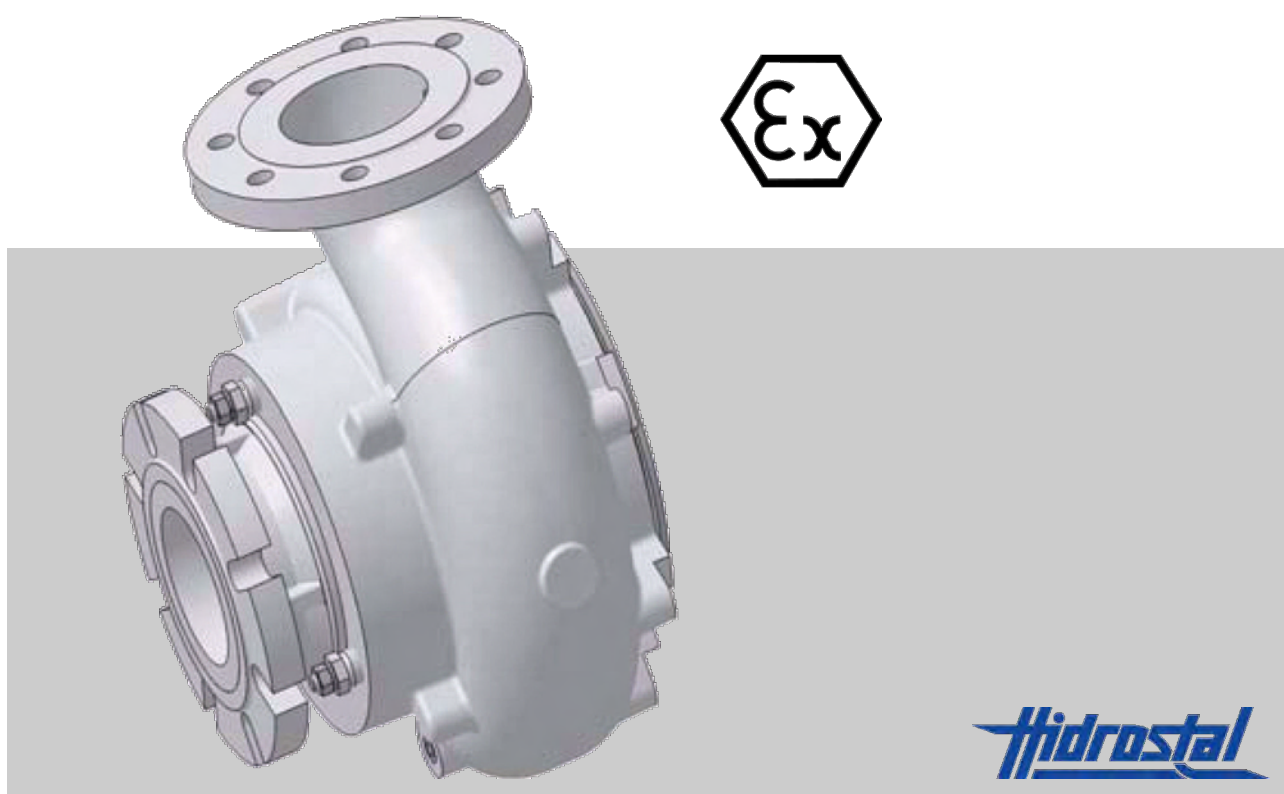


Operating instructions

Submersible and immersible screw-centrifugal pumps



Hydraulic B-N
Motor size 002-300 and B-Z



Read the manual before starting work!

09-BA7529en

Translation of original operating instructions

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Table of contents

1	General.....	6
1.1	Information on these instructions.....	6
1.2	Explanation of symbols.....	6
1.3	Limitation of liability.....	7
1.4	Spare parts.....	8
1.5	Warranty terms.....	9
1.6	Customer Service.....	9
1.7	Copyright.....	9
2	Safety.....	10
2.1	Responsibility of operating company.....	10
2.2	Personnel requirements.....	11
2.2.1	Qualifications.....	11
2.2.2	Unauthorised persons.....	12
2.2.3	Instructions.....	12
2.3	Intended use.....	12
2.4	Personal safety equipment.....	13
2.5	Principal hazards.....	14
2.6	Safety devices.....	17
2.7	Securing to prevent restart.....	18
2.8	Behaviour in the event of fire or accidents.....	19
2.9	Environmental protection.....	20
2.10	Labelling.....	20
3	Technical data.....	22
3.1	General information.....	22
3.2	Type code.....	22
3.3	Operating conditions.....	22
3.4	Operating materials.....	22
3.5	Type plate.....	23
3.6	Ex marking.....	26
4	Structure and function.....	27
4.1	Overview.....	27
4.2	Electric motors.....	28
4.2.1	Submersible motors (cooling method "N").....	29
4.2.2	Immersible electric motors (cooling method "E", "K", "F").....	29
4.3	Operational safety components.....	33
4.4	Hydraulics.....	34
4.5	Connections.....	34
4.6	Operating elements.....	35
5	Transport, packaging and storage.....	36
5.1	Safety instructions for transport.....	36
5.2	Transport inspection.....	37
5.3	Transport.....	38

5.4	Symbols on packaging.....	39
5.5	Packaging.....	40
5.6	Storage.....	41
6	Installation and initial commissioning.....	42
6.1	Safety.....	42
6.2	Preparations.....	44
6.2.1	Set-up location requirements.....	44
6.2.2	Pipeline requirements.....	44
6.3	Initial set-up.....	47
6.3.1	Installing pump in sump.....	47
6.3.2	Installing pump dry.....	52
6.3.3	Connecting to energy supply.....	53
6.3.4	Check rotational direction.....	56
6.3.5	Requirements on installation of options.....	57
6.3.6	To be done prior to starting the pump.....	58
6.3.7	Starting the pump.....	59
7	Operation.....	61
7.1	Switching on.....	61
7.2	Switching off.....	62
7.3	Standard operation.....	62
7.4	Required submersion depth.....	63
7.4.1	Submersible motors (cooling method "N").....	63
7.4.2	Immersible electric motors (cooling method "E", "K", "F").....	64
7.5	Special conditions.....	65
7.6	Emergency shutdown.....	65
8	Maintenance.....	67
8.1	Safety.....	67
8.2	Maintenance schedule.....	68
8.3	Service connections and inspection openings.....	70
8.4	Maintenance work.....	71
8.4.1	Visual condition check.....	71
8.4.2	Check/readjust impeller clearance.....	72
8.4.3	Check insulation resistance.....	85
8.4.4	Check oil level.....	86
8.4.5	Check oil quality.....	88
8.4.6	Change oil.....	90
8.5	Actions after maintenance has been completed.....	94
9	Malfunctions.....	95
9.1	Safety.....	95
9.2	Malfunction table.....	96
9.3	Startup after fault has been rectified.....	101
10	Disassembly.....	102
10.1	Safety.....	102

10.2	Dismantling.....	103
10.3	Disposal.....	103
11	Appendix.....	105
12	Index.....	106

1 General

1.1 Information on these instructions

This manual enables safe and efficient handling of the system. This manual is an integral part of the system, and must be kept in close proximity to the system where it is permanently accessible to the personnel.

Before starting any work, the personnel must have read the manual thoroughly and understood its contents. Compliance with all specified safety instructions and operating instructions is vital to ensure safe operation.

In addition, local accident prevention regulations and general safety instructions must be observed for the operational area of the system.

Illustrations in this manual are intended to facilitate basic understanding, and may differ from the actual design.

1.2 Explanation of symbols

Safety instructions

The safety instructions provided in this manual are marked by symbols. The safety instructions are introduced by keywords used to express the extent of the danger.

Strictly adhere to all safety instructions and use caution to prevent accidents, personal injury and material damage.



DANGER!

This combination of symbol and keyword points to a situation of immediate danger which may lead to serious injury or death unless avoided.



WARNING!

This combination of symbol and keyword points to a situation of possible danger which may lead to serious injury or death unless avoided.



CAUTION!

This combination of symbol and keyword points to a possibly dangerous situation which may lead to slight or minor injury unless avoided.



NOTICE!

This combination of symbol and keyword points to a possibly dangerous situation which may lead to material and environmental damage unless avoided.

Tips and recommendations



This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:



DANGER!

This combination of symbol and signal word indicates dangers posed by electric power. If the safety instructions are not observed, there is a danger of serious or fatal injuries.



WARNING!

This combination of symbol and signal word indicates content and instructions which apply for use in potentially explosive areas according to the ATEX directive. Non-observance of this content and these instructions may result in loss of explosion protection.

Symbols used in this manual

To indicate guidelines, descriptions of results, lists, references and other elements, the following symbols and markings are used in this manual:



Indicates step-by-step guidelines.



Indicates a condition or automatic sequence as result of action taken.



Indicates lists or list entries without a certain sequence.



„Symbols used in this manual“ on page 7 Indicates references to chapters in this manual.

1.3 Limitation of liability

All information and notes in this manual were compiled under consideration of the applicable standards and regulations, the present state of technology, as well as our many years of knowledge and experience.

The manufacturer assumes no liability for damages caused by:



Non-observance of this manual



Any use other than intended



Assignment of untrained personnel

- Unauthorised conversions
- Technical modifications
- Use of unapproved spare parts
- Disassembly and repair of pump by unauthorised service centre ➤ *Chapter 1.6 „Customer Service“ on page 9.*

In case of customised versions, utilisation of additional order options, or latest technical modifications, the actual scope of delivery can vary from the explanations and interpretations described herein.

The commitments set out in the delivery contract, the general terms and conditions, as well as the delivery conditions of the manufacturer and the regulations applicable at the time of contract conclusion are in force.

1.4 Spare parts

Procure spare parts from authorised dealer or directly from manufacturer. For contact information refer to Internet address on page 2.

Explosion protection



WARNING! **EXPLOSION PROTECTION!**

Using other than original spare parts can cause explosions in the explosion-hazard area. Thus, when replacing parts on devices in explosion-hazard area:

- Obtain written approval before beginning any work.
- Perform installation/removal of equipment parts only in a non-explosive atmosphere.
- Use only original manufacturer spare parts!
- Use only tools that are approved for application in explosion-hazard areas.

Non-compliance with these instructions results in loss of explosion protection and can lead to severe injuries, even death and property damage.



When using unapproved spare parts, all claims concerning warranty, service, damage and/or liability against manufacturer or his agents, dealers and representatives will be forfeited.

When making spare parts enquiries or placing spare parts orders, complete information must be provided ➤ *Type designation in contract.*

Spare parts list can be found in appendix.

1.5 Warranty terms

The warranty terms are included in the manufacturer's Terms and Conditions.

1.6 Customer Service

Contact our Customer Service for technical information. For contact information refer to Internet address on page 2.

In addition, our employees are always interested in new information and experiences that result from application and may be beneficial for improving our products.

1.7 Copyright

This manual is protected by copyright and intended solely for internal use.

This manual must not be made available to third parties, duplicated in any manner or form – whether in whole or in part – and the content must not be used and/or communicated, except for internal purposes, without the written consent of the manufacturer.

Violation of the copyright will result in legal action for damages. We reserve the right to assert further claims.

2 Safety

This section provides an overview of all the main safety aspects involved in ensuring optimal personnel protection and safe and smooth operation.

Non-compliance with the action guidelines and safety instructions contained in this manual may result in serious hazards.

2.1 Responsibility of operating company

Owner

The term 'owner' refers to the person who himself operates the system for trade or commercial purposes, or who surrenders the system to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

Owner's obligations

The system is used in the industrial sector. The owner of the system must therefore comply with statutory occupational safety requirements.

In addition to the safety instructions in this manual, the safety, accident prevention and environmental protection regulations governing the operating area of the system must be observed.

In this regard, the following requirements should be particularly observed:

- The owner must obtain information about the applicable occupational safety regulations, and - in the context of a risk assessment - must determine any additional dangers resulting from the specific working conditions at the usage location of the system. The owner must then implement this information in a set of operating instructions governing operation of the system.
- During the complete operating time of the system, the owner must assess whether the operating instructions issued comply with the current status of regulations, and must update the operating instructions if necessary.
- The owner must clearly lay down and specify responsibilities with respect to installation, operation, troubleshooting, maintenance and cleaning.
- The owner must ensure that all personnel dealing with the system have read and understood this manual. In addition, the owner must provide personnel with training and hazards information at regular intervals.
- The owner must provide the personnel with the necessary protective equipment.

Furthermore, the owner is responsible for ensuring that the system is always in a technically faultless condition. Therefore, the following applies:

- The owner must ensure that the maintenance intervals described in this manual are observed.
- The owner must ensure that all safety devices are regularly checked to ensure full functionality and completeness.

2.2 Personnel requirements

2.2.1 Qualifications


WARNING!
Danger of injury if personnel are insufficiently qualified

If unqualified personnel perform work on the system or are in the system's danger zone, hazards may arise which can cause serious injury and substantial damage to property.

- Therefore, all work must only be carried out by appropriately qualified personnel.
- Unqualified personnel must be kept away from the danger zones.

This manual specifies the personnel qualifications required for the different areas of work, listed below:

Forklift driver

The forklift driver must be at least 18 years old and, based on his physical and intellectual attributes and character, suited to driving industrial trucks with a driver's seat or driver's platform.

Furthermore, the forklift driver has been trained to drive industrial trucks with a driver's seat or driver's platform.

The forklift driver has provided the owner with evidence of his skills in driving industrial trucks with a driver's seat or driver's platform and has therefore been authorised in writing by the owner to drive the forklift.

Instructed person (operator)

has been informed by the operating company about the assigned tasks and possible hazards in case of incorrect behaviour.

Manufacturer (service centre)

Certain types of work may only be performed by our professionals. Any other personnel is not authorised to perform this work. To schedule the corresponding work, contact our Service department, see address on page 2.

Qualified personnel

Qualified personnel is able to carry out assigned work and to recognize and prevent possible dangers self-reliantly due to its professional training, knowledge and experience as well as profound knowledge of applicable regulations.

Trained electrician

The trained electrician is able to carry out work on electric systems and to recognize and avoid possible dangers due to his professional training, knowledge and experience as well as profound knowledge of applicable regulations.

The trained electrician has been trained specifically for his working environment and he has profound knowledge of relevant standards and regulations.

The trained electrician must comply with all legal requirements regarding workplace safety and accident prevention.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

2.2.2 Unauthorised persons



WARNING!

Risk to life for unauthorised persons due to hazards in the danger and working zone!

Unauthorised persons who do not meet the requirements described here will not be familiar with the dangers in the working zone. Therefore, unauthorised persons face the risk of serious injury or death.

- Unauthorised persons must be kept away from the danger and working zone.
- If in doubt, address the persons in question and ask them to leave the danger and working zone.
- Cease work while unauthorised persons are in the danger and working zone.

2.2.3 Instructions

The personnel must receive regular instruction from the owner. The instruction must be documented to facilitate improved verification.

Date	Name	Type of the instruction	Instruction provided by	Signature

2.3 Intended use

The pumps are exclusively designed and constructed for the intended use described herein.

The pumps are intended for use in the food and chemical industry, environmental technology for domestic and industrial wastewater, mines and in the petroleum industry.

The pump serves exclusively for the delivery of media according to technical data sheets ↗ *Chapter 11 „Appendix“ on page 105.*

Intended use also includes compliance with all information contained in this manual.

Any use other than the one intended or any other type of use, is considered incorrect.


WARNING!
Risk due to incorrect use!

Any use beyond the intended one, or other use of the equipment, can result in dangerous situations.

- Use device only as intended.
- Strictly follow the information contained in these operating instructions.
- Refrain from delivery of flammable liquid.
- Refrain from altering, converting or modifying the construction or individual pieces of equipment, aimed at changing the area of application or the use of the device.
- Never operate device outside the technical application and operating limits.

Claims of any kind for damages due to incorrect use are excluded.

2.4 Personal safety equipment

Personal protective equipment is used to protect the personnel from dangers which could affect their safety or health while working.

The personnel must wear personal protective equipment while carrying out the different operations at and with the system. This equipment will be indicated separately in the individual chapters of this manual. This personal protective equipment is described below:

- It is mandatory to put on the personal protective equipment specified in the different chapters of this manual before starting work.
- Always comply with the instructions governing personal protective equipment posted in the work area.

Description of the personal protective equipment



Protective clothing

Protective clothing are tight fitting working clothes with low tear resistance, with tight sleeves and without any parts sticking out. These clothes primarily protect against getting caught by moving machine parts. Do not wear rings, chains, necklaces, and other jewellery.



Protective helmet

The protective helmet provides protection against falling and flying parts and materials.



Safety boots

Safety boots are intended to protect against slipping hazards or foot hazards like heavy gear.



Safety gloves

Safety gloves are intended to protect hands against friction, abrasion, stabs or deeper wounds and against direct contact with hot surfaces.

2.5 Principal hazards

The following section specifies the residual risks determined on the basis of a risk assessment.

In order to reduce health risks and avoid dangerous situations, observe the safety instructions listed here and the safety instructions contained in other chapters of this manual.

Electrical current



DANGER!

Life-threatening hazard from electric shock!

There is an imminent life-threatening hazard from electric shocks from live parts. Damage to insulation or to specific components can pose a life-threatening hazard.

- Only a qualified electrician should perform work on the electrical equipment.
- Immediately switch off the power supply and have it repaired if there is damage to the insulation.
- Before beginning work at live parts of electrical systems and resources, cut the electricity and ensure it remains off for the duration of the work. Comply with the five safety rules in the process:
 - cut electricity;
 - safeguard against restart;
 - ensure electricity is not flowing;
 - earth and short-circuit; and
 - cover or shield neighbouring live parts.
- Never bypass fuses or render them inoperable. Always use the correct amperage when changing fuses.
- Keep moisture away from live parts. Moisture can cause short circuits.

Impeller



WARNING!

Risk of injury from rotating parts!

Impeller of pump can cause severe injuries.

- Never reach into impeller while in operation.
- Observe delay time: Before performing any maintenance, ensure that parts have come to a complete stop.

Highly inflammable substances



WARNING!

Danger to life in the event of fire due to highly inflammable substances!

Highly inflammable substances, liquids or gases may catch fire, causing serious or fatal injuries.

- Do not smoke within or around the danger zone. Do not handle open flames, fire or ignition sources of any kind.
- Ensure availability of suitable extinguishing agents (fire blanket, fire extinguisher).
- Immediately report suspicious substances, liquids or gases to the person in charge.
- Cease work immediately in the event of fire. Leave the danger zone until the all-clear is sounded and notify the fire brigade.

Risk of entanglement caused by submersible pump



WARNING!

Risk of entanglement caused by submersible pump!

During operation of the submersible pump there is a risk of entanglement at the side of the pump's suction inlet. This can cause severe injuries.

- Do not enter hazardous area during operation.
- Prior to any set-up and maintenance work as well as troubleshooting measures, switch off power supply and protect against restart.

Lubricants, preservatives



WARNING!

Fire hazard due to lubricants and preservatives!

Oil and grease can ignite after contact with ignition sources.

- No open fire when working on devices.
- No smoking.
- Remove oil and grease residues from device and floor.

Hot surfaces



WARNING!

Danger of injury from hot surfaces!

Component surfaces may heat up greatly during operation. Skin contact with hot surfaces will cause severe skin burns.

- Always wear heat-resistant protective work clothing and protective gloves as a matter of principle when working in the vicinity of hot surfaces.
- Before carrying out any work, make sure that the surfaces have cooled down to the ambient temperature.

Poisoning hazard



CAUTION!

Poisoning hazard from oil, grease and preservatives!

Contact with oil and grease can be harmful to health.

- Avoid skin contact with oil and grease.
- Remove oil and grease immediately from skin.
- Do not inhale oil and grease vapours.

2.6 Safety devices



WARNING!

Mortal danger due to non-functioning safety devices!

Safety is only guaranteed if safety devices are faultless.

- Always maintain safety components in good order.
- Never disable safety devices.
- Do not bypass or modify safety components.
- Ensure that safety devices, such as emergency-stop buttons, ripcords, etc. are always accessible.

The operating company must retrofit the following safety devices:

Integration in an emergency-stop concept required

The device is intended for use within a system. It has no separate emergency-stop function.

Before initial use of the device, install emergency-stop devices and main switch, and integrate into safety chain of system control.

Connect emergency-stop devices so as to prevent situations that could endanger human life or property in case of energy supply interruption or energy supply activation after an interruption.

The emergency-stop devices must be freely accessible at all times.

Time-lag fuses or circuit breakers

Time-lag fuses or circuit breakers must be installed in each supply phase.

Lightning protection

Overcurrent circuit breakers must be installed in each supply phase if there is a risk of lightning damage.

Motor starting switch

A magnetic contact starter, designed for full voltage, must be installed and dimensioned according to applicable local regulations, based on motor power rating.

Quick trip overcurrent circuit breakers

They must be selected based on the power consumption indicated on the type plate. In case of locked rotor (approximately 6 times the full-load current) they must switch off within 6 seconds to sufficiently protect the motor windings. Check "switch-off curve" of circuit breaker to ensure that this requirement is met.



The warranty for the immersible motors applies only if quick trip overcurrent circuit breakers are installed in all phases. For repair of motors under warranty, provide documents proving that the correct overcurrent circuit breakers were installed.

2.7 Securing to prevent restart



WARNING!

Danger to life from an unauthorised restart!

In the event of an unauthorised restart of the power supply, there is a danger of serious injuries or death for persons in the danger zone.

- Observe all instructions in the chapters of this manual relating to preventing a restart
- Always comply with the sequence described below to prevent a restart.

Securing to prevent restart

Switch secured with lock
on: at o'clock.
DO NOT SWITCH ON
The lock may be removed
only by:
after making sure that no
persons are in the hazardous
area.

Fig. 1: "Switch secured using a lock" sign

Switched off
on: at o'clock.
DO NOT SWITCH ON
Switching on may be performed
only by:
after making sure that no
persons are in the hazardous
area.

Fig. 2: "Switched off" sign

1. ➤ Switch off the power supply.
2. ➤ If possible, secure the switch using a lock and attach a corresponding sign Fig. 1 to the switch ensuring high visibility.
3. ➤ Place the key in the safekeeping of the personnel specified on the sign.
4. ➤ If it is not possible to secure a switch using a lock, an appropriate sign Fig. 2 should be attached.
5. ➤ After all work has been completed, ensure that the danger zone has been cleared of people.
6. ➤ Ensure that all safety and protective devices are installed and completely functional.
7. ➤ Only then should the sign be removed.

2.8 Behaviour in the event of fire or accidents

Precautions

- Always be prepared for accidents or fire!
- Ensure that first aid supplies (box of dressings, blankets etc.) and fire extinguishers are completely functional and ready to hand.
- Ensure that personnel are familiar with accident reporting, first aid and rescue equipment.
- Keep access routes clear for emergency service vehicles.

Actions in the event of accidents

- Immediately use the emergency stop device to trigger an emergency stop.
- Rescue people from the danger zone.
- Initiate first aid measures.
- Notify the rescue services.
- Notify those responsible at the place of use.
- Clear access routes for emergency service vehicles.

2.9 Environmental protection



NOTICE!

Danger to the environment from incorrect handling of pollutants!

Incorrect handling of pollutants, particularly incorrect waste disposal, may cause serious damage to the environment.

- Always observe the instructions below regarding handling and disposal of pollutants.
- Take the appropriate actions immediately if pollutants escape accidentally into the environment. If in doubt, inform the responsible municipal authorities about the damage and ask about the appropriate actions to be taken.

The following pollutants are used:

Lubricants, preservatives

Lubricants, such as greases, oils and preservatives, contain poisonous substances. Do not allow them to enter the environment. Disposal must be carried out by a professional disposal company.

2.10 Labelling

The following symbols and information signs can be found in the work area. They refer to their immediate surroundings.



WARNING!

Danger of injury from illegible symbols!

Stickers and signs can become dirty or otherwise obscured over time, with the result that dangers cannot be recognised and the necessary operating instructions cannot be complied with. This, in turn, poses a risk of injury.

- All safety, warning and operating instructions must always be maintained in a completely legible condition.
- Damaged signs or stickers must be replaced immediately.

Electrical voltage

Only qualified electricians are permitted to work in a work room marked by this sign.

Unauthorised persons must not enter the workplaces thus marked and must not open the marked cabinet.

Information label on motors with PTC thermistors

All motors equipped with PTC thermistors have the following information label at the cable end:

"CAUTION! PTC thermistor! Voltage larger than 2,5 V destroys the winding!"

3 Technical data

3.1 General information



For technical data (dimensions, weights, performances, connected loads, etc.) refer to enclosed delivery drawings and data sheets. ↪ Chapter 11 „Appendix“ on page 105.

3.2 Type code



Explanation of type code (motor code and hydraulic designation) ↪ Chapter 11 „Appendix“ on page 105).

3.3 Operating conditions

Environment

Specification	Value	Unit
Temperature of medium	up to 40	°C
Ambient temperature	up to 40	°C



Minimum values for medium and ambient temperature depend on operating conditions. For additional information ↪ Chapter 7.5 „Special conditions“ on page 65.

Duration

Specification	Value
Maximum operating time	designed for continuous operation

3.4 Operating materials

Operating material	Characteristic	Value	Unit
STABURAGS NBU 8EP from Klüber-Lubrication (lubricant)	Colour	beige	
	Apparent dynamic viscosity	6000	mPas
	Range of operating temperature	-30...150	°C

Operating material	Characteristic	Value	Unit
	Max. temperature (short-term)	170	°C
	Viscosity grade (NLGI)	2	
	Penetration, DIN ISO 2137 (0.1 mm)	280	
	Dropping point DIN ISO 2176, minimum	220	°C
	Corrosion protection DIN 51802	0	
	RPM parameters (n x d m)	5 x 10 ⁵	
Hydraulic fluid no. 856 or equivalent oil (cooling and sealing liquid)	Specific gravity at 20 °C	0,812	g/ml
	Viscosity at 40 °C	3,5	mm ² /s (cst)
	Pour point	-38	°C
	Flash point	132	°C
	Fire point	142	°C
	Heat of vaporization	251	kJ/kg
	Water solubility	none	
Corrosion protection No. 846 (Preservative)	Boiling point/boiling range	148	°C
	Flash point	30	°C
	Ignition temperature	260	°C
	Lower explosive limit	0,5	Vol. %
	Upper explosive limit	6,5	Vol. %
	Density at 20 °C	0,87	g/cm ³

3.5 Type plate

The type plate is located on the motor casing.

Type plate mains operation




		Gigering 27 8213 NEUNKIRCH/SWITZERLAND	
3~ Motor für Netzbetrieb		IC <input type="text"/>	IP <input type="text"/> S <input type="text"/>
Typ <input type="text"/>			
P2	<input type="text"/> kW	<input type="text"/> min ⁻¹	<input type="text"/> Hz
Con. Schalt.	<input type="text"/>	V <input type="text"/>	A <input type="text"/>
EEx d	<input type="text"/> IIB T <input type="text"/>	EN 60034	<input type="text"/> cos φ <input type="text"/>
IA/IN	<input type="text"/>	t _A <input type="text"/> s	Th.c.L. <input type="text"/>
PTC DIN 44081/82- <input type="text"/>		Auslösegerät <input type="text"/>	
 0102  II 2 G PTB <input type="text"/>		ATEX <input type="text"/>	
Bauj.	<input type="text"/>	M.NR.	<input type="text"/> kg
Q	<input type="text"/> l/s	H	<input type="text"/> m
TMS, bei Angabe der t _A -Zeit, nur mit zugelassenem PTC-Auslösegerät			

Fig. 3

Type plate






		Gigering 27 8213 NEUNKIRCH/SWITZERLAND	
3~ Motor für Umrichterbetrieb		IC <input type="text"/>	IP <input type="text"/> S <input type="text"/>
Typ <input type="text"/>			
Umrichter Typ	<input type="text"/>	Motordaten bei	<input type="text"/> Hz
P2	<input type="text"/> kW	<input type="text"/> min ⁻¹	<input type="text"/> V
EEx d	<input type="text"/> IIB T <input type="text"/>	EN 60034	<input type="text"/> A
Auslösegerät <input type="text"/>		Th.c.L.	<input type="text"/>
PTC DIN 44081/82- <input type="text"/>		t _A <input type="text"/> s	
 0102  II 2 G PTB <input type="text"/>		ATEX <input type="text"/>	
Bauj.	<input type="text"/>	M.NR.	<input type="text"/> kg
Q	<input type="text"/> l/s	H	<input type="text"/> m
M	<input type="text"/> Nm	<input type="text"/> min ⁻¹	ED <input type="text"/> %/ <input type="text"/> min
M	<input type="text"/> Nm	<input type="text"/> min ⁻¹	MA <input type="text"/> Nm
P2	<input type="text"/> kW	<input type="text"/> min ⁻¹	<input type="text"/> Hz

Fig. 4

Type plates include the following information:

Explanation	Information	Example	Unit
Name and address of manufacturer	Manufacturer		
CE marking  Chapter 3.6 „Ex marking“ on page 26	CE		
Ex marking  Chapter 3.6 „Ex marking“ on page 26	Ex		

Explanation	Information	Example	Unit
Classification of cooling method	IC Code	51W0	
Degrees of protection (based on overall design)	IP Code	68	
Operating mode, rating class	S	1	
Hidrostal motor code	Type		
Inverter principle	Inverter type	DTC	
Mains frequency	Motor data at	50	Hz
Nominal output	P ₂		kW
Nominal speed			rpm
Mains frequency		50	Hz
Phase circuits	Con		
Nominal voltage (operating voltage)		400	V
Nominal motor current			A
Type of ignition protection	Ex d		
Gas group, temperature class	IIB T	4	
Test number, certification number	ATEX	IST 05ATEX 14187	
DIN EN 60034: „Rotating electrical machines“	EN 60034		
Power factor	cos φ		
Ratio: Starting current/nominal current	I _A /I _N		
Thermal machine protection	TMS		
Response time of TMS	t _A		s
Temperature class of winding insulation	Th.cl.		
PTS type	PTS DIN 44081/82		°C
In connection with PTS for TMS	Tripping unit		Licence No.
Year of manufacture	YOM		
Serial number	M.No.		
Weight			kg
Flow rate	Q		l/s
Delivery head	H		m
Torque	M		Nm
Speed			rpm
Maximum shaft power	P ₂		kW
Starting torque	M _A		Nm

3.6 Ex marking



WARNING!

Devices that are in compliance with directive 94/9/EC contain additional information on the type plate.



Fig. 5: ATEX marking

Marking	Designation	Description
CE	CE marking	Conformity marking according to appendix X of directive 94/9/EC. Applied by manufacturer before placing on market.
II	Device group	Device group II. The device may be used in potentially explosive areas, except in mining.
2G	Device category	Device category 2G allows the occasional occurrence of a potentially explosive atmosphere, involving gases, vapours and fog atmosphere (G). The device ensures a high level of safety and can be applied in zone 1 and zone 2.

4 Structure and function

4.1 Overview

The pump is used for the delivery of media according to technical data sheets ↗ *Chapter 11 „Appendix“ on page 105.*

- 1 Cable part
- 2 Electric motor
- 3 Hydraulic part
- 4 Suction flange
- 5 Pressure flange

The medium is sucked via the suction inlet (4) by means of the impeller of the hydraulic part (3) and delivered to the pressure line.

The pump may be installed horizontally or vertically.

Depending on type of electric motor, the pump is suitable for wet or dry installation ↗ *Chapter 4.2 „Electric motors“ on page 28.*

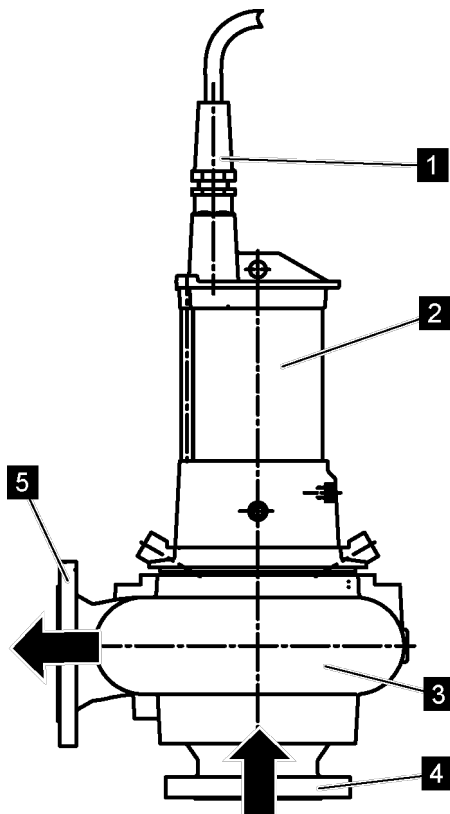
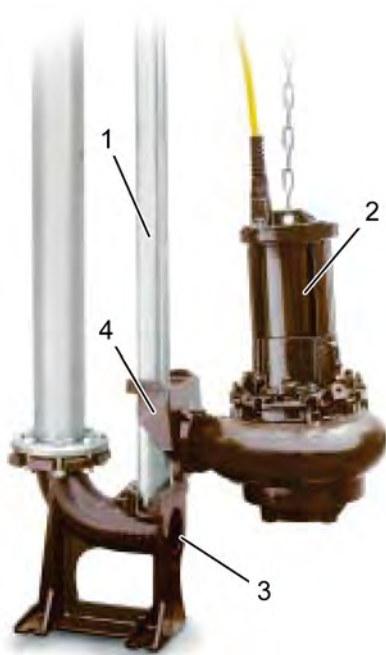


Fig. 6



If pump (2) is sump-mounted, it is equipped with guide rail (1) (optional) and slide shoe (4). This ensures that pump is precisely positioned on the automatic coupling on the discharge outlet (3).

Fig. 7

4.2 Electric motors

Cooling methods for electric motors

Depending on motor size and application, various cooling methods can be applied (second digit of motor code):

- Submersible motors for sump installation (cooling method "N")
The pump is fully submerged during operation, but it can emerge.
- Immersible electric motors for dry installation in immersed area (cooling method "E", "K", "F") The pump is installed dry, but can be immersed.

4.2.1 Submersible motors (cooling method "N")

Immersion cooling (cooling method "N")

On this type, the waste heat of the motor is transferred directly to the surrounding liquid via the stator housing (1).

- 1 Stator housing
- 2 Oil drain opening
- 3 Stator housing opening
- 4 Flushing connection

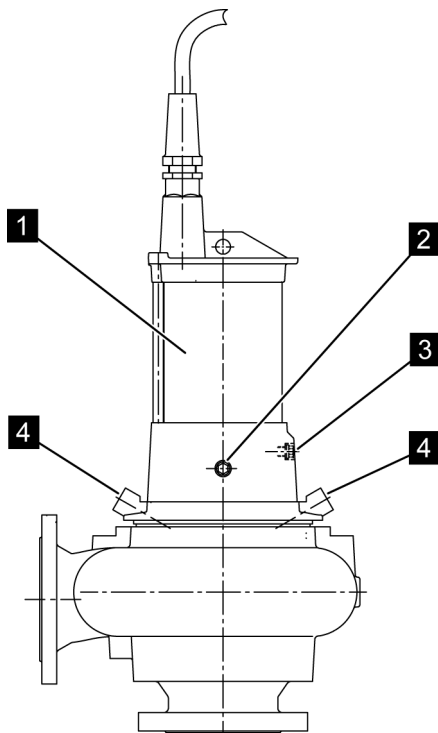
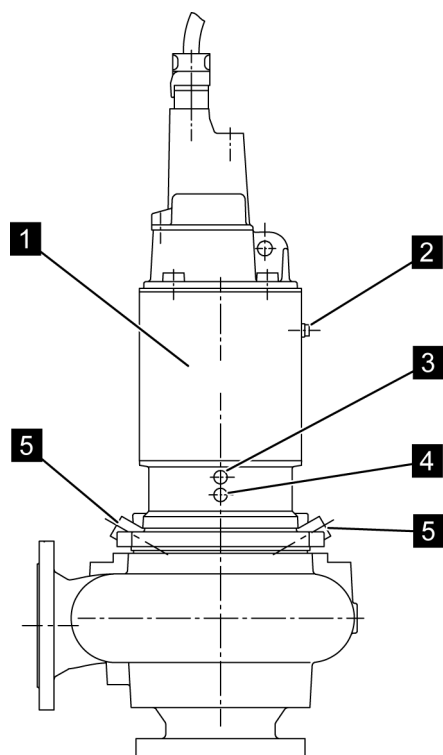


Fig. 8

4.2.2 Immersible electric motors (cooling method "E", "K", "F")

Self-cooling (cooling method "E")

On this type, the pump is equipped with an oil jacket (1) with forced circulation.



- 1 Cooling jacket of stator housing
- 2 Oil filler opening
- 3 Stator housing opening
- 4 Oil drain opening
- 5 Flushing connection

The waste heat of the motor is transferred to the cooling oil, which circulates in the cooling jacket. The oil discharges the waste heat through the sealing part of the motor (serves as heat exchanger). The oil is circulated by an impeller on the motor shaft.

Fig. 9

Convection cooling (cooling method "K")

On this type, the waste heat of the motor is transferred directly to the surrounding liquid (pump submerged) or the air (pump not submerged) via the stator housing (1).

- 1 Stator housing
- 2 Stator housing opening
- 3 Oil drain opening
- 4 Flushing connection

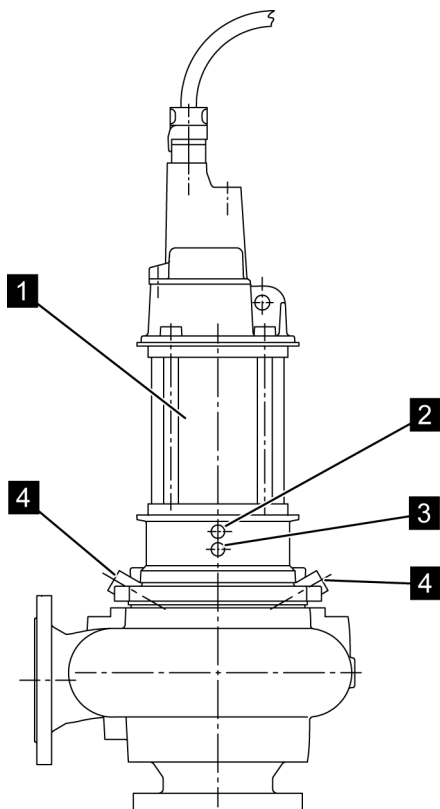
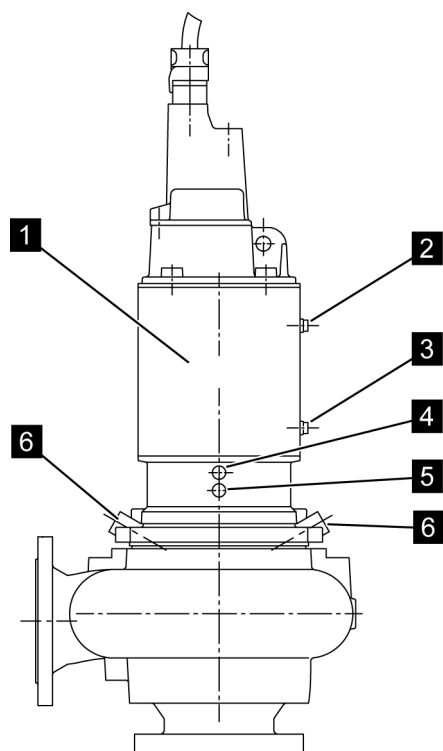


Fig. 10

Forced cooling (cooling method "F")

On this type, the waste heat of the motor is transferred from the stator to a cooling liquid. It circulates in the cooling jacket (1), which encloses the stator housing. The cooling liquid transfers the waste heat to an external heat exchanger. It must be circulated by an external pump system.



- 1 Cooling jacket of stator housing
- 2 Coolant outlet
- 3 Coolant inlet
- 4 Stator housing opening
- 5 Oil drain opening
- 6 Flushing connection

This type is suitable for applications where self-cooling is not sufficient, particularly when the temperature of the delivered medium is too high for an effective cooling.

Fig. 11

4.3 Operational safety components

The following components are installed:

- 1 Cable protection
- 2 Bearing temperature probe in upper bearing (optional)
- 3 Winding head with built-in temperature limiter
- 4 Bearing temperature probe in lower bearing (optional)
- 5 Float switch (optional)
- 6 Moisture probe (optional)

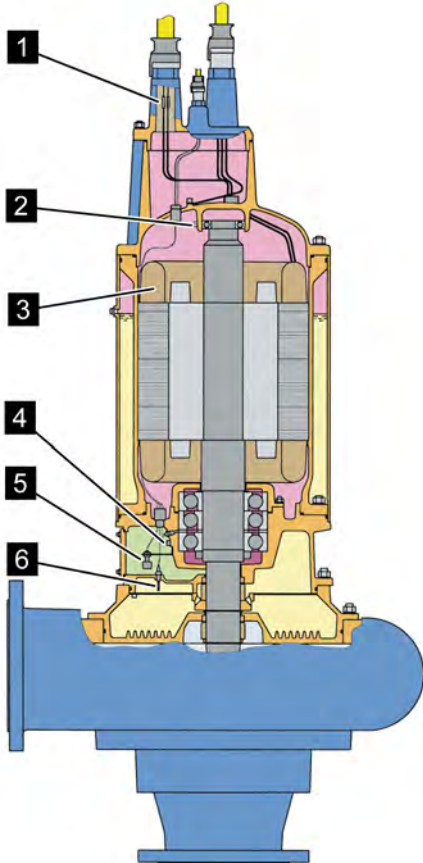


Fig. 12

Cable protection (1)

The cable inlet prevents moisture from entering the interior of the motor. The cables are sealed with epoxy resin; the wires are fed into separate conductors, which also form the connection to the motor, thus completely sealing the interior space between the cable sheathing and the wires.

Temperature limiter - circuit with temperature controller built into the winding (3)

The motors are made with temperature limiters, which are installed in the winding head (conductor connection 1 and 2). When trigger temperature of limit switch is reached, operation is interrupted. They are bimetallic switches (similar to Klixon). They can be directly connected to the motor's control circuit at 220/240 volt, with a maximum load of 2.5 A.

A temperature controller (conductor terminal 1 and 3) ensures that operation is interrupted 12 to 15 °C before reaching the trigger temperature of the limit switch.

Overtemperature protection of windings (when in inverter mode)

Overtemperature protection takes place via PTC thermistor and PTC thermistor triggering device. PTC thermistor sensors protect against excessive temperatures in case of blocking rotors, heavy start-ups, counter-current operation, undervoltage and phase failure, increased ambient temperature and impaired cooling.

Bearing temperature probe in lower bearing (optional) (4); in upper bearing (optional) (2)

The bearing temperatures of the lower and upper bearings of the electric motor are monitored by temperature probes. Thus, bearing damage can be detected at an early stage and necessary measures can be taken.

Float switch (5) (optional)

Leakage monitoring of upper seal is performed by means of a float switch, which is installed in the oil chamber. If water enters the drying chamber, it reacts before the water reaches the lower bearing. This prevents lubricating grease from washing out and damage to the bearing.

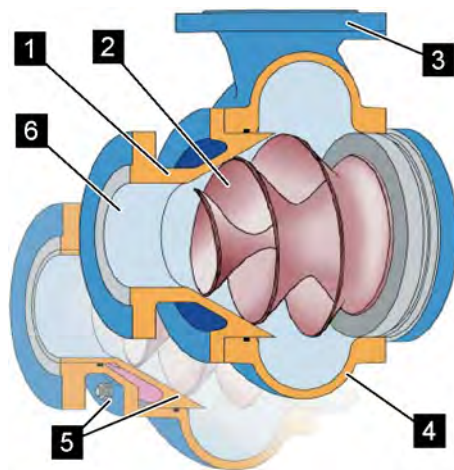
Moisture probe (6) (optional)

Moisture is monitored by means of a moisture probe. If a certain water content is exceeded in the oil chamber of the electric motor, the integrated moisture probe triggers an alarm.

Operating hours counter (optional)

The operating hours counter is used to keep track of operating hours.

4.4 Hydraulics



- 1 Suction cone
- 2 Screw centrifugal impeller (impeller)
- 3 Outlet
- 4 Spiral casing
- 5 Clearance adjustment
- 6 Inlet

The standard hydraulic system consists of a spiral casing (4), an impeller (2) and a suction cone (1). The impeller - suction cone clearance can be adjusted (5).

Fig. 13

4.5 Connections

The pump is connected to the energy supply by means of an electric cable.

Each cable set has three or six power current leads per rotational speed, a ground conductor and additional conductors for overtemperature protection and leakage monitoring.

4.6 Operating elements



The device has no separate operating elements. Operation is performed via a separate control & separate operating manual.

5 Transport, packaging and storage

5.1 Safety instructions for transport

Industrial trucks



WARNING!

Danger to life from industrial trucks!

Objects and other loads may fall from industrial trucks during transport in an uncontrolled manner, causing serious injuries or death. There is also a danger that the vehicle driver will fail to see persons and may run over them.

- Industrial trucks should only be operated by trained drivers (e.g. forklift operators).
- Only pass an industrial truck once the driver has signalled that he has seen the persons.
- Only use approved industrial trucks with sufficient load-bearing capacity.
- Never drive material transports around people or areas where people gather.

Eccentric centre of gravity



WARNING!

Danger of injury from falling or tipping packages!

Packages may have an eccentric centre of gravity. Incorrect attachment may cause the package to tip and fall. Falling or tipping packages may cause serious injury.

- Observe the markings and specifications on the packages relating to the centre of gravity.
- When transporting with a crane, attach the crane hook so that it is above the package's centre of gravity.
- Lift the package carefully and observe whether it tips. Change the attachment position if necessary.

Suspended loads**WARNING!****Danger of fatal injury from suspended loads!**

During lifting operations, loads may swing out and fall down. This may result in serious injury or death.

- Never step under suspended loads, and do not step within their pivoting range.
- Only move loads under supervision.
- Only use approved hoists and lifting gear with a sufficient load-bearing capacity.
- Do not use torn or abraded hoists such as ropes and straps.
- Do not place hoists such as ropes and straps against sharp edges or corners and do not knot or twist them.
- Set the load down when leaving the workplace.

Improper transport**NOTICE!****Damage to property due to improper transport!**

Transport units may fall or tip over as a result of improper transport. This can cause a significant level of property damage.

- Proceed carefully when unloading transport units at delivery and during in-house transport; observe the symbols and instructions on the packaging.
- Only use the attachment points provided.
- Only remove the packaging shortly before assembly.

5.2 Transport inspection

On receipt, immediately inspect the delivery for completeness and transport damage.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Issue a complaint in respect of each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

5.3 Transport

Attachment points

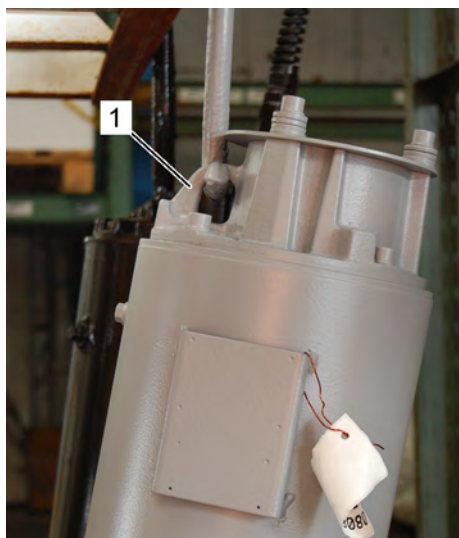


Fig. 14

The following attachment points are provided:

- Attachment lugs (1) on electric motor and on pump

Transporting packages with a crane

Packages with lifting eyes can be transported directly with a crane subject to the following conditions:

- The crane and hoists must be designed for the weight of the packages.
- The operator must be authorised to operate the crane

Attachment

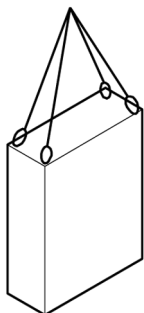


Fig. 15: Transport with a crane

Protective equipment: ■ Protective helmet

1. ➤ Attach ropes, straps or multi-point suspension gear in accordance with Fig. 15.
2. ➤ Ensure that the package hangs straight; if necessary, take account of eccentric centre of gravity.
3. ➤ Start transport.

Transporting pallets with a crane

Attachment

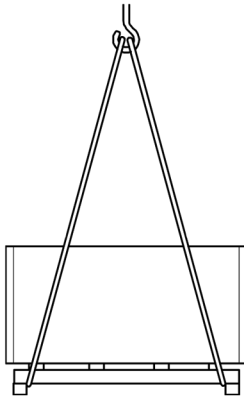


Fig. 16: Attaching the hoist

Packages fixed to pallets can be transported directly with a crane subject to the following conditions:

- The crane and hoists must be designed for the weight of the packages.
- The operator must be authorised to operate the crane.

Protective equipment: ■ Protective helmet

1. ➤ Attach ropes, straps or multi-point suspension gear in accordance with Fig. 16 to the pallet and secure the pallet to prevent slippage.
2. ➤ Check that the packages are not damaged by the lifting gear. Use different lifting gear if necessary.
3. ➤ In the event of an eccentric centre of gravity, ensure that the pallet cannot tip over.
4. ➤ Start transport.

Transporting pallets with a forklift

Transporting

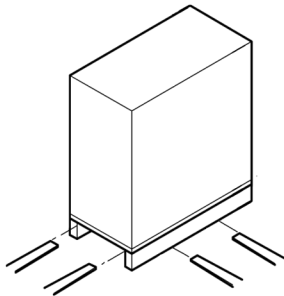


Fig. 17: Transport with a forklift

Packages fixed to pallets can be transported with a forklift subject to the following conditions:

- The forklift must be designed for the weight of the packages.
- The package must be securely fixed to the pallet.

Personnel: ■ Forklift driver

1. ➤ Drive the forklift with the forks between or beneath the pallet struts.
2. ➤ Drive the forks in to such an extent that they protrude from the opposite side.
3. ➤ In the event of an eccentric centre of gravity, ensure that the pallet cannot tip over.
4. ➤ Lift the pallet with its package and start the transport.

5.4 Symbols on packaging

Top



The arrow tips on the sign mark the top of the package. They must always point upwards; otherwise the content could be damaged.

Attach here



Lifting gear (lifting chain, lifting strap) must only be attached to points bearing this symbol.

Centre of gravity



Marks the centre of gravity of packages.

Note the location of the centre of gravity when lifting and transporting.

Weight, attached load



Indicates the weight of packages.

Handle the marked package in accordance with its weight.

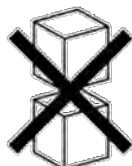
Permitted stacking load



Indicates packages which are partially stackable.

Do not exceed the maximum load-bearing capacity specified in the symbol in order to avoid damaging or destroying the content.

Do not stack



Indicates packages that cannot be stacked.

5.5 Packaging

About packaging

The individual packages are packaged in accordance with anticipated transport conditions. Only environmentally-friendly materials have been used in the packaging.

The packaging is intended to protect the individual components from transport damage, corrosion and other damage prior to assembly. Therefore do not destroy the packaging and only remove it shortly before assembly.

Handling packaging materials

Dispose of packaging material in accordance with the relevant applicable legal requirements and local regulations.



NOTICE!

Danger to the environment due to incorrect disposal!

Packaging materials are valuable raw materials and in many cases can continue to be used or can be properly processed and recycled. Incorrect disposal of packaging materials may pose risks to the environment.

- Dispose of packaging materials in accordance with the environmental regulations.
- Observe locally applicable waste disposal regulations. If necessary, outsource the disposal to a specialist company.

5.6 Storage



NOTICE!

Damage to property due to incorrect storage!

Incorrect storage can cause considerable damage to property.

- Always observe the following instructions on storage:

Storage of packages

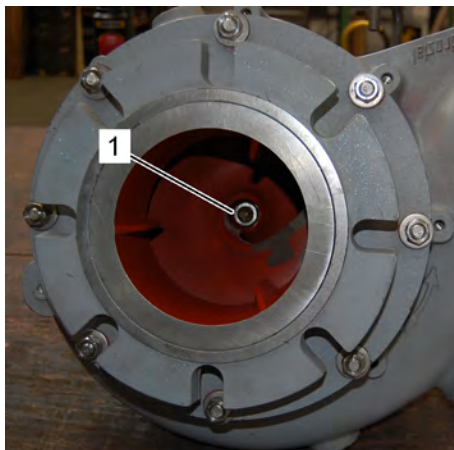


Fig. 18

Store packages under the following conditions:

- Do not store outside.
- Keep dry and dust-free.
- Do not expose to aggressive media.
- Do not expose to any mechanical agitations and vibrations.
- Turn shaft of impeller via front screw (1) every two weeks to prevent oxidation and rust.
- Storage temperature: -10 to 40° C.
- Relative humidity: max. 60 %.
- If storage exceeds 3 months, check general condition of all parts and of packaging in regular intervals. If necessary, refresh or renew preservation ↪ Chapter 3.4 „Operating materials“ on page 22.



It is possible that the packages contain storage instructions that go beyond the requirements mentioned here. Please follow them.

6 Installation and initial commissioning



Installation and initial commissioning shall only be performed by employees appointed by the manufacturer, or by individuals authorised by him. In the event of non-compliance, all warranty claims against manufacturer or his representative shall be forfeited.



WARNING!

Danger due to faulty installation and initial commissioning!

Installation and initial commissioning require trained professionals with adequate experience. Errors during installation can result in fatal situations or considerable property damage.

- Ensure that installation and initial commissioning is performed exclusively by trained professionals or specialist department.

After set-up, completion of installation, initial commissioning and performance of recorded test runs by manufacturer or his representatives, the equipment is handed over to the operating company.

After this, the operating company is allowed to carry out operation as intended in compliance with the information contained in these operating instructions.

6.1 Safety



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing assembly work on devices in explosion-hazard area:

- Obtain written approval before beginning assembly.
- Perform assembly only after exclusion of potentially explosive atmosphere.
- Use only tools that are approved for application in explosion-hazard areas.

Non-observance of these instructions results in loss of explosion protection.

Electrical system

**DANGER!****Danger to life from electric power!**

Contact with live parts may prove fatal. When switched on, electric components can be subject to uncontrolled movements and may cause grave injury or death.

- Switch off the power supply before starting work and make sure that it cannot be switched on again.

Securing to prevent restart

**WARNING!****Danger to life from an unauthorised restart!**

In the event of an unauthorised restart of the power supply during installation, there is a danger of serious injuries or death for persons in the danger zone.

- Switch off all power supplies before starting work and make sure they cannot be switched on again.

Improper installation and initial commissioning

**WARNING!****Danger of injury from an improper installation and initial commissioning!**

Improper installation and initial commissioning can result in serious injury and significant damage to property.

- Ensure sufficient assembly space before starting work.
- Handle exposed, sharp-edged components with caution.
- Pay attention to orderliness and cleanliness in the assembly location! Loosely stacked or scattered components and tools could cause accidents.
- Assemble the components properly. Comply with the specified bolt tightening torques.
- Secure components so that they cannot fall down or topple over.
- Before the initial commissioning, ensure that
 - all installation work has been carried out and completed in accordance with the specifications and instructions in this manual.
 - no persons are in the danger zone.

6.2 Preparations

6.2.1 Set-up location requirements

Prior to installing the device ensure that set-up location meets the following requirements:

- Ensure observance of applicable local safety regulations.
- The set-up location of the pump must be as close to the liquid source as possible.
- Ensure that pump room has sufficient ventilation.
- Ensure that length of supplied cable is sufficient for local requirements.
- The device must not be subject to any vibrations or agitations of adjacent machines or systems. Under no circumstances is the generation of resonance oscillations by the foundation/fastening structure allowed.
- There must be sufficient space for assembly, maintenance and cleaning work.



Manufacturer recommends that a minimum operating space of 1 metre around the device is kept clear for maintenance and servicing work.

For sump installation

In addition to above requirements, observe the following:

- When installing submersible pump in sump, ensure that sump floor is level and smooth.
- For installation and service work above the pump sump, a pulley or chain hoist must be installed. The load capacity of the lifting gear must be at least twice that of the pump weight.
- A water connection with a pressure of about 4 bar (70 psi) must be available to hose down pump when pulling it out of the sump.

6.2.2 Pipeline requirements

- Irrespective of the pump, suction and pressure lines must be supported so as not to place additional load on the pump.
- Temperature or pressure expansion of pipelines are not to affect the pump.

6.2.2.1 Suction line



WARNING!

Explosion hazard and property damage caused by air or gas pockets in suction lines!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Install suction lines in such a way that pump is never operated with positive suction head (pump higher than suction point) and the liquid carries air or gas.
- Do not install any check valves in suction line.
- Install gate valve with horizontal spindle in suction line to prevent air or gas pockets.

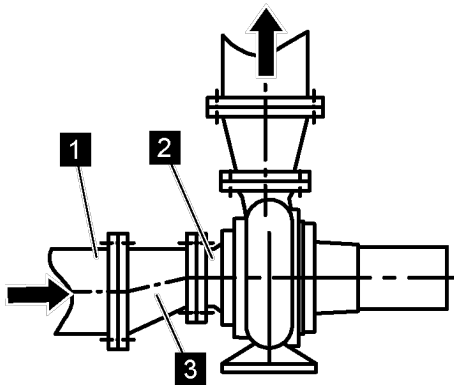


Fig. 19: Horizontal pump installation

- To achieve maximum available suction head, the suction line must be as direct and short as possible and without any bends. If bends are unavoidable, they should preferably have large radii.
- The suction line must be free of counterbores. They result in air accumulations and loss of suction.
- Ensure that suction line is airtight if the medium is to be lifted by suction.
- Install suction line in such a way as to prevent formation of air pockets.

In doing so, observe the following:

- The suction line (1) must point towards the suction inlet (2) of the pump (Fig. 19) or upward (Fig. 20).

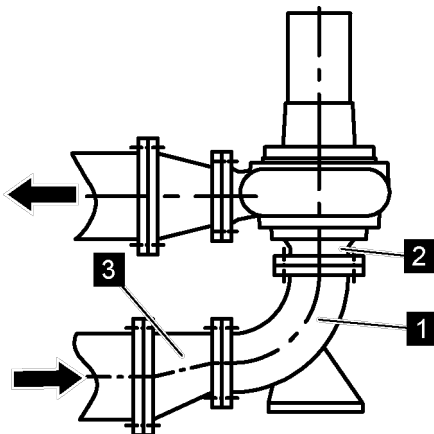


Fig. 20: Vertical pump installation

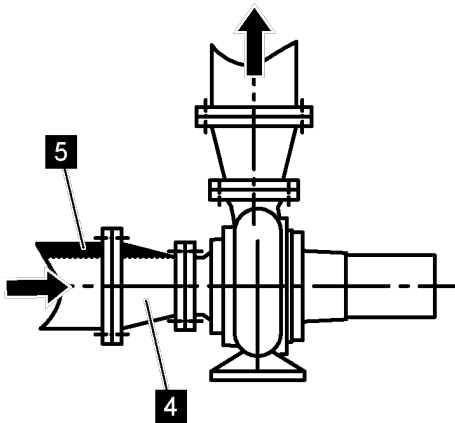


Fig. 21: Air pocket when installing pump horizontally

- Use only eccentric reducers (Fig. 203) whose flat part must be on top. Centric reducers (4) result in air pockets (5).

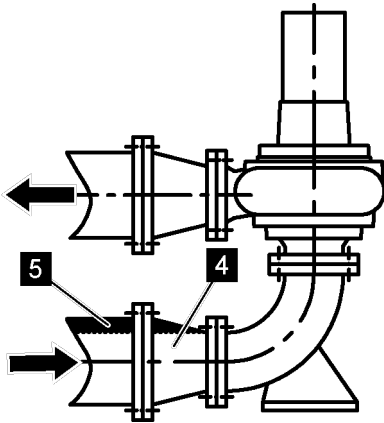


Fig. 22: Air pocket when installing pump vertically

Dimensioning

- To prevent excessive losses, the suction line diameter must be one nominal size larger than the diameter of the pump's suction inlet.

Unusual suction conditions

Unusual suction conditions, such as high liquid temperature, altitude from sea level and high specific gravity, must be compensated by proper planning and adequate dimensioning of the suction line.

6.2.2.2 Pressure line

- Use as few fittings as possible. If the medium is pumped up, guide the line vertically upward starting from the pump, and then horizontally to the outlet point.
- Do not exceed maximum permitted speed if using check valves in the pressure line. The maximum speed for simple check valves in waste water is 3.5 m/s. Exceeding these values can result in pressure shocks when closing check valve: Sealing error by lifting of the surface of the mechanical seal, or coolant loss.

6.3 Initial set-up

The pump may be installed horizontally or vertically.

6.3.1 Installing pump in sump

Personnel: ■ Qualified personnel

Protective equipment: ■ Protective clothing

■ Safety gloves

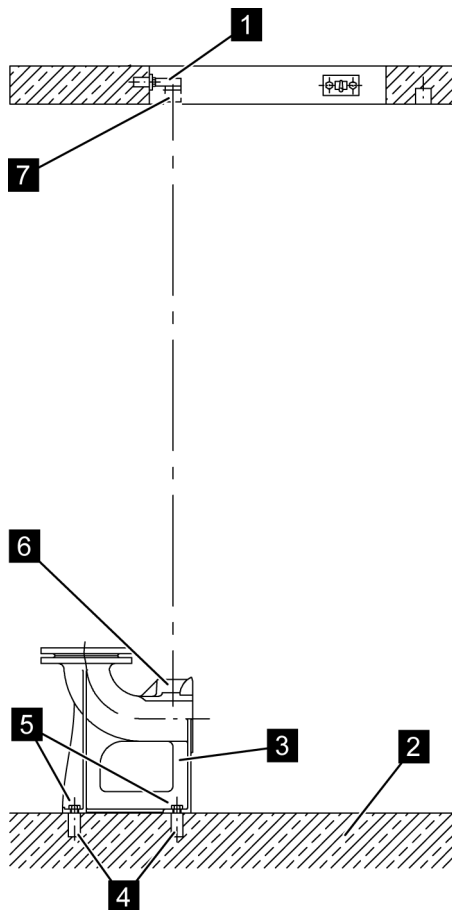
■ Protective helmet

■ Safety boots

Special tool: ■ Pulley or chain hoist

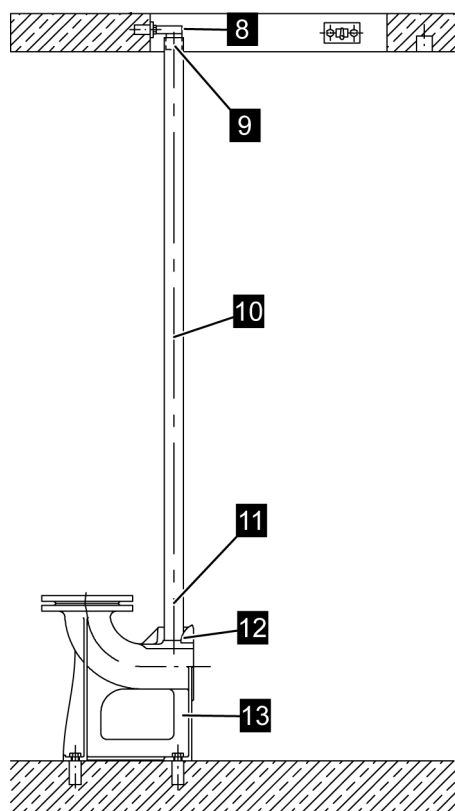
1. ➤ Ensure that there is no potentially explosive atmosphere.
2. ➤ Ensure that the sump floor at installation site of pump is level and smooth.

Installing pump guide rail system:



3. ➤ Complete foundation (2).
4. ➤ Wait until foundation has hardened (if cast-in sleeves (4) are used).
5. ➤ Fasten pipe bracket (1). Make sure that there is enough space available for the slide shoe.
6. ➤ Attach outlet bracket (3) with cast-in sleeves (4) or expansion anchors and nuts (5) to sump floor.
7. ➤ Ensure that guide tube bolts or recesses (6) of outlet bracket (3) are vertically aligned with the guide tube bolts (7) of the pipe bracket (1).

Fig. 23



- 8.** ➤ Produce guide tube (10) from galvanized steel pipe (or stainless steel).
- 9.** ➤ Cut guide tube (10) to correct length.
- 10.** ➤ Push lower pipe end (11) over guide tube bolts or into recesses (12) of outlet bracket (13).
- 11.** ➤ Unscrew pipe bracket (8) and insert into upper pipe end (9).
- 12.** ➤ Attach pipe bracket (8) again.
- 13.** ➤ Ensure that guide tube (10) is vertical and parallel.

Fig. 24

Installing pressure line:

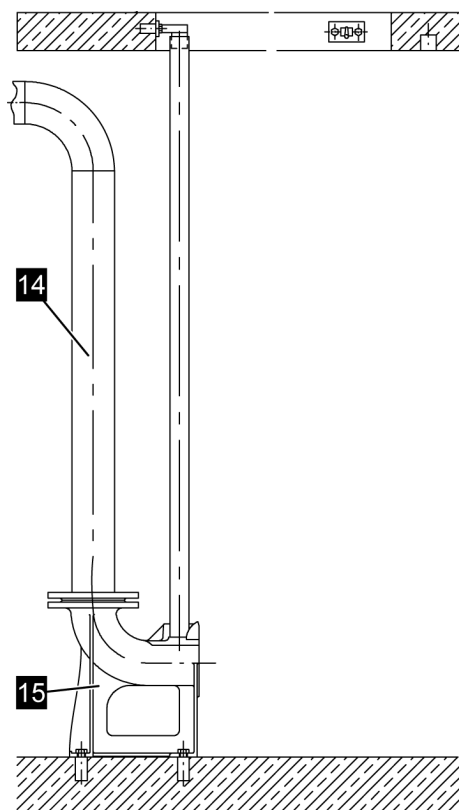


Fig. 25

- 14.** ▶ Install pressure line (14) to outlet bracket (15) ↗ *Chapter 6.2.2.2 „Pressure line“ on page 46.*
- 15.** ▶ Ensure that pressure line (14) is connected to outlet bracket (15) without any tension or misalignments.
- 16.** ▶ Connect pump to energy supply ↗ *Chapter 6.3.3 „Connecting to energy supply“ on page 53.*

Lowering pump into sump:



Fig. 26

- 17.** ▶ Carefully remove old construction waste and other solid parts from sump floor.
- 18.** ▶ Check rubber seal (1) at pump outlet for damages and correct position in the groove.
- 19.** ▶ Using a brush, lubricate rubber seal with standard grease.

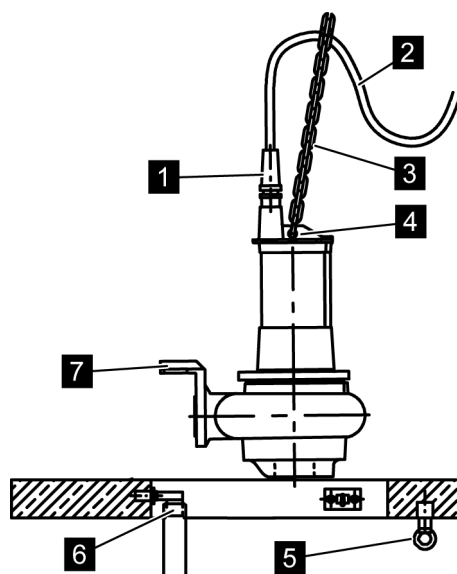


Fig. 27

- 20.▶ Correctly attach hoisting chain or steel hoisting rope (3) to suspension lugs (4).

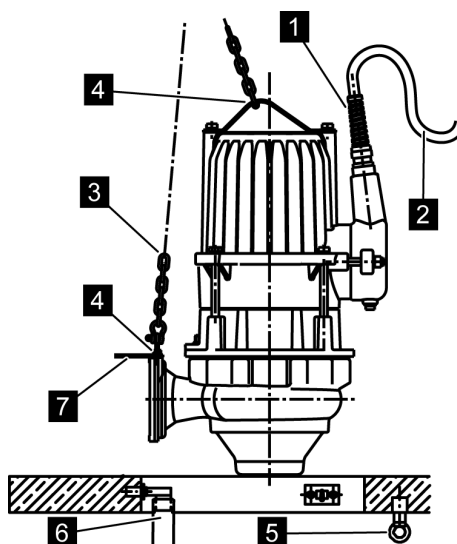


Fig. 28

- 21.▶ Check cable inlet (1) for damage.
 22.▶ Ensure that the cable (2) is firmly clamped in the cable inlet (1).
 23.▶ Feed cable (2) through the cable bracket (5). Make sure that cable is long enough to follow the pump.
 24.▶ Lift pump with crane and move directly over the guide rail (6) until the slide shoe (7) engages.

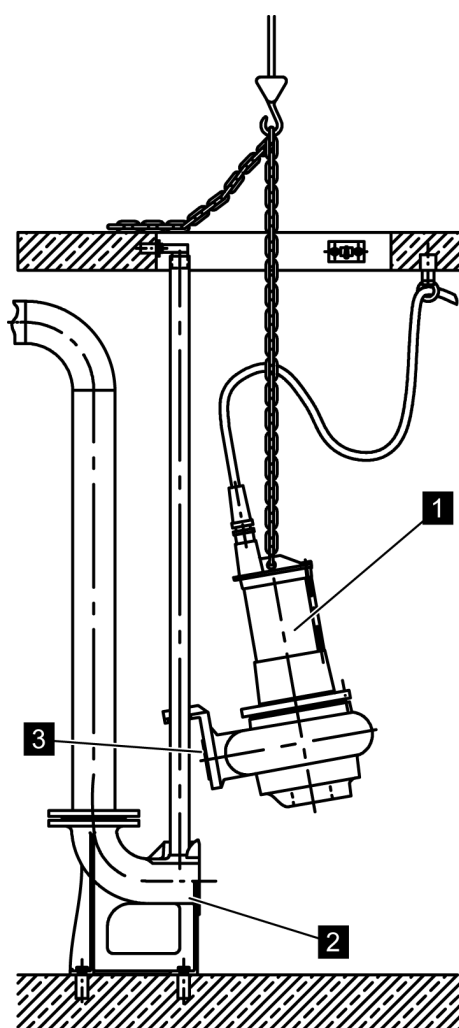


Fig. 29

- 25.** Lower pump (1) until it rests against the outlet bracket (2). The fitting surfaces are sealed by means of the rubber seal (3) that is installed in the slide shoe at the outlet flange. The empty weight of the pump pushes it onto the outlet bracket (2) (as soon as the pump is in its place).

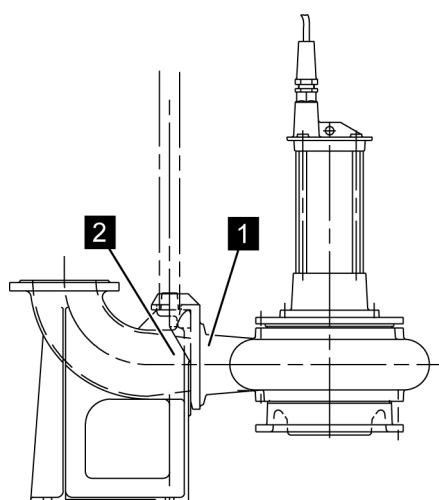
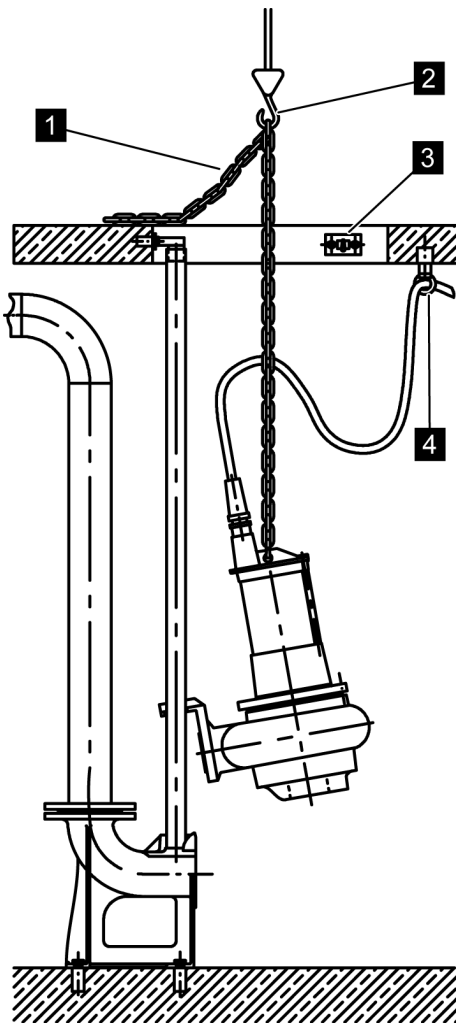


Fig. 30

- 26.** Ensure proper connection between pump (1) and outlet bracket (2).



27. ➤ Release hoisting chain (1) from crane (2) and firmly fasten to chain bracket (3).



WARNING!

Risk of injury and damage to property due to loose hoisting chain and cable!

Loose hoisting chain or cable can be drawn into the suction inlet of the pump. This can result in considerable personal injury and property damage.

- Always fasten cable to cable bracket (4).
- After installation and maintenance work, always fasten hoisting chain to chain bracket (3).

6.3.2 Installing pump dry

- Personnel: ■ Qualified personnel
- Protective equipment: ■ Protective clothing
 ■ Safety gloves
 ■ Protective helmet
 ■ Safety boots



If a pulley or chain hoist is used for pump installation, perform the steps according to chapter "Installing pump in sump".

1. ➤ Ensure that there is no potentially explosive atmosphere.
2. ➤ Complete foundation.
3. ➤ Wait until foundation has hardened (if cast-in sleeves are used).

4. ➤ Install suction and pressure lines ☞ *Chapter 6.2.2 „Pipeline requirements“ on page 44.*
5. ➤ Connect pump to energy supply ☞ *Chapter 6.3.3 „Connecting to energy supply“ on page 53.*
6. ➤ Remove all construction waste from pump basin.
7. ➤ Mount pump to foundation.
8. ➤ Ensure that suction and pressure lines are equipped with all seals.
9. ➤ Mount suction line (1) and pressure line (2) to pump flange and tighten screws evenly.



Fig. 31



WARNING!

Risk of explosion and damage to property due to pipeline pressure!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Never expose pump casing to pipeline pressure.
- When connecting the pipelines, always tighten screws evenly and ensure a solid fit.
- Ensure that flanges are parallel.
- Ensure that base plate or suction bend are fastened to the foundation.

6.3.3 Connecting to energy supply

- | | |
|-----------------------|-----------------------|
| Personnel: | ■ Trained electrician |
| Protective equipment: | ■ Protective clothing |
| | ■ Protective helmet |
| | ■ Safety boots |



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Any work on electrical system must be performed by authorized electricians.
- Make sure that cable ends never get in contact with water during connection to power supply. This could cause a short circuit.
- Never open motor to connect power supply. Opening the motor can damage the hermetic seal applied in the factory.

Connection table

Each cable set has three or six power current leads per rotational speed, a ground conductor and additional conductors for overtemperature protection and leakage monitoring.

The power current leads of the motor are marked according to the following table:

Motor type	Number of revolutions	Number of conductors	Speed	Winding connection	Designation at cable end, according to standard DIN VDE 0530
up to 4 kW, direct start	1	3 + C + E		Y	U1 V1 W1
via 4 kW star delta start	1	6 + C + E		Δ	U1 V1 W1 W2 U2 V2
Dahlander pole changing Y/YY for two speeds, direct start	2	6 + C + E	N	Y	1U 1V 1W
			H	YY	1U 1V 1W 2U 2V 2W
Pole-changing motor, all speeds with direct start	2	6 + C + E	N	Y	1U1 1V1 1W1
			H	Y	2U1 2V1 2W1
Pole changing motor, low speed: Direct start, high speed: Star delta start	2	9 + C + E	N	Y 1)	1U1 1V1 1W1
			H	Δ	2U1 2V1 2W1 2U2 2V2 2W2
Pole changing motor, low and high speed with star delta start	2	12 + C + E	N	Δ	1U1 1V1 1W1 1U2 1V2 1W2
			H	Δ	2U1 2V1 2W1 2U2 2V2 2W2

The following abbreviations are used in the table:

Designation	Abbreviation	Explanation
Number of conductors	E	Earthing (yellow-green)
	C	Control conductor
Speed	N	Low speed
	H	High speed
Winding connection	Y/YY	Direct start (Dahlander)
	Δ	The starting current at this speed is lower than the starting current at high speed during star delta start
	1)	Star delta start possible



Seal monitoring is located in a separate cable, which is led through the motor.

1. ➔ Turn impeller by hand to ensure free rotation.
2. ➔ Check motor cover (2) and cable inlet (1) for visible damage.
3. ➔ Ensure that the cable is firmly clamped in the cable inlet (1).
4. ➔ Perform electrical connections according to electrical diagram ↪ *Chapter 11 „Appendix“ on page 105.*
5. ➔ Ensure that PTC thermistor is connected in such a way that motor is deenergized without delay in case of overheating ↪ *Information label on motors with PTC thermistor.*



Non-observance results in forfeiture of all warranty claims.

6. ➔ Check rotational direction ↪ *Chapter 6.3.4 „Check rotational direction“ on page 56.*
7. ➔ Ensure that the options are installed correctly. ↪ *Chapter 6.3.5 „Requirements on installation of options“ on page 57.*

Fig. 32

When establishing connection to power supply, observe the following:

Electrical controls and junction boxes	<ul style="list-style-type: none"> ■ The electrical controls and junction boxes of the pump's power supply cable must be installed above the anticipated flood level. They should be adequately sealed and/or ventilated to prevent interior condensation.
Lowest threshold value (temperature controller)	<ul style="list-style-type: none"> ■ Connect control conductors 1 and 3 in such a way to allow automatic restart of motor after it has cooled down and circuit is closed again. An overheated motor can resume operation as soon as it is submerged again in cooling water.
Highest threshold value (temperature limiter)	<ul style="list-style-type: none"> ■ Connect control conductors 1 and 2 in such a way to prevent automatic restart of motor. In case of malfunction it must be determined why the temperature control circuit did not switch off first. The malfunction must be corrected before motor is started up again.
Temperature sensor	<ul style="list-style-type: none"> ■ Motor is only deenergized by the temperature sensors if it gradually overheats due to an electrical malfunction. This device does not provide protection against fast temperature increase caused by overload, such as a locked rotor. They are therefore no adequate substitute for the specified overcurrent circuit breakers (e.g. for pump stations with several pumps).

6.3.4 Check rotational direction

- Personnel: ■ Trained electrician
- Protective equipment: ■ Protective clothing
■ Protective helmet
■ Safety boots



WARNING!

Risk of injury and damage to property due to incorrect rotational direction!

Incorrect rotational direction can result in serious injuries or property damages.

- In case of incorrect rotational direction, switch only the pump's cable conductors or speed with wrong rotational direction at the corresponding starting switch in the control panel.
- Never switch the primary feeders to the control panel. This reverses the rotational direction of all pumps at all speeds.

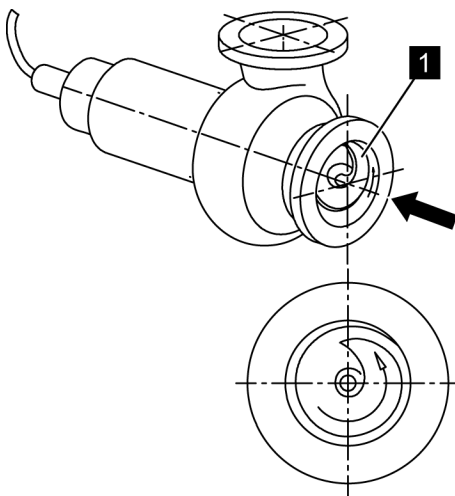


Fig. 33

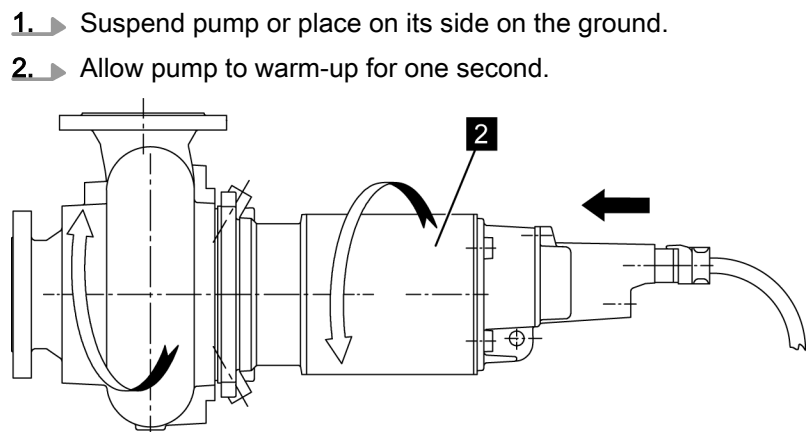


Fig. 34

1. ➔ Suspend pump or place on its side on the ground.
2. ➔ Allow pump to warm-up for one second.
3. ➔ Ensure that rotational direction of impeller (1) is counter clockwise as seen from suction end (Fig. 33). The starting jerk must act counter clockwise as seen from the drive end of the motor (2) (Fig. 34).
4. ➔ On pump units with several speeds, repeat points 2 to 3 for each speed.



In case of incorrect rotational direction on systems with several speeds or pumps, switch speed with wrong rotational direction at the corresponding starting switch in the control panel.

6.3.5 Requirements on installation of options



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing assembly work on devices in explosion-hazard area:

- Use only electrical equipment that is approved for application in explosion-hazard areas.

Non-observance of these instructions results in loss of explosion protection.

It is recommended to install the following options:

- "Manual – Off – Automatic" switch
- Low voltage terminals for level switch
- Signal lamps "Pump on" and "Pump defective"
- Operating hours counter ↗ „*Operating hours counter (optional)*“ on page 34
- Changeover switch for pump stations with several pumps
- Alarm system for high sump level with separate power supply. This ensures uninterrupted protection in case of main power supply failure.
- Moisture probe ↗ „*Moisture probe (6) (optional)*“ on page 34
- Float switch ↗ „*Float switch (5) (optional)*“ on page 34
- Bearing temperature probe ↗ „*Bearing temperature probe in lower bearing (optional) (4); in upper bearing (optional) (2)*“ on page 34

When installing the options, observe the following:

Level switch

- For the level switches (switching on and off), use control systems that are suitable for the liquid that is being delivered.
- Use float switches for the high level alarm, even if another type is used for the pump control.
- To prevent wrong alarm, arrange float switches for the alarm at reasonable distance.

Level control

- Set level switches "ON" and "OFF" in such a way to allow for sufficient sump volume in between. This prevents that the pump is switched on more than 10 times per hour. More starts can cause damage to the controls in the control panel. This also increases power consumption. The minimum sump volume is calculated with the following formula:

$$V = \frac{0,9 \times Q_p}{Z}$$

Fig. 35: Formula minimum sump volume

V = Capacity or sump volume between switch-on and switch-off level (in cubic metres)

Q_p = Flow rate of a pump (litres per second)

Z = Number of starts per hour (Z = max. 10)

6.3.6 To be done prior to starting the pump

Personnel: ■ Instructed person (operator)

Protective equipment: ■ Protective clothing

■ Protective helmet

■ Safety boots

1. ➤ Ensure that all level controls are set correctly. The switch-off level must be high enough to prevent air from entering the pump part.
2. ➤ Ensure that all inlet and outlet valves on suction and pressure side are completely open.
3. ➤ Immerse pump sump.
4. ➤ Calculate sump in such a way as to prevent pump from running dry under normal conditions ↪ Chapter 7.4 „Required submer-sion depth“ on page 63.
5. ➤ Ensure that there is no potentially explosive atmosphere.



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Never allow dry pumping or pumping against closed gate valve (except check valve).
- Start pump only after exclusion of potentially explosive atmosphere.

6. ➤ Vent air between pump and check valve if necessary.

Vent air between pump and check valve

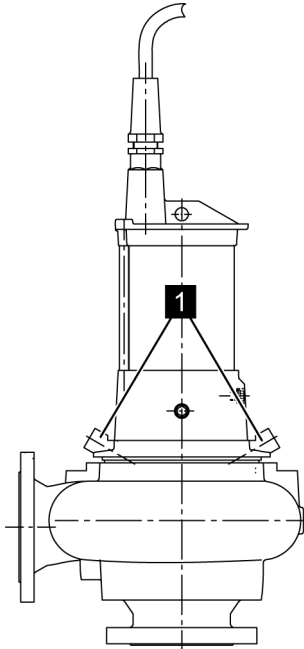


Fig. 36

Personnel: ■ Instructed person (operator)

1. ➤ If a check valve is installed near the pump, air can collect between pump and check valve. To allow pump to prime, the air must be vented from the casing or pressure line (upstream of check valve) during initial commissioning.
2. ➤ Maintain flush water pressure via pressure regulator at 0,5 to 1 bar (7 to 14 psi) above outlet pressure.
3. ➤ Flush pump for 60 seconds. The water is controlled by means of a solenoid valve and a timer, and drained via flush water connections (1).
 - ⇒ The flush water rate fluctuates depending on pump size and application. Usually flow rates of 6-8 litre per minute are adequate.



If pump is operating with positive suction head (pump above suction level), it can be evacuated via jet or vacuum pump. Vertically installed HIDROSTAL solids handling pumps are self-priming when the impeller tip is submerged into the liquid to be pumped and an automatic vent valve is connected to the pump casing or the pressure line (between pump and check valve).

6.3.7 Starting the pump

Personnel: ■ Trained electrician

Protective equipment: ■ Protective clothing
■ Protective helmet
■ Safety boots

1. ➤ Ensure that no persons are in the danger zone.
2. ➤ Switch on pump in manual mode.
3. ➤ Measure power input separately in each phase.
4. ➤ Write down measured values and compare to information on type plate.



If power input is more than 5% higher, shut down pump, determine cause and correct malfunction ➤ Chapter "Malfunctions" → Malfunction „Motor overloaded“.

5. ➤ Switch pump to automatic mode.
6. ➤ Allow basin to be emptied several times.
7. ➤ Ensure that level switch is set correctly and functions properly.

8. ➤ Ensure that alarm system and changeover switch (if installed in control panel) function correctly.
9. ➤ Record date and operating hours to determine the actual operating hours for maintenance.

7 Operation

Improper operation


WARNING!
Danger of injury from improper operation!

Improper operation can result in serious injury and significant damage to property.

- Carry out all operating steps in accordance with the specifications and instructions in this manual.
- Before starting work, ensure that
 - all covers and safety devices are installed and functioning properly.
 - no persons are in the danger zone.
- Never disable or bypass safety devices during operation.

7.1 Switching on

- | | |
|-----------------------|--------------------------------|
| Personnel: | ■ Instructed person (operator) |
| Protective equipment: | ■ Protective clothing |
| | ■ Safety boots |


WARNING!
EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Never allow dry pumping or pumping against closed gate valve (except check valve).
- Start pump only after exclusion of potentially explosive atmosphere.

1. ➞ Ensure that all inlet and outlet valves on suction and pressure side are completely open.
2. ➞ Ensure that there is no potentially explosive atmosphere.
3. ➞ Ensure that no persons are in the danger zone.
4. ➞ Place main switch of system in „On“ position.

7.2 Switching off

➔ Place main switch of system in „Off“ position.

7.3 Standard operation

„Automatic mode“ is the pump's standard operating mode.



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area.

- Never operate pump with positive suction head (pump above suction point). This prevents that air or gas is entrained in the liquid.
- Avoid vortex formation.
- Keep medium from drying out.
- Never operate pump with closed or clogged suction and pressure line.
- Do not operate pump in continuous operation in duty points that are outside the outlet pressure - flow rate curve: High outlet pressure at low flow rate or low outlet pressure at high flow rate.

The duties and responsibilities of the operator are restricted to the following activities during operation:

- Flushing of pump in case of high concentrations of dirt or sludge
- Draining of pump when shut down for more than 14 days
- Reaction to malfunctions ➔ *Chapter 9 „Malfunctions“ on page 95*

Flushing of pump

- Personnel: ■ Instructed person (operator)
- Protective equipment: ■ Protective clothing
■ Safety boots

In special cases, e.g. high concentrations of dirt or sludge, accumulated solids (between impeller and mechanical seal on pump side) can be periodically flushed away.

1. ➔ Maintain flush water pressure via pressure regulator at 0,5 to 1 bar (7 to 14 psi) above outlet pressure.
2. ➔ Flush pump for 60 seconds. The water is controlled by means of a solenoid valve and a timer, and drained via the flush water connection (1).

The flush water rate fluctuates depending on pump size and application. Usually flow rates of 6-8 litre per minute are adequate.



The frequency of flushing must be determined individually for each system.

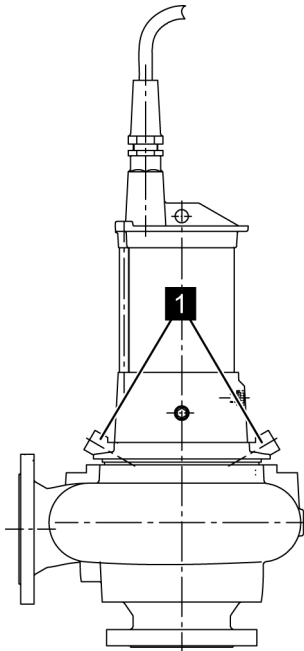


Fig. 37

Draining of pump

- When shut down for more than 14 days, drain pump completely. This prevents movable parts from being stuck due to corrosion.
- Turn pump every 14 days (by hand or by switching impulse) to lubricate mechanical seal.

7.4 Required submersion depth

7.4.1 Submersible motors (cooling method "N")

Submersible motors perform at their maximum level when staying submerged in liquid.

However, on submersible motors it is permitted to install the switch-off level below the upper edge of the motor.

Dry run times

The possible dry run time of a pump depends on ambient temperature and liquid temperature, hydraulic load of motor and duty point on pump curve.

The following times are maximum operating times for a fully loaded motor, which is first fully submerged in a liquid of 15 °C and then suddenly operates in 40 °C air:

Size of motor	Dry run time
B, Y, 002, 003	5 minutes
Z, X, 004, 006, 007	7 minutes
4/W, 5/V, 6/U, 7/T, 014, 020, 030, 090, 130	9 minutes
300/S	15 minutes

If motor operates in air for a longer time, it is shut down by the over-temperature fuse circuit and suffers no damage. The sump must have sufficient volume to hold the inflowing liquid until motor has cooled down and can be restarted.

Cool-down periods

Approximate cool down periods for the various motor sizes at maximum liquid temperature of 15 °C:

Size of motor	Cool down period to restart
B, Y, 002, 003	3 minutes
Z, X, 004, 006, 007	4 minutes
4/W, 014, 020	5 minutes
5/V, 030	8 minutes
6/U, 090, 130	11 minutes
7/T	15 minutes
300/S	20 minutes



If sump construction requires that motor runs for an extended period while not fully submerged, use immersible electric motors with independent cooling Chapter 7.4.2 „Immersible electric motors (cooling method "E", "K", "F")“ on page 64.

7.4.2 Immersible electric motors (cooling method "E", "K", "F")

Dry run times

Immersible electric motors can operate continuously in fully submerged condition or in completely dry environment.

Cool-down periods

For cooling purposes, the motors must not be continuously immersed.

To start the pump, the "ON" level must be at least as high as the impeller tip.

7.5 Special conditions

Operation around the freezing point


WARNING!

Risk of injury and damage to property due to ice formation and bursting construction!

Ice formation and bursting construction when operating pump around the freezing point can result in severe injuries.

- When operating pump around the freezing point, drain all hollow spaces filled with medium by opening the according plugs.

Pump operation in food sector


WARNING!

Hazard due to deposition of harmful substances and bacteria!

Lack of hygiene can cause diseases and infections.

- Drain and clean pump on a regular basis. Intervals of cleaning work ↗ *separate operating instructions for food system*.

7.6 Emergency shutdown

Emergency shutdown

In a danger situation, it is vital to stop components moving as quickly as possible and to switch off the power supply.

Proceed as follows in an emergency:

1. ➤ Immediately use the emergency stop device to trigger an emergency stop.
2. ➤ Rescue people from the danger zone.
Initiate first aid measures.
3. ➤ Notify a doctor and the fire brigade.
4. ➤ Notify those responsible at the place of use.
5. ➤ Switch off the main switch and secure to prevent a restart.
6. ➤ Keep access routes clear for emergency service vehicles.
7. ➤ If warranted by the gravity of the emergency, notify the responsible authorities.
8. ➤ Delegate specialist personnel to rectify the fault.

After rescue measures have been taken



WARNING!

Danger to life from an unauthorised restart!

In the event of an unauthorised restart of the power supply, there is a danger of serious injuries or death for persons in the danger zone.

- Before a restart, ensure that there are no persons still in the danger zone.

- 9.** ➤ Before the restart, check the system and ensure that all safety devices are installed and fully functional.

8 Maintenance

8.1 Safety


WARNING!
EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing assembly work on devices in explosion-hazard area:

- Obtain written approval before beginning maintenance work.
- Perform maintenance work only after exclusion of potentially explosive atmosphere.
- Use only tools that are approved for application in explosion-hazard areas.
- Non-observance of these instructions results in loss of explosion protection.

Electrical system


DANGER!
Danger to life from electric power!

Contact with live parts may prove fatal. When switched on, electric components may be subject to uncontrolled movements and may cause grave injury.

- Switch off the power supply before starting work and make sure that it cannot be switched on again.

Securing to prevent restart


WARNING!
Danger to life from an unauthorised restart!

In the event of an unauthorised restart of the power supply during maintenance, there is a danger of serious injuries or death for persons in the danger zone.

- Switch off all power supplies before starting work and make sure they cannot be switched on again.

Improperly executed maintenance work



WARNING!

Danger of injury from improperly executed maintenance work!

Improper maintenance may result in serious injury and significant damage to property.

- Ensure sufficient assembly space before starting work.
- Pay attention to orderliness and cleanliness in the assembly location! Loosely stacked or scattered components and tools could cause accidents.
- If components have been removed, pay attention to correct assembly, refit all fixing elements and comply with bolt tightening torques.
- Before the restart, ensure that
 - all maintenance work has been carried out and completed in accordance with the specifications and instructions in this manual.
 - no persons are in the danger zone.
 - all covers and safety devices are installed and functioning properly.

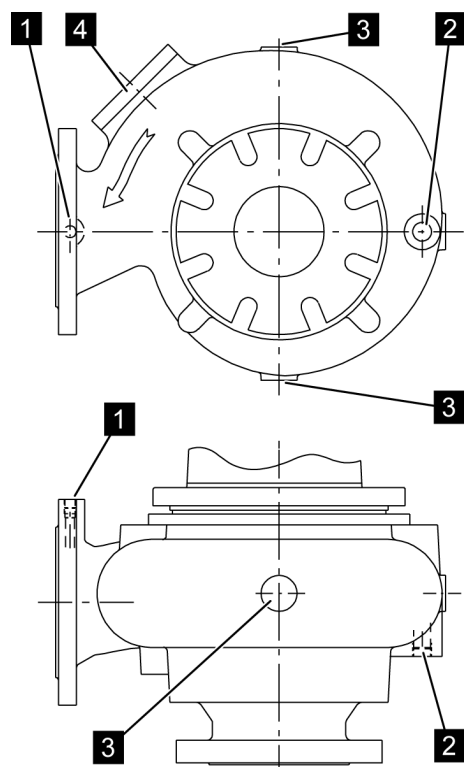
8.2 Maintenance schedule

The sections below describe the maintenance work required to ensure optimal and smooth operation of the system.

If increased wear is found during regular checks, the required maintenance intervals should be shortened in accordance with the actual wear occurrences. Contact the manufacturer in the event of queries regarding maintenance work and intervals; see the service address on page 2.

Interval	Maintenance task	Personnel
Weekly	Check pump for damages ↗ <i>Chapter 8.4.1 „Visual condition check“ on page 71</i>	Instructed person (operator)
Monthly	Check function of level control, correct if necessary ↗ <i>Chapter 6.3.5 „Requirements on installation of options“ on page 57</i>	Instructed person (operator)
Initially after about 1000 oh (operating hours)	Check oil level ↗ <i>Chapter 8.4.4 „Check oil level“ on page 86</i>	Qualified personnel
Semi-annual	Check flow rate and outlet pressure according to flow rate – outlet pressure curve ↗ <i>Technical data sheets</i> , readjust impeller clearance if necessary ↗ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
Annually	Check electric motor and cable for damage	Trained electrician
	Check overcurrent relay, fuses and time relay (if available) for accurate setting, correct if necessary	Trained electrician
	Check insulation resistance of motor winding and cable ↗ <i>Chapter 8.4.3 „Check insulation resistance“ on page 85</i>	Trained electrician
	Check mechanical seal on motor side in motor casing	Manufacturer (service centre)
	Check mechanical seals on pump side	Manufacturer (service centre)
	Check oil level ↗ <i>Chapter 8.4.4 „Check oil level“ on page 86</i>	Qualified personnel
	Check oil quality ↗ <i>Chapter 8.4.5 „Check oil quality“ on page 88</i>	Qualified personnel
	Check impeller clearance, readjust if necessary ↗ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Qualified personnel
If needed	change oil ↗ <i>Chapter 8.4.6 „Change oil“ on page 90</i>	Qualified personnel
	Revision work	Manufacturer (service centre)

8.3 Service connections and inspection openings



- 1 Connection at pressure flange
- 2 Connection as drain opening for horizontally installed pumps with vertical outlet
- 3 Position of additional connections for horizontally installed pumps with horizontal outlet
- 4 Inspection opening on casing for checking hydraulics (starting at hydraulic size E05Q/E125)

The service connections (1), (2) and (3) are for transport of the pump.

The inspection opening (4) is used to check the hydraulic system during repair work.

Inspection openings are only to be opened at complete standstill and with power supply switched off and protected against restart.

The inspection openings can only be opened with tools. After completion of work and before restart, the inspection openings must be closed and all fasteners properly mounted again.



Refer to the following table for the size of connection thread for connections (1) and (2).

Fig. 38

Hydraulic type designation	Size of connection thread		Diameter
	Connection (1)	Connection (2)	
B02Q	G ½"	-	-
B050	G ½"	G ¼"	-
B0BQ/B065	G ½"	-	30
C0CQ	-	-	-
C080/C03Q	G ½"	G ¼"	-
D0DQ	-	-	-
D03Q/D04Q/D080/D100	G ½"	G ¼"	35
D03R/DE3R/D04R/DE4R	G ½"	G ¼"	40
D03H/DE3H/D03M/DE3M/D04M/DE4M	-	G ¼"	40
D03U/DE3U/D04U/DE4U	G ½"	G ¼"	40
D06M	-	G ½"	40
D06U/E03Q/E080	G ½"	G ½"	35
E0EQ	-	-	-
DE5Q/E05Q/E125/E08Q/E06U/E08U/E200	G ½"	G ½"	50

Hydraulic type designation	Size of connection thread		Diameter
	Connection (1)	Connection (2)	
E06M/E08M	-	G ½"	40
F06Q/F150	G ½"	G ½"	60
H125/H08Q/H200	G ½"	G ½"	35
L12Q/L300/L20Q/L500	G 1"	G ½"	60
M16Q/M400	G 1"	G ½"	60
M28Q/M700	G 2"	G ½"	60

8.4 Maintenance work



WARNING!

EXPLOSION PROTECTION!

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing maintenance work on device in explosion-hazard area:

- When unfastening the power supply cable at the control panel, make sure that cable ends never get in contact with water. This could cause a short circuit.
- Place protective plastic tube on cable ends or wrap cable ends in a plastic sack and seal with tape.
- Never open motor. This can damage the hermetic seal applied in the factory.

8.4.1 Visual condition check

Personnel: ■ Instructed person (operator)

Protective equipment: ■ Protective clothing

■ Safety gloves

■ Safety boots

1. ➞ Turn off pump or system and protect against restart.
2. ➞ If pump is submerged in sump, pull pump from sump with pulley or chain hoist.
3. ➞ Hose down pump with water.
4. ➞ Check pump and motor for mechanical damages.
5. ➞ Check motor cover and cable inlet for visual damages.

6. ➤ Ensure that cables are firmly clamped in the cable inlet.

8.4.2 Check/readjust impeller clearance

Personnel: ■ Instructed person (operator)

Protective equipment: ■ Protective clothing

■ Safety boots

Special tool: ■ Feeler gauge

1. ➤ Turn off pump or system and protect against restart.
2. ➤ If pump is submerged in sump, pull pump from sump with pulley or chain hoist.
3. ➤ If necessary, hose down pump with water and lay on side (Fig. 39).



Fig. 39

8.4.2.1 Check impeller clearance "C"

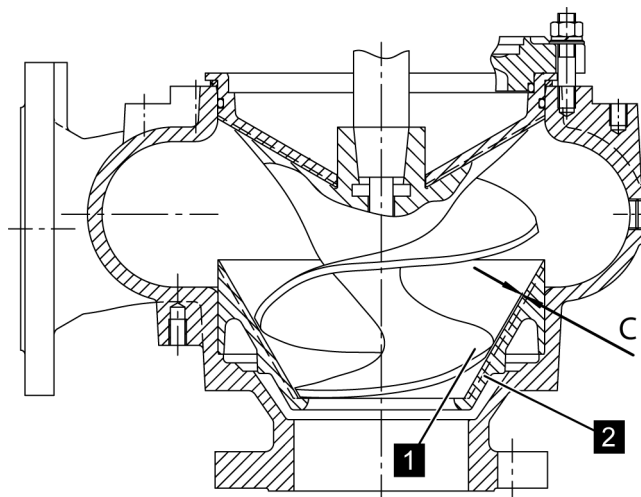


Fig. 40



Fig. 41

Impeller clearance "C" is clearance between impeller (1) and inlet cone (2).

1. ➤ Measure clearance between impeller (2) and inlet cone with feeler gauge (1) after 0, ¼, ½ and ¾ impeller rotations.
2. ➤ Compare measured values with value specified in the following table.

Hydraulic size	Impeller clearance "C"
B	0,2 mm
C, D	0,3 mm
E	0,4 mm
F	0,6 mm
H	0,8 mm
I	1,0 mm
L, M	1,5 mm

3. ➤ If the measured values do not match the specified values, readjust impeller clearance ☞ *Chapter 8.4.2.1 „Check impeller clearance "C" on page 72.*

8.4.2.2 Readjust impeller clearance "C"

8.4.2.2.1 Adjustable pump with three adjusting screws

The impeller clearance is set via three adjusting screws (arrows) on the casing.

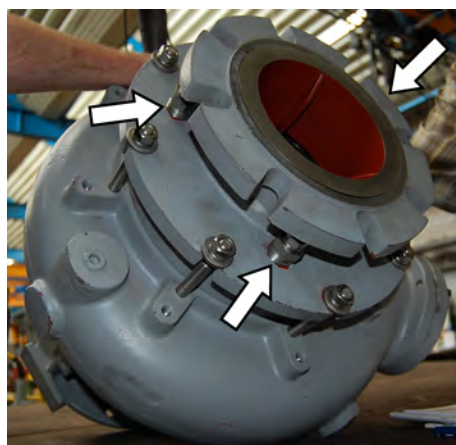


Fig. 42

1. ➤ Perform chapter "Check impeller clearance "S" ☞ *Chapter 8.4.2.3 „Check impeller clearance "S" on page 83.*

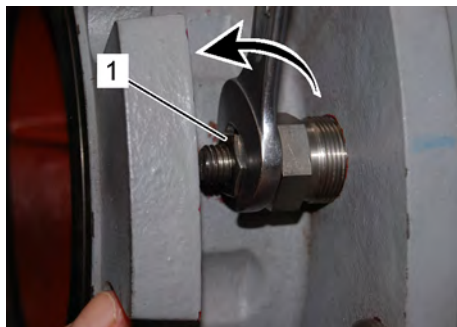


Fig. 43

2. ➤ Loosen locknut (1) counter clockwise and turn back.



Pump types L500 and M700 have two locking screws beside the adjusting sleeves. Loosen them before setting the clearance, then tighten them again.

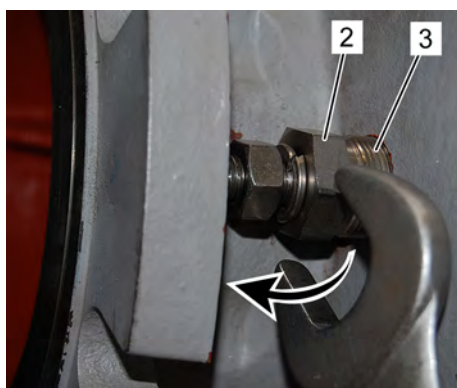


Fig. 44

3. ➤ Slowly and evenly tighten all three adjusting sleeves (3) clockwise by means of hexagon nut (2), until inlet cone is blocked by pump shaft. Ensure that the same amount of rotations are performed on each adjusting sleeve, allowing inlet cone to remain concentric to the impeller.

The clearance between impeller and inlet cone is cancelled.

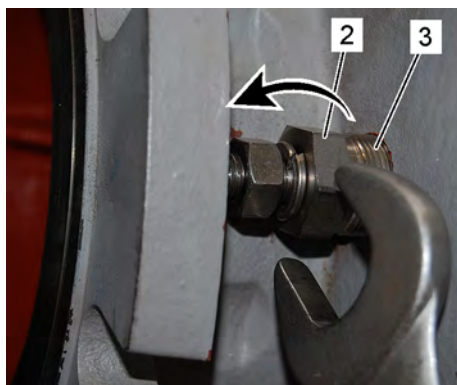


Fig. 45

4. ➤ Turn back all three adjusting sleeves (3) evenly via hexagon nut (2) counter clockwise (e.g. by $\frac{1}{3}$ rotation).

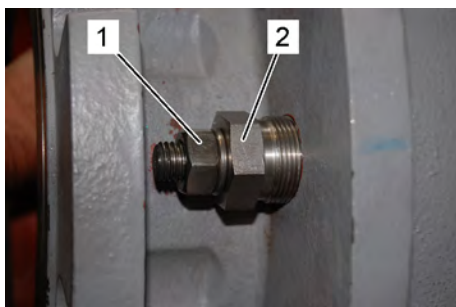


Fig. 46

5. ➤ Hold locknut (2) with spanner and tighten hexagon nuts (1) clockwise.

The inlet cone is pulled back from the impeller by the required clearance and the adjusting sleeves (3) are firmly clamped again.



Fig. 47

6. ➤ Check clearance between impeller (2) and inlet cone with feeler gauge (1) after 0, 1/4, 1/2 and 3/4 impeller rotations ↻ *Table from chapter 8.4.2.1 Check impeller clearance "C" on page 72.*

In case of non-uniform clearance



In case impeller clearance is irregular or too large, have wear parts of pump checked for wear by a service centre.

In case of uniform clearance

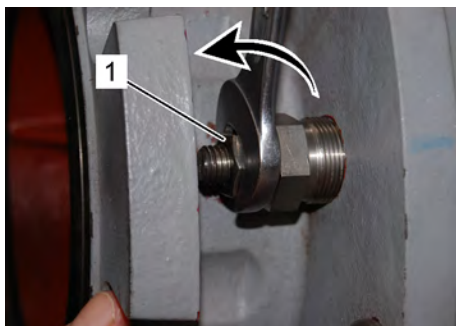


Fig. 48

If the impeller clearance is uniform and deviates from value in table, proceed as follows:

1. ➤ Loosen locknut (1) counter clockwise and turn back.

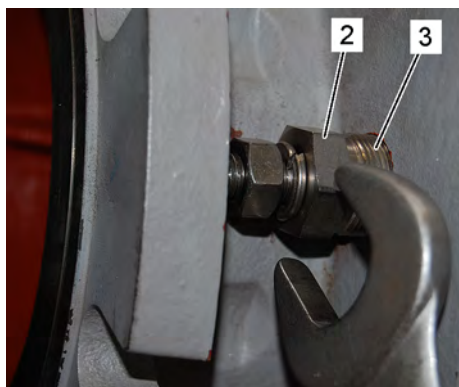


Fig. 49

2. ➤ Tighten all three adjusting sleeves (3) via hexagon nut (2) with the same number of clockwise rotations (in case of excessive clearance), or counter clockwise (in case of insufficient clearance).



Fig. 50

3. ➤ Check clearance between impeller (2) and inlet cone with feeler gauge (1) after 0, $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ impeller rotations ➤ *Table from chapter 8.4.2.1 Check impeller clearance "C" on page 72.*
4. ➤ Repeat steps 2 to 3 until clearance between impeller and inlet cone is correctly set.

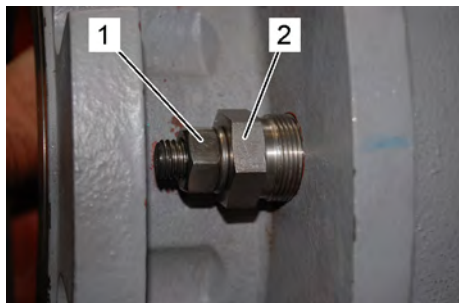


Fig. 51

5. ➤ Hold locknut (2) with spanner and tighten hexagon nuts (1) clockwise.

8.4.2.2.2 Adjustable pump with two adjusting screws

The impeller clearance is set via two adjusting screws on the casing.

1. ➔ Perform chapter "Check impeller clearance "S"" & Chapter 8.4.2.3 „Check impeller clearance "S"" on page 83.
2. ➔ Loosen locknut (1) and turn back.
3. ➔ Turn back adjusting screw (2) by several mm.

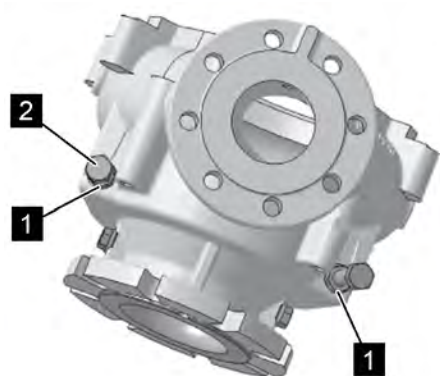


Fig. 52

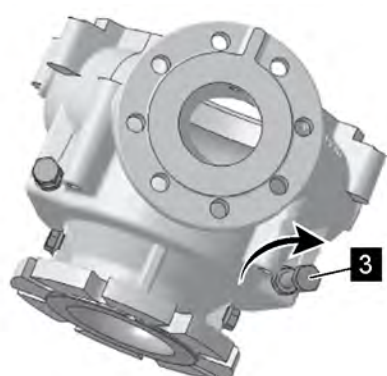


Fig. 53

4. ➔ Slowly insert adjusting screw (3) until inlet cone is blocked by pump shaft. The clearance between impeller and inlet cone is cancelled.



The cast-in arrow beside the adjusting screw indicates the direction in which the inlet cone is moved when the corresponding screw is inserted.

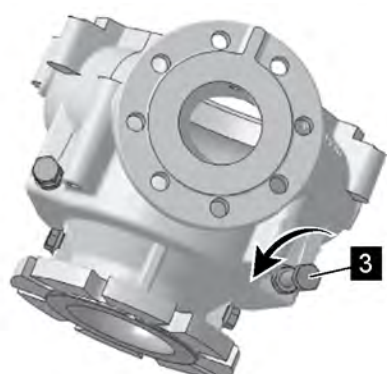
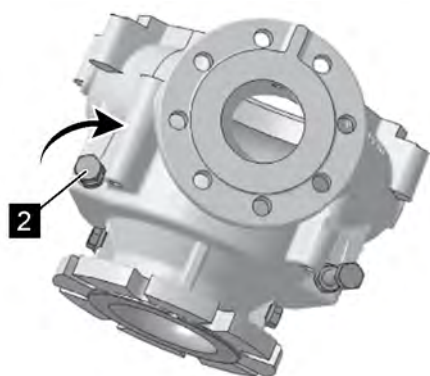


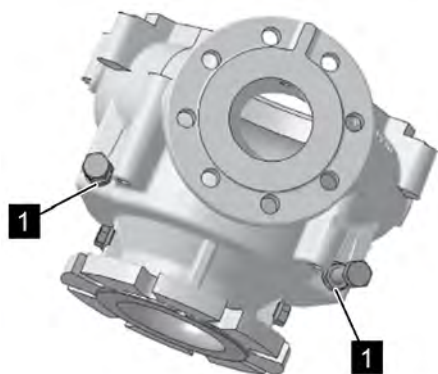
Fig. 54

5. ➔ Turn back adjusting screw (3), e.g. by a quarter rotation.



6. ➤ Tighten adjusting screw (2) with small torque. The inlet cone is pulled back from the impeller by the required clearance and the adjusting sleeve firmly clamped.

Fig. 55



7. ➤ Tighten locknut (1) again.

Fig. 56



8. ➤ Check clearance between impeller (2) and inlet cone with feeler gauge (1) after 0, $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ impeller rotations ➤ *Table from chapter 8.4.2.1 Check impeller clearance "C" on page 72.*

Fig. 57

In case of non-uniform clearance



In case impeller clearance is irregular or too large, have wear parts of pump checked for wear by a service centre.

In case of uniform clearance

If the impeller clearance is uniform and deviates from value in table, proceed as follows:

1. ➤ Loosen locknut (1) and turn back.

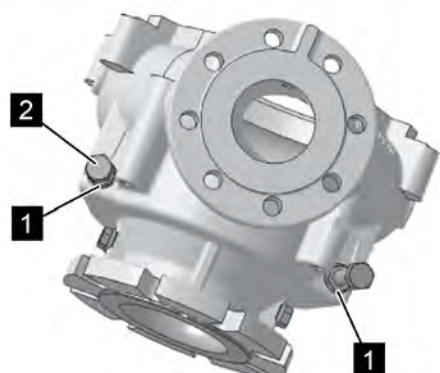


Fig. 58

2. ➤ Tighten adjusting screw (3) clockwise (in case of excessive clearance) or turn back adjusting screw (2) counter clockwise (in case of insufficient clearance).



Fig. 59



Fig. 60

3. ➤ Check clearance between impeller (2) and inlet cone with feeler gauge (1) after 0, $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ impeller rotations & Table from chapter 8.4.2.1 Check impeller clearance "C" on page 72.
4. ➤ Repeat steps 2 to 3 until clearance between impeller and inlet cone is correctly set.



5. ➤ Tighten locknut (1) again.

Fig. 61

8.4.2.2.3 Non-adjustable pump

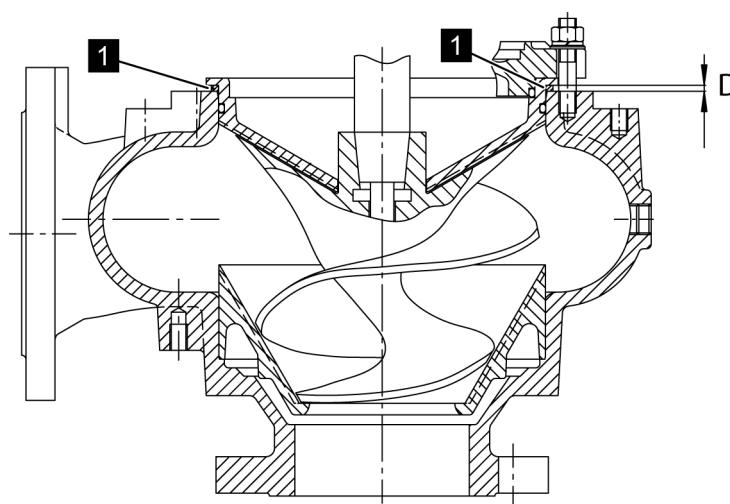


Fig. 62

On non-adjustable pumps, the impeller clearance is adjusted via adjustment spacers D (1).

1. ➤ Loosen and remove all hexagon nuts (1) on casing.



Fig. 63

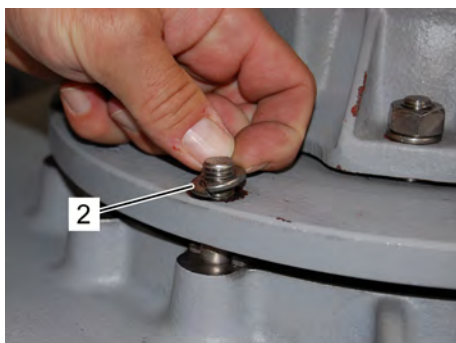


Fig. 64

2. ➤ Remove all washers (2).

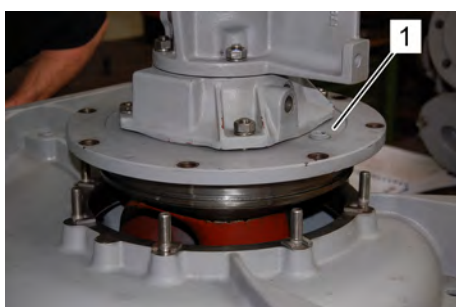


Fig. 65

3. ➤ Lift drive unit of pump (1) with lifting gear.

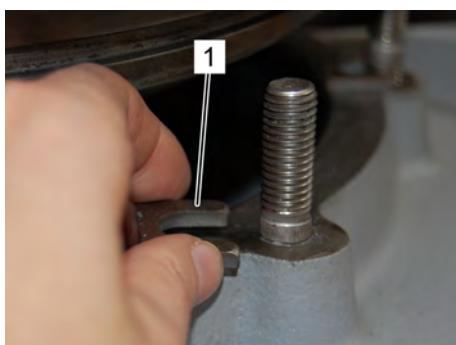


Fig. 66

4. ➤ Remove all adjustment spacers (1).

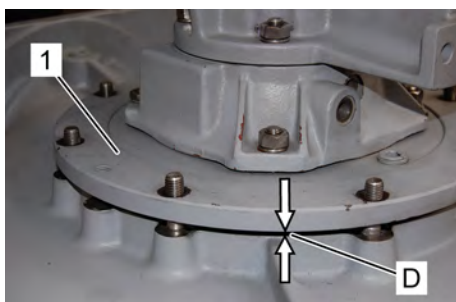


Fig. 67

5. ➤ Lower drive unit of pump (1) again with lifting gear.
6. ➤ Perform chapter "Check impeller clearance "S"" & Chapter 8.4.2.3 „Check impeller clearance "S"" on page 83.
7. ➤ Measure gap D between drive unit and pump casing at several points in the circumference and use to calculate mean value.
8. ➤ Add about 0,5–1,0 mm to measured value. The result is the required thickness of the adjusting spacer to obtain clearance "C" & Table from chapter 8.4.2.1 Check impeller clearance "C" on page 72.

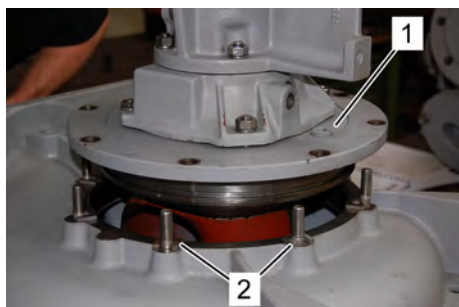


Fig. 68

- 9. ► Lift drive unit of pump (1) again with lifting gear.
- 10. ► Insert adjusting spacers (2) with calculated thickness at each fastening.



Fig. 69

- 11. ► Lower drive unit of pump (1) again with lifting gear.

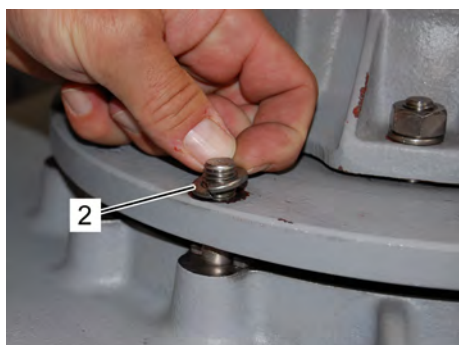


Fig. 70

- 12. ► Put all washers (2) in place again.

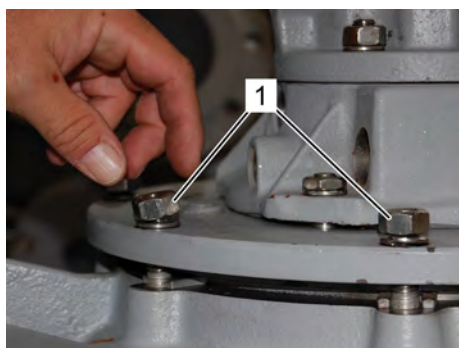


Fig. 71

- 13. ► Position all hexagon nuts (1).

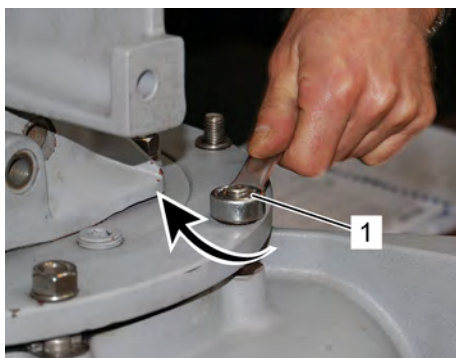


Fig. 72

8.4.2.3 Check impeller clearance "S"

14. ➔ Tighten all hexagon nuts (1).



On hydraulic type B0BQ/B065, the impeller clearance is adjusted via a spacer ring that is located on the fastenings between pump and suction cover.

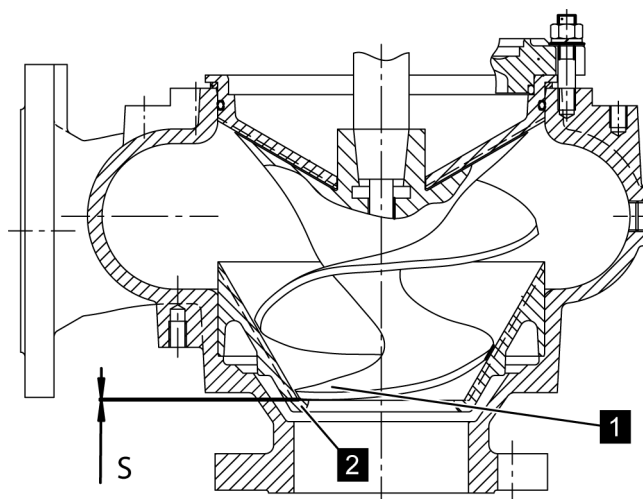


Fig. 73

Impeller clearance "S" is clearance between impeller tip (1) and wear ring (2).

➔ Check clearance between impeller tip (1) and wear ring (2) with a feeler gauge. The clearance must be about 1 to 2 mm.



Contact Service Centre if clearance is too small or impeller tip touches wear ring ➔ Chapter 1.6 „Customer Service“ on page 9.

8.4.2.4 Check impeller clearance "B"

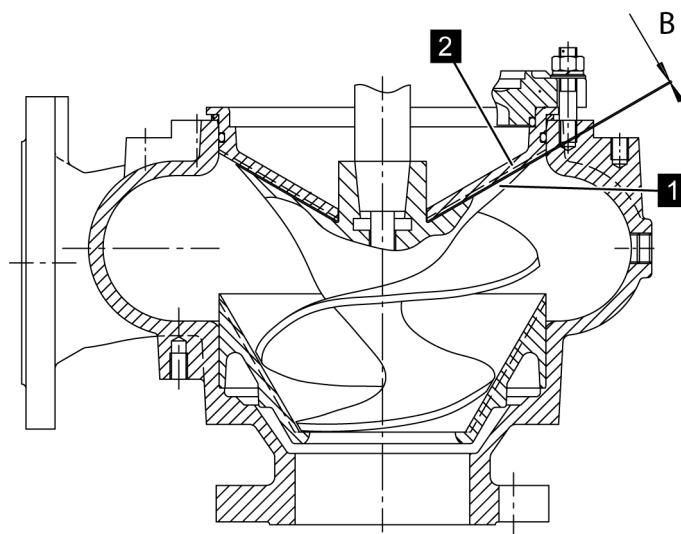


Fig. 74

Impeller clearance "B" is clearance between impeller (1) and rear cone (2) or seal.

Clearance "B" must be kept as small as possible to hinder fibres or solids from entering the seal space. Due to abrasive media, the clearance can increase over time.

1. ➤ Perform steps 1 to 3 ↗ Chapter 8.4.2.2.3 „Non-adjustable pump“ on page 80.
2. ➤ Measure clearance "B" (Fig. 74) between impeller and rear cone or seal via feeler gauge at several points in the circumference.
3. ➤ Compare the smallest measured value with the value listed in the following table:

Hydraulic size	Impeller clearance "B"
B, C, D, E	0,2–0,5 mm
F, H	0,3–0,8 mm
I, L, M	0,5–1,5 mm



Contact Service Centre in case of excessive or insufficient clearance ↗ Chapter 1.6 „Customer Service“ on page 9.

8.4.3 Check insulation resistance

- Personnel: ■ Trained electrician
- Protective equipment: ■ Protective clothing
■ Safety boots

Check insulation resistance of motor windings and cable with a high-voltage ohmmeter.


NOTICE!

Damage to property due to excessive voltage!

Voltages above 2,5 volt destroy motors with built-in PTC thermistor.

- Never perform tests with a high-voltage ohmmeter on motors with built-in triple PTC thermistor.

1. ➔ Attach cable at starter switch of motor.
2. ➔ Measure resistance of winding conductors among themselves.
3. ➔ Check earth resistance of each conductor.
4. ➔ Compare the measured resistance values with the values in the following insulation table.

Resistance in ohm	Resistance in mega ohm	Assessment of motor condition and cables
$\geq 2\,000\,000$	2	New motor
$\geq 1\,000\,000$	1	Used motor, which can be reinstalled in pit
500 000–1 000 000	0,5–1,0	Motor in pit. The ohm values apply to the cable and motor. Motor is in good condition.
20 000–500 000	0,02–0,5	Motor, which possibly was damaged by lightening or conductor damages. Do not pull out pump.
10 000–20 000	0,01–0,02	Motor with wet or damaged cable or windings. Motor will not fail due to this reason alone, but will not continue operation for long.
$\leq 10\,000$	0–0,01	Defective motor, or motor with completely destroyed cable insulation. Motor must be replaced.
0	0	<ul style="list-style-type: none"> – Motor will not remain operational for long – Motor is defective



Each reading below 1,0 mega ohm can be an indication for cable or winding damage. If a defect is suspected, have pump repaired by a service centre.

8.4.4 Check oil level

Personnel: ■ Qualified personnel

Protective equipment: ■ Protective clothing

■ Safety boots

1. ➤ Let pump run several minutes to evenly distribute contaminations in the oil.
2. ➤ Turn off pump or system and protect against restart.
3. ➤ If pump is submerged in sump, pull pump from sump with pulley or chain hoist.
4. ➤ Hose down pump with water.

8.4.4.1 Cooling method "N", "K" and "F"

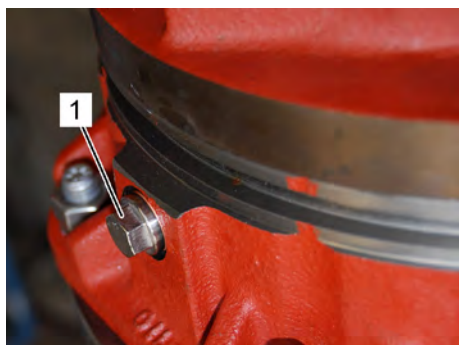


Fig. 75

1. ➤ Place the pump vertically.
2. ➤ Loosen screw plug (1) of oil drain opening and remove.

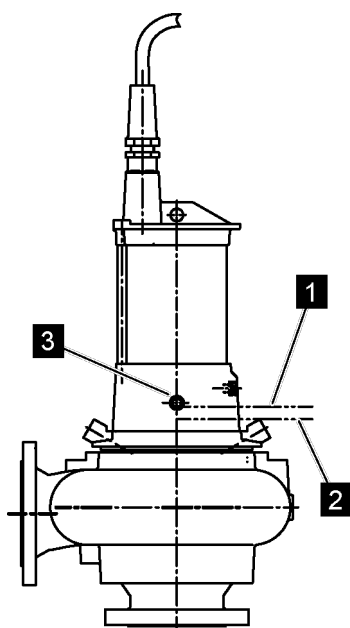


Fig. 76

3. ➤ Check level. Level must reach to bottom edge (1) of oil drain opening (3). If level (2) is only slightly lower, add new oil via opening (3) and check again after 200-500 hours.



A significantly lower level could be caused by a leak in the pump-side seal, which must be replaced by the Service Centre.

4. ➤ Close oil drain opening (3) with screw plug.
5. ➤ Tighten screw plug (1).

8.4.4.2 Cooling method "E"



Fig. 77

1. ➔ Place the pump vertically.
2. ➔ Loosen screw plug (1) of oil filler opening and remove.

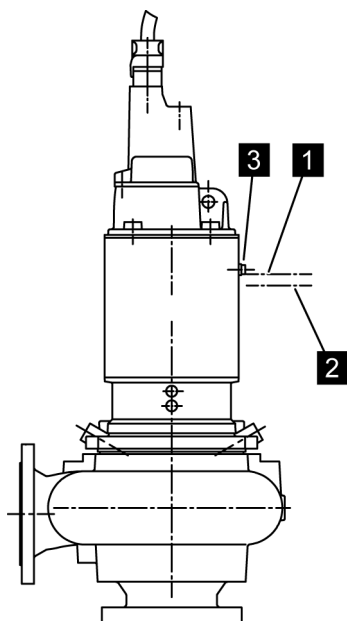


Fig. 78

3. ➔ Check level. Level must reach to bottom edge (1) of oil drain opening (3).

If level (2) is only slightly lower, add new oil via opening (3) and check again after 200-500 hours



A significantly lower level could be caused by a leak in the pump-side seal, which must be replaced by the Service Centre.

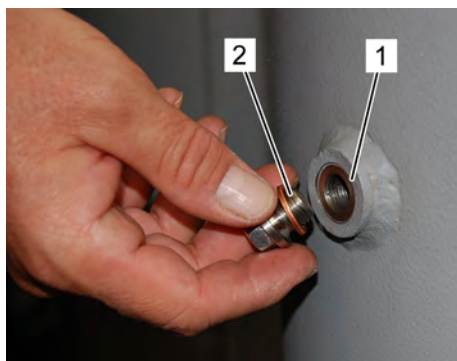


Fig. 79

4. ➤ Close oil drain opening (1) with screw plug (2).



Fig. 80

5. ➤ Tighten screw plug (1).

8.4.5 Check oil quality

Personnel: ■ Qualified personnel

Protective equipment: ■ Protective clothing

■ Safety boots



Fig. 81

1. ➤ Place pump horizontally. The oil drain opening must be on top.
2. ➤ Loosen screw plug (1) and remove.
3. ➤ Insert pipette into oil drain opening and remove a small amount of oil.
4. ➤ Place oil from pipette into a glass bowl.
5. ➤ Repeat steps 3 to 4 until an adequate amount is available for observation.
6. ➤ Assess oil quality as follows:

Clear oil

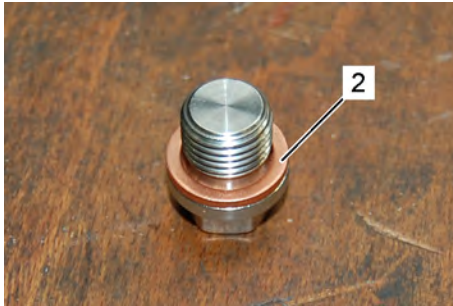


Fig. 82

- If oil is clear, add oil to level (Fig. 76/1). Close oil drain opening with screw plug with new, annealed copper seal (2).

Clear oil with a small amount of water

Oil with a small amount of water has a milky appearance.

- Drain oil, remove water from oil and refill or add new oil. Close oil drain opening with new annealed copper seal (Fig. 82/2).

Too much water in oil

If too much water enters the oil, the viscosity is much higher. The oil is as thick as motor oil, or even thicker.



If oil contains too much water and smells like waste water, the pump-side seal must be repaired or replaced by the Service Centre.

8.4.6 Change oil

- Personnel: ■ Qualified personnel
- Protective equipment: ■ Protective clothing
■ Safety boots



Replace oil only if it is heavily contaminated. Otherwise, just separate the water from the oil and reuse. On the characteristics of the required oil ↗ Chapter 3.4 „Operating materials“ on page 22.

8.4.6.1 Cooling method "N", "K" and "F"



Fig. 83

1. ➤ Loosen screw plug (1) of oil drain opening and remove.

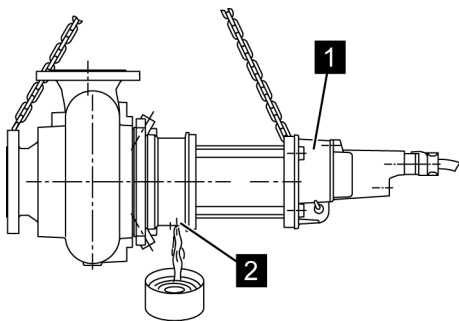


Fig. 84

2. ➤ Lift and turn pump (1) with lifting gear until oil drain opening (2) points downward.
3. ➤ Completely drain oil chamber casing.



Some larger motors are equipped with a second screw plug, positioned directly below the oil drain opening at the seal. By removing this screw plug it is possible to drain even the last oil residues.

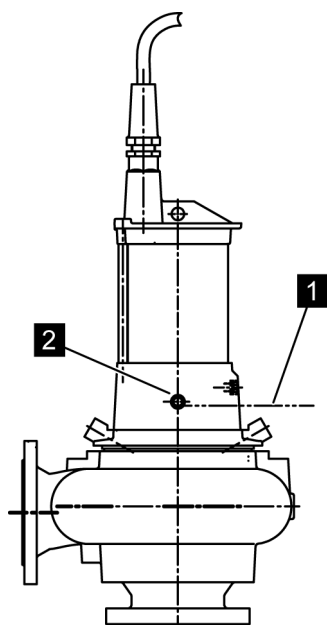


Fig. 85

4. ➔ Place pump vertically onto the suction flange.
5. ➔ Add dewatered or new oil via oil drain opening (2) until correct level (1) (bottom edge of oil drain opening) is reached.

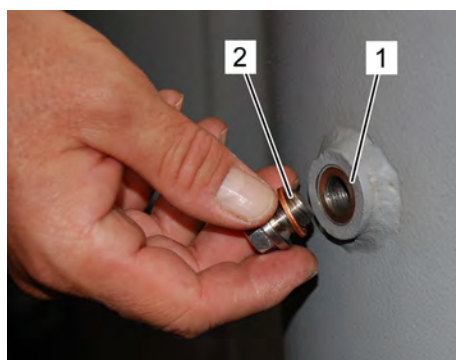


Fig. 86

6. ➔ Close oil drain opening (1) with screw plug (2) with the annealed copper seal.



Fig. 87

7. ➔ Tighten screw plug (1).

8.4.6.2 Cooling method "E"

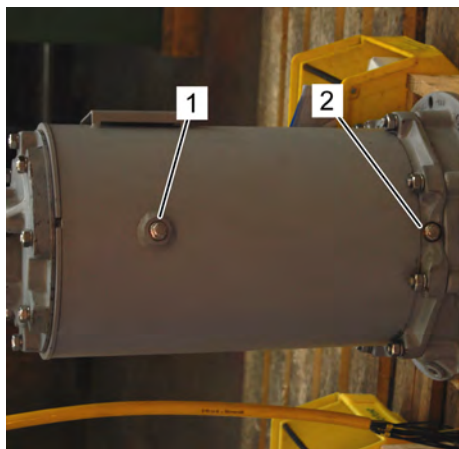


Fig. 88

1. ➤ Loosen and remove screw plug of oil filler opening (1) and oil drain opening (2).

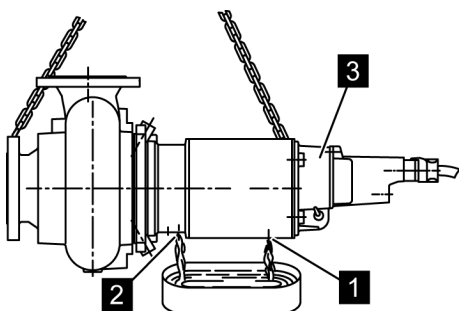


Fig. 89

2. ➤ Lift and turn pump (3) with lifting gear and turn until oil drain openings (1) and (2) point downward.
3. ➤ Completely drain oil chamber casing.



Fig. 90

4. ➤ Close oil drain opening (2) with screw plug with the annealed copper seal.

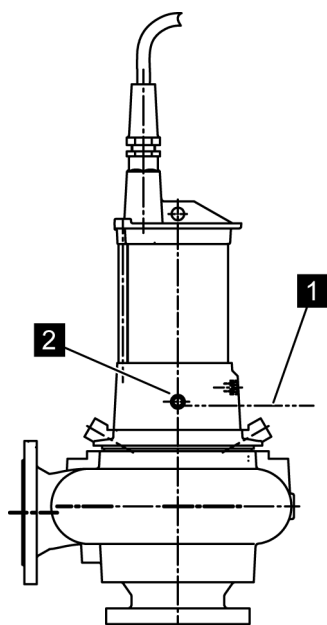


Fig. 91

5. ➔ Place pump vertically onto the suction flange.
6. ➔ Add dewatered or new oil via oil drain opening (2) until correct level (1) (bottom edge of oil drain opening) is reached.

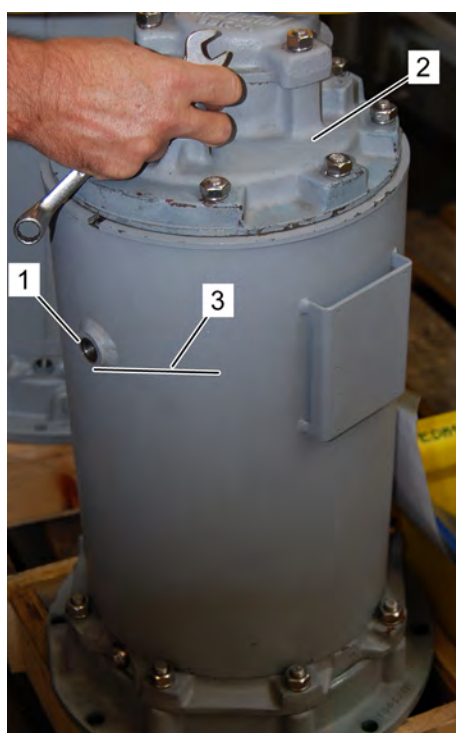


Fig. 92

7. ➔ Place the pump (2) vertically.
8. ➔ Add dewatered or new oil via oil drain opening (1) until correct level (3) (bottom edge of oil drain opening) is reached.

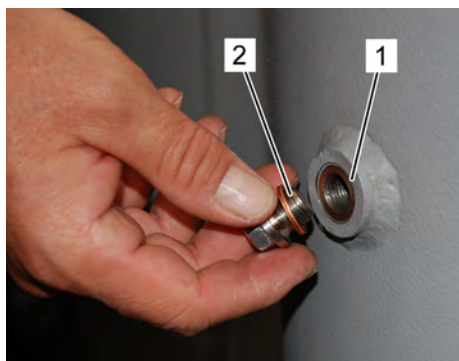


Fig. 93

9. ➤ Close oil drain opening (1) with screw plug (2) with the annealed copper seal.



Fig. 94

10. ➤ Tighten screw plug (1).

8.5 Actions after maintenance has been completed

After completing the maintenance work and before switching on the system, carry out the following steps:

1. ➤ Check that all previously loosened threaded connections are tight.
2. ➤ Check that all previously removed protective devices and covers have been replaced properly.
3. ➤ Check that all tools, materials and other equipment used have been removed from the work area.
4. ➤ Clean the work area and remove any substances which may have escaped, such as liquids, processing material or similar.
5. ➤ Ensure that all the system's safety devices are completely functional.

9 Malfunctions

The following chapter describes possible causes for malfunctions and what needs to be done to correct them.

If malfunctions occur more frequently, shorten maintenance intervals according to actual load.

If malfunctions cannot be corrected by the following information, contact manufacturer or service partner, see service addresses in appendix.

9.1 Safety

Explosion protection



WARNING! **EXPLOSION PROTECTION!**

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing any troubleshooting on devices in explosion-hazard area:

- To prevent static charge, ensure that device is earthed. To be performed only by professional electrician.

Non-observance of this information results in loss of explosion protection.

Electrical system



DANGER! **Danger to life from electric power!**

Contact with live parts may prove fatal. When switched on, electric components may be subject to uncontrolled movements and may cause grave injury.

- Switch off the power supply before starting work and make sure that it cannot be switched on again.

Securing to prevent restart



WARNING! **Danger to life from an unauthorised restart!**

In the event of an unauthorised restart of the power supply while tracking down and rectifying a fault, there is a danger of serious injuries or death for persons in the danger zone.

- Switch off all power supplies before starting work and make sure they cannot be switched on again.

Behaviour in the event of faults

The following applies in principle:

1. ➤ Immediately initiate an emergency stop in the event of faults posing an immediate danger to people or property.
2. ➤ Ascertain the cause of the fault.
3. ➤ If fault rectification requires work in the danger zone, shut down the system and secure to prevent restarting.
Immediately notify those responsible at the place of use about the fault.
4. ➤ Depending on the nature of the fault, have it rectified by authorised specialised personnel or rectify it yourself.



The fault table below provides information about who is authorised to rectify the fault.

9.2 Malfunction table

Error description	Cause	Solution	Personnel
No delivery	Pump not sufficiently submerged or not vented	Check required submersion depth ↳ Chapter 7.4 „Required submersion depth“ on page 63 or vent pump	Instructed person (operator)

Error description	Cause	Solution	Personnel
	Speed too low	Check speed, increase if necessary	Instructed person (operator)
	Air entering suction line	Check suction line	Instructed person (operator)
	Pressure line clogged / gate valve closed	Check pressure line/gate valve	Instructed person (operator)
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Delivery head too high (exceeds calculation)	Check delivery head	Instructed person (operator)
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
	Impeller or suction line clogged	Check pump and suction line for obstruction	Instructed person (operator)
	Wrong rotational direction	Check rotational direction, make correction if necessary ↺ <i>Chapter 6.3.4 „Check rotational direction“ on page 56</i>	Trained electrician
	Air or gas on back side of impeller	Check delivery medium for air or gas	Instructed person (operator)
Insufficient flow rate	Air entering suction line	Check suction line	Instructed person (operator)

Error description	Cause	Solution	Personnel
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Delivery head too high (exceeds calculation)	Check delivery head	Instructed person (operator)
	Insufficient suction pressure for hot liquids	Check suction pressure, increase if necessary	Qualified personnel
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
	Solids concentration higher than assumed	Check solids concentration	Instructed person (operator)
	Impeller or suction line clogged	Check pump and suction line for obstruction	Instructed person (operator)
	Wrong rotational direction	Check rotational direction, make correction if necessary ↪ <i>Chapter 6.3.4 „Check rotational direction“ on page 56</i>	Trained electrician
	Excessive impeller clearance	Check impeller clearance ↪ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
	Impeller damaged	Check impeller for damage, replace if necessary	Manufacturer (service centre)
	Voltage too low	Check voltage	Trained electrician
Insufficient delivery pressure	Speed too low	Check speed, increase if necessary	Instructed person (operator)
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
	Solids concentration higher than assumed	Check solids concentration	Instructed person (operator)
	Wrong rotational direction	Check rotational direction, make correction if necessary ↪ <i>Chapter 6.3.4 „Check rotational direction“ on page 56</i>	Trained electrician
	Excessive impeller clearance	Check impeller clearance, readjust if necessary ↪ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
	Impeller damaged	Check impeller for damage, replace if necessary	Manufacturer (service centre)
	Voltage too low	Check voltage	Trained electrician
	Impeller too small	Check impeller, replace if necessary	Instructed person (operator)

Error description	Cause	Solution	Personnel
			Manufacturer (service centre)
	Air or gas on back side of impeller	Check delivery medium for air or gas	Instructed person (operator)
Decrease in flow rate or loss of pressure after startup	Air entering suction line	Check suction line	Instructed person (operator)
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Suction head too high	Check suction head	Instructed person (operator)
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
Vibrations	Speed too high	Check speed, reduce if necessary	Instructed person (operator)
	Air entering suction line	Check suction line	Instructed person (operator)
	Pressure line clogged / gate valve closed	Check pressure line/gate valve	Instructed person (operator)
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Delivery head too high (exceeds calculation)	Check delivery head	Instructed person (operator)
	Suction head too high	Check suction head	Instructed person (operator)
	Insufficient suction pressure for hot liquids	Check suction pressure, increase if necessary	Qualified personnel
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
	Impeller or suction line clogged	Check pump and suction line for obstruction	Instructed person (operator)
	Impeller damaged	Check impeller for damage, replace if necessary	Manufacturer (service centre)
	Motor damaged	Check motor, repair if necessary	Trained electrician Manufacturer (service centre)
	Loose fastening	Check fastening, make correction if necessary	Qualified personnel
	Worn bearing	Check bearing for damage, replace if necessary	Qualified personnel

Error description	Cause	Solution	Personnel
			Manufacturer (service centre)
	Impeller out-of-balance	Check impeller, replace if necessary	Instructed person (operator)
	Impeller touches suction cover	Check impeller clearance, readjust if necessary ↪ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
Motor overloaded	Speed too high	Check speed, reduce if necessary	Instructed person (operator)
	Pressure line clogged / gate valve closed	Check pressure line/gate valve	Instructed person (operator)
	Solids concentration higher than assumed	Check solids concentration	Instructed person (operator)
	Specific gravity of delivery medium higher than assumed	Check specific gravity of delivery medium	Qualified personnel
	Motor damaged	Check motor, repair if necessary	Trained electrician Manufacturer (service centre)
	Voltage too low	Check voltage	Trained electrician
	Loss of coolant	Check coolant level or oil level, add if necessary ↪ <i>Chapter 8.4.4 „Check oil level“ on page 86</i>	Qualified personnel
	Impeller touches suction cover	Check impeller clearance, readjust if necessary ↪ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
	Thick sludge and small impeller clearance	Increase impeller clearance ↪ <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)
Motor does not start	Main switch is off	Place main switch in „On“ position.	Instructed person (operator)
	Thermal overcurrent trip has responded	Check overcurrent trip	Trained electrician
	Motor damaged	Check motor, repair if necessary	Trained electrician Manufacturer (service centre)
	Voltage too low	Check voltage	Trained electrician
	Switch-on level not reached; defective probe or switch	Check fluid level; check level switch for function, replace if necessary	Qualified personnel
Noise	Speed too high	Check speed, reduce if necessary	Instructed person (operator)

Error description	Cause	Solution	Personnel
	Air entering suction line	Check suction line	Instructed person (operator)
	Air or gas in delivery medium	Check delivery medium for air or gas	Instructed person (operator)
	Suction head too high	Check suction head	Instructed person (operator)
	Insufficient suction pressure for hot liquids	Check suction pressure, increase if necessary	Qualified personnel
	Suction pipe insufficiently submerged	Check submersion depth of suction pipe	Instructed person (operator)
	Motor damaged	Check motor, repair if necessary	Trained electrician Manufacturer (service centre)
	Loose fastening	Check fastening, make correction if necessary	Qualified personnel
	Impeller touches suction cover	Check impeller clearance, readjust if necessary → <i>Chapter 8.4.2 „Check/readjust impeller clearance“ on page 72</i>	Instructed person (operator)

9.3 Startup after fault has been rectified

After repair of malfunction, perform the following steps to restart:

1. ➡ Check if all protective devices and covers that were previously removed are properly installed again.
2. ➡ Check all screw connections that were previously loosened for tightness.
3. ➡ Ensure that all tools, materials and other equipment used have been removed from working area.
4. ➡ Clean device and remove any escaped substances, such as liquids, processing material or the like.
5. ➡ Ensure that all safety devices of the system function properly.
6. ➡ Ensure that no persons are in the danger zone.
7. ➡ Start according to the information in chapter “Operation”.

10 Disassembly

Following the end of its useful life, the system must be dismantled and disposed of in accordance with the environmental regulations.

10.1 Safety



WARNING! **EXPLOSION PROTECTION!**

The introduction of ignition sources, such as sparks, open flames or hot surfaces, can cause explosions in the explosion-hazard area. Thus, when performing disassembly work on devices in explosion-hazard area:

- Obtain written approval before beginning disassembly.
- Perform disassembly only after excluding potentially explosive atmosphere.
- Use only tools that are approved for application in explosion-hazard areas.

Non-observance of these instructions results in loss of explosion protection.

Electrical system



DANGER! **Danger to life from electric power!**

Contact with live parts may prove fatal. When switched on, electric components may be subject to uncontrolled movements and may cause grave injury.

- Before starting the dismantling, switch off the electric power supply and disconnect completely.

Improper dismantling



WARNING!

Danger of injury due to improper dismantling!

Stored residual energy, angular components, points and edges on or in the system or on the tools needed can cause injuries.

- Ensure sufficient space before starting work.
- Handle exposed, sharp-edged components with care.
- Pay attention to orderliness and cleanliness in the workplace! Loosely stacked or scattered components and tools could cause accidents.
- Dismantle the components properly. Note that some components may have a high intrinsic weight. Use hoists if necessary.
- Secure components so that they cannot fall down or topple over.
- Consult the manufacturer if in doubt.

10.2 Dismantling

Before starting dismantling:

- Shut down the system and secure to prevent restarting.
- Physically disconnect the power supply from the system; discharge stored residual energy.
- Remove consumables, auxiliary materials and other processing materials and dispose of in accordance with the environmental regulations.

Then clean assemblies and parts properly and dismantle in compliance with applicable local occupational safety and environmental protection regulations.

10.3 Disposal

If no return or disposal agreement has been made, send the dismantled components for recycling.

- Scrap metals.
- Send plastic elements for recycling.
- Sort and dispose of other components in accordance with their material composition.



NOTICE!

Danger to the environment due to incorrect disposal!

Incorrect disposal may pose risks to the environment.

- Electrical scrap, electronic components, lubricants and other auxiliary materials must be disposed of by authorised specialist companies.
- If in doubt, obtain information about disposal in accordance with the environmental regulations from the local municipal authorities or specialised waste disposal companies.

11 Appendix

- Technical data sheets
- Technical drawings
- CE Declaration of Conformity
- Spare parts list
- Connection diagram
- Explanation of type code
- Transfer protocol

12 Index

A	
Accident.....	19
Adjustable pump.....	73, 77
B	
Bearing temperature probe.....	33
C	
Cable part.....	27
Cable protection.....	33
Clearance adjustment.....	34
Compression flange.....	27
Connections.....	34
Contact.....	9
Coolant inlet.....	32
Coolant outlet.....	32
Cool-down periods.....	64
Cooling jacket of stator housing.....	30, 32
Copyright.....	9
Customer Service.....	9
D	
Discharge outlet.....	28
Dismantling.....	103
Disposal.....	103
Dry run times.....	63, 64
E	
Electrical current	15
Electric motor.....	27
Electric motors	
Cooling methods.....	28
EMERGENCY STOP.....	65
Energy supply	
Connecting.....	53
Ex marking.....	26
F	
Fire.....	19
First aid.....	19
Float switch.....	33
Flushing connection.....	29, 30, 31, 32
Flush water connections.....	59
G	
Guide rail.....	28
H	
Hydraulic part.....	27
Hydraulics.....	34
I	
Impeller.....	15
Impeller clearance.....	72
Inlet.....	34
Inspection at delivery.....	37
Intended use.....	12
L	
Level control.....	57
Level switch.....	57
Lifting eyes.....	38
Limitation of liability.....	7
Loads.....	37
Lubricants.....	20
M	
Maintenance schedule.....	69
Maintenance work.....	71
Malfunction table.....	96
Moisture probe.....	33
N	
Non-adjustable pump.....	80
O	
Oil drain opening.....	29, 30, 31, 32
Oil filler opening.....	30
Operating conditions.....	22
Operating elements.....	35
Operating materials.....	22
Operational safety components.....	33
Outlet.....	34
Owner.....	10
P	
Packaging.....	40
Personnel.....	11
Preservatives.....	20
Pressure line.....	46
Protective equipment.....	13
Pump	
Draining.....	63
Flushing.....	63

R			
Rot. direction.....	56	Submersion depth	
S		Submersible motors.....	63
Safety		Suction cone.....	34
General.....	10	Suction flange.....	27
Safety devices.....	17	Suction line.....	45
Screw centrifugal impeller.....	34	Switching off.....	62
Service.....	9	Switching on.....	61
Service connections.....	70	Symbols	
Set-up location		in this manual.....	6
Requirements.....	44	T	
Signs.....	20	Temperature limiter.....	33
Slide shoe.....	28	Transport	
Spare parts.....	8	Crane.....	38
Spiral casing.....	34	Pallets.....	39
Standard operation.....	62	Type code.....	22
Stator housing.....	29, 31	U	
Stator housing opening.....	29, 30, 31, 32	Use.....	12
Storage.....	41	W	
		Warranty terms.....	9