Pioneering for You



Wilo-EMU D, DCH, K, KD, KM, NK, SCH Wilo-Actun ZETOS-K + NU...T/U...T-Motor (Trinkwasser/drinking water) mit Druckmantel/with Pressure shroud





en Installation and operating instructions

6094325 01-05/2007 Wilo Hof



Table of Contents

1	Introduction	1-1
	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
2	Safety	2-1
	Instructions and safety information	2 1
	Cuidelines used and CE contification	2-1
	General safety	2-2
	Electrical work	2-2
	Electrical connection	2-2
	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
3	Product description	3-1
		2.1
	Broner use and fields of application	3-1 2 1
	Conditions of use	3-1 2 1
	Construction	2 -L 2 1
	Cooling	1-C 2 2
	Type designation	2_2 2_2
	Name nlate	z_z c_c
	Technical data	3-4

4-1
4-1
4-1
4-1
4-2

5	Installation	5-1
	Installation types	5-1
	The operating area	5-1
	Assembly accessories	5-1
	Installation	5-9
	Flooding and draining the pressure shroud	5-13
	Removal	5-14
		5-14
6	Startup	6-1
	Preparatory measures	6-1
	Electrical system	6-2
	Direction of rotation	6-2
	Motor protection and activation types	6-2
	After starting	6-3
7	Maintenance	7-1
	Lubricants	7-1
	Glycol Overview	7-2
	Maintenance intervals	7-2
	Maintenance tasks	7-3
		7-4
8	Shutdown	8-1
	Temporary shutdown	8-1
	Final shutdown / storage	8-1
	Restarting after an extended period of storage	8-2
		8-2
9	Troubleshooting	9-1
		<u> </u>
	Fault: The machine will not start	9-1
	Fault: The motor starts, but the motor protection switch triggers shortly after start-up Fault: Machine runs but does not numn	9-1
	Fault: The machine runs, but not at the stated operating levels	9-2 9-2
	Fault: The machine does not run smoothly and is noisy	9-3
	Fault: Mechanical shaft seal leaks, sealing chamber monitor reports fault and switches the machine off	9-3
	Further steps for troubleshooting	9-4
A	List of machine operators and maintenance	A-1
	List of machine operators	Λ 1
	Maintenance and inspection log	A-1 A-2

В	Operation using a static frequency converter	B-1
	Standard equipment from well-known manufacturers Special equipment from well-known manufacturers Selection of motor and converter Minimum speeds for submersible pumps (well pumps) Operation Maximum voltage peaks and rise speed EMC Motor protection Operation at	B-1 B-1 B-1 B-1 B-2 B-2 B-2
	over-frequency Efficiency Relevant motor specifications for FC operation	B-2 B-2 B-3
С	Instructions on filling the NU 611 and NU 811 motors	C-1
	General product information Special characteristics Motor filling fluid	C-1 C-1 C-1
D	Instructions for filling the NU4 / NU5 / NU7 motors	D-1
	General product information Special characteristics Motor filling fluid	D-1 D-1 D-1
Ε	Use as a sprinkle pump	E-1
	Proper use and fields of application Approved units Features of sprinkler pumps Technical data Signs used	E-1 E-1 E-1 E-1 E-1

Preface

Structure of the manual

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.	Personnel qualification
Operating and maintenance staff must also work according to local accident prevention regula- tions.	
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 realis- tic 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 infor- mation and/or the installation plan.	Illustrations
This operation and maintenance manual has been copyrighted by the manufacturer. The operation	Copyright

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. Abbreviations all the abbreviations, and Table 2 all the technical terms.

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" installa- tion 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" installa- tion 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!
"transport- able" installa- tion 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" operat- ing mode (con- tinuous operation)	At the rated load, a constant temperature is reached that does not increase even in prolonged operation. The operating equipment can operate uninter- ruptedly at the rated load without exceeding the maximum permissible tem- perature.

Table 1-2: Terms

Technical term	Explanation
"S2" operat- ing 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, $S2-\underline{15}$. 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 pro- tection	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

WILO SE Nortkirchenstr. 100 DE - 44263 Dortmund Tel.: +49 231 4102-0 Fax: +49 231 4102-7363 Internet: www.wilo.com E - mail: wilo@wilo.com 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.

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 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:

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.

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.

Instructions and safety information

Instructions

Safety information

Guidelines used and CE	Our products are subject to
certification	- 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, dis- mantling, 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, caples and insulation
	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 stabil- ity 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. Further- more, 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 inter- rupted 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.

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.

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.

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

Electrical connection



Operating procedure

Safety and control devices

Ground connection







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 manufacter 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 ini- tial 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 inspec- tion 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 autho- rized 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 fac- tory 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 opera- tor 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. Troublefree operation is guaranteed if it is installed and maintained correctly. The machine is supplied as an enclosed and compact unit.

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.

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/

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m ³ 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.	
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 (≥ 10 ") or is in accordance with the NEMA regulations (≤ 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 lubri– cated 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

General product information

Proper use and fields of



application

Conditions of use

Impellers	The impellers are designed in radial or semi–axial versions. The materials used are bronze and plas– tic. 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 tempera- ture 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.

Discharge port Filling and ventilation line for motor Power supply line Pressure shroud Machine Л Foot valve (optional)

Fig. 3-1: Machine structure

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

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

Example pump: NK 86 X (S)–8		
NK 86	Internal product designation (TWI, NK, K, KD, D, KM, KP, DCH, SCH)	
Х	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 ver- sion)	
801	Internal product code	
Х	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.

Symbol	Name	Symbol	Name
Р-Туре	Pump type	MFY	Year of manufacture
М-Туре	Motor type	Р	Rated power
s/N	Machine number	F	Frequency
Q	Pump flow	U	Rated voltage
Н	Pump head	I	Rated current
Ν	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
IMø/S	Impeller diameter/number of levels		

Table 3-2: Name plate key

Name plate

 $\label{eq:sharesbarrodba} E:\ barrodbarr$

Type designation

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.

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 safety. If chains are used they must be secured against slipping.

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.

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.

Storage



Delivery

Transport

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.

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.

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 defector 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 accessoriesThe 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 gearThe 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 *Fixing materials and tools* anchor bolts). The fastening materials should be sufficiently stable to ensure safe assembly.

Installation types

The operating area

Motor filling fluid Motors are used on these units which must be filled up before installation. Drinking water (not dis-tilled) can be used as motor filling fluid.

The motors NU 611T and NU 811T are already filled at the factory.

The units are not frostproof. They must be stored accordingly (in an ambient temperature of between 3 $^{\circ}$ C and 40 $^{\circ}$ C) and installed immediately after being filled.

The motor is designed to that it can be filled from the outside. Fill the motor and check the level before installation.

The exact details about the filling fluid to be used and the required quantity can be found in the technical data.

Please refer to the supplementary sheet "Instructions on filling the motors..." for the following motors: NU 4..., NU 5..., NU 7...

Checking the filling level as well as filling the motors NU 611 and NU 811 may only be performed by the factory customer service.

Please note that the motor must be filled before the pressure shroud is flooded.

There are two different designs of pressure shroud, a normal version and a standardized one. The new standardized design can be recognized by its wide flange on the discharge side. The flange is considerably wider than the pressure shroud itself. The following section describes how to fill and empty the machine, and check the filling level.



The screw plugs are affixed at the discharge port.

Vertical installation

Installation

Filling the motors	1 Place the machine vertically or suspend it.
	2 Unscrew the plugs (1) and (2) with the sealing ring. Be careful not to damage or lose the seal- ing ring.
	3 Using a suitable funnel, fill pure, cold, drinking water (not distilled) or P35 into the threaded opening (2). The threaded opening (1) serves as a vent. The correct filling level is when the fluid is just below the two threaded openings.
	4 Before screwing in the plugs (1) and (2) again, wait for 30 minutes until all the air has escaped from the motor. Slightly rocking it back and forth supports this process. You may need to top it up with pure, cold drinking water (not distilled!) or P35.
	5 Screw in the plugs (1) and (2) with the sealing ring.
Checking the filling level	1 Place the machine vertically or suspend it.
	2 Unscrew the plugs (1) and (2) with the sealing ring. Be careful not to damage or lose the seal- ing ring.
	3 The fluid should be just below the two threaded openings. You may need to top it up with pure, cold drinking water (not distilled!) or P35. See "Filling the motors".
Horizontal installation	The plugs for filling and draining are on the pressure shroud. During installation, make sure the plugs and the type plate are facing upwards.
Filling the motors	1 Remove both plug ports (1) by loosening the screws (2) in question.
	2 Unscrew the plugs (3).
	3 Using a suitable funnel fill nure cold drinking water (not distilled) or P35 into one of the two

3 Using a suitable funnel, fill pure, cold, drinking water **(not distilled)** or P35 into one of the two openings. The other opening acts as a vent when filling the motor. The correct water level is when the fluid is just below the threaded opening.



4 Before screwing in the plugs (3), wait approximately 30 minutes until all the air has escaped

from the motor. Top up again with pure, cold drinking water (not distilled) or P35 if necessary.

5 Screw in the plugs (3) tightly. Put both plug ports (1) back on and tighten them with the bolts (2).



Checking the filling level

- 1 Remove both plug ports (1) by loosening the screws (2) in question.
- 2 Unscrew the plugs (3).
- 3 The fluid should reach the threaded opening. You may need to top it up with pure, cold drinking water **(not distilled)** or P35. See "Filling the motors".

Fig. 5-1: Vertical and horizontal installation

The screw plugs are affixed at the pressure shroud. When doing this, ensure that the filling openings are at the front during installation so that checks can be carried out later.

- 1 Place the machine vertically or suspend it.
- 2 Unscrew both sealing caps (1). Unscrew the screw plug (2) with sealing ring and and plug (3). Be careful not to damage or lose the sealing ring.
- 3 Plug a hose into the adapter piece and attach the other end to the water supply. Screw the supplied adapter piece gently into the threaded opening (3). The threaded opening (2) serves as a vent. The filling level is attained if the liquid emerges from the threaded opening (2). If not water connection is available, you can use a hand pump to fill. This can be obtained from the manufacturer as an accessory.
- 4 Before screwing in the plugs (2), wait approximately 30 minutes until all the air has escaped from the motor. Top up again with pure, cold drinking water **(not distilled)** or P35 if necessary.
- 5 Screw the screw plug (2) with the sealing ring and plug (3) back in tightly. Put both sealing caps back on and seal them with an appropriate sealant.
- 1 Place the machine vertically or suspend it.
- 2 Unscrew the sealing cap (1). Unscrew the screw plug (2) with the sealing ring. Be careful not to damage or lose the sealing ring.
- 3 The fluid should reach the threaded opening. You may need to top it up with pure, cold drinking water (not distilled) or P35. See "Filling the motors".



Fig. 5–2: Vertical installation

Standardized design – vertical installation

Filling the motors

Checking the filling level

Installation

Standardized design - horizontal installation	The screw plugs are affixed at the pressure shroud. When doing this, ensure that the filling openings are at the top during installation so that checks can be carried out later.	
Filling the motors	1 Unscrew both sealing caps (1). Unscrew the screw plugs (2) with the sealing ring. Be careful not to damage or lose the sealing ring.	
	2 Using a suitable funnel, fill pure, cold, drinking water (not distilled) or P35 into one of the two openings. The other opening acts as a vent when filling the motor. The correct water level is when the fluid is just below the threaded opening.	
	3 Before screwing in the plugs (2), wait approximately 30 minutes until all the air has escaped from the motor. Top up again with pure, cold drinking water (not distilled) or P35 if necessary.	
	4 Screw in the plugs (2) tightly. Put both plug ports (1) back on and seal them with an appro- priate sealant.	
Checking the filling level	1 Unscrew the sealing caps (1). Unscrew the screw plugs (2) with the sealing ring. Be careful not to damage or lose the sealing ring.	
	2 The fluid should reach the threaded opening. You may need to top it up with pure, cold drink- ing water (not distilled) or P35. See "Filling the motors".	
Draining the motors	To drain the motor, you must first remove it from the pressure shroud. These tasks may only be car- ried out by authorized service dealers, or by qualified personnel after consulting the manufacturer.	



Fig. 5-3: Standardized design – horizontal installation

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

- 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.

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.

Dry installation

Installation



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. 5-4: Example installation

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

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 2–3m. 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.

Flooding and draining the

Fig. 5–5: Example installation

Check tions	whether the machine has been correctly installed, the pipes are connected and all connec- are sealed.	pressure shroud
		Without foot valve
1	Close the slider on the discharge side.	Flooding the pressure shroud
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.	
1	Switch off the machine and close both sliders.	Draining the pressure shroud
2	Carefully unscrew the drain plug (2) and drain the water. Be careful not to damage or lose the sealing ring.	
	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 seal- ing 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.	Flooding the pressure shroud
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 neces- sary.	
4	Screw in the plug (1) with the sealing ring.	

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

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

Fig. 5–6: 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.

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.

Preparatory measures

- 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 recom- mend 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.	Operation with frequency
Observe the data sheet in the appendix of this manual.	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 DINVDE 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:

Maintenance

 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 	LVETY SIX MONTHS
Visual inspection of accessories of a pressure shroud atc	
- Visual Inspection of accessories, e.g. pressure smoud, 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 con- sumption 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 moni- tor, 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 = 1000 V DC). The following values may not be exceeded:	Checking the insulation resis- tance
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.	
Insulation resistance too low: Moisture may have penetrated the cable and/or the motor. Do not connect the machine, consult manufacturer.	
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
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. 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.	Visual inspection of the power supply cable
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. 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 the power supply cable Visual inspection of accesso- ries
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. 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. Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc.	Visual inspection of the power supply cable Visual inspection of accesso- ries Functional inspection of safe- ty and control devices
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. 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. Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc. Motor protection and overvoltage relays and other trip elements can generally be triggered manu- ally for test purposes.	Visual inspection of the power supply cable Visual inspection of accesso- ries Functional inspection of safe- ty and control devices
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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. 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. Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc. 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	Visual inspection of the power supply cable Visual inspection of accesso- ries Functional inspection of safe- ty and control devices
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. 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. Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc. 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.	Visual inspection of the power supply cable Visual inspection of accesso- ries Functional inspection of safe- ty and control devices
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. 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. Monitoring devices are temperature sensors in the motor, sealing room monitors, motor protection relays, overvoltage relays, etc. 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 300 ohms. PT 100 sensor: PT 100 sensors have a value of 100ohms at 0°C. Between 0°C and 100°C this value increases by 0.385 ohms per 1°C. PT 20 sensors have a value of 107.7 ohms at 20°C.	Visual inspection of the power supply cable Visual inspection of accesso- ries Functional inspection of safe- ty and control devices

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.

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.

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:

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.

Temporary shutdown

Final shutdown / storage



Caution!

You must ensure that products filled with drinking water are stored in a room with an ambient temperature of between $3 \degree C$ and $40 \degree C$. 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.

Restarting after an ex-
tended period of storageBefore restarting the machine, clean it of dust and oil deposits. Then carry out the necessary main-
tenance 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.

Cause	Remedy
Electricity supply interrupted – short circuit or earth connection in the cable or motor wind– ings	Have the motor and wires checked by a spe- cialist and replaced if necessary
	Have a specialist inspect the connection and correct them as necessary
Fuses, the motor protection switch and/or monitoring devices are triggered	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

Fault: The machine will not start

Table 9-1: The machine will not start

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 neces- sary
Incorrect direction of rotation	Swap the 2 phases from the mains supply

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

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

Troubleshooting

Cause	Remedy
Impeller/propeller impeded by adhesive mate- rial, 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 neces- sary open it completely, use a different impel- ler 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

Cause	Remedy
Machine is running in an impermissable oper- ation 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/pro- peller is blocked	Clean the suction port, strainer and/or impel– ler/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

Fault: The machine does not run smoothly and is noisy

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.)

Cause	Remedy
Condensation build-up due to lengthy stor- age 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 10 m 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 con- tacting the factory

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

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

Further steps for troubleshooting

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.

A List of machine operators and maintenance

All persons working on or with the product confirms with their signatures that they have received, read and understood this operating and maintenance manual. In addition, they obligate themselves to conscientiously follow the instructions provided. Non-observation releases the manufacturer from any warranty obligations.

List of machine operators

Name	Starting date	Signature

Table A-1: List of machine operators

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

Standard equipment

B Operation using a static frequency converter

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

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 with-out a frequency converter!** The following points must be observed when operating the converter:

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.	from well-known manufacturers		
Common additional functions in frequency converters from well-known manufacturers:	Special equipment		
Fault diagnosis – Reduction of motor noise – Fading out of resonance frequencies – Remote data transmission – Remote control – etc.	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.	Minimum speeds for		
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.	(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, reso– nance, 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 qua- dratic 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 fea-			

other parameters, please see the operating instructions of the converter.

ture an automatic power optimization function which achieves the same effect. For this setting and

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 pump filter. Contact the factory for t converter pulse frequency should	os of <1 kV and are usually reach he permitted values for motors also be selected.	ed by using a sine filter or du/dt s of >1 kV. The lowest-possible			
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	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 als be taken into account. The efficiency of all components is reduced if the speed is reduced.					
	Formulas					
	Volume flow	Delivery head	Power			

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

Tabelle B-1: Formulas

Operation using a static frequency converter

Relevant motor specifications for FC operation

Motor type	Construction	f _{nominal} [Hz]	Num- ber 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 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 General product motors. The steps for this procedure are described in this chapter. information Only motors that are completely and correctly filled guarantee problemfree operation. The motor is filled with the manufacturer's special fluid. These motors can be stored at tempera-Special characteristics tures down to -40 °C for one year and can be operated at down to -8 °C. These motors are already filled by the manufacturer and are ready for operation. 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. C-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. C-2: Draining the motor

D Instructions for filling the NU4 / NU5 / NU7 motors

The p motor	rocedures for filling, draining and checking fluid levels for these motors differ from our other s. The steps for this procedure are described in this chapter.	General product infor- mation	
	Only motors that are completely and correctly filled guarantee problem- free operation.		
The N motor These	U4 / NU5 / NU7 motors are filled with a special filling fluid from the manufacturer. These s can be stored at temperatures up to -40 °C for one year and can be operated at up to -8 °C. motors are already filled by the manufacturer and are ready for operation.	Special characteristics	
The N back 1 persoi	U4 motor may only be filled and drained by the manufacturer. The machines must be sent to the manufacturer's plant for this. The fluid level checks must be conducted by qualified nnel.	Motor filling fluid	
1	Clean the motor and set up vertically.	Filling the motor (not NU4	
2	Screw the hose connection (B1) with two seals into the thread (B).	motor)	
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.



Fig. D-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)

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).



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

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.

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.

Pump type	Motor type	VDS approval
К 86	NU 60/NU 80	P 4840420
К 87	NU 60/NU 80	P 4840421
КМ 350	NU 80/NU901	P 4840422
КМ 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 *Feat* shrouds.

Only clean water which does cause sediment may be used as the pumped fluid. The temperature of the pumped fluid may not exceed 25 $^{\circ}$ C.

The guaranteed emergency flow volume is at least $2 \% Q_z$ on normal units and at least $4 \% Q_z$ 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	Technical data
sheet in our catalog or in the specifications on the order confirmation.	

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.

Proper use and fields of application

Approved units

Features of sprinkler pumps

Signs used

Type plate

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

Fig. E-1: Type plate

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