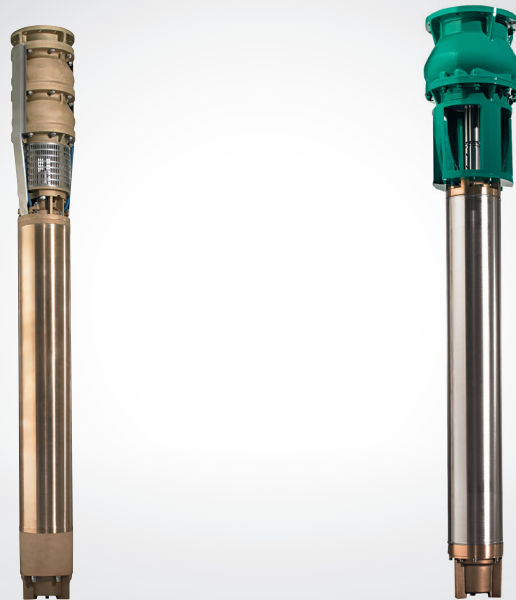


**Wilo-EMU D, DCH, K, KD, KM, NK, SCH
Wilo-Actun ZETOS-K
+ NU.../U...-Motor
mit Druckmantel/with Pressure shroud**



en Installation and operating instructions



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

Table 1-1: Abbreviations

Technical term	Explanation
Dry run	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.
“wet” installation type	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.
“dry” installation type	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!
“transportable” installation type	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.
“S1” operating mode (continuous operation)	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
“S2” operating mode (short-term operation)	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 2K.
“Siphoning operation”	Siphoning operation is similar to dry running. The product operates at full speed, but only small amounts of liquid are pumped. Siphoning operation is only possible with certain types; see the “Product description” chapter.
Dry-run protection	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.
Level control	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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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:

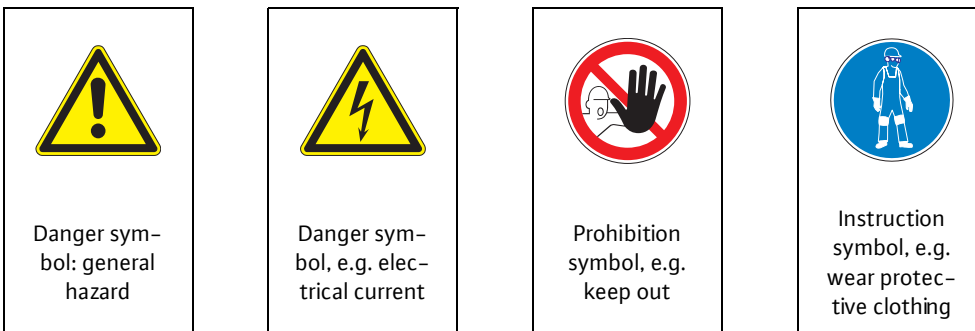
Instructions

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:



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
Danger	Serious or fatal injuries can occur.
Warning	Serious injuries can occur.
Caution	Injuries can occur.
Caution (Instruction without symbol)	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 pipeline, 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. *General information*
- 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.

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. The machine is supplied as an enclosed and compact unit.

General product information

Danger of explosion!

Machines of this type are not explosion-proof, and may therefore not be operated in explosive atmospheres.



The applications for the machine include:

- Pumping drinking water, mineral water, industrial water and thermal water from deep wells, shafts, collecting reservoirs, storage reservoirs or intermediate storage reservoirs (such as lakes, dams or rivers).
- Water supply and extraction, pressure boosting
- Maintaining and lowering the water table
- Fire extinguishing and sprinkler systems
- Irrigation, watering, cooling, washing, spraying, water preparation, wells and much more.

Proper use and fields of application

The machine is used to pump clean or only slightly dirty water, with a maximum sand content of 35g/m³. In the standard version, the pumped liquid has a permitted maximum density of 1000kg/m³ and a maximum viscosity of 1 mPas. As well as this, there are special models (made of G-CuSn10 and other materials) for abrasive and corrosive media. For information on these models, please consult the manufacturer. The exact details about your unit version can be found in the technical data.

Conditions of use

The machine is operated from the operating position intended for this purpose.

Only start the machine once it is installed and when the motor is filled and the pressure shroud is flooded and bled. Dry running is inadmissible.

The machine consists of a motor section and a pump section. These two components are fastened together and together make up the unit. The entire unit is installed in a pressure shroud. This makes it possible to install the machine directly in the pipeline.

Construction

The submersible motor has a waterproof winding made of PVC or PE2 wire. 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 connection for pump parts is standardized ($\geq 10''$) or is in accordance with the NEMA regulations ($\leq 8''$).

Motor

The submersible pump consists of the intake port, the individual pump levels and the discharge port. The number of levels is dependent on both the motor performance and the desired pump head. The individual housing components are manufactured from gray cast iron or special materials such as G-CuSn10. The connection for motors is standardized or is in accordance with the NEMA regulations.

Pump

The machine is equipped with special, maintenance-free bearings. The motor bearings are lubricated by the fluid in the motor, and the pump bearings by the pumped fluid.

Motor and pump bearings

The seal between the pump and motor sections consists of mechanical shaft seals (with SiC/SiC pairing) or rotary shaft seals.

Sealing

Product description

Impellers

The impellers are designed in radial or semi-axial versions. The materials used are bronze and plastic. Depending on the application, the impellers have relief holes to reduce the axial thrust.

Safety and monitoring devices

If desired, the submersible motor can be equipped with temperature sensors. Depending on the motor type and specification, the motor is then equipped with bimetal or cold conductor temperature sensors. These monitoring devices protect the motor from overheating.

Specifications on whether a temperature sensor should be installed, and what kind, and how they are connected can be found in the “Electrical connection plan” data sheet.

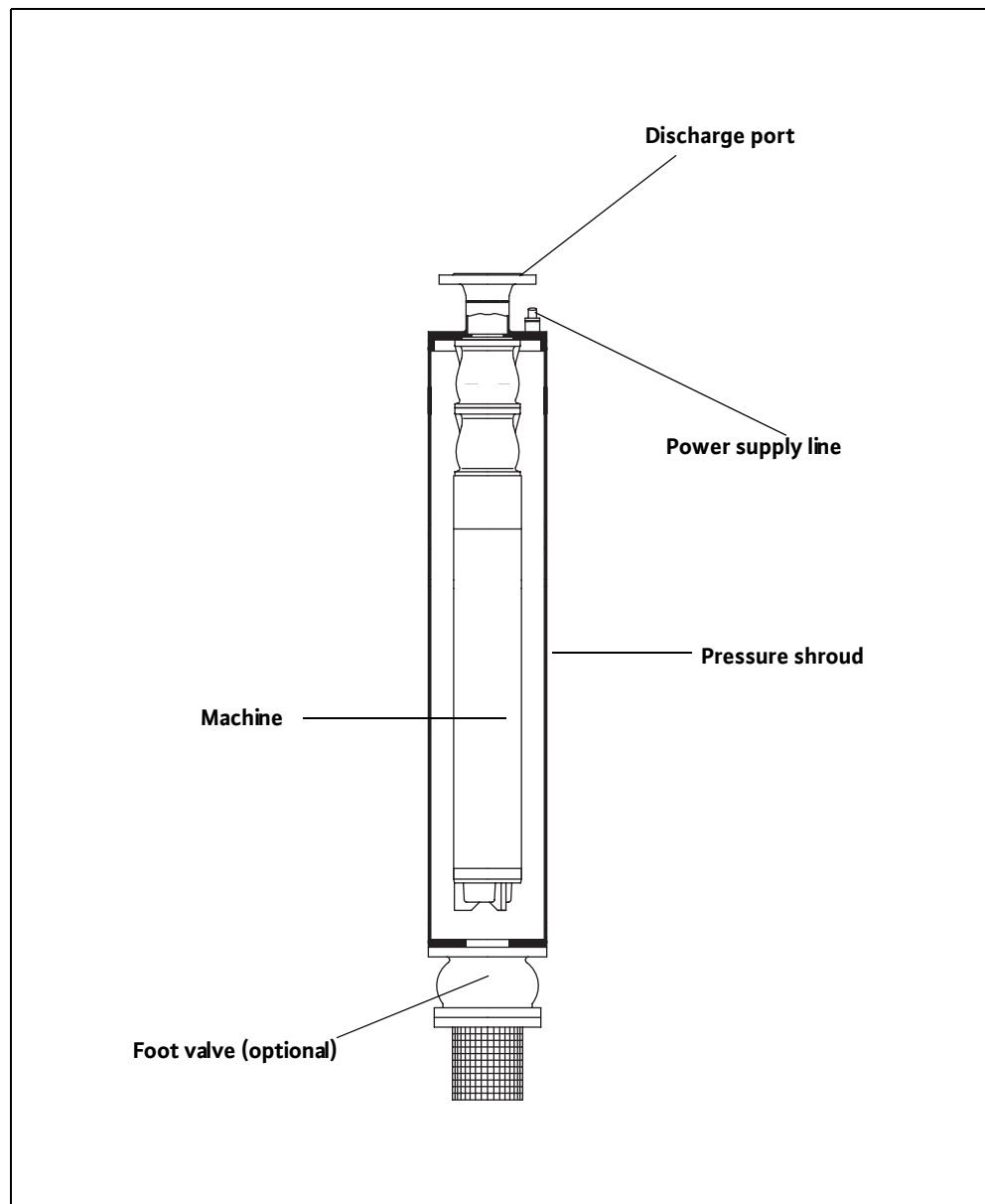


Fig. 3-1: Machine structure

Motors of this type are cooled by the pumped fluid circulating around it. The heat is carried outward directly via the motor casing and the stator casing to the pumped liquid.

Cooling

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

Type designation

Example pump: NK 86 X (S)-8	
NK 86	Internal product designation (TWI..., NK..., K..., KD..., D..., KM..., KP..., DCH..., SCH..)
X	P = Polder pump
S	Modified impeller
8	Number of levels
Example motor: x 801X-2/75	
x	Motor type (NU = submersible motor, M = submersible motor, marine version)
801	Internal product code
X	Fluid in motor (T = drinking water, without = manufacturer filling fluid P35 / P100)
2	Number of poles
75	Package length in cm (rounded)

Table 3-1: Type designation

U15..., U17... and U21... motors are generally filled with drinking water. These types have no "T" in the motor designation.

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 _{ST}	Starting current
TPF	Temperature of pumped fluid	SF	Service factor
IP	Protection class	I _{SF}	Current at service factor
OT	Operating mode (s = wet / e = dry)	MC	Motor wiring
Cos φ	Cosine phi	∇	Max. submersion
IMφ / S	Impeller diameter/number of levels		

Table 3-2: Name plate key

4 Transport and storage

On arrival, the delivered items must be inspected for damage. Also check 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. Claims made after this date cannot be recognized. Any damage must be noted on the delivery or consignment note.

Delivery

Only the appropriate and approved fastening devices, transportation means and lifting gear 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 personnel must be qualified for the tasks and must follow all applicable national safety regulations during the work.

The product is delivered by the manufacturer or 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 for reuse if the product is frequently used at different locations.

Beware of frost!

If drinking water is used as a coolant/lubricant, the product must be protected against frost during transport (minimum temperature +3 °C). If this is not possible, the product must be drained and dried out.

Newly supplied products are prepared so that they can be stored for at least 1 year. The product should be cleaned thoroughly before it is put into temporary storage.

Storage

The following should be observed for storage:

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

Danger from falling over!

Never set 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 must be stored in rooms with an ambient temperature of between +3 °C and +40 °C. If this is not possible, they must be drained and dried out!

- The product may not be stored in rooms where welding work is conducted as the resulting gases and radiated heat 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 must be protected against kinking, damage and moisture.



Electrical hazard!

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

Beware of moisture!

Moisture penetrating cables can damage the cables and render them useless. Therefore, never immerse cable ends in the pumped liquid 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 rotated 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 locking 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 injury! 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 operation. The housing coatings should be checked for damage.

Before start-up, the filling levels (oil, motor filling etc) of the individual products should be checked and topped up if required. Products that are to be filled with drinking water must be completely filled before start-up if necessary. 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 the intended use.

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

Return delivery

Products which are returned to the plant must be clean and correctly packaged. In this context, clean means that impurities have been removed and decontaminated if the products have been used with materials which are hazardous to health. The packaging must protect the product against damage. If you 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.

Possible types of vertical installation for the machine:

- Dry installation – directly or with diversion
- Wet installation with foot valve in tanks, basins and shafts

Possible types of horizontal installation for the machine:

- Dry installation – directly or with diversion
- Wet installation with foot valve in tanks and basins

You will find the specified installation type in the technical data.

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

Motor filling fluid

Pre-filled pumps are installed in these units. The manufacturer's filling fluid P35/P100 is used as motor filling fluid. This guarantees that the machine remains frostproof down to -15°C .

The pump unit is installed in such a way that the pump must be taken out of the pressure shroud to check the motor filling fluid. For this reason, the motor filling fluid level must be checked by the manufacturer or an authorized service workshop.

The motor filling fluid must be checked after a longer period in storage (> 1 year)!

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

Installation

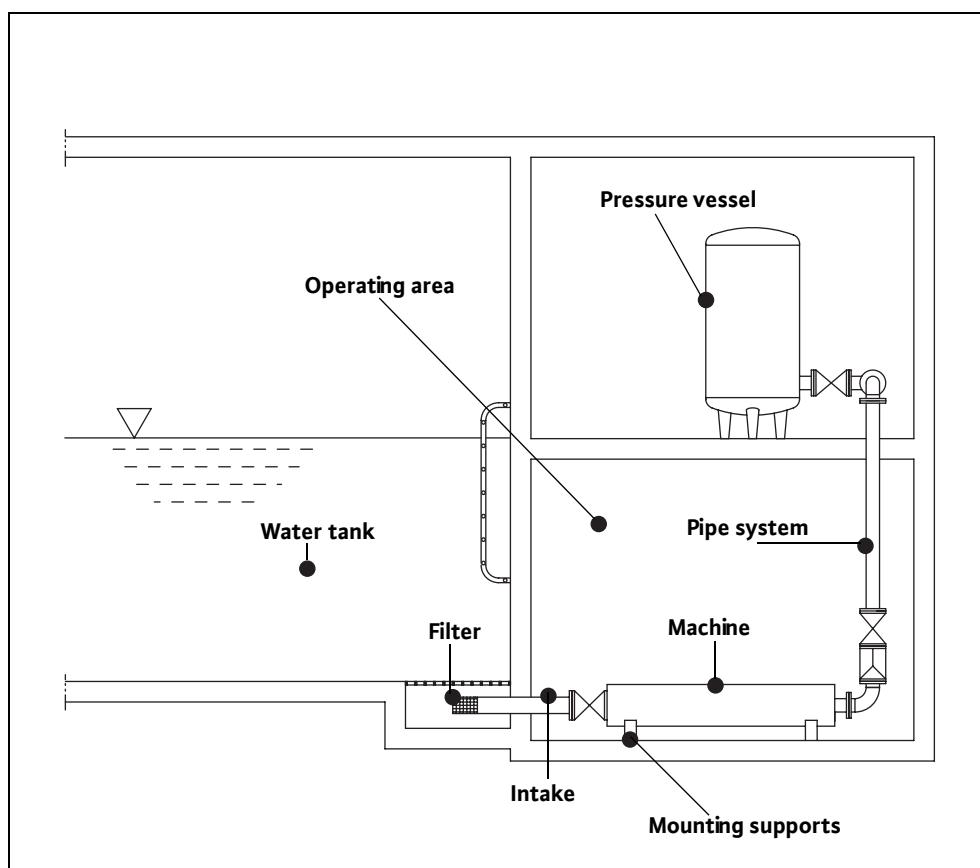
- This work may only be carried out by qualified personnel. Electrical work may only be carried out by qualified electricians.
- Use suspension straps or chains to lift the machine. This must be attached to the unit with fastening devices. Fastening devices must have official approval.
- Please observe 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 can be performed directly on the edge of the well or 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.

Machines of this type must always be submerged during operation to attain the necessary cooling. Make sure the pressure shroud is flooded



and bled. Do not let air pockets form anywhere in the system during

operation.

Never let the machine run dry. We recommend that dry-run protection be installed. If fluid levels deviate dramatically, a dry-run protection or level control must be installed.

Dry installation

The machine is installed in an existing pipe system. The pipeline system must support its own weight and may not be supported by the machine. Use elastic connecting pieces to join the machine and the pipe system. This ensures that there is no tension during assembly and minimizes vibrations during operation. The pipe system and the machine are fitted separately.

If you are using supports such as bearing brackets or a pedestal, assemble these first. The exact position can be found on the planning documentation. Then mount the machine on the supports.

If installed vertically, the pressure shroud machine can also be mounted directly on the foundation. For this, drill fastening holes on the floor of the operating area at the point where the machine will be used. You will find specifications for the anchor bolts, distances between holes and their sizes in the assembly data sheets. Using appropriate hoisting gear, bring the machine into the proper position and affix it with the required fastening material.

Once the machine is firmly mounted, you can install the piping system or flange-connect a piping system which is already in place. Make sure that the connections of the machine and the pipeline are level. Connect the intake pipe to the intake port and the discharge pipe to the discharge port.

This makes it possible to install the machine directly in the pipeline without assembly supports. This is only possible up to a certain size, as the unit must be supported by the piping system. Furthermore, bending tension is too great when the units are large. You must contact the manufacturer concerning this installation type.

A seal must be placed between the flanges of the pipeline and the unit. Tighten the fastening bolts in a cross pattern to avoid damaging the seal.

Please note that the connections on the machine may not be used to support the pipe system, and that the pipe system must be mounted so that there is no vibration or tension. Use elastic connection pieces here.

Lay the cables in such a manner that no-one (maintenance personnel etc.) will be endangered by them at any time (operation, quick repairs). Do not damage the power supply lines. The electrical connection must be carried out by an authorized technician in accordance with the "Electrical connection plan" data sheet.

Note when assembling that the piping supports its own weight. The foundation, the screws and the wall plugs must be of the required strength.

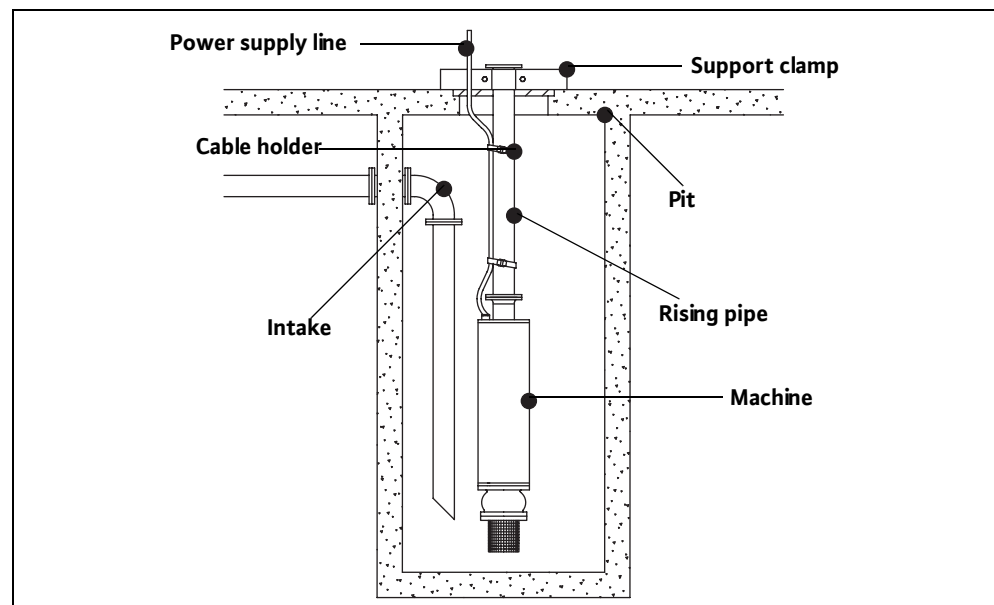


Fig. 5-1: Example installation

As well as a hoisting gear of sufficient strength, you will also need a support clamp for installation to support the rising pipe.

*Wet installation in a basin/
tank*

Place two pieces of square timber across the tank opening. The support clamp will later be placed on these during the installation, so they should have sufficient bearing capacity for the weight of the unit, the pipeline and the cable.

Place the machine vertically and secure it from falling over or slipping. Attach the load-carrying equipment (cable, chain) to the flange of the rising pipe, hang them the lifting gear on the load-carrying equipment and lift out the first pipe. Fasten the free end of the rising pipe to the discharge port of the machine. A seal must be placed between the connections. Always insert the bolts from below, so that the nuts can be screwed on from above. Always tighten the bolts in a cross pattern to avoid pressure on the seal from one side. Fasten the cable with a cable clip slightly above the flange.

Lift up the machine with the pipe, move it over the opening and lower it until the support clamp on the rising pipe can be loosely connected. When doing this, make sure that the cable remains outside the support clamp, so that it does not get squeezed. Now let the support clamp rest on the pieces of square timber that you put in beforehand. Now you can continue lowering the system until the upper flange of the rising main rests on the attached support clamp.

Remove the load-carrying equipment from the flange and attach it to the flange of the next rising pipe. Lift up the rising pipe, move it over the opening and flange-bolt the free end to the rising pipe. Place another seal between the connections. Keep the lifting gear taut and remove the support clamp. Fasten the cable slightly above and below the flange with a cable clip. For heavy, large-diameter cables, it is advisable to attach a cable clip every 2–3 m. If several cables are used, each must be fastened separately. Lower the rising pipe so that the flange is in the opening, put the support clamp back on and lower the rising pipe until the next flange touches the support clamp.

Keep repeating this process until the rising pipe reaches the required depth. On the last flange, remove the load-carrying equipment and attach the cover. Attach the lifting gear to the cover and raise it slightly. Remove the support clamp and feed the cable through the cover. Lower the cover onto the opening and bolt it fast.

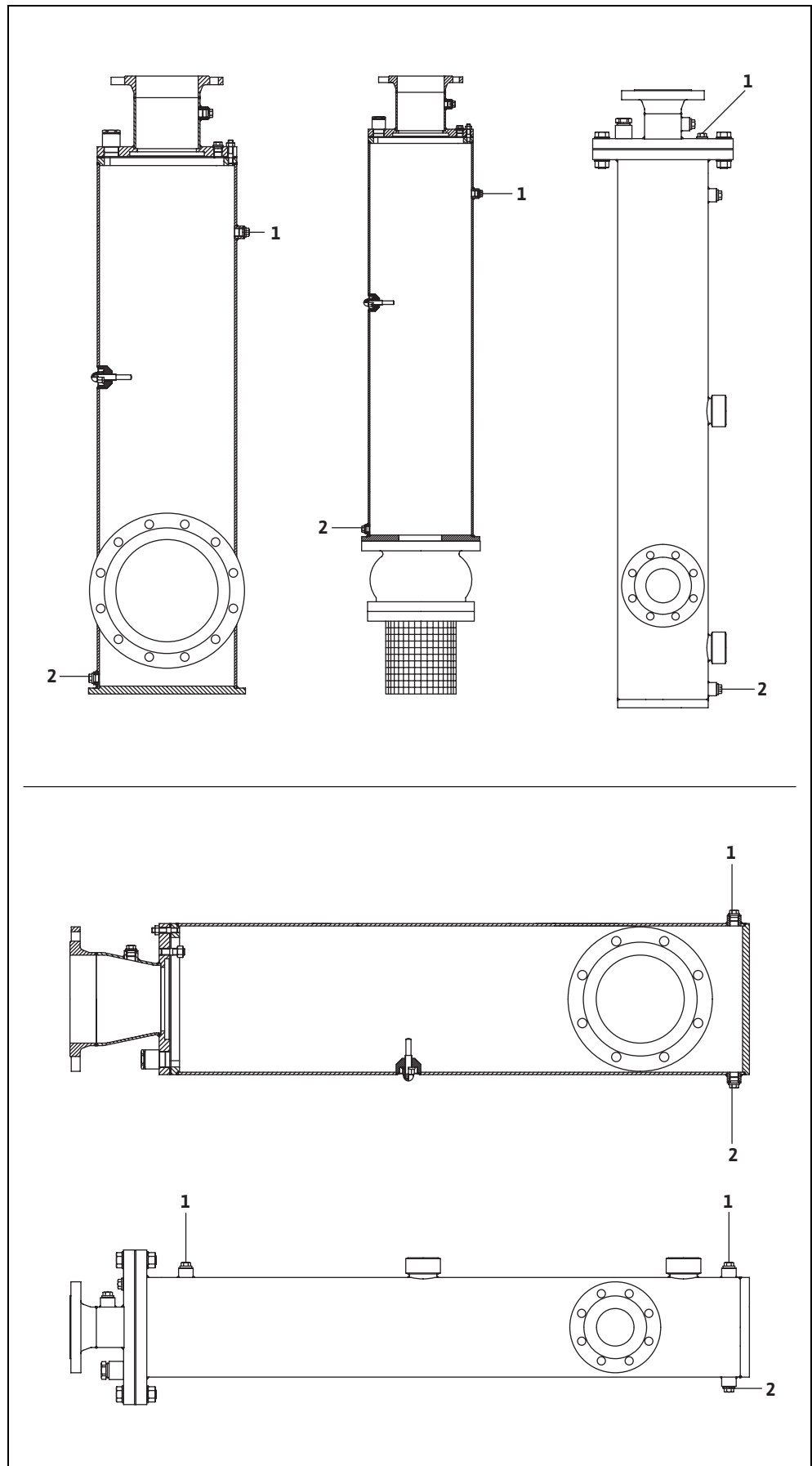


Fig. 5-2: Example installation

After installation, you must flood and bleed the pressure shroud before starting up the machine. Check whether the machine has been correctly installed, the pipes are connected and all connections are sealed.

Flooding and draining the pressure shroud

Without foot valve

- 1 Close the slider on the discharge side.
- 2 Remove the plug (1) with the seal (to bleed the air from the pressure shroud). Be careful not to damage or lose the sealing ring.
- 3 Only open the slider on the intake side to the extent that the pressure shroud is slowly flooded. When the water flows out of the threaded opening, screw the plug (1) with the sealing ring back in.
- 4 Open the slider on the intake side fully.
- 5 Slowly open the slider on the discharge side until it is half open, and flood the pipe system. The pipe system may need to be bled separately.

Flooding the pressure shroud

- 1 Switch off the machine and close both sliders.
- 2 Carefully unscrew the drain plug (2) and drain the water. Be careful not to damage or lose the sealing ring.

Draining the pressure shroud

Caution: The pressure shroud may still be pressurized.

- 3 Unscrew the plug (1) to let air into the pressure shroud. Be careful not to damage or lose the sealing ring.
- 4 When the pressure shroud is empty, screw in the drain plug (2) and the plug (1) with the sealing ring.

With foot valve

- 1 Remove the plug (1) with the seal to bleed the air from the pressure shroud. Be careful not to damage or lose the sealing ring.
- 2 Then fill the machine with water via the rising pipe on the discharge side or the plug opening.
- 3 Wait approximately 30 minutes until all the air has escaped and top up with water if necessary.
- 4 Screw in the plug (1) with the sealing ring.

Flooding the pressure shroud

See “Draining the pressure shroud ” under “Pressure shroud pump vertical, without foot valve”. The water which collects in the foot valve can be drained off when the machine is removed.

Draining the pressure shroud

Fig. 5-3: Flooding and draining the pressure shroud

Removal

When removing the machine, make sure

- that it is first disconnected from the power supply by an authorized electrician and secured against inadvertent switching on,
- that the weight of the water column in the rising pipe has been taken into account when lifting the machine, and
- that the pressure shroud has been drained.

Then you can remove the complete installation, for example removing the pipe system from the machine, and the machine from the bearing blocks. To remove the machine, you must secure it and lift it out using lifting gear. You may have to dismantle part of the pipe system, as otherwise you cannot remove the machine.

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
- Motor full, or motor filling level correct
- Pressure shroud flooded and bled

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.

Preparatory measures

Please check the following:

- Cable guidance – no loops, slightly taut
- Check the temperature of the pumped liquid and the submersion depth – see technical data
- The machine is fixed securely – vibration-free operation must be assured
- The accessories – pedestal, bearing blocks etc. are securely fixed
- Our planning and assembly specifications are observed during installation
- The suction chamber of the pump sump and the pipelines must be completely free of dirt. Flush out the pipeline and the machine before connecting them to the supply network.
- An insulation test and filling level check of the engine filling must be carried out prior to start-up. For details on this, see the "Maintenance" and "Installation" chapters.
- The sliders on the pressure side should be half opened during commissioning so that the pipeline can be bled.

You can use an electrically actuated check valve to reduce or prevent water impact. The machine can be switched on in a throttled or closed slider position (not "KP" types).

However, do not operate the machine for long periods (>5 min) with the slider closed or nearly closed, and do not run the machine dry.

The sliders on types "KP..." must always be completely opened. Never operate the machine if the sliders are closed.

- The valves and sliders on the intake side should be completely opened
- The pressure shroud must be flooded and bled of air.
- There must not be any air pockets in the pressure shroud and the pipeline. See chapter 5, Flooding/draining the pressure shroud. This bleeding device should be present in a suitable position in the pipeline.



Beware of high pressure

The pressure shroud and the pipeline are highly pressurized. Due to the high pressure the bleeder screws may shoot out if they are fully removed. Loosen the bleeder screws slowly and only by 2 turns.

Electrical system

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. If the direction of rotation is incorrect, the machine will not perform as specified, and under certain circumstances, can become damaged. In accordance with the machine data sheet, check the operating voltage and make certain that the current consumption remains uniform during all phases.

Make sure that all temperature sensors and monitoring devices, such as the sealing chamber monitor, are connected and that their function is tested. For details on this, 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 data sheet "Electrical connection plan". Rotation direction 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 swapped.

The pump and performance data specified can only be achieved when there is a clockwise rotating field. The machine is not designed for operation with a counter-clockwise rotating field.

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.

If the machine is used in a fire extinguishing or sprinkler system, this may not be turned off by a safety device under any circumstances. The motor protection may only signal faults.

Activation types for cables with free ends (without plugs)

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.

Direct activation

If the motor protection is installed in the line:

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

Star-delta activation

If the motor protection is not installed in the line:

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

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.

Starting transformer/soft start

The machine can be operated on frequency transformers.

Observe the data sheet in the appendix of this manual.

Operation with frequency transformers

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 +/- 5% of the rated voltage)
- Frequency (permissible deviation +/-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 intake – observe infeed pressure!
- Smooth running
- After 10–30 min., switch off the machine and loosen the bleeder screw on the pressure shroud a few revolutions. If air is released, the machine may only be operated again when the cause of the air intake has been rectified.

The maximum limit range deviation for operational data is +/- 10% of the rated voltage and +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.

The motor is filled with a lubricant to lubricate the bearings and for additional internal cooling. You can either use drinking water (not distilled) or a special fluid supplied by the manufacturer (P35, P100) for this. Motors with a "T" in the motor code, e.g. NU 911T, are filled with drinking water.

Lubricants

Motors filled with drinking water may not be operated or stored where there is a risk of frost.

Motors which are not marked with the “T” (with the exception of U15, U17, U21...) are filled with our manufacturer filling fluid. For details on this, please see the technical data.

The manufacturer fillings P35 and P100 are made from a propylene glycole concentrate (P35 = 35%, P100 = 100%) and water (P35 = 65%). When topping up or filling the cooling system, this manufacturer’s filling should only be used in the stated ratio, otherwise frost and corrosion protection cannot be guaranteed. The manufacturer’s filling guarantees an anti-freeze effect to -15°C.

The manufacturer’s filling fluid must be disposed of properly, in accordance with official regulations. (If necessary, please contact the waste association responsible!)

Drinking water used for filling can be fed to the waste water.

Glycol Overview

Technical data:

Status	Production stopped	Product used	Possible alternatives	
Product name	Thermofrost	Zitrec	Pekasol L	Propylene glycol
Company	BP	LEU Energie GmbH & Co. KG	Prokühlsol GmbH	Fauth & Co. KG
Basis	Monopropylene glycol	Propane-1,2-diol	Propane-1,2-diol	Propane-1,2-diol
Color	None	None	Light yellow	None
Purity	80% - 94,99%	96%	-	98%
Density	1.056 g/ml	1.051 g/ml	1.050 g/cm ³	1.051 g/ml
Boiling point	140 °C	164 °C	185 °C	188 °C
pH value	7.9	9.9	7.5 - 9.5	-
Water	3% - 9.99%	Max. 5%.	-	0,20%
Nitrite	None	None	None	None
Amine	-	None	None	None
Phosphate	-	None	None	None
Silicate	-	None	None	None
Water hazard class	1	1	1	1
FDA approval	-	Yes	-	-
HT1 approval	-	Yes	-	-
Afssa approval	-	Yes	-	-
Remarks	-	-	-	For medical use

Table 7-1: Technical Data – Glycol Overview

Maintenance intervals

Overview of the maintenance intervals needed:

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

- Checking the insulation resistance *Every six months*
- Visual inspection of the power supply cable
- Visual inspection of accessories, e.g. pressure shroud, etc.

- Functional inspection of all safety and monitoring devices and auxiliary hoisting gear *Yearly*

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 posistors, 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.

Inspect accessories such as the pressure shroud, etc., to check whether they are secured in a stable manner and are leakproof. 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 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 100ohms at 0°C. Between 0°C and 100°C this value increases by 0.385ohms per 1°C. PT 20 sensors have a value of 107.7ohms at 20°C.

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

Maintenance

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

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!

You must ensure that products filled with drinking water are stored in a room with an ambient temperature of between 3 °C and 40 °C. If this is not possible, the motor filling fluid must be drained and the machine dried out.

- 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 jamming.
- See also the “Transport and storage” section.

Shutdown

Restarting after an extended period of 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.

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

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 electric system. Take appropriate safety precautions.
- Always have a second person make sure the machine is switched off in an emergency.
- Secure moving parts to prevent injury.
- Independent work on the machine is at one's own risk and releases the manufacturer from any warranty obligation.

Fault: The machine will not start

Cause	Remedy
Electricity supply interrupted – short circuit or earth connection 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 connection and correct them as necessary Have the motor protection switch adjusted according to the technical specifications, and reset monitoring equipment Check that the impeller/propeller runs smoothly. Clean it or free it as necessary
The moisture sensors (option) has interrupted the power circuit (operator-related)	See fault: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches 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	Remedy
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 adjust it 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
Incorrect direction of rotation	Swap the 2 phases from the mains supply

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

Cause	Remedy
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 suction 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	Remedy
No pumped fluid	Open the container intake or sliders
Intake blocked	Clean the intake, slider, suction 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 piping	Replace defective parts
Intermittent operation	Check the control panel

Table 9-3: Machine runs but does not pump

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

Cause	Remedy
Intake blocked	Clean the intake, slider, suction port or intake strainer
Slide in the discharge line closed	Fully open the slide
Impeller/propeller blocked or obstructed	Switch off the machine, secure it against being switched on again and free the impeller/propeller
Incorrect direction of rotation	Replace 2 phases on the mains supply
Air in the system	Check the pipes, pressure shroud and/or pump unit, and bleed if necessary
Machine pumping against excessive pressure	Check the slide in the discharge line, if necessary open it completely, use a different impeller or contact the factory
Signs of wear	Replace worn parts
Defective hose or piping	Replace defective parts
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

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

Cause	Remedy
Excessive decrease in the water table during operation	Check the supply and capacity of the system, and inspect the level control settings and function

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

Fault: The machine does not run smoothly and is noisy

Cause	Remedy
Machine is running in an impermissible operation range	Check the operational data of the machine and correct if necessary and/or adjust the operating conditions
The suction port, strainer and/or impeller/propeller is blocked	Clean the suction 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	Replace 2 phases on the mains supply
Signs of wear	Replace worn parts
Defective motor bearing	Contact the factory
The machine is installed with mechanical strain	Check the installation, use rubber spacers if necessary

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

(Sealing chamber monitoring is optional, and is not available for all types. For details on this, see the order confirmation or the electrical terminal connection plan.)

Fault: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off

Cause	Remedy
Condensation build-up due to lengthy storage and/or temperature fluctuation	Operate the machine briefly (max. 5 min.) without sealing chamber monitoring
Expansion tank (optional for polder pumps) is too high	Install the expansion tank no more than 10m above the top edge of the suction port
Increased leakage when running in new mechanical shaft seals	Change the oil
Defective sealing chamber cables	Replace the moisture sensors
Mechanical shaft seal is defective	Replace the mechanical shaft seal after contacting the factory

Table 9-6: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off

Further steps for trouble-shooting

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

- Telephone or written help from customer service
- On-site support from customer service
- Checking and repairing the machine at the factory

Note that you may be charged for some services provided by our customer support. Customer service will provide you with details on this.

B Operation using a static frequency converter

Wilo **asynchronous motors can** be operated with commercial frequency converters. **Permanent magnet motors (PM motors) must** be operated with frequency converters. These are usually designed as "pulse-width modulated" converters. **It is not possible to operate PM motors without a frequency converter!** The following points must be observed when operating the converter:

Typical standard functions and parameters in converters from well-known manufacturers:

Maximum frequency – Minimum frequency – Motor temperature evaluation – Excess current – Start-up time – Starting torque – Display of current – Frequency – Speed – U/f characteristics (quadratic load curve for centrifugal pumps) – Protection against overvoltage and undervoltage – etc.

Standard equipment from well-known manufacturers

Common additional functions in frequency converters from well-known manufacturers:

Fault diagnosis – Reduction of motor noise – Fading out of resonance frequencies – Remote data transmission – Remote control – etc.

Special equipment from well-known manufacturers

Every submersible motor from the Wilo product series can be used. **In the case of a rated voltage exceeding 415 V, the factory should be consulted.** 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 decrease the 10 % power reserve. This is normally done by using output filters. Ask the converter manufacturer.

Selection of motor and converter

The converter is dimensioned according to the rated motor current! Selecting a frequency converter based on the motor power in kW, as often occurs, can cause problems. A choice based on motor power in kW is suitable for standard motors. However, the rated motor current of a submersible motor is usually higher at the same power.

Submersible motors have water-lubricated bearings. A minimum speed is required to build up a lubricating film.

Continuous duty below the minimum frequency must be avoided at all times, as the lack of lubrication and the potentially resulting mechanical vibrations are likely to lead to damage to the bearings.

Minimum speeds for submersible pumps (well pumps)

In practice, the speed should not be reduced beyond the point at which a volume flow of at least 10 % of the maximum flow rate is maintained. The precise value depends on the type of motor and must be checked with the factory.

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

Operation

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

During the parameterisation of the converter, be sure to pay attention to the setting of the quadratic pump curve (U/f curve) for pumps! This ensures that the output voltage is adjusted to the pump's power requirement at frequencies below the maximum frequency. Newer converters feature an automatic power optimization function which achieves the same effect. For this setting and other parameters, please see the operating instructions of the converter.

Operation using a static frequency converter

Maximum voltage peaks and rise speed

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

The motor-specific maximum voltage rise speed, as well as the maximum allowable voltages to ground, must not be exceeded.

These values apply to well pumps of <1 kV and are usually reached by using a sine filter or du/dt filter. Contact the factory for the permitted values for motors of >1 kV. The lowest-possible converter pulse frequency should also be selected.

EMC

To comply with the EMC guidelines (electromagnetic compatibility), the use of shielded lines or the installation of the cable in metal pipes, as well as the installation of filters, may be necessary. The particular measures required for complying with EMC guidelines depend on the converter type, converter manufacturer, the routed cable length and other factors. It is therefore necessary to look up the required measures in operating instructions for the converter or to directly consult the manufacturer of the converter in some cases.

Motor protection

In addition to the built-in electronic current monitoring in the converter or the thermal relays in the switching system, we also recommend the installation of temperature sensors in the motor. PTC thermistor temperature sensors are suitable, as are resistance temperature sensors (PT 100).

Operation at over-frequency

Wilo submersible motors with a rated frequency of 50 Hz can be regulated up to 60 Hz. Motors with a rated frequency of 100 Hz can be accordingly regulated up to 120 Hz.

A requirement for this is that the motor has been rated for the higher power requirement of the pump. Nevertheless, the rated power is to be taken from the data sheets for 50 Hz or 100 Hz as applicable.

Efficiency

In addition to the efficiency of the motor and the pump, the efficiency of the converter must also be taken into account. The efficiency of all components is reduced if the speed is reduced.

Formulas

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

Tabelle B-1: Formulas

Relevant motor specifications for FC operation

Motor type	Construction	f_{nominal} [Hz]	Number of poles	f_{min} (S1) [Hz]	Ramp time [s]	f_{max} [Hz]	Max. voltage rise rate at the motor terminals [V/?s]	Max. voltage peaks at the motor terminals [V]
NU43	encapsulated, asynchronous	50	2	30	1	60	500	1000
NU501	encapsulated, asynchronous	50	2	30	1	60	500	1250
NU511	rewindable, permanent magnet	100	4	60	1	120	500	1000
NU611	encapsulated, asynchronous	50	2	25	2	60	500	1250
NU701	encapsulated, asynchronous	50	2	30	1	60	500	1250
NU711	rewindable, permanent magnet	100	4	60	1	120	500	1000
NU801	rewindable, asynchronous	50	2	25	2	60	500	1250
NU811	rewindable, asynchronous	50	2	25	2	60	500	1250
NU911	rewindable, asynchronous	50	2	25	2	60	500	1250
NU911	rewindable, asynchronous	50	4	30	2	60	500	1250
NU121	rewindable, asynchronous	50	4	30	2	60	500	1250
NU122	rewindable, asynchronous	50	2	25	2	60	500	1250
NU160	rewindable, asynchronous	50	2	25	2	60	500	1250
NU160	rewindable, asynchronous	50	4	30	2	60	500	1250
U210	rewindable, asynchronous	50	2	25	2	60	500	1250
U210	rewindable, asynchronous	50	4	25	2	60	500	1250

Tabelle B-2:

C Instructions for filling the NU4 / NU5 / NU7 motors

The procedures for filling, draining and checking fluid levels for these motors differ from our other motors. The steps for this procedure are described in this chapter.

General product information

Only motors that are completely and correctly filled guarantee problem-free operation.

The NU4 / NU5 / NU7 motors are filled with a special filling fluid from the manufacturer. These motors can be stored at temperatures up to $-40\text{ }^{\circ}\text{C}$ for one year and can be operated at up to $-8\text{ }^{\circ}\text{C}$. These motors are already filled by the manufacturer and are ready for operation.

Special characteristics

The NU4 motor may only be filled and drained by the manufacturer. The machines must be sent back to the manufacturer's plant for this. The fluid level checks must be conducted by qualified personnel.

Motor filling fluid

- 1 Clean the motor and set up vertically.
- 2 Screw the hose connection (B1) with two seals into the thread (B).
- 3 Put the filling hose with the funnel on the connector (B1).
- 4 Hold the funnel above the overflow (A) and fill slowly until water emerges from the overflow (A).
- 5 Screw in screw (A) again with the seal.
- 6 Lay down the motor horizontally with the hose connection pointing upwards. Pull off the filling hose, remove the hose connection piece (B1) and screw in the screw (B) again with the seal.
- 7 Check the fluid level and top up, if necessary.

Filling the motor (not NU4 motor)

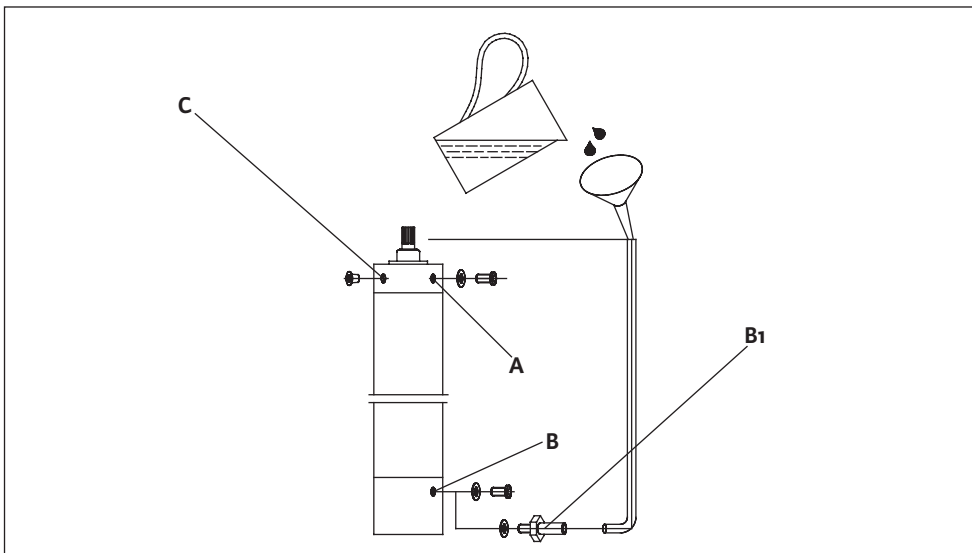


Fig. C-1: Filling the motor

- 1 Place the motor horizontally with the screw (B) pointing upwards and remove the screw (B).
- 2 Place the motor above a collecting tank and remove the screw (A). The fluid pours out.

Draining the motor (not NU4 motor)

Instructions for filling the NU4 / NU5 / NU7 motors

Checking and correcting the fluid level

- 1 Place the motor horizontally with the opening (C) pointing upwards.
- 2 Insert the test pin into the hole (E) on the diaphragm housing and check the diaphragm spacing (D) (see table 1). The notch on the test pin must match the outer edge of the hole.
- 3 Remove the filter (C) if the water level is too low.
- 4 Position the filled syringe on the valve and inject water into the motor.
- 5 To bleed, push in the valve briefly with the test pin until the water with no bubbles emerges. Be careful to avoid excess pressure.
- 6 Keep injecting water until the diaphragm spacing (D) is reached.
- 7 Replace the filter (C).

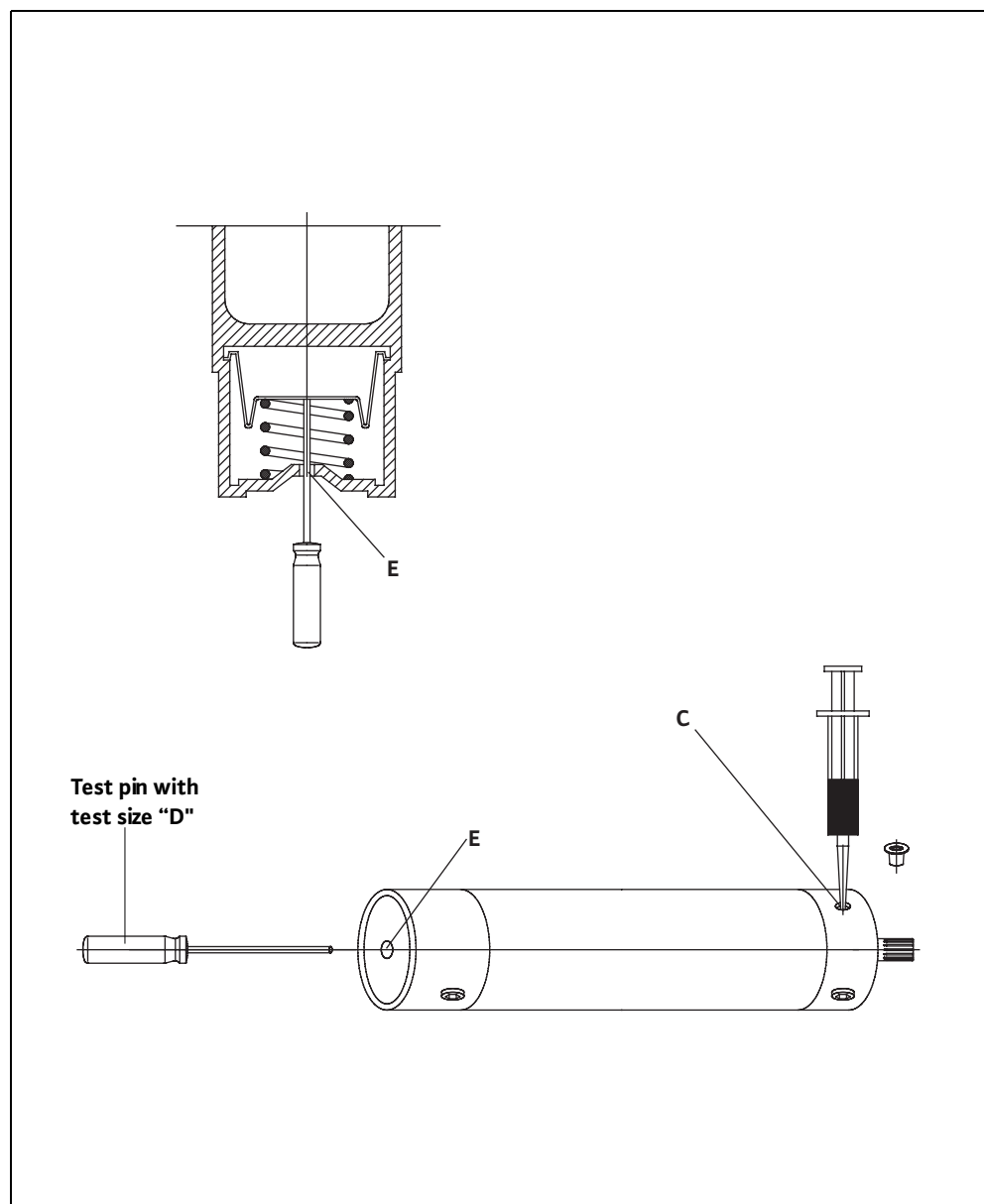


Fig. C-2: Checking and correcting the fluid level

Motor type	Test size (D)	Tolerance
4" 234...	10 mm	+/- 2mm
6" 236...	59 mm	+/- 2mm
6" 236... (AISI 316 SS)	19 mm	+/- 2mm
8" 239... (93kW...150kW)	38 mm	+/- 2mm
8" 239... (30kW...75kW)	35mm	+/- 3mm

Table C-1: Test size "D" for 4"-, 6"- and 8" motors

D Instructions on filling the NU 611 and NU 811 motors

The procedures for filling, draining and checking fluid levels for these motors differ from our other motors. The steps for this procedure are described in this chapter.

General product information

Only motors that are completely and correctly filled guarantee problem-free operation.

The motor is filled with the manufacturer's special fluid. These motors can be stored at temperatures down to $-40\text{ }^{\circ}\text{C}$ for one year and can be operated at down to $-8\text{ }^{\circ}\text{C}$. These motors are already filled by the manufacturer and are ready for operation.

Special characteristics

Motors with a "T" in the motor code are filled with drinking water (not distilled). This work must be performed on site and before commissioning. Motors filled with drinking water are susceptible to frost.

Motor filling fluid

- 1 Clean the motor and place it upright so that the shaft (1) is at the top.

Checking and correcting the filling level

The motor must be secured against falling over.

- 2 Undo the screw (2) located on the side or on the top of the motor housing.
- 3 The fluid in the motor must reach to the top of the opening.
- 4 Top up the fluid in the motor if necessary. Fill the motor with the manufacturer's fluid or with drinking water (not distilled water) through the hole in the screw (2). Fill up the motor until water comes out of the hole.

If the motor is filled with the manufacturer's fluid, do not top up with more than 1/2 liter of drinking water (not distilled water). If the motor is filled with more than 1/2 liter of drinking water (not distilled water), the antifreeze effect is impaired.

- 5 After testing, screw in the screw (2) again.

- 1 Clean the motor and place it upright so that the shaft (1) is at the top.

Filling the motor

The motor must be secured against falling over.

- 2 Undo the screw (2) located on the side or on the top of the motor housing.
- 3 Fill the motor with water through the hole in the screw (2).

The motor can be filled with the manufacturer's fluid or with drinking water (not distilled water). If the motor is filled with drinking water (not distilled water), there is no antifreeze effect.

- 4 Fill up the motor until water comes out of the hole.
- 5 Leave the motor open for 30 minutes to allow any residual air to escape.
- 6 Check the fluid level and top up to the upper edge of the hole if necessary.

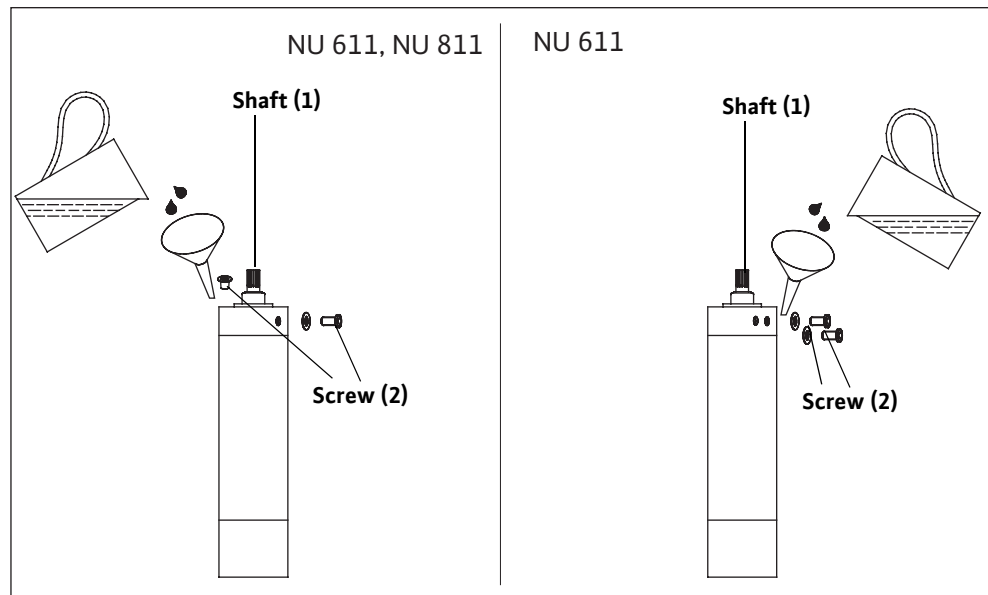


Fig. D-1: Filling the motor

Draining the motor

- 1 Lay the motor horizontally and remove the screw (1).
- 2 The motor fluid flows out.
- 3 Slightly raise the motor to allow the remaining fluid to drain out.

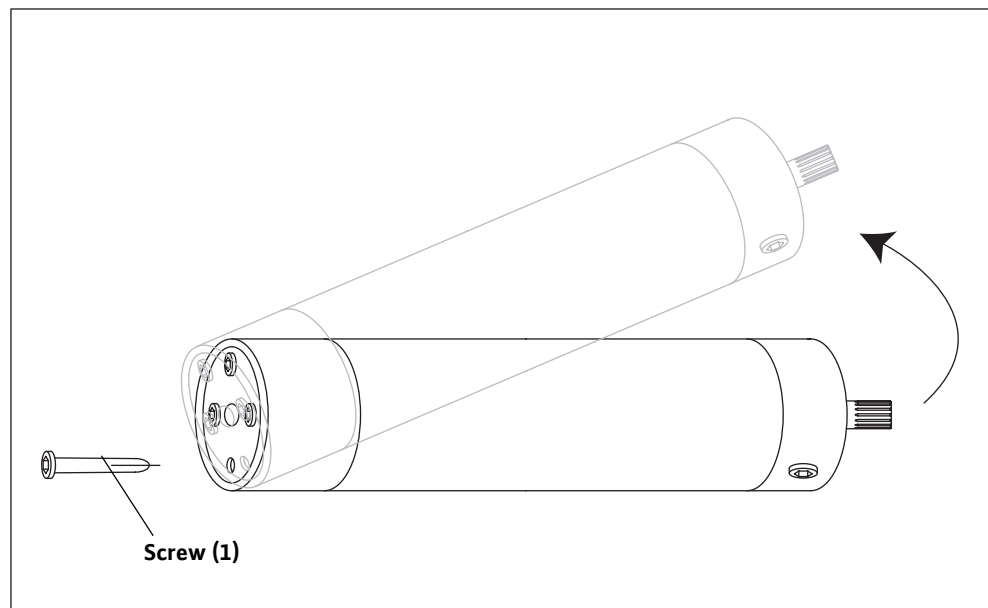


Fig. D-2: Draining the motor

E Use as a sprinkle pump

These machines are used in sprinkler fire extinguishing systems in buildings. The units are designed for this use and have been tested and certified by a named authority.

Proper use and fields of application

Only machines which are suitably certified (VdS, PAWUS etc.) may be used as sprinkler pumps. You can find the certification on the order confirmation or the machine data sheet.

The table shows a list of certified units. The certification is only valid when the motor and pump are used as a unit. The certification becomes invalid if they are used as individual components.

Approved units

Pump type	Motor type	VDS approval
K 86...	NU 60.../NU 80...	P 4840420
K 87...	NU 60.../NU 80...	P 4840421
KM 350...	NU 80.../NU901...	P 4840422
KM 750...	NU 80.../NU901...	P 4840423
KM 1300...	NU 80.../NU901...	P 4840424
D 500...	NU 801.../NU 901.../NU 121.../ NU 160.../U 156...	P 4080003

Table E-1: Overview of approved sprinkler pumps

Sprinkler pumps are clean water units with a prefilled motor. They can also be used with pressure shrouds.

Features of sprinkler pumps

Only clean water which does not cause sediment may be used as the pumped fluid. The temperature of the pumped fluid may not exceed 25 °C.

The guaranteed emergency flow volume is at least 2 %Q₂ on normal units and at least 4 %Q₂ on units with pressure shrouds. The maximum period pumping the emergency flow volume is 48 hours.

The operating company is responsible for ensuring that the required volume of pumped fluid and a sufficient power supply are available. Furthermore, sprinkler pumps may not be deactivated when in use by monitoring devices such as surge voltage protectors and FI protection switches.

You can find the technical data of the machine on the data sheet in this manual, the product data sheet in our catalog or in the specifications on the order confirmation.

Technical data

The minimum water coverage level refers to the top edge of the discharge port of an upright machine.

On horizontally installed machines, it refers to the top edge of the intake strainer.

When planning, you should add a safety allowance of 0.5 m to the stated net positive suction head.

The following signs are attached to the machine.

Signs used

Use as a sprinkle pump

Type plate

The type plate is attached to the motor casing. This sign contains the technical data.


P-Typ		
M-Typ	S/N	
U	Q	IM ϕ
I	H	OT _{S,E} /
I _{ST}	cos ϕ	TPF _{max}
P	SF	Σ
F	I _{SF}	IP
MFY	N	MC
IM ϕ	Mat.Ph	VdS
		

Fig. E-1: Type plate



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