maintenance manual and all types of repair work may only be performed by the manufacturer and its authorized service centers.

## Maintenance

The machine operator list **must** be filled out completely. By signing this list, all persons working on or with the product confirms that they have received, read and understood this operating and maintenance manual.

## List of machine operators

Damage as well as malfunctions that endanger safety must be eliminated immediately by authorized personnel. The product should only be operated if it is in proper working order. During the agreed warranty period, the product may only be repaired by the manufacturer or an authorized service workshop! The manufacturer reserves the right to recall the damaged product to the factory for inspection!

## Damage to the product

No liability will be assumed for product damage if one or more of the following points applies:

## Exclusion from liability

- Incorrect design on our part due to faulty and/or incorrect information provided by the operator or customer
- Non-compliance with the safety instructions, the regulations and the requirements set forth by German law and this operating and maintenance manual
- Incorrect storage and transport
- Improper assembly/dismantling
- Improper maintenance
- Unqualified repairs
- Faulty construction site and/or construction work
- Chemical, electrochemical and electrical influences
- Wear

This means the manufacturer's liability excludes all liability for personal, material or financial injury.





### 3 Product description

The machine is manufactured with great care and is subject to constant quality controls. Trouble-free operation is guaranteed if it is installed and maintained correctly.

Axial machines are suspended directly in the discharge pipe. They are used to pump large amounts of pure, river, raw and cooling water, pre-cleaned waste water or activated sludge up small elevations.

Axial machines with T motors are installed wet.

**Use in siphoning mode is not permitted. The machine must be submerged in pumped liquid at least up to the top of the machine housing.**

The machine can be used to pump water of all contamination levels. In the standard version, the pumped liquid has a permitted maximum density of 1050 kg/m<sup>3</sup> and a maximum viscosity of approx. 1x10<sup>-6</sup> m<sup>2</sup>/s. Additionally, special models are also available for use with abrasive and corrosive liquids. For information on these models, please consult the manufacturer. The exact details about your machine version can be found in the technical data.

The machine is operated from the operating position intended for this purpose or by using the relay supplied.

**The machine can only be operated in the “wet” installation type. Please also note the appropriate information on operating mode and minimum water coverage.**

**Please also note that this machine is not self-suctioning, meaning that the propeller must always be surrounded by liquid in order to pump.**

The machine consists of the motor, guide housing and intake funnel as well as the corresponding propeller wheel.

The shaft and screw connections are made of stainless steel. The three-phase asynchronous motor consists of a stator in the “F” or “H” insulation class as well as the motor shaft with rotor package. The power supply cable is designed for the maximum mechanical load and is sealed against water pressure from the pumped liquid. The motor cable lead connections are sealed from the pumped liquid as well. The bearings used are permanently lubricated maintenance-free antifriction bearings.

The pumped liquid is supplied optimally to the propeller blades through the intake funnel. The two-part stationary wear ring is rotated spherically and allows a minimal gap between the blades and the ring. Both parts of the ring can be replaced when worn. The guide housing diverts the flow past the sealing chamber and motor. The outer and inner parts of the guide housing are connected to each other by the guide blades. The complete unit is found in a pipe / pit.

The motor is equipped with temperature sensors. These protect the motor from overheating. The sealing chamber can optionally be equipped with a sealing chamber electrode. This switches the machine off when the water reaches an impermissible level in the sealing chamber chamber. In addition, the machine is equipped with an electrode for motor chamber and terminal chamber monitoring. Depending on the connection, a warning signal can be displayed and/or the machine switched off if water enters the motor chamber, terminal chamber or the sealing housing.

**Details of the safety and monitoring devices used and how to connect these can be found in the “Electrical connection plan” data sheet.**

The sealing chamber is integrated in the guide housing and is filled with medicinal white oil, which ensures a long-lasting lubrication of the sealing.

*Proper use and fields of application*

*Conditions of use*

*Construction*

*Motor*

*Axial pump*

*Safety and monitoring devices*

*Sealing housing*

## Product description

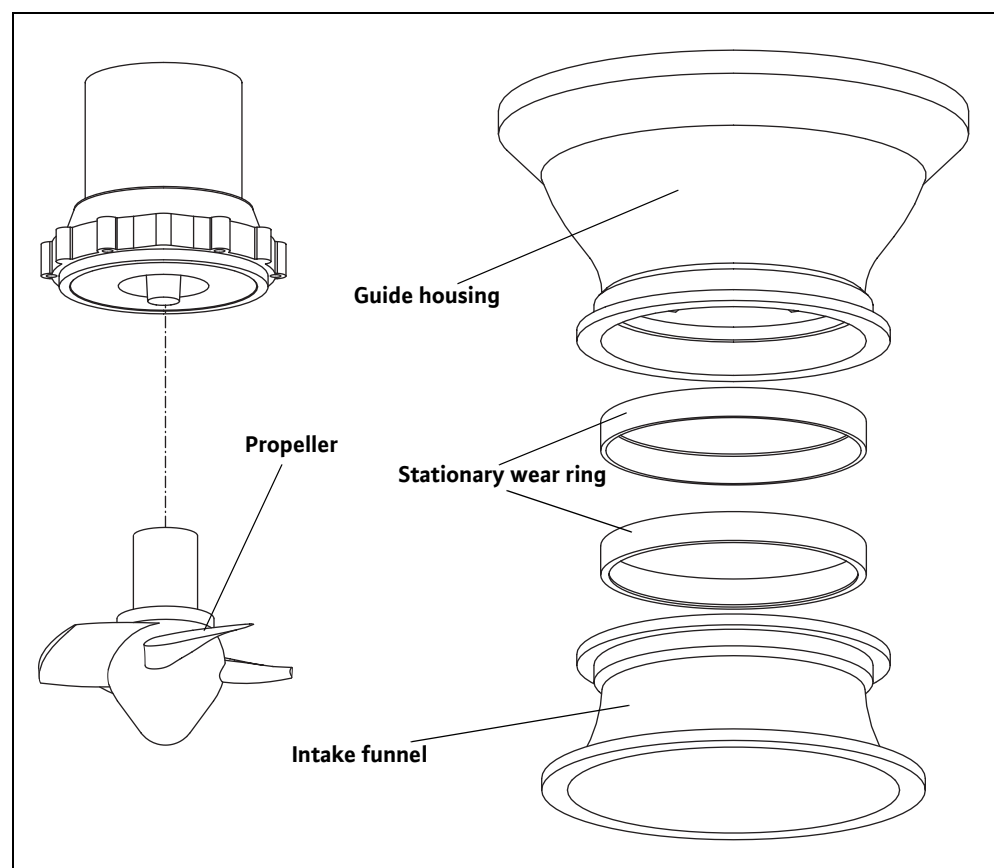
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### *Sealing*

The sealing between the pump and motor is made by two mechanical shaft seals or a stainless steel block seal cartridge. The sliding and counter rings of the mechanical shaft seals are made from silicon carbide.

### *Propeller wheel*

The propeller is fastened on the rotor shaft of the motor and is driven directly. The propeller blade angle can be adjusted using a setting washer.



**Fig. 3-1: Propeller wheel**

Machine structure

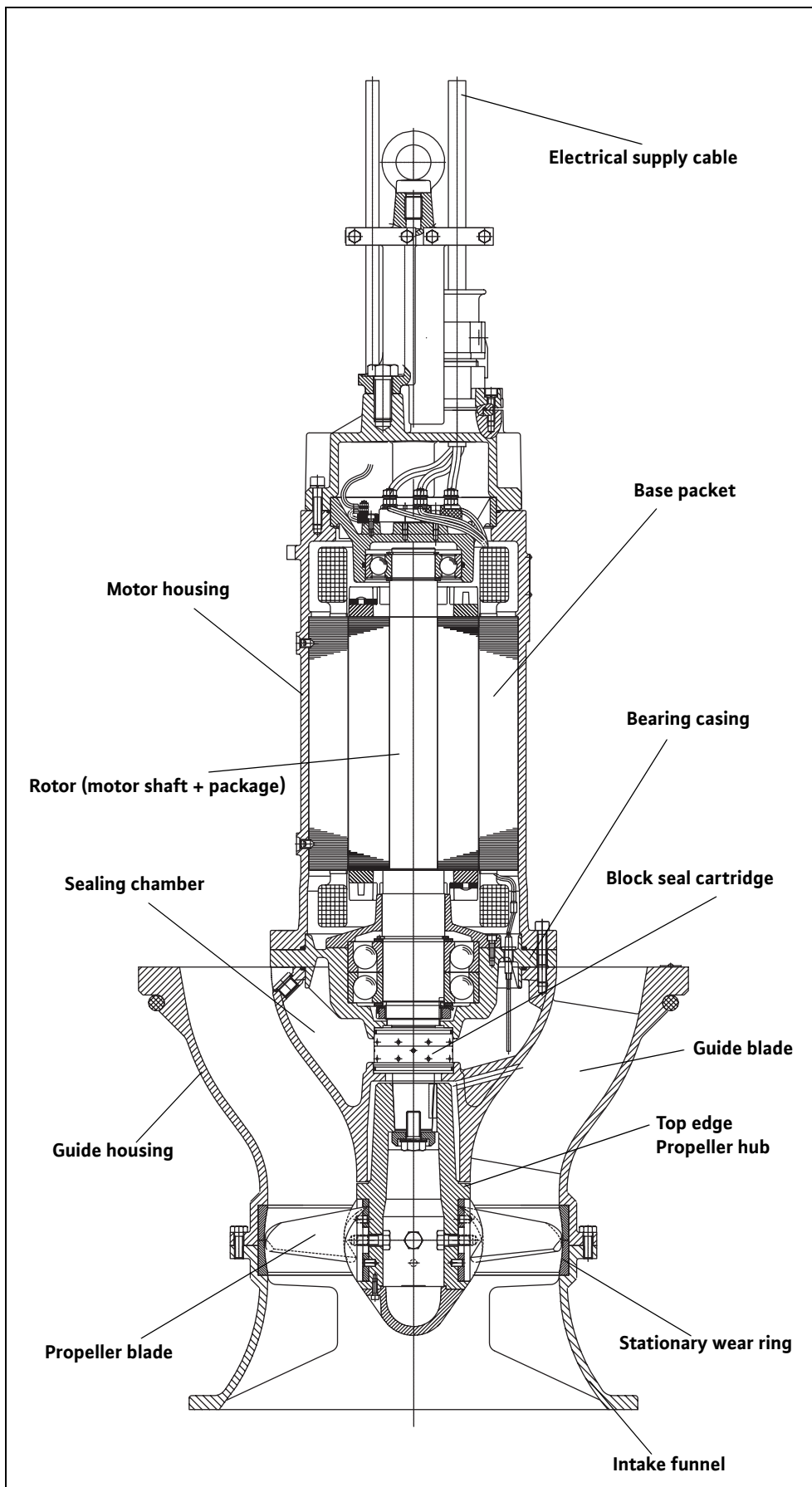


Fig. 3-2: Machine structure

## Product description

### Type designation

The type code provides information about the design of the machine.

Example pump: KPR340-6°	
KPR	Propeller submersible motor pump
340	Propeller diameter
6°	Propeller angle
Example motor: T 24-4/36P Ex	
T	Motor type
24	Package diameter
4	Number of poles
36	Package length in cm (rounded)
P	Motor for KPR
Ex	Ex-approval

**Table 3-1: Type designation**

### Cooling

The T motor is a dry runner. This means that the motor chamber is filled with air. The heat escapes through the housing parts. These transfer the heat to the pumped liquid. Note the following information:

**The machine must be immersed up to the top edge of the propeller hub.**

### Name plate

Symbol	Name	Symbol	Name
P-Type	Pump type	MFY	Year of manufacture
M-Type	Motor type	P	Rated power
S/N	Machine number	F	Frequency
Q	Pump flow	U	Rated voltage
H	Pump head	I	Rated current
N	Speed	I <sub>ST</sub>	Starting current
TPF	Temperature of pumped fluid	SF	Service factor
IP	Protection class	I <sub>SF</sub>	Current at service factor
OT	Operating mode (s = wet / e = dry)	MC	Motor wiring
Cos φ	Cosine phi	▽	Max. submersion
IMø / S	Impeller diameter/number of levels		

**Table 3-2: Name plate key**

*Technical data*

*Unit*

Year of manufacture:	2008
Order no.::	template
Machine number:	TMPKPRXX
Product description:	Wilo-EMU
Pump type:	KPR...
Version:	A
Model:	0
Impeller diameter:	- / corrected: -
Downstream device:	-
Motor type:	T56...P
Version:	A
Model:	0
Discharge port:	-
Suction port:	-

**Tabelle 3-3:**

*Operating point\**

Q water flow:	-
H <sub>man</sub> head:	-
Speed:	-
Voltage:	-
Frequency:	50 Hz

**Tabelle 3-4:**

*Motor data\**

Starting current:	-
Rated current:	-
Rated power:	-
Activation type:	direct
Cos phi:	-
Max. starts per hour:	15 /h

**Tabelle 3-5:**

## Product description

---

Min. switching break:	3 min
Service factor:	1.00
Operating mode:	
Wet installation:	S1
Dry installation:	-
Explosion coding:	-
Explosion number:	-

**Tabelle 3-5:**

### *Filling quantity/lubricant*

Motor chamber:	-	Esso Marcol 82 (White oil)
Sealing room:	-	Esso Marcol 82 (White oil)
Cooling system:	-	Esso Marcol 82 (White oil)

**Table 3-6:**

### *Coatings*

Pump:	-
Rotor:	-

**Tabelle 3-7:**

### *Power supply connection*

Connector:	-
Relay:	-
Power cable length:	10.00 m
Power cable 1	
Number:	1
Type:	-
Size:	-
Power cable 2	
Number:	0
Type:	-
Size:	-
Power cable 3	
Number:	0

**Tabelle 3-8:**

Type:	-
Size:	-
Trip line	
Number:	0
Type:	-
Size:	-
Sealing chamber monitor	
Number:	0
Type:	-
Size:	-

**Tabelle 3-8:**
*General information*

Type of erection:	wet
Installation type:	vertical
Max. submersion:	12.5 m
Min. water coverage:	0.10 m
Max. pump fluid temperature:	40 °C
Dimensions:	see dimension sheet/catalogue
Weight:	see dimension sheet/catalogue
Sound pressure:	system-dependent

**Tabelle 3-9:**

\*Valid for standard conditions (pumped fluid: pure water. Density: 1 kg/dm<sup>3</sup>, Viscosity: 1\*10<sup>-6</sup> m<sup>2</sup>/s, temperature: 20 °C, pressure: 1.013 bar)





## 4 Transport and storage

On arrival, the delivered items must be inspected for damage and a check made that all parts are present. If any parts are damaged or missing, the transport company or the manufacturer must be informed on the day of delivery. Any claim made at a later date will be deemed invalid. Damage to parts must be noted on the delivery or freight documentation.

### *Delivery*

Only the appropriate and approved fastening devices, transportation means and lifting equipment may be used. These must have sufficient load bearing capacity to ensure that the product can be transported safely. If chains are used they must be secured against slipping.

### *Transport*

The staff must be qualified for the tasks and must follow all applicable national safety regulations during the work.

The product is delivered by the manufacturer/shipping agency in suitable packaging. This normally precludes the possibility of damage occurring during transport and storage. The packaging should be stored in a safe place if the location used is changed frequently.

#### **Beware of frost**

**If drinking water is used as a coolant/lubricant, the product must be protected against frost during transport. If this is not possible, the product must be drained and dried out.**

Newly supplied products are prepared that they can be stored for at least 1 year. The product should be cleaned thoroughly before interim storage.

### *Storage*

The following should be taken into consideration for storage:

- Place the product on a firm surface and secure it against falling over. Submersible mixers, auxiliary lifting devices and pressure shroud pumps should be stored horizontally and waste water and sewage pumps, submersible sewage pumps and submersible motor pumps should be stored vertically. Submersible motor pumps can also be stored horizontally. It should be ensured that they cannot bend if stored horizontally. Otherwise excessive bending tension may arise.

#### **Danger from falling over**

**Never put down the product unsecured. If the product falls over, injury can occur.**



- Our products can be stored at temperatures down to -15 °C. The store room must be dry. We recommend a frost-protected room with a temperature of between 5 °C and 25 °C for storage.

**Products that are filled with drinking water can only be stored in frost-free rooms for up to 4 weeks. If longer storage is intended they should be emptied and dried out beforehand.**

- The product may not be stored in rooms where welding work is conducted as the resulting gases and radiation can damage the elastomer parts and coatings.
- Any suction or pressure connections on products should be closed tightly before storage to prevent impurities.

- The power supply cables should be protected against kinking, damage and moisture.



### **Beware of electrical current**

**Damaged power supply cables can cause fatal injury! Defective cables must be replaced by a qualified electrician immediately.**

### **Beware of damp**

**Moisture penetrating cables can damage them and render them useless. Therefore, never immerse cable ends in the pumped fluid or other liquids.**

- The machine must be protected from direct sunlight, heat, dust, and frost. Heat and frost can cause considerable damage to propellers, rotors and coatings.
- The rotors or propellers must be turned at regular intervals. This prevents the bearing from locking and the film of lubricant on the mechanical shaft seal is renewed. This also prevents the gear pinions (if present on the product) from becoming fixed as they turn and also renews the lubricating film on the gear pinions (preventing rust film deposits).



### **Beware of sharp edges**

**Sharp edges can form on rotors and propellers. There is a risk of injuries. Wear protective gloves.**

- If the product has been stored for a long period of time it should be cleaned of impurities such as dust and oil deposits before start-up. Rotors and propellers should be checked for smooth running, housing coating and damage.

**Before start-up, the filling levels (oil, motor filling etc.) of the individual products should be checked and topped up if required. Products filled with drinking water should be completely filled before start-up. Please refer to the machine data sheet for specifications on filling.**

**Damaged coatings should be repaired immediately. Only a coating that is completely intact fulfills the criteria for intended usage.**

If these rules are observed, your product can be stored for a longer period. Please remember that elastomer parts and coatings become brittle naturally. If the product is to be stored for longer than 6 months, we recommend checking these parts and replacing them as necessary. Please consult the manufacturer.

## *Returning to the supplier*

Products which are delivered to the plant must be clean and correctly packaged. In this context, clean means that impurities have been removed and decontaminated if it has been used with materials which are hazardous to health. The packaging must protect the product against damage. If you should have any questions please contact the manufacturer.

## 5 Installation

In order to prevent damage to the machine or serious injury during installation the following points must be observed:

- Installation work – assembly and installation of the machine – may only be carried out by qualified persons. The safety instructions must be followed at all times.
- The machine must be inspected for transport damage before any installation work is carried out.

After pumping water containing lime, clay or cement, flush out the machine with clean water in order to prevent encrustation and subsequent breakdowns.

If you are using level control, make sure that the minimum water coverage is present. Air pockets in the pipeline system must be avoided at all costs and must be removed using a suitable ventilation system. Protect the machine from frost.

### *General information*

Possible types of vertical machine installation:

- Installation in pipes with underground discharge
- Installation in pipes in covered intake chambers
- Installation in pipe overflow models

### *Installation types*

The operating area must be laid out for each machine. You must ensure that lifting gear can be fitted without any trouble, since this is required for assembly and removal of the machine. It must be possible to safely reach the machine in its operating and storage locations using the hoisting gear. The machine must be located on a firm foundation.

### *The operating area*

Electric power cables must be laid out in such a way that safe operation and non-problematic assembly/dismantling are possible at all times.

The structural components and foundations must be of sufficient stability to ensure safe and functional operation. The operator or the supplier is responsible for the provision of the foundations and their accuracy in terms of dimensions, stability and strength.

Never let the machine run dry. Therefore, we recommend installing a level control unit or a dry-run protection system where there are great variations in the level.

Use guide and deflector plates for the pumped fluid intake. If the water jet reaches the surface of the water or the machine, air will be introduced into the pumped liquid. This will lead to unfavorable current and pumping conditions. As a result, the machine does not run smoothly and is subjected to higher wear and tear.

### *Assembly accessories*

The maximum bearing capacity must be greater than the weight of the machine, add-on units and cable. It is essential that the machine can be lifted and lowered without hindrance or endangering personnel. There should be no objects or obstacles in the swiveling range of the hoisting gear.

### *Swiveling hoisting gear*

The electric power cables should be fastened properly to the pipeline with cable holders or other suitable equipment. This should prevent loose hanging and damage to the electric power cables. Depending on the cable length and weight, a cable holder should be fitted every two to three meters.

### *Cable holders*

Make sure you have the required tools (such as wrenches) and other material (such as plugs and anchor bolts). The fastening materials should be sufficiently stable to ensure safe assembly.

### *Fixing materials and tools*

The following information should be taken into consideration when installing the machine:

### *Installation*

- This work may only be carried out by qualified personnel. Electrical work may only be carried out by qualified electricians.
- Lift the machine by the handle or lifting eyelets, never by the power supply cable. When assembling with chains, they must be connected with a shackle to the lifting eyelets or the carrying handle. Fastening devices must have official approval.
- Please observe all guidelines, rules and legal requirements for working with and underneath heavy suspended loads.
- Wear the appropriate protective clothing/equipment.
- If there is danger that poisonous or asphyxiating gases may collect, then the necessary counter-measures should be taken.
- Please also observe all accident prevention guidelines, trade association safety guidelines and the advice contained in this operating and maintenance manual.
- The coating of the machine is to be examined before installation. If defects are found, these must be eliminated.

**An intact coating is necessary for the best possible protection from corrosion.**

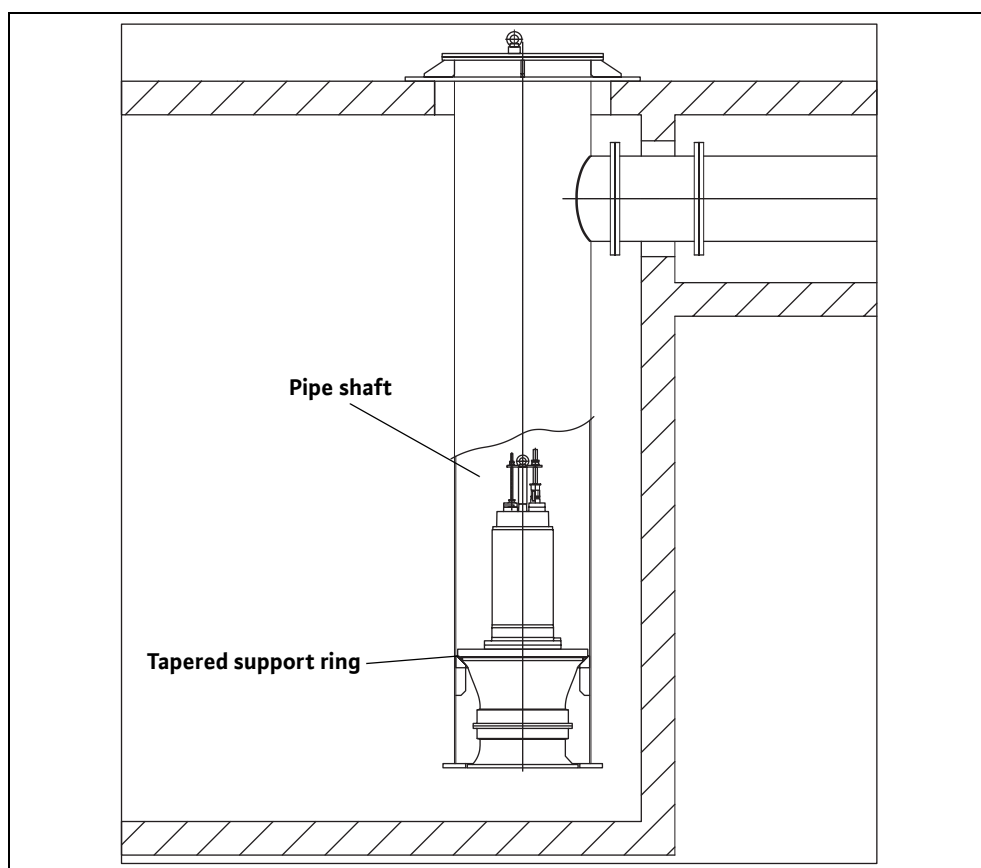


### **Danger of falling!**

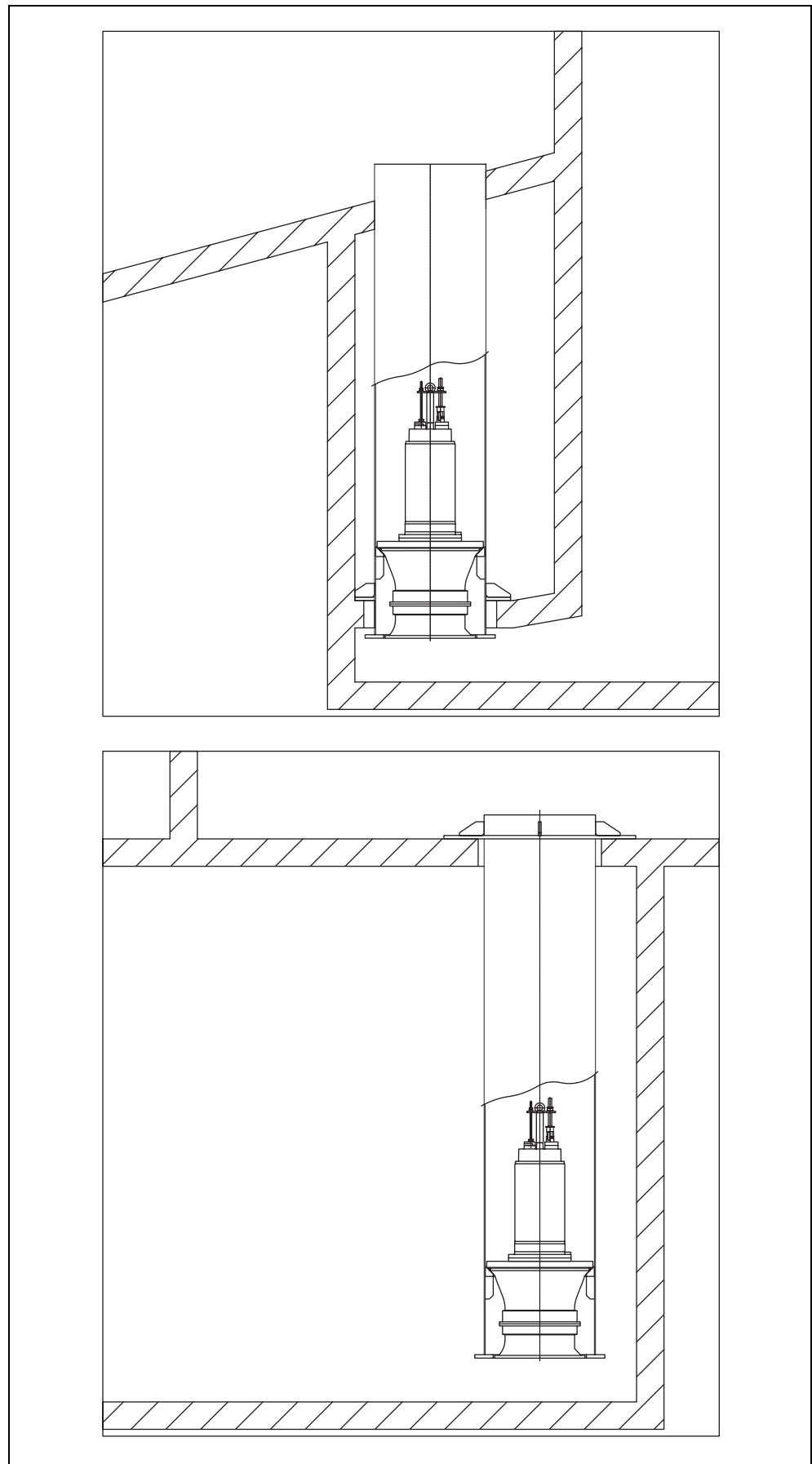
**Installation work for the machine and its accessories is performed directly on the edge of the basin. Carelessness or wearing inappropriate clothing could result in a fall. There is a risk of fatal injury! Take all necessary safety precautions to prevent this.**

- 1 Lower the pump into the steel pipe or concrete pit.
- 2 Ensure that the pump lies correctly on the support ring and is centered on the tapered ring.
- 3 The round cord ring on the guide housing seals the intake and discharge sides apart from each other after the centering process.
- 4 The cables within a pipe shaft should be guided through the bolted connection and clamped so that they do not strike against the pipe walls during operation.
- 5 The chain should be tightened without raising the machine.

*Installation*



**Fig. 5-1: Installation in pipes with underground discharge**



**Fig. 5-2: Installation in pipes in covered intake chambers and pipe overflow models**

The machine must always be immersed up to the top edge of the propeller hub.

For optimum reliability, we recommend installing a dry-run protection system. Correct running is ensured by float switches or electrodes. The float switch / electrode is fastened in the pit and switches off the machine when the water level falls below the minimum coverage level.

**Please observe the information about the minimum water coverage.**

**If dry-run protection is only put into effect with one float or electrode when filling levels deviate strongly, then the machine may turn on and off constantly!**

**This can result in the maximum number of motor start-ups being exceeded.**

### *Dry-run protection*

### *Corrective measures*

The motor is switched off when the water level falls below the minimum coverage level and switched back on when a sufficient water level is reached.

### *Manual reset*

Using a second switching point (additional float or electrode), a sufficient difference is obtained between the activation and deactivation points. This prevents constant switching. This function can be put into effect with a level control relay.

### *Separate reactivation point*

When removing the machine, make sure that it is first disconnected from the mains.

### *Removal*

The machine is raised out of the pit by the chain or lifting cable with the help of a hoisting gear. This does not have to be emptied especially for this purpose. Make sure the power supply cable does not become damaged.

**Beware of poisonous substances!**

**Machines which pump fluids hazardous to health present a fatal risk. These machines must be decontaminated before any other work is carried out. Wear the necessary protective clothing/ equipment when doing so.**







## 6 Startup

The "Startup" chapter contains all the important instructions for the operating personnel for starting up and operating the machine safely.

The following specifications must be adhered to and checked:

- Type of installation
- Operating mode
- Minimum water coverage / max. submersion

**If the machine has not been operated for some time, check these specifications again and rectify any faults you find.**

**The operation and maintenance handbook must always be kept either by the machine or in a place specially reserved for it where it is accessible for operating personnel at all times.**

In order to prevent damage or serious injury during startup of the machine, the following points must be observed:

**The machine may only be started up by qualified personnel. The safety advice must be followed at all times.**

- Every person working on the machine must have received, read and understood this operating and maintenance manual. This must also be confirmed with a signature in the machine operator list.
- Activate all safety devices and emergency stop elements before startup.
- Electrical and mechanical settings may only be made by specialists.
- This machine may only be used under the working conditions specified in this handbook.

The machine has been designed and constructed using the very latest technology. Under normal working conditions it will operate reliably and for long periods. The one condition for this is that all instructions and advice are observed.

Minor oil leakage in the mechanical shaft seal on delivery is no cause for concern. However, it must be removed prior to submersion in the pumped liquid.

Please check the following:

- Cable guidance – no loops, slightly taut
- Check the temperature of the pumped liquid and the submersion depth – see machine data sheet
- Clean the pump sump
- Clean the pipeline system on the discharge and intake side, and open all sliders
- The guide housing must be flooded, i.e. it should be completely filled with liquid
- Check that all accessories, the pipeline system and the clamping system are properly fitted
- Check all level control and dry-run protection systems

**An insulation test and filling level check must be carried out prior to start-up, as described in chapter 7.**

### *Preparatory measures*

Observe the relevant local and national regulations when laying out and selecting the electric lines as well as when connecting the motor. The motor must be protected by a motor protection switch. Have the motor connected in accordance with the "Electrical connection" data sheet. Pay attention to the direction of rotation. Using an incorrect direction of rotation will damage the machine. In accordance with the machine data sheet, check the operating voltage and make certain that the current consumption remains uniform during all phases.

### *Electrical system*

Make sure that all temperature sensors and monitoring devices, such as the moisture sensors, are connected and that their functionality is tested. For more details, see the “Electrical connection plan” data sheet.



### **Beware of electrical current!**

**Electrical current can cause fatal injuries if not handled correctly!**  
**All machines with free cable ends (i.e. without plugs) must be connected by a qualified electrician.**

### *Direction of rotation*

The machine must be connected in accordance with the “Electrical connection plan” data sheet. The direction of rotation is controlled by a rotating field tester. This tester is switched on when the pump is connected and displays the rotation direction of the rotating field. There must be a clockwise rotating field for the machine to run correctly.

If a counter-clockwise rotating field is displayed, two phases must be replaced.

### **Ensure the direction of rotation is correct!**

**A clockwise rotating field is necessary. Using an incorrect direction of rotation will damage the machine!**

### *Motor protection and activation types*

#### *Motor protection*

The minimum requirement is a thermal relay / motor protection switch with temperature compensation, differential triggering and an anti-reactivation device in accordance with VDE 0660 or the appropriate national regulations. If the machines are connected to electrical systems in which faults frequently occur, we recommend installing additional protective devices (overvoltage, undervoltage or phase failure relays, lightning protection). Local and national regulations must be adhered to when connecting the machine.

#### *Activation types for cables with free ends (without plugs)*

##### **Direct activation**

Motor protection should be set to the rated current when fully loaded. At partial load, we recommend that motor protection is set 5 % above the measured current at the operating point.

##### **Star-delta activation**

If the motor protection is installed in the line:

Set the motor protection to  $0.58 \times$  the rated current. The maximum start-up time in star-delta mode is 3 seconds.

If the motor protection is not installed in the line:

Set the motor protection to the rated current when fully loaded.

##### **Starting transformer/soft start**

Motor protection should be set to the rated current when fully loaded. At partial load, we recommend that motor protection is set 5 % above the measured current at the operating point. The maximum start-up time at reduced voltage (approx. 70 %) is 3 seconds.

#### *Operation with frequency transformers*

The machine can be operated on frequency transformers.

**Observe the data sheet in the appendix of this manual.**

#### *Activation types with plugs / relays*

##### **Units with plugs**

Connect the plug to the socket provided and press the On/Off switch on the relay.

**Please observe the relay manual.****Units with relays**

The rated current is briefly exceeded during the start-up procedure. Once this process has ended, the operating current should no longer exceed the rated current.

**After starting**

If the motor does not start immediately after the machine is switched on, it must be switched off immediately. The start pauses specified in the technical data must be adhered to before starting up again. If the fault recurs, the machine must be switched off again immediately. The machine may only be started again once the fault has been rectified.

The following items should be monitored:

- Operating voltage (permissible deviation  $\pm 5\%$  of the rated voltage)
- Frequency (permissible deviation  $\pm 2\%$  of the rated frequency)
- Current consumption (permissible deviation between phases is a maximum of 5%)
- Voltage difference between the individual phases (max. 1%)
- Starts and stops per hour (see technical data)
- Air entry in the infeed, a deflector plate should be fitted if necessary
- Minimum water immersion level, level control unit, dry-run protection
- Smooth running
- Check for leaks, if need be, follow the necessary steps as set out in "Maintenance"

**As mechanical shaft seals have a certain running-in phase, it is possible that minor leaks may occur. This running-in phase lasts approx. 1 – 3 months. Change the oil several times during this phase. Please consult the manufacturer if leakage continues after this running-in phase has ended.**

The maximum limit range deviation for operational data is  $\pm 10\%$  of the rated voltage and  $\pm 3\%$  to  $-5\%$  of the rated frequency. Significant deviation from the operational data is to be expected (also see DIN VDE 0530, Section 1). The permissible voltage difference between the individual phases is a maximum of 1%. Continuous operation in the limit range is not recommended.

**Operation in the limit range**



## 7 Maintenance

The machine and the entire system must be inspected and maintained at regular intervals. The time limit for maintenance is set by the manufacturer and applies to the general conditions of use. The manufacturer should be consulted if the system is to be used with corrosive and/or abrasive pumped liquids, as the time limit between inspections may need to be reduced.

Note the following information:

- The operating and maintenance manual must be available to the maintenance personnel and its instructions followed. Only the repair and maintenance measures listed here may be performed.
- All maintenance, inspection and cleaning work on the machine and the system may only be carried out by trained specialists exercising extreme care in a safe workplace. Proper protective clothing is to be worn. The machine must be disconnected from the electricity supply before any work is carried out. There must be no way that it can be inadvertently switched on. Additionally, the appropriate protective measures as defined by the BGV/GNV should be enforced when working in basins and/or containers.
- Above a weight of 50kg, only hoisting gear which has been officially approved and which is in a technically perfect condition should be used for lowering and raising the machine.

**Make sure that all fastening devices, ropes and safety devices of the hand winch are in a technically perfect condition. Work may only commence if the auxiliary hoisting gear has been checked and found to be in perfect working order. If it is not inspected, danger to personnel may result.**

- Electrical work on the machine and system must be carried out by an electrician. For machines approved for work in areas subject to explosion danger, please refer to the "Explosion protection in accordance with the .... regulation" chapter. Defective fuses must be replaced. Under no circumstances are they to be repaired. Only fuses at the specified current and of the prescribed type may be used.
- When working with inflammable solvents and cleaning agents, fires, unshielded lighting and smoking are prohibited.
- Machines which circulate fluids hazardous to health, or which come into contact with them, must be decontaminated. It must be ensured that no dangerous gases can form or are present.

**If injuries involving hazardous pumping liquids or gases occur, first-aid measures must be performed in accordance with the notices in the workplace and a doctor should be called immediately.**

- Ensure that all necessary tools and materials are available. Tidiness and cleanliness guarantee safe and problem-free operation of the machine. After working on the machine all cleaning materials and tools should be removed from it. All materials and tools should be stored in an appropriate place.
- Operating supplies such as oil and lubricants must be collected in appropriate vessels and properly disposed of (in accordance with the 75/439/EEC directive and with §§ 5a, 5b AbfG). Appropriate protective clothing is to be worn for cleaning and maintenance jobs. This is to be disposed of in accordance with waste code TA 524 02 and EC Directive 91/689/EEC. Only lubricants expressly recommended by the manufacturer may be used. Oils and lubricants should not be mixed. Only use genuine parts made by the manufacturer.

**A trial run or functional test of the machine must be performed as instructed in the general operating conditions.**

## Maintenance

### Lubricants

You will find an overview of the lubricants used below:

Manufacturer	Gear oil (DIN 51 519 / ISO VG 220 Type CLP)	Transformer oil (DIN 57370 / VDE 0370)	White oil
Aral	Degol BG 220	Isolan T	Autin PL*
Shell	Omala 220	Diala D	ONDINA G13*, 15*, G17*
Esso	Spartan EP 220	UNIVOLT 56	MARCOL 52*, 82*
BP	Energol GR-XP 220	Energol JS-R	Energol WM2*
DEA	Falcon CLP 220	Eltec GK 2	
Texaco	Meropa 220	KG 2	Pharmaceutical 30*, 40*
ELF mineral oil		TRANSFO 50	ALFBELF C15
Tripol	Food Proof 1810/220*		

**Table 7-1: Lubricant overview**

The following can be used as grease in accordance with DIN 51818/NLGI class 3:

- Esso Unirex N3
- Tripol Molub-Alloy-Food Proof 823 FM\*

When using white oil, note the following:

- The machine lubricants may only be topped up or replaced with lubricants from the same manufacturer.
- Machines which have previously been operated using other lubricants must first be thoroughly cleaned before they can be operated using white oil.

**Lubricants which are approved for use with foodstuffs in accordance with USDA-H1 are marked with an asterisk.**

The specified lubricants are used in the motor chamber and/or sealing chamber.

### Maintenance intervals

Overview of the maintenance intervals needed:

*Before initial start-up or after  
a longer period of storage*

- Checking the insulation resistance
- Fill level check in sealing room/chamber – lubricant must reach up to the lower edge of the filling opening

*Monthly*

- Monitoring the current consumption and voltage
- Checking the used relays for posistors, sealing room monitor, etc.

*Every six months*

- Visual inspection of the power supply cable
- Visual inspection of the cable holder and the cable bracing
- Visual inspection of accessories, e.g. the suspension device and hoisting gears

*8,000 operating hours or after  
two years, whichever is earlier*

- Checking the insulation resistance
- Changing the lubricant in the sealing room/chamber
- Emptying the leakage chamber (not present in all models)
- Functional inspection of all safety and control devices

- Coating check and touch-up as required

- General overhaul

**If it is used in highly abrasive or corrosive material, the maintenance intervals should be reduced by 50%!**

*15,000 operating hours or after five years, whichever is earlier*

Overview of the individual maintenance intervals:

## Maintenance tasks

The current consumption and voltage is to be monitored periodically during all 3 phases. This remains constant during normal operation. Slight fluctuations are a result of the composition of the pumped fluid. The current consumption can assist in early detection and correction of damage and/or faulty operation in the impeller/propeller, bearings and/or the motor. More extensive resulting damage can thus be largely prevented and the risk of a total failure can be reduced.

*Monitoring the current consumption and voltage*

Check the relays used are functioning fault-free. Defective devices must be immediately replaced, because these cannot ensure safe operation of the machine. The test procedure details should be followed closely (in the operating instructions for each relay).

*Checking the used relays for pistons, sealing room monitor, etc.*

To check the insulation resistance, the power supply cable must be disconnected. The resistance can then be measured with an insulation tester (measuring voltage = 1000V DC). The following values may not be exceeded:

*Checking the insulation resistance*

The insulation resistance may not be below 20mega-ohms during initial operation. For all further measurements the value must be greater than 2mega-ohms.

Insulation resistance too low: Moisture may have penetrated the cable and/or the motor.

**Do not connect the machine, consult manufacturer.**

The power supply line must be examined for bubbles, cracks, scratches, chafed areas and/or crushed sections. If damage is found, the power cable must be exchanged immediately.

*Visual inspection of the power supply cable*

**The cables may only be changed by the manufacturer or an authorized/certified service workshop. The machine may not be used again until the damage has been adequately rectified.**

When the machine is used in basins or pits, the lifting cables/cable holders (carabiners) and the cable bracing are subject to constant wear. Regular inspections are necessary in order to prevent the lifting cables/cable holders (carabiners) and/or cable bracing from wearing out and to prevent the electricity cable from being damaged.

*Visual examination of the cable holders (carabiners) and the cable bracing*

**The lifting cables/cable holders (carabiners) and the cable bracing are to be immediately replaced if any signs of wear appear.**

Inspect accessories such as suspension units and hoisting gear to check whether they are secured in a stable manner. Loose and/or defective accessories should be repaired immediately or replaced.

*Visual inspection of accessories*

Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc.

*Functional inspection of safety and control devices*

Motor protection and overvoltage relays and other trip elements can generally be triggered manually for test purposes.

To inspect the sealing room monitor or the temperature sensor, the machine must be cooled to ambient temperature and the electrical supply cable of the monitoring device in the switch cabinet must be disconnected. The monitoring device is then tested with an ohmmeter. The following values should be measured:

Bi-metal sensor: Value = "0" – throughput

PTC sensor: A PTC sensor has a cold resistance of between 20 and 100ohms. For 3 sensors in series this would result in a value of between 60 and 300ohms.

PT 100 sensor: PT 100 sensors have a value of 100 ohms at 0°C. Between 0°C and 100°C this value increases by 0.385 ohms per 1°C. PT 20 sensors have a value of 107.7 ohms at 20°C.

Moisture sensor: This value must approach infinity. If there is a low value, there may be water in the oil. Also observe the instructions of the optionally available evaluation relay.

**In the case of larger deviations, please consult the manufacturer.**

Please consult the appropriate operating manual for details on inspecting the safety and monitoring devices on the auxiliary lifting gear.

### *General overhaul*

During this the bearings, shaft seals, O rings and power supply cables are inspected and replaced as required in addition to normal maintenance work. This work may only be conducted by the manufacturer or an authorized service workshop.

### *Changing the lubricant*

The drained lubricant must be checked for dirt and water content. If the lubricant is very dirty and contains more than 1/3 water, it must be changed again after four weeks. If there is again water in the lubricant then, it seems likely that a seal is defective. In this case, please consult the manufacturer.

If a sealing room or leakage monitoring system is being used, the display will light up again within four weeks of changing the lubricant if a seal is defective.

**The general procedure for changing lubricants is as follows:**

**Switch off the machine, let it cool down, disconnect it from the mains (have this done by an electrician), clean it and place it vertically on a solid base.**

**Warm or hot lubricants may be pressurized. The leaking lubricant may cause burns. For that reason, let the machine cool down to ambient temperature before you touch it.**

**Secure it from falling over and/or slipping. For certain housing coatings (e.g. Ceram C0) the plugs are protected with plastic covers. These must be removed and put back on after a successful lubricant change. They must be lined with an acid-resistant sealant (such as SIKAFLEX 11FC).**

### *Sealing chamber*

As there are several versions and designs of these motors, the exact location of the screw plugs varies depending on the pump unit used.

- 1 Slowly and carefully remove the filling plug (D+) from the sealing room.

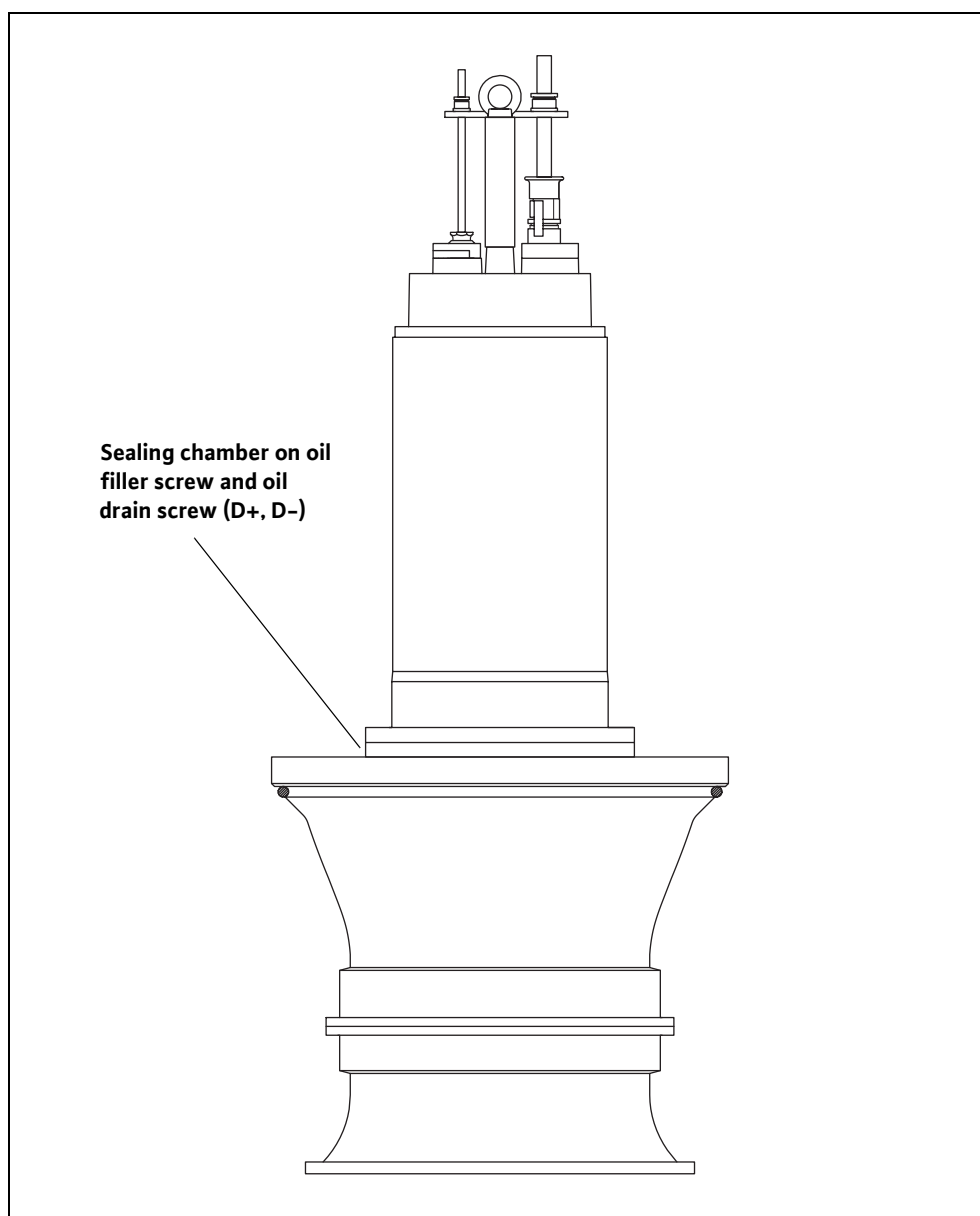
**Caution: The lubricant may be pressurized.**

- 2 Remove the drain plug (D-). Drain the lubricant and collect it in a suitable reservoir. Clean the drain plug, fit with a new sealing ring and screw it in again. For complete drainage, the machine must be slightly tipped on to its side.

**Make sure that the machine cannot fall and/or slip away.**

- 3 Fill lubricant by means of the opening in the filling plug (D+). Comply with the specified lubricants and filling quantities.
- 4 Clean the filling plug (D+), fit with a new sealing ring and screw it in again.





**Fig. 7-1: Position of the screw plugs**

The following repairs can be carried out on this machine:

- Changing the propeller
- Changing the stationary wear rings

When carrying out repair work, the following information should always be observed:

- Round sealing rings as well as existing seals should always be replaced.
- Thread lockers such as spring washers or the self-locking Nord-Lock thread lockers should always be replaced.
- If no self-locking Nord-Lock thread lockers are used or it is not possible to use them, then screws made from A2 or A4 materials must be used. The correct torques must be observed.
- If self-locking Nord-Lock thread lockers are used, then only dacromet-coated screws (strength category 10.9) may be used.
- Never use brute force during this work.

**In general, the following applies to repairs:**

**Switch off the machine, disconnect it from the mains (have this done by**

## *Repairs*

an electrician), clean it and place it on a solid base in a horizontal position. Secure it from falling over and/or slipping. For certain housing coatings (e.g. Ceram C0) the screw plugs are protected with plastic covers. These must be removed and then replaced after a successful lubricant change. They must be lined with an acid-resistant sealant (e.g. SIKAFLEX 11FC).

### *Changing the propeller*

- Loosen the screws on the guide housing and set it down with the spring washer.
- Carefully lift up the axial machine slightly using a suitable hoisting gear.
- Lightly tap the intake funnel using a rubber mallet until it comes free from the guide housing.
- Unscrew the three M5 hexagon socket screws and remove the propeller cap.
- Unscrew the M16 hexagon socket screw and set it down with the washer.
- Pull the propeller from the shaft. A tight propeller can be removed using a wheel puller or two pry bars.
- Assembly is carried out in the reverse order.

**If required, new stationary wear rings should be used during propeller installation.**

### *Changing the stationary wear ring*

If this gap between the propeller blade and stationary wear ring is too large, then the performance of the machine decreases and/or it can lead to entanglements. The stationary wear ring is designed so that it can be replaced. This minimizes wear on the intake funnel and guide housing, which consequently reduces replacement part costs.

**The correct manual for changing the stationary wear rings is supplied with the replacement part.**

### *Changing the sealing parts*

Changing the sealing parts on the liquid side (e.g. the block seal cartridge and the mechanical seal shaft) requires a certain amount of specialist knowledge about these sensitive components. Additionally, much of the machine must be dismantled in order to carry out the work.

**Only original parts may be used for replacement.**

Inspection and replacement of these parts is performed by the manufacturer during the general overhaul or by specially trained personnel.

**For machines approved for work in explosive areas, please refer to the "Explosion protection in accordance with the .... regulation" chapter.**

### *Torque values*

Overview of the correct torques for dacromet-coated screws with Nord-Lock screw fixing

Thread	Tensile strength 10.9	
	Nm	kp m
M5	9.2	0.94
M6	15.0	1.53
M8	36.8	3.75
M10	73.6	7.50
M12	126.5	12.90
M16	316.3	32.24
M20	621.0	63.30
M24	1069.5	109.02
M27	1610.0	164.12

**Table 7-2: Dacromet-coated screws with Nord-Lock screw fixing**

Thread	Tensile strength 10.9	
	Nm	kp m
M30	2127.5	216.87

**Table 7-2: Dacromet-coated screws with Nord-Lock screw fixing**

Overview of the correct torques for rustproof screws without screw fixing:

Thread	Nm	kp m	Thread	Nm	kp m
M5	5.5	0.56	M16	135.0	13.76
M6	7.5	0.76	M20	230.0	23.45
M8	18.5	1.89	M24	285.0	29.05
M10	37.0	3.77	M27	415.0	42.30
M12	57.0	5.81	M30	565.0	57.59

**Table 7-3: Rustproof screws without Nord-Lock screw fixing**



## 8 Shutdown

This chapter provides an overview of the various ways to shut down the machine.

For this type of shutdown, the machine remains installed and is not cut off from the electricity supply. For temporary shutdown, the machine must remain completely submerged so that it is protected from frost and ice. Make sure the operating room and the pumped fluid cannot be covered by ice.

### *Temporary shutdown*

This ensures that the machine is always ready for operation. During longer shutdown periods, carry out a regular (monthly to quarterly) function run for a period of 5 minutes.

#### **Caution**

**Only carry out a function run under the proper conditions of operation and use (see “Product Description”). Never run the machine dry. This can result in irreparable damage!**

Switch off the system, disconnect the machine from the electricity supply and dismantle and store it. Note the following information concerning storage:

### *Final shutdown / storage*

#### **Beware of hot parts!**

**When removing the machine, be careful of the temperature of the housing components. These can heat up to well above 40°C. Let the machine cool down to ambient temperature before you touch it.**



#### **Caution**

**For machines filled with drinking water, drain out the water and let the machine dry out if it is not operated for more than 4 weeks, or if there is a risk of freezing.**

- Clean the machine.
- Store it in a clean, dry place, protect the machine against frost.
- Place it down vertically onto a firm foundation and secure it against falling.
- Seal the intake and discharge ports of pumps with suitable material (such as foil).
- Support the electric connecting lead on the cable lead-in to help avoid a permanent deformation.
- Protect the ends of the electric power cable from moisture.
- Protect the machine from direct sunshine as a preventive measure against brittleness in elastomer parts and the propeller and casing coating.
- When storing the machine in a garage please remember: Radiation and gases which occur during electric welding destroy the elastomers of the seals.
- During lengthy periods of storage, regularly (for example every six months) turn the impeller or propeller by hand. This prevents indentations in the bearings and stops the rotor from rusting up.
- See also “Transport and Storage”.

Before restarting the machine, clean it of dust and oil deposits. Then carry out the necessary maintenance actions (see “Maintenance”). Check that the mechanical shaft seal is in good order and working properly.

### *Restarting after an extended period of storage*

## Shutdown

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Once this work has been completed, the machine can be installed (see “Installation”) and connected to the electricity supply by a specialist. See “Startup” a for instructions on restarting.

**Only restart the machine if it is in perfect condition and ready for operation.**

## 9 Troubleshooting and possible solutions

In order to prevent damage or serious injury while rectifying machine faults, the following points must be observed:

- Only attempt to rectify a fault if you have qualified staff. This means each job must be carried out by trained specialist staff. For example, electrical work must be performed by a trained electrician.
- Always secure the machine against an accidental restart by disconnecting it from the mains. Take appropriate safety precautions.
- Always have a second person on hand to ensure the machine is switched off in an emergency.
- Secure moving parts to prevent injury.
- Unsanctioned changes to the machine are made at the operator's own risk and release the manufacturer from any warranty obligations.

*Fault: The machine will not start*

Cause	Solution
Electricity supply interrupted, short circuit or earth fault in the cable or motor windings	Have the motor and wires checked by a specialist and replaced if necessary
Fuses, the motor protection switch and/or monitoring devices are triggered	Have a specialist inspect the connections and correct them as necessary Have the motor protection switches and fuses installed or adjusted according to the technical specifications, and reset monitoring equipment Check that the impeller/propeller runs smoothly. Clean or free it as necessary
The moisture sensors (optional) have interrupted the power circuit (operator-related)	See fault: Mechanical shaft seal leaks, moisture sensors report a fault or switch the machine off

**Table 9-1: The machine will not start**

*Fault: The motor starts, but the motor protection switch triggers shortly after start-up*

Cause	Solution
The thermal trigger on the motor protection switch is incorrectly set	Have a specialist compare the setting of the trigger with the technical specifications and correct if necessary
Increased power consumption due to major voltage drop	Have an electrician check the voltage on each phase and rewire if necessary
Two-phase operation	Have a specialist inspect the connection and correct it as necessary
Excessive voltage differences on the three phases	Have a specialist inspect the connection and the switching system and correct it as necessary

**Table 9-2: The motor starts, but the motor protection switch triggers shortly after start-up**

## Troubleshooting and possible solutions

Cause	Solution
Impeller/propeller impeded by adhesive material, blockages and/or solid matter, increased current consumption	Switch off the machine, secure it against being switched on again and free the impeller/propeller or clean the intake port
The pumped fluid is too dense	Contact the manufacturer

**Table 9-2: The motor starts, but the motor protection switch triggers shortly after start-up**

*Fault: Machine runs but does not pump*

Cause	Solution
No pumped fluid	Open the container intake or sliders
Intake blocked	Clean the intake, slider, intake port or intake strainer
Impeller/propeller blocked or obstructed	Switch off the machine, secure it against being switched on again and free the impeller/propeller
Defective hose or pipeline	Replace defective parts
Intermittent operation	Check the control panel
Incorrect direction of rotation	Check the machine for damage. Replace two phases on the mains supply

**Table 9-3: Machine runs but does not pump**

*Fault: The machine runs, but not at the stated operating levels*

Cause	Solution
Intake blocked	Clean the intake, slider, intake port or intake strainer
Slider in the discharge pipe closed	Fully open the slider
Impeller/propeller blocked or obstructed	Switch off the machine, secure it against being switched on again and free the impeller/propeller
Air in the system	Check the pipelines, pressure shroud and/or pump unit, and bleed if necessary
Machine pumping against excessive pressure	Check the slider in the discharge pipe and open it completely if necessary, use a different impeller or contact the factory
Signs of wear	Replace worn parts
Defective hose or pipeline	Replace defective parts
Inadmissible levels of gas in the pumped liquid	Contact the factory

**Table 9-4: The machine runs, but not at the stated operating levels**



Cause	Solution
Two-phase operation	Have a specialist inspect the connection and correct it as necessary
Excessive decrease in the water table during operation	Check the supply and capacity of the system, and inspect the level control settings and functionality

**Table 9-4: The machine runs, but not at the stated operating levels**

Cause	Solution
Machine is running in an inadmissible operation range	Check the operational data of the machine and correct if necessary and/or adjust the operating conditions
The intake port, strainer and/or impeller/propeller is blocked	Clean the intake port, strainer and/or impeller/propeller
The impeller is impeded	Switch off the machine, secure it against being switched on again and free the impeller
Inadmissible levels of gas in the pumped liquid	Contact the factory
Two-phase operation	Have a specialist inspect the connection and correct it as necessary
Incorrect direction of rotation	Check the machine for damage. Replace two phases on the mains supply
Signs of wear	Replace worn parts
Defective motor bearing	Contact the factory
The machine is installed under mechanical strain	Check the installation, use rubber spacers if necessary

**Table 9-5: The machine does not run smoothly and is noisy**

*Fault: The machine does not run smoothly and is noisy*

Moisture sensor monitoring is optional, and is not available for all types. For more details, see the order confirmation or the electrical connection plan

Cause	Solution
Condensation build-up due to lengthy storage and/or temperature fluctuations	Operate the machine briefly (max. 5 min.) without moisture sensors
Expansion tank (optional for polder pumps) is too high	Install the expansion tank no more than 10m above the bottom edge of the intake port
Increased leakage when running in new mechanical shaft seals	Change the oil
Defective moisture sensor cables	Replace the moisture sensors

**Table 9-6: Mechanical shaft seal leaks, moisture sensors report a fault or switch the machine off**

*Fault: Mechanical shaft seal leaks, moisture sensors report a fault or switch the machine off*

## Troubleshooting and possible solutions

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Cause	Solution
Mechanical shaft seal is defective	Replace the mechanical shaft seal and contact the factory!

**Table 9-6: Mechanical shaft seal leaks, moisture sensors report a fault or switch the machine off**

### *Further steps for troubleshooting*

If the points listed here do not rectify the fault, contact our customer service. They can help you as follows:

- Telephone or written support from customer service
- On-site support from customer service
- Inspection or repair of the machine at the factory

Please note that you may be charged for some services provided by our customer support. For more details, please contact customer service.

*List of machine operators*

[illegible]

A-1

# List of machine operators and maintenance

## Maintenance and inspection log

Every person is required to enter all maintenance and alteration work which then is to be confirmed with the person's own signature and that of their supervisor.

This list is to be shown on request to representatives of controlling organizations, government inspection teams and the manufacturer!

Maintenance / Revision on	Date	Signature	Signature of the person in charge

Table A-2: Maintenance and inspection log

## **B Key for the labelling of the screw plugs**

For large units, or on request of the customer, the plugs required for the maintenance work are marked with labels. The following is a key explaining exactly what each letter on the labels mean:

- **K**=Cooling system plug. The top plug is the filling plug (also marked as K+) for the coolant, the bottom one is the coolant draining plug (also marked K-).
- **D**=Sealing room or sealing chamber plug. The top plug is the filling plug (also marked as D+) for the oil, the bottom one is the oil draining plug (also marked D-). If only one plug is labelled, the oil must be drained off and refilled using this plug.
- **M**=Motor chamber plug. The top plug is the filling plug (also marked as M+) for the oil, the bottom one is the oil draining plug (also marked M-). If only one plug is labelled, the oil must be drained off and refilled using this plug.
- **L**=Leak chamber plug. The fluid is drained off from the leak chamber through this plug (also marked L-).
- **S**=Condensation chamber plug. The fluid is drained off into the condensation chamber through this plug.
- **F**=Leak chamber plug for the lubricating nipple. This plug protects the lubricating nipple from dirt. The anti-friction bearings are regreased using the lubricating nipple behind them.

The signs are made out of stainless steel or PVC. They are attached in the immediate vicinity of the respective plug. They are designed to help when maintenance is required. If the signs have been removed or lost, you will find an illustration of the plugs in the "Servicing" chapter.



## C Assembly Sheet For the Anchor Bolts

Anchor bolts consist of a metal anchor rod, a grout cartridge (a glass tube or plastic bag containing adhesive cement), a washer and a hexagonal nut. They create a firm connection in concrete foundations, thus enabling heavy loads to be supported. Once fitted, the anchor cannot be removed!

*General product information*

The anchor bolts supplied by WILO EMU GmbH may only be used for WILO auxiliary hoisting gear and accessories.

*Scope of proper use*

These anchor bolts may only be used in normal reinforced or non-reinforced concrete in a strength class of min. C20/25 and max. C50/60 (according to EN 206:2000-12). The foundation for the anchors should be dry. The anchor bolt is only suitable for non-cracked concrete. Anchor bolts are also available for cracked concrete.

Before using the anchor bolts, make sure the background structure is strong enough to withstand the reactive forces generated by the auxiliary hoisting gears and their accessories.

The anchor bolts are designed to fasten auxiliary hoisting gears and their accessories to the basis edge and/or basin floor.

Take care not to damage the grout cartridge during transport, as otherwise the adhesive cement will harden. Do not use faulty grout cartridges. Do not use grout cartridges after the expiration date printed on them.

*Transport and storage*

The cartridges must be transported only at temperatures between -5°C and 30°C and stored at temperatures between 5°C to 25°C. The mortar cartridge must be kept in a cool, dry, dark place.

**Beware of irritant substances!**

**The grout cartridges contain dibenzoyl peroxide. This substance is caustic. Note the following information:**

**R36/38 Irritates eyes and skin**

**R43 Skin may react to contact**

**S37/39 Wear suitable protective clothing during work**

**S26 If it comes into contact with the eyes, wash them out with water and call a doctor**

**S28 If it comes into contact with the skin, wash thoroughly with water and plenty of soap**



*Setting the anchor bolts*

Name	Rod length	Drill hole depth	Drill hole diameter	Min. distance from edge $a_r$
HAS-R M8x80/14	110mm	80mm	10mm	100mm
HAS-R M12x110/28	160mm	110mm	14mm	135mm
HAS-R M16x125/38	190mm	125mm	18mm	155mm
HAS-R M16x125/108	260mm	125mm	18mm	155mm
HAS-E-R M20x170/48	240mm	170mm	24mm	210mm
HAS-E-R M24x210/54	290mm	210mm	28mm	260mm

**Table C-1: Dimensions and tightening torque values**

## Assembly Sheet For the Anchor Bolts

Name	Rod length	Drill hole depth	Drill hole diameter	Min. distance from edge $a_r$
HIS-RN M16x170	170 mm	170 mm	28 mm	210 mm

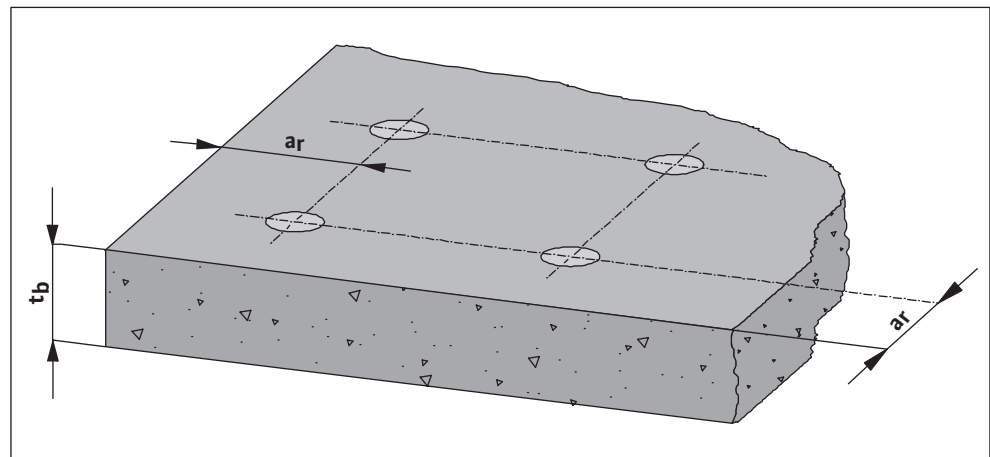
**Table C-1: Dimensions and tightening torque values**

Name	Minimum thickness $t_b$	Torque $T_{inst}$	Max. thickness of the part to be fastened
HAS-R M8x80/14	130 mm	10 Nm	14 mm
HAS-R M12x110/28	160 mm	40 Nm	28 mm
HAS-R M16x125/38	175 mm	80 Nm	38 mm
HAS-R M16x125/108	175 mm	80 Nm	108 mm
HAS-E-R M20x170/48	220 mm	150 Nm	48 mm (without hexagon head)
HAS-E-R M24x210/54	260 mm	200 Nm	54 mm (without hexagon head)
HIS-RN M16x170	220 mm	80 Nm	(internal thread M16)

**Table C-2: Dimensions and tightening torque values**

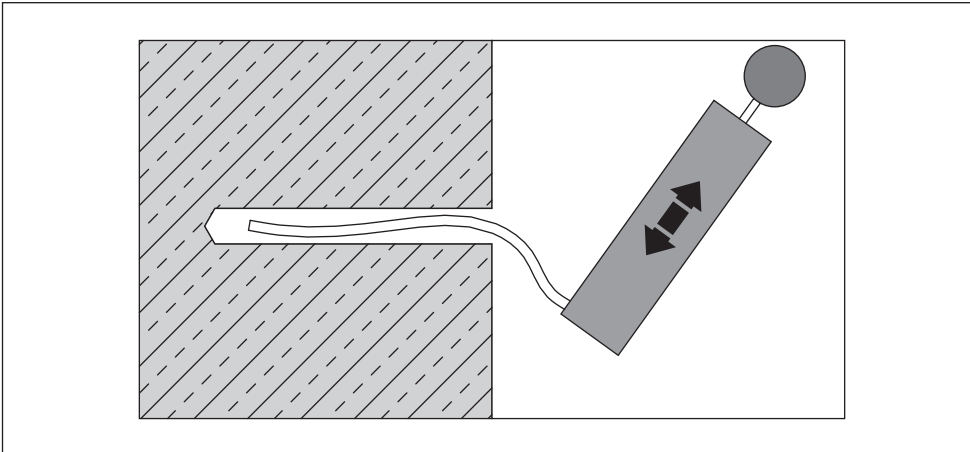
- 1 Drill the holes as shown in table 1 and the following drawing.

**Note: The quality of the fastening depends on how well the anchor bolts are correctly seated!**

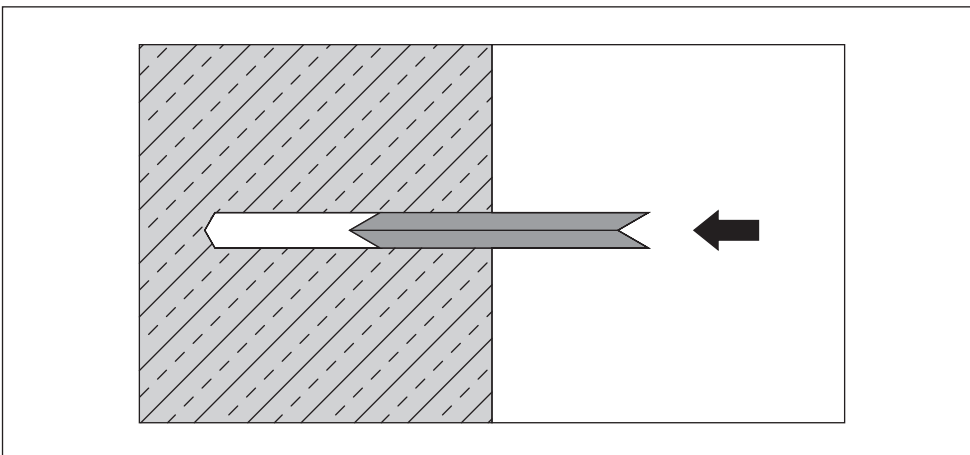




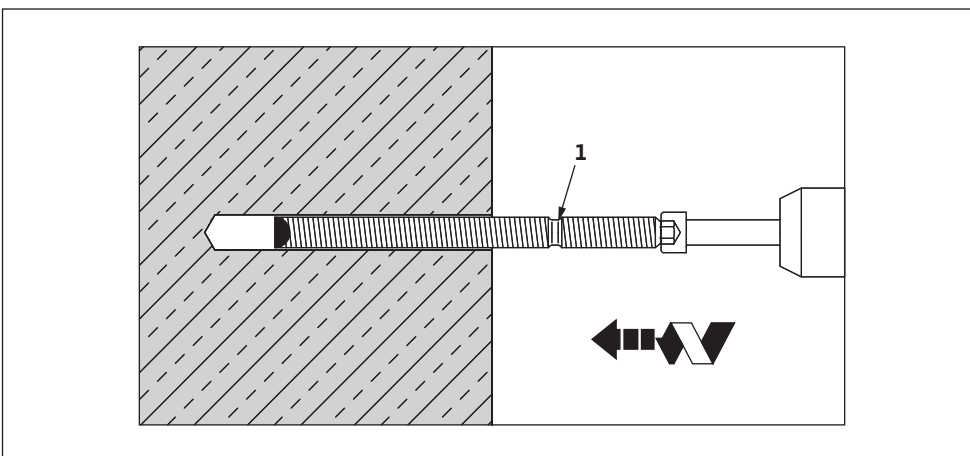
- 2 Carefully and thoroughly clean the holes using a brush and bellows.



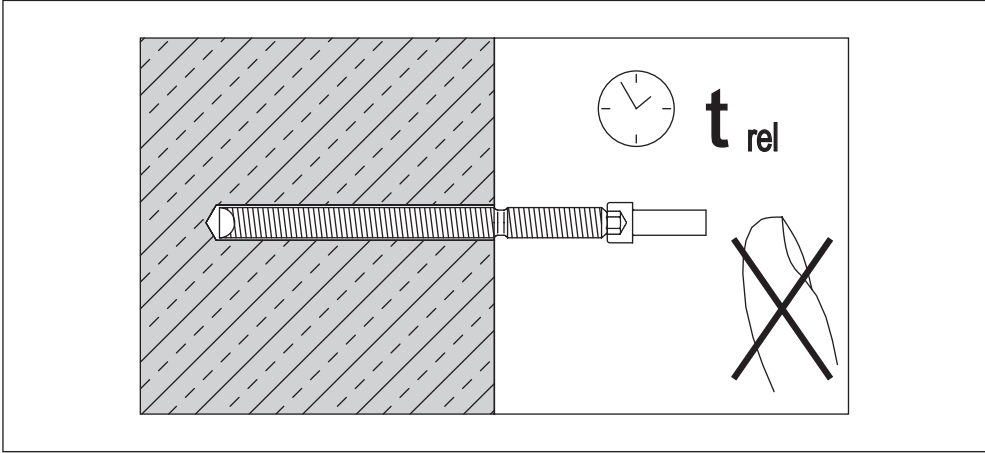
- 3 Insert the grout cartridge carefully into the hole. Any air bubbles must face outwards. If the drilled hole is too deep or broken at the edges, you may need to use more than one grout cartridge.



- 4 Using a suitable insertion tool, turn and knock the anchor bolt into the mortar cartridge until it reaches the insertion depth marking (1). The gap between the anchor bolt and the back-ground structure must be completely filled with grout.



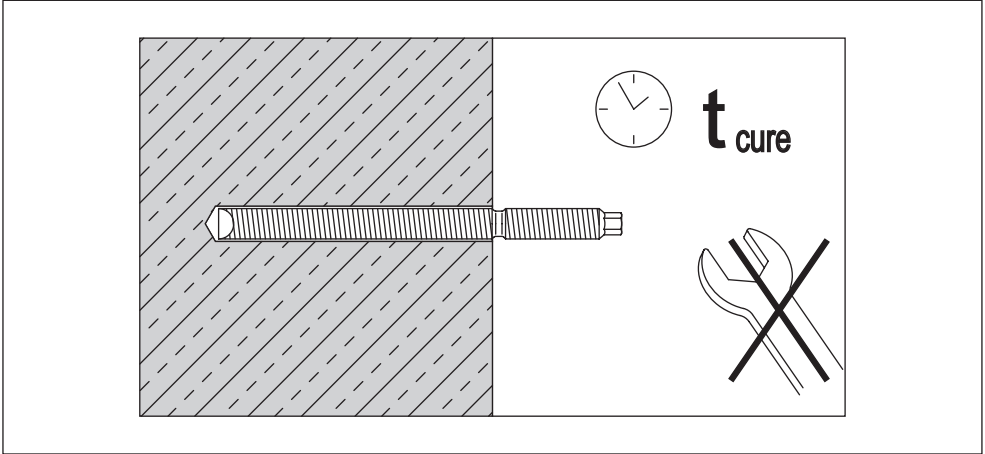
- 5 Carefully remove the insertion tool, do not remove a jammed insertion tool until  $t_{rel}$  has elapsed – see Table 2.



Temp. in the drill hole	>+ 20 °C	>+ 10 °C	> 0 °C	>- 5 °C
Waiting time $t_{rel}$	8 min	20 min	30 min	1 hr
Waiting time $t_{cure}$	20 min	30 min	1 hr	5 hr
If the background structure is damp, the waiting time must be doubled!				

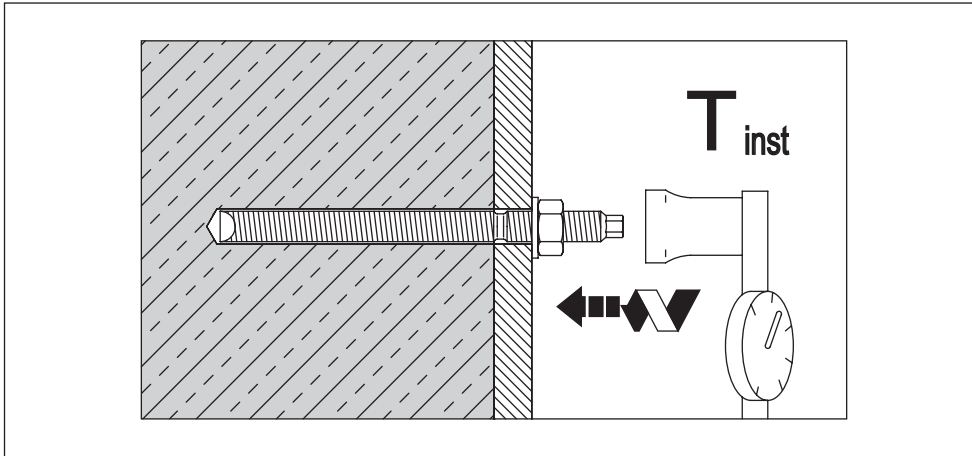
Table C-3: Hardening time

- 6 Let the anchor bolts harden – see  $t_{cure}$  in Table 2. While curing, do not move or place any load on the anchor bolt.



- 7 When the anchor bolts has hardened, clean the bearing surface of any impurities such as dirt, adhesive resin or drilling dust. The part to be attached must be firmly fitted to the base and may not be in any way loose. Then bolt the part to the base and tighten it to the specified torque (see Table 1). To secure the nut, coat it with Loctite 2701 locking glue and re-tighten

it to the specified torque at least three times in order to compensate for any movement due to setting.





## D Operation with a static frequency converter

WILO products can be operated with standard frequency converters. These are normally pulse-width-modulated converters. However, the following points must be observed when operating the converter:

Any standard WILO motor can be used. **If the rated voltage is above 415 V, you must consult the manufacturer.** Because of the additional heating caused by harmonics, the rated power of the motor should be around 10% more than the power requirement of the pump. For converters with a **low-harmonic output**, it may be possible to reduce the 10% power reserve. This is normally done by using output filters. Ask the converter manufacturer.

The size of the converter depends on the rated motor current. Selecting the motor power in kW can cause problems, since submersible motors have **different specifications** to standard motors. **Waste water motors are marked with the appropriate rated power** (type sheet power in catalog).

Submersible pumps have water-lubricated bearings. A minimum speed is required in order for a lubricating film to form.

**Continuous operation at frequencies below 25 Hz (30 Hz 4-pole) must be avoided**, since the lack of lubrication and possible occurrence of mechanical vibrations may cause damage to the bearings.

**The lowest speed range (up to 12.5 Hz) should be passed through within 2 seconds.**

In practice, the speed should only be lowered to the extent that a pump flow of at least 10% of the maximum flow remains. The precise value depends on the type – ask the manufacturer for details.

There is no prescribed minimum speed for waste water and sewage pumps.

However, make sure that the motor operates without jerking or vibrating, especially in the lower speed range. Otherwise, the mechanical shaft seals could be damaged and start leaking.

It is important that the pump motor operates across the entire control range without vibrations, resonance, oscillation or excessive noise (ask the manufacturer if necessary).

Increased motor noise caused by the harmonics of the power supply is normal.

When configuring the converter, always make sure the quadratic curve (U/F characteristic) for pumps and fans is correctly set. This ensures that the output voltage at < 50 Hz frequencies is adjusted to the power requirement of the pump. Newer converters feature an automatic power optimization function which achieves the same effect. See the converter operating manual for this setting and other parameters.

Submersible motors with water-cooled windings are more susceptible to voltage peaks than dry motors.

**The following thresholds may not be exceeded:**

**Max. voltage rise speed: 500 V/μs**

**Max. voltage peak to earth: 1250 V**

These values apply for well pumps < 1 kV and can usually be attained by replacing a sinusoidal filter or dV/dt filter. For motors > 1 kV, the permissible values can be obtained from the plant. It remains the case that the lowest possible pulse frequency should be set.

*Selecting the motor and converter*

*Minimum speed for submersible pumps (well pumps)*

*Minimum speed for waste water and sewage pumps*

*Operation*

*Max. voltage peaks and rise speed*

# Operation with a static frequency converter

## EMC

In order to comply with EMC (electromagnetic compatibility) regulations, it may be necessary to use shielded wires, lay cables in metal tubes and install filters. The exact actions required to comply with the EMC directives depend on the converter type, converter manufacturer, length of cable laid and other factors. In individual cases it is therefore necessary to look up the actions to be taken in the converter operating manual or contact the manufacturer directly.

## Motor protection

As well as the built-in electrical current monitor system in the converter, or the thermal relay in the switching system, we recommend installing temperature sensors in the motor. Cold conductor temperature sensors (PTC) and resistor temperature sensors (PT 100) are both suitable.

**Explosion-proof motors (whose type code has the addition “Ex”) must always be fitted with cold-type thermistors in frequency conversion mode. Also, an approved motor protection relay for cold-type thermistors (such as MSS) must be used.**

## Operation up to 60 Hz

A WILO submersible motor can be adjusted up to 60 Hz provided the motor has been rated for the pump’s higher power requirement. However, the rated power should be taken from the 50 Hz data sheets.

## Efficiency

As well as the efficiency of the motor and the pump, the efficiency of the converter (approx. 95 %) must also be taken into account. The efficiency of all components is lower when the speed is reduced.

Formulas

Pump flow	Pump head	Power
$Q_2 = Q_1 * \left( \frac{n_2}{n_1} \right)$	$H_2 = H_1 * \left( \frac{n_2}{n_1} \right)^2$	$P_2 = P_1 * \left( \frac{n_2}{n_1} \right)^3$

Table D-1: Formulas

## Summary

As long as all these points are taken into account and the instructions for the converter are followed, speed-regulated operation with WILO products is possible without any problems.

## E Ceram C0 data sheet

WILO products are used for many different pumped liquids and installation sites. We want our coatings to offer an even higher degree of protection against wear and corrosion. For this purpose, we mainly use our Ceram coatings. However, only an intact coating provides the best possible protection.

Therefore check the coating after all installation and maintenance work, and repair any minor damage immediately. In the event of major damage, please consult the manufacturer.

### General information

Ceram C0 is a sprayable, solvent-free, two-component aluminum-oxide-based coating material which protects our products from corrosion under particularly harsh mechanical conditions.

### Description

Solvent-free epoxy polymer with solvent-free polyamine hardener and various extenders.

### Composition

- A tough, hard and long-lasting coating with high mechanical and chemical resistance and excellent resistance to abrasion.
- Excellent wet adhesion and compatibility with corrosion protection as a single-layer coating on steel surfaces.
- Very good adhesion to steel surfaces.
- Replaces coatings containing tar.
- Cost-effective thanks to its durability, low maintenance and easiness to repair.
- Tested by the Federal Waterways Engineering and Research Institute (BAW).
- Solvent-free.
- High-gloss coating when hardened.

### Properties

### Technical data

Density (mixture)	ASTM D 792	1.4	g/cm <sup>3</sup>
Adhesion / steel	ISO 4624	15	N/mm <sup>2</sup>
Impact resistance / hardness	DIN EN ISO 6272	9	J
Temperature resistance: dry, long-term		60	°C
Temperature resistance: dry, short-term		120	°C
Temperature resistance: wet / fluid	Depends on pumped fluid	Information on request	°C
Solid content (mixture)	Volume	97	%
	Weight	98	%

Table E-1: Technical data

## Resistance

Pumped fluid	Temperature	Resistance rating
Waste water, alkaline (pH 11)	+20 °C	1
Waste water, alkaline (pH 11)	+40 °C	1
Waste water, slightly acidic (pH 6)	+20 °C	1
Waste water, slightly acidic (pH 6)	+40 °C	1
Waste water, very acidic (pH 1)	+20 °C	2
Waste water, very acidic (pH 1)	+40 °C	3
Ammonium hydroxide (5%)	+40 °C	3
Decanol (fatty alcohol)	+20 °C	1
Decanol (fatty alcohol)	+50 °C	1
Ethanol (40%)	+20 °C	1
Ethanol (96%)	+20 °C	3
Ethylene glycol	+20 °C	1
Heating oil / diesel	+20 °C	1
Compressor oil	+20 °C	1
Methyl ethyl ketone (MEK)	+20 °C	3
Sodium hydroxide solution (5%)	+20 °C	1
Sodium hydroxide solution (5%)	+50 °C	2
Sodium chloride solution (10%)	+20 °C	1
Hydrochloric acid (5%)	+20 °C	2
Hydrochloric acid (10%)	+20 °C	2
Hydrochloric acid (20%)	+20 °C	3
Sulfuric acid (10%)	+20 °C	2
Sulfuric acid (20%)	+20 °C	3
Nitric acid (5%)	+20 °C	3
Toluene	+20 °C	2
Water (cooling/industrial water)	+50 °C	1
Xylene	+20 °C	1

**Table E-2: Resistance**

Total layer thickness: at least 400µm

Key: 1 = resistant; 2 = resistant for 40 days; 3 = resistant against overflow, immediate cleaning recommended



In order to achieve the best results with this product, proper preparation of the surface is of critical importance. The exact requirements change depending on the application, expected period of service and original surface condition.

### Surface preparation

Make sure it is clean, dry and free of grease. The best results are attained by removing rust by blasting in accordance with DIN EN ISO 12944-4, standard cleanliness grade Sa 2.5 – 3. The roughness should be at least 50µm deep. A test certificate for the blasting equipment must be available.

### Steel

**Please ask for our advice on preparing other surfaces.**

The material is supplied in the agreed mixing ratio. Mix all the hardener component into the basic component, preferably using a mechanical mixer, also mixing around the walls and bottom of the container. Only mix as much material as can be applied during the pot life.

### Material preparation

The mixing ratio is 4:1 by weight.

### Application instructions

The surface and air temperatures must be at least +10°C, and the relative air humidity at most 80%. The temperature of the surface to be coated must be at least 3°C above the dew point. Low temperatures slow down hardening and make application more difficult. For the coating to harden completely, the surface temperature must be above the minimum hardening temperature. High air humidity or temperatures below the dew point can cause condensation to form on the substrate or the coating surface. This can cause problems of adhesion to the surface and between layers. These object conditions must be maintained during the application and hardening period. If the temperature or humidity approach the threshold values, we recommend the use of heating or drying equipment. Ceram C0 can be applied on small surfaces by roller or brush.

### Object requirements

Temperature	16 °C	20 °C	25 °C	32 °C
Pot life (minutes)	30	20	15	10

### Pot life

**Table E-3: Pot life**

**This table shows the practical hardening time from the start of mixing.**

Ceram C0 is applied in layers of 400µm to around 1000µm, depending on the media and intended duration of protection.

Theoretical yield: 1.8m<sup>2</sup>/kg at 400µm or 0.9m<sup>2</sup>/kg at 800µm.

Theoretical consumption: 0.60kg/m<sup>2</sup> at 400µm or 1.15kg/m<sup>2</sup> at 800µm.

In practice, consumption depends on the surface properties and the application method.

Use the following formula to determine how much is needed to cover a given surface:

$$\text{Density x area (m}^2\text{) x average thickness (mm) = consumption (kg)}$$

### Coating layers and material requirements

Another layer of Ceram C0 can be applied after around 16 hours up to 24 hours at +20°C. The surfaces must be clean, dry and free of oil or grease. If this interval is exceeded, the coating must be blasted. In hot sunshine, the repeat coating interval is much shorter. Take suitable measures to prevent this.

### Repeat coating intervals / subsequent coating

### Hardening time

Temperature	15 °C	25 °C	30 °C
Hand dry	8 hours	4.5 hours	4 hours

**Table E-4: Hardening time**

Light load	1 day	13 hours	10 hours
Full load	6 days	3 days	2 days
Chemically resistant	10 days	6 days	4 days

**Table E-4: Hardening time**

### *Material needed*

- Cleaning agent for cleaning the surface
- Abrasive paper for roughening the surface (select the roughness according to the surface)
- Paintbrush for applying the coating (select the size according to the extent of the damage)
- 2 component coating (Ceram C0 + hardener)
- Vessel for mixing the two components

### *Working steps*

- 1 Lift the WILO machine from the basin, place it on a secure surface and clean it.
- 2 Thoroughly clean the damaged area with suitable cleaning agent.
- 3 Roughen the surface around the damaged area.
- 4 Mix the 2 component coating (Ceram C0 + hardener) in a 4 to 1 ratio in a suitable vessel.
- 5 Wait 10 to 15 minutes.
- 6 Apply the finished Ceram C0 coating to the damaged area with a suitable paintbrush. Make sure the coating is of at least the minimum thickness: 400µm

**If you are using a combination of different Ceram types (e.g. C2+C1), please consult the manufacturer.**

- 7 After repairing the damage, let the Ceram C0 completely dry. See "Hardening time".

### *Cleaning tools*

Use a commercial solvent (acetone, alcohol or methyl ethyl ketone) to clean your tools immediately after use. Once the material has dried, it can only be removed by abrasion.

### *Storage*

Store at temperatures between 10°C and 32°C, slight deviations during transport are acceptable. The containers can be stored unopened for 12 months.

### *Safety precautions*

Before using any products, read the material DIN safety data sheet (MSDS) or the safety regulations regarding them. Observe all applicable safety regulations when working in enclosed rooms.

## F Notes on unloading large units

Large units must be specially packaged for transportation. When unloading, certain steps must be taken to prevent excessive forces acting on the material. The intake funnel in particular can be damaged or destroyed by such forces.

### **Danger – Suspended loads!**

**Please observe all guidelines, rules and legal requirements for working with and underneath heavy suspended loads.**

**Fastening devices must be officially certified.**



- 1 Place the packaging on to a firm foundation. Two hoisting gears are required. The work area must not be restricted by obstacles.
- 2 Secure the first suspension cable to the pump section and the first hoisting gear.
- 3 Secure the second suspension cable to the two suspension eyelets on the motor section and to the second hoisting gear.

***Please observe the following instructions for unloading***

**Use steel cables as suspension straps which are suitable for carrying the weight of the machine. The use of chains is strictly forbidden as they can cause damage to the machine and may slip.**

- 4 Tighten the suspension cables, remove the tensioning bands.
- 5 Carefully lift the machine, ensuring that it remains in a horizontal position.
- 6 Remove the packaging and any transport protection.

**When removing the transport protection, please note the accompanying information sheet.**

- 7 Carefully move the unit to an upright position with the help of the two hoisting gears.

**Pay attention that the machine does not come into contact with the floor.**

- 8 When the machine is in an upright position, it can be carefully put down. The foundation must be suitable for the load. The unit must be secured against falling over or slipping.
- 9 The machine can now be prepared for the operating area. For more detailed information on this, see the chapter on installation and starting-up as well as the respective accessory data sheets in this operating and maintenance manual.

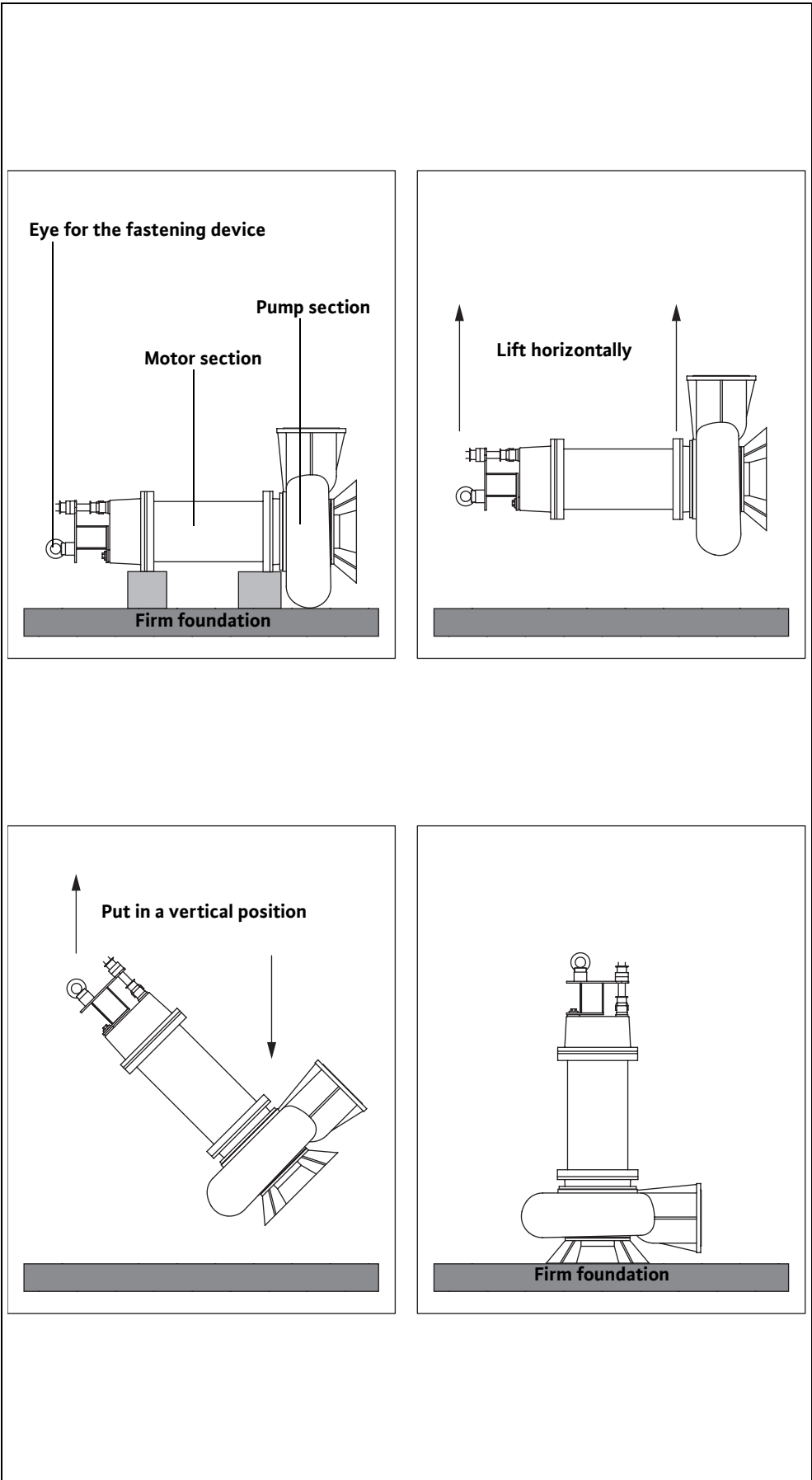


Fig. F-1: Step-by-step description of the procedure

## G Transport protection

The transport protection consists of steel U plates and threaded rods. These are made of steel or stainless steel.

The transport protection is used for large machines or on request of the customer. This protects the machine against damage while it is being transported. The transport protection is on the bottom of the pump unit and must be removed before installation.

If transport protection was used for the initial delivery, it should be used again if the machine has to be stored or transported.

- Use suitable equipment to move the machine to a safe, horizontal position.
- Loosen and remove the hexagon nuts (1).
- Remove the steel U plate (2).
- Take out the threaded rods (3) or remove them from the impeller.
- Some models come with a rounded cap (4). This should be screwed onto the impeller after the threaded rods have been removed. It is fastened using the cylindrical bolts supplied.
- Assembly is carried out in the reverse order of disassembly.

### **Beware of damage to the machine**

**To prevent any damage to the machine, it should be placed in an upright position immediately after removing the transport protection.**

### **Danger – Suspended loads!**

**To remove the transport protection, the machine must be in a secure, horizontal position. It must be ensured that the machine cannot slip and/or topple over. Under no circumstances is work to be performed under suspended machinery.**

*Product description and proper use*

*Instructions for the storage and transport of the machine*

*Dismantling / assembling the transport protection*



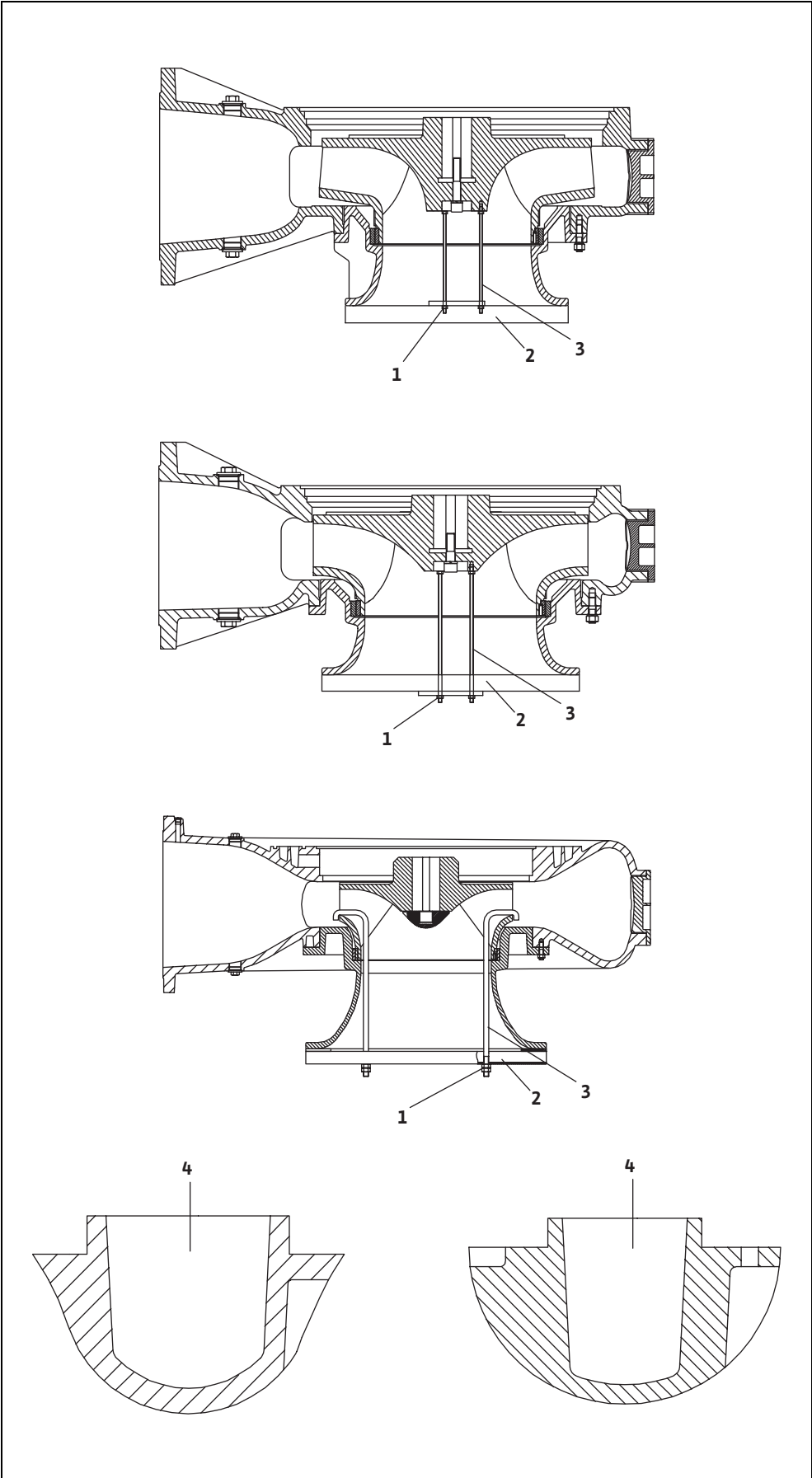


Fig. G-1: Transport protection

## H Data Sheet – Electrical Connection

The motor must be connected only by an authorized electrician: The relevant local regulations must be observed when laying the cables and connecting the motor. The installation of motor protection equipment is mandatory. Refer to the Machine Data Sheet for the electrical values. The motor turns in the correct direction with a clockwise rotary field.

### Safety notes

The insulation resistance must not fall below 20 MOhm on commissioning. The insulation resistance must be  $\geq 2$  MOhm for further tests. The direct measuring voltage is 1000 V.

### Insulation resistance

### Monitoring equipment

Monitoring device	Wire identification	Recommended analyzing device	Threshold	Triggered condition
<b>Motor monitoring</b>				
Bimetal sensor (1st temperature circuit)	20/21	–	–	Switch off
Bimetal sensor (2nd temperature circuit)	20/21/22	–	–	Low temperature: early warning High temperature: switch off
PTC sensor (1st temperature circuit)	10/11	CM-MSS	Preset	Switch off
PTC sensor (2nd temperature circuit)	10/11/12	CM-MSS	Preset	Low temperature: early warning High temperature: switch off
PT-100 winding temperature sensor	1/2	DGW 2.01G	Depending on winding*	Switch off
PT-100 bearing temperature sensor	T1/T2	DGW 2.01G	100°C	Switch off
Pressure switch	D20/D21	–	–	Switch off
Thermo float switch	20/21	–	–	Switch off
<b>Leak monitoring</b>				
Seal chamber / motor chamber / terminal chamber monitoring	DK/DK	NIV 101	30 KOhm	Warning or switch off
Seal chamber monitoring for Ex	DK/DK	ER 143	30 KOhm	Switch off

**Table H-1: \* Limit temperature: insulation class F = 140°, insulation class H = 160°, for oil motors = 110°, PVC wire = 80°, PE2 wire = 90°**

Monitoring device	Wire identification	Recommended analyzing device	Threshold	Triggered condition
Leak chamber monitoring	K20/21	Coupling relay (CM-MSS or NIV 101)	–	Warning or switch off
<b>Protection device provided by customer</b>				
Bimetal relay / motor protection switch	–	–	Rated motor current	Switch off
Dry-run protection with float	–	–	–	Switch off
Dry-run protection with electrode	–	NIV 105	30 KOhm	Switch off

**Table H-1: \* Limit temperature: insulation class F = 140°, insulation class H = 160°, for oil motors = 110°, PVC wire = 80°, PE2 wire = 90°**

*When used in Ex-protected areas*

The temperature monitoring system should be connected in such a manner that if the early warning is triggered an automatic switch on can be performed. If a switch off is triggered then switching on again should only be possible if the release button has been manually activated!

*Wire designation of the connection lead*

- 1 designation
- 2 core
- 3 main cable
- 4 control cable
- 5 electrode cable
- 6 green-yellow
- 7 blue
- 8 black
- 9 brown
- 10 protective conductor
- 11 motor connection cable
- 12 motor connection cable beginning
- 13 motor connection cable end
- 14 motor connection cable low speed
- 15 motor connection cable high speed
- 16 cold type thermistor as per DIN 44081
- 17 cold type thermistor beginning
- 18 cold type thermistor high temperature per DIN 44081
- 19 cold type thermistor low temperature as per DIN 44081
- 20 bimetallic thermistor (break contact) 250V 2A cos  $\phi$  = 1
- 21 bimetallic thermistor beginning
- 22 bimetallic thermistor high temperature (break contact)
- 23 bimetallic thermistor low temperature (break contact)
- 24 temperature control Pt 100 beginning as per DIN 43760 B



- 25 temperature control Pt 100 end as per DIN 43760 B
- 26 leakage float (break contact) 250V 3A cos j = 1
- 27 motor overpressure switch (break contact) 250V 4A cos j = 1
- 28 thermal float (break contact) 250V 2A cos j = 1
- 29 sealing chamber control
- 30 bearing temperature control
- 31 bearing temperature control Pt 100 as per DIN 43760 B
- 32 motor – terminal and sealing chamber control
- 33 motor and terminal chamber control
- 34 thermal float and bimetallic thermistor (break contact) 250V 2A cos j = 1
- 35 Thermal float and cold type thermistors as per DIN 44081
- 36 Screening
- 37 Cold type thermistors end as per DIN 44081
- 38 Cold type thermistors tapping as per DIN 44081
- 39 white
- 40 Motor overpressure switch and cold type thermistors as per DIN 44081
- 41 Thermal float and motor over pressure switch (break contact) 250V 2A cos j = 1
- 42 Bi-metallic thermistors and motor overpressure switch (break contact) 250V 2A cos j = 1
- 43 red
- 44 motor chamber monitor
- 45 motor leak and sealing chamber monitor
- 46 motor and sealing chamber monitor
- 47 yellow
- 48 orange
- 49 green
- 50 white-black
- 51 Leak monitoring
- 52 Bimetal & Pt 100 temperature sensor start
- 53 Gray
- 54 Gray /(blue)
- 55 Cold conductor temperature sensor for winding/oil as DIN 44081

## Sicherheitshinweise:

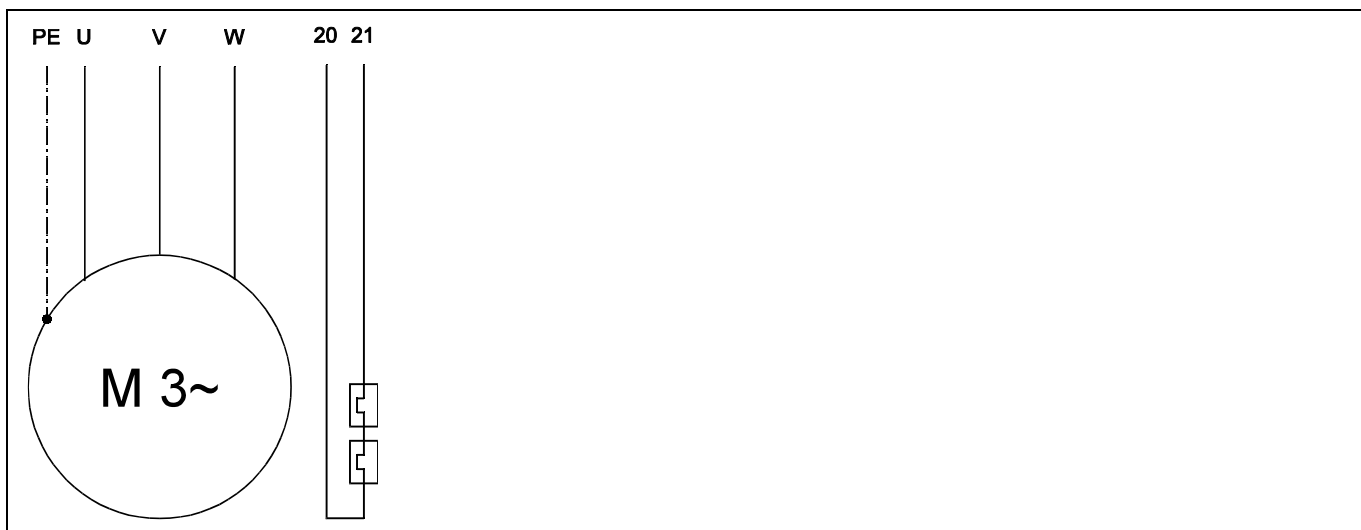
Der Anschluß des Motors darf nur von einer autorisierten Elektrofachkraft vorgenommen werden. Es sind bei der Leitungsverlegung und beim Anschließen des Motors die VDE- und die örtlichen Vorschriften zu beachten. Der Einbau eines Motorschutzes ist zwingend vorgeschrieben. Die elektrischen Werte sind aus dem Maschinendatenblatt zu entnehmen. Bei rechtsdrehendem Drehfeld hat der Motor die richtige Drehrichtung.

## Isolationswiderstand:

Bei Erstinbetriebnahme darf der Isolationswiderstand 20 MΩ nicht unterschreiten. Bei weiteren Prüfungen muß der Isolationswiderstand  $\geq 2$  MΩ sein. Die Meßgleichspannung ist 1000 V

## Aderbezeichnung der Anschlußleitung:

Bezeichnung <sup>1)</sup>	Ader <sup>2)</sup>	
<b>Hauptleitung <sup>3)</sup></b>		
<b>PE</b>	<b>grün-gelb <sup>6)</sup></b>	Schutzleiter <sup>10)</sup>
<b>U</b>	<b>3</b>	Motoranschlußleitung <sup>11)</sup>
<b>V</b>	<b>4</b>	
<b>W</b>	<b>5</b>	
<b>20</b>	<b>1</b>	Bi-Metalltemperaturfühler (Öffner) 250V 2A cos $\varphi$ = 1 <sup>20)</sup>
<b>21</b>	<b>2</b>	



## EC declaration of conformity

According to EC directive 98/37/EC

We hereby state that the product

Product designation:	Wilo-EMU
Type designation:	KPR... + T56...P
Machine number:	TMPKPRXX

### *Product definition*

fulfills the following relevant legal requirements:

EC – Machinery directive 98/37/EC  
EC – Electromagnetic compatibility directive 89/336/EEC  
EC – Low voltage directive 73/23/EEC

### *EC directives*

Harmonized standards used, in particular:

DIN EN ISO 12100-1:2004  
DIN EN ISO 12100-2:2004  
DIN EN 809:1998  
DIN EN 60034-1:2005  
DIN EN 61000-6-2:2006  
DIN EN 61000-6-3:2005  
DIN EN 61000-3-2:2001  
DIN EN 61000-3-3:2006

### *Harmonized standards*

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Address:	Heimgartenstr. 1, 95030 Hof
Authorized representative:	Volker Netsch
Position:	CE-Manager
Date:	2008

### *Manufacturer's information*

Signature:

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