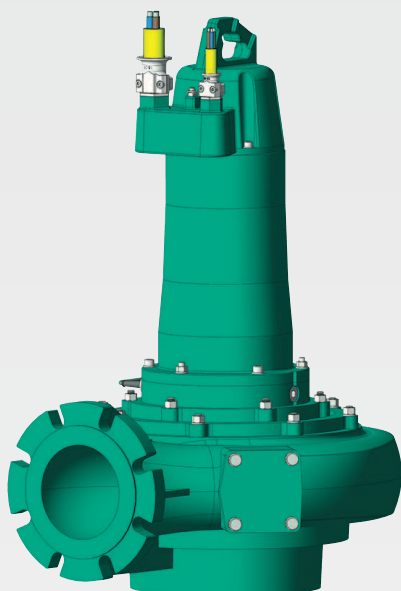


Wilo Motor FK 17.1, FK 202, FK 34, FK 42 + EMU FA, Rexa SUPRA, Rexa SOLID



en Installation and operating instructions



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1 General information

1.1 About these instructions

These installation and operating instructions are an integral part of the product. Read these instructions before commencing work and keep them in an accessible place at all times. Strict adherence to these instructions is a precondition for the intended use and correct operation of the product. All information and markings on the product must be observed.

The language of the original operating instructions is German. All other languages of these instructions are translations of the original operating instructions.

1.2 Copyright

These installation and operating instructions have been copyrighted by the manufacturer. Contents of any kind may not be reproduced or distributed, or used for purposes of competition and shared with others.

1.3 Subject to change

The manufacturer reserves the right to make technical modifications to the device or individual components. The illustrations used may differ from the original and are intended as an example representation of the device.

1.4 Warranty

The specifications in the current "General Terms and Conditions" apply to the warranty and the warranty period. These can be found at www.wilo.com/legal

Any deviations must be contractually agreed and shall then be given priority.

Claim to warranty

If the following points are complied with, the manufacturer is obligated to rectify every qualitative or constructive flaw:

- The defects are reported in writing to the manufacturer within the warranty period.
- Application according to intended use.
- All monitoring devices are connected and tested before commissioning.

Exclusion from liability

Exclusion from liability excludes all liability for personal injury, material damage or financial losses. This exclusion ensues as soon as one of the following applies:

- Inadequate configuration due to inadequate or incorrect instructions by the operator or the client
- Non-compliance with installation and operating instructions
- Improper use
- Incorrect storage or transport
- Incorrect installation or dismantling
- Insufficient maintenance
- Unauthorised repairs
- Inadequate construction site
- Chemical, electrical or electro-chemical influences
- Wear

2 Safety

This chapter contains basic information for the individual phases of the life cycle. Failure to observe this information carries the following risks:

- Injury to persons from electrical, mechanical and bacteriological factors as well as electromagnetic fields
- Environmental damage from discharge of hazardous substances
- Property damage
- Failure of important functions of the product

Failure to observe the information contained herein will result in the loss of claims for damages.

The instructions and safety instructions in the other chapters must also be observed!

2.1 Identification of safety instructions

These installation and operating instructions set out safety instructions for preventing personal injury and damage to property. These safety instructions are shown differently:

- Safety instructions relating to personal injury start with a signal word, are **preceded by a corresponding symbol** and are shaded in grey.



DANGER

Type and source of the danger!

Consequences of the danger and instructions for avoidance.

→ Safety instructions relating to property damage start with a signal word and are displayed **without** a symbol.

CAUTION

Type and source of the danger!

Consequences or information.

Signal words

→ **DANGER!**

Failure to observe the safety instructions will result in serious injuries or death!

→ **WARNING!**

Failure to follow the instructions can lead to (serious) injuries!

→ **CAUTION!**

Failure to follow the instructions can lead to property damage and a possible total loss.

→ **NOTICE!**

Useful information on handling the product

Markups

✓ Prerequisite

1. Work step/list

⇒ Notice/instructions

► Result

Symbols

These instructions use the following symbols:



Danger of electric voltage



Danger of bacterial infection



Danger of explosion



Danger – explosive atmosphere



General warning symbols



Warning of cutting injuries



Warning of hot surfaces



Warning of high pressure



Warning of suspended loads



Personal protective equipment: Wear a safety helmet



Personal protective equipment: Wear foot protection



Personal protective equipment: Wear hand protection



Personal protective equipment: Wear mouth protection



Personal protective equipment: Wear safety goggles



Autonomous work prohibited! A second person must be present.



Useful information

2.2 Personnel qualifications

Personnel must:

- Be instructed about locally applicable regulations governing accident prevention.
- Have read and understood the installation and operating instructions.

Personnel must have the following qualifications.

- Electrical work: A qualified electrician must carry out the electrical work.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.
- Maintenance tasks: The technician must be familiar with the use of operating fluids and their disposal. In addition, the technician must have basic knowledge of mechanical engineering.

Definition of “qualified electrician”

A qualified electrician is a person with appropriate technical education, knowledge and experience who can identify **and** prevent electrical hazards.

2.3 Electrical work

- Electrical work must be carried out by a qualified electrician.
- Before commencing work, disconnect the product from the mains and safeguard it from being switched on again.
- Observe applicable local regulations when connecting to the mains power supply.
- Adhere to the requirements of the local energy supply company.
- Train personnel in connecting electrics.
- Instruct personnel in options for switching off the device.
- Comply with the technical specifications contained in these installation and operating instructions and on the rating plate.
- Earth the device.
- Observe regulations for connection to the electrical switching system.
- Comply with the specifications on electro-magnetic compatibility when using electronic start-up controllers (e.g. soft starter or frequency converter). If required, take into account special measures (e.g. shielded cables, filters etc.).
- Replace defective connection cables. Contact customer service.

2.4 Monitoring devices

The following monitoring devices must be provided on-site:

Circuit breaker

The size and switching characteristics of the circuit breakers must conform to the rated current of the connected product. Observe local regulations.

Motor protection switch

Make provision for an on-site motor protection switch for devices without a plug! The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential triggering and anti-reactivation device in accordance with the local regulations. In case of sensitive mains, make provision for the installation on-site of other protective equipment (e.g. overvoltage, undervoltage or phase failure relay, etc.).

Residual-current device (RCD)

Comply with the regulations of the local energy supply company! The use of a residual-current device is recommended.

If persons come into contact with the device and conductive fluids, secure the connection **with** a residual-current device (RCD).

2.5 Use in fluids hazardous to health

There is a danger of bacterial infection when using the device in fluids hazardous to health! Thoroughly clean and disinfect the device after dismantling and prior to further use. The operator must ensure the following:

- The following protective equipment is provided and worn when cleaning the device:
 - Closed safety goggles
 - Breathing mask
 - Protective gloves
- All persons are informed about the fluid, the associated danger and its correct handling!

2.6 Transport

- The following protective equipment must be worn:
 - Safety shoes
 - Safety helmet (when using lifting equipment)
- Always hold the handle to transport the device. Never pull the power supply cable!
- Only use legally specified and approved lifting gear.
- Select the lifting gear based on the existing conditions (weather, attachment point, load, etc.).
- Always attach the lifting gear to the attachment points (handle or lifting eyelet).
- The stability of the lifting equipment must be ensured during operation.
- When using lifting equipment, a second person must be present to coordinate the procedure if required (e.g. if the operator's field of vision is blocked).
- Persons are not permitted to stand beneath suspended loads. Do **not** carry suspended loads over workplaces where people are present.

2.7 Installing/dismantling

- Wear the following protective equipment:
 - Safety shoes
 - Safety gloves for protection against cuts
 - Safety helmet (when using lifting equipment)
- Locally applicable laws and regulations for work safety and accident prevention must be complied with.
- Disconnect the device from the mains and secure it against being switched on again without authorisation.
- All rotating parts must be at a standstill.
- Provide adequate aeration in closed rooms.
- When working in chambers and closed spaces, a second person must be present for safety reasons.
- Take immediate countermeasures if there is a build-up of toxic or suffocating gases!
- Clean the device thoroughly. Disinfect devices that are used in fluids hazardous to health!
- Make sure that there is no risk of explosion when carrying out any type of welding work or work with electrical devices.

2.8 During operation

- Wear the following protective equipment:
 - Safety shoes
 - Ear protection (in accordance with the notice of the work regulations)
- Work area of the device is not a recreational area. No persons are allowed in the work area during operation.
- The operator must immediately report any faults or irregularities to their line manager.
- If safety-endangering defects occur, the operator must immediately deactivate the device:

- Malfunction of the safety and monitoring device
- Damage to the housing parts
- Damage to the electrical equipment
- Never reach into the suction port. The rotating parts can crush and sever limbs.
- If the motor emerges during operation, as well as in dry well installation, the motor housing can heat up to above 40 °C (104 °F).
- Open all gate valves in the piping on the suction and pressure side.
- Ensure minimum water submersion through dry-running protection.
- Under normal operating conditions, the sound pressure level of the device is below 85 dB(A). However, the actual sound-pressure level depends on several factors:
 - Installation depth
 - Installation
 - Fixation of accessories and pipe
 - Duty point
 - Immersion depth
- If the device is operated under normal operating conditions, the operator must measure the sound pressure. Ear protection must be worn for sound pressure levels of 85 dB(A) and above and this must be noted in the work regulations!

2.9 Maintenance tasks

- Wear the following protective equipment:
 - Closed safety goggles
 - Safety shoes
 - Safety gloves for protection against cuts
- Always carry out maintenance tasks outside the operating space/installation site.
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- Only original parts from the manufacturer may be used for maintenance and repairs. Use of parts other than the original parts releases the manufacturer from any liability.
- Collect any leakage of fluid and operating fluid immediately and dispose of it according to the locally applicable guidelines.
- Store tools at the designated locations.
- After completing work, reattach all safety and monitoring devices and check that they function properly.

Changing operating fluid

In case of a defect, a pressure **of several bar can build up** in the motor! This pressure escapes when the screw plugs are **opened**. If screw plugs are opened without due caution, they can be ejected at high speed! To avoid injuries, observe the following instructions:

- Adhere to the prescribed sequence of work steps.
- Unscrew the screw plugs slowly, but never unscrew them completely. As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further.

WARNING! Hot operating fluids can also spray out when the pressure is escaping. This can result in scalding! To avoid injuries, allow the motor to cool down to the ambient temperature before carrying out any work!

- When the pressure has completely dissipated, fully unscrew the screw plug.

2.10 Operating fluid

Motor in the motor compartment and the sealing chamber is filled with white oil or a water-glycol mixture. Operating fluids must be replaced during regular maintenance work and disposed of according to the local guidelines.

2.11 Operator responsibilities

- Installation and operating instructions must be in a language which the personnel can understand.
- Make sure that the personnel is relevantly trained for the specified work.
- Provide the necessary protective equipment and make sure that the personnel wears it.
- Safety and information signs mounted on the device must be always legible.
- Train the personnel pertaining to the functioning of the system.
- Eliminate risk from electrical current.
- Equip hazardous components inside the system with an on-site guard.
- Identify and cordon off the work area.
- To ensure safe working practice, define the responsibilities of the employees.

Children and persons younger than 16 years or with reduced physical, sensory or mental capacities or limited experience are prohibited from handling the product! A technician must supervise persons younger than 18 years!

3 Application/use

3.1 Intended use

Submersible pumps are suitable for pumping:

- Sewage containing faeces
- Wastewater (with small amounts of sand and gravel)
- Process sewage
- Fluids with dry matter up to max. 8 %

3.2 Improper use



DANGER

Explosion due to pumping of explosive fluids!

Pumping of highly flammable and explosive fluids (gasoline, kerosene, etc.) in pure form is strictly prohibited. There is a risk of fatal injury due to explosion! The pumps are not designed for these fluids.



DANGER

Danger due to fluids hazardous to health!

If the pump is used in fluids hazardous to health, decontaminate the pump after dismantling and before carrying out any other work! There is a risk of fatal injury! Observe the specifications in the work regulations! The operator must make sure that the personnel have received and read the work regulations!

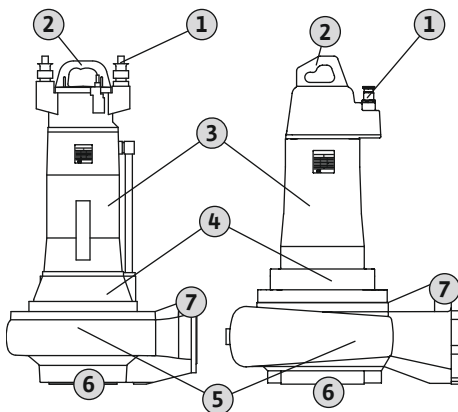
The submersible pumps must **not be used** for pumping:

- Drinking water
- Fluids containing hard components (such as stones, wood, metal, etc.)
- Fluids containing large quantities of abrasive contents (e.g. sand, gravel)

Intended use also includes compliance with this manual. Any other use is regarded as non-compliant with the intended use.

4 Product description

4.1 Design



Submersible sewage pump as submersible monobloc unit for continuous duty in wet well and dry well installation.

1	Power supply cable
2	Handle/attachment point
3	Motor
4	Seal housing
5	Hydraulics housing
6	Suction port
7	Pressure port

Fig. 1: Overview

4.1.1 Hydraulics

Centrifugal hydraulics with different impeller shapes, horizontal flange connection on the pressure side, inspection cover as well as casing and impeller wear rings. The hydraulics are **not** self-priming, in other words, the fluid must flow in either automatically or with supply pressure.

Impeller shapes

The individual impeller shapes depend on the size of the hydraulics and not every impeller shape is available for every hydraulic system. The following is an overview of the different impeller shapes:

- Vortex impeller
- Single-channel impeller
- Two-channel impeller
- Three-channel impeller
- Four-channel impeller
- SOLID impeller, closed or half open

Inspection cover (depending on the hydraulics)

Additional opening on the hydraulics housing. This opening is used to remove clogging in the hydraulics.

Casing and impeller wear rings (depending on the hydraulics)

The suction port and impeller are subjected to the most stress when pumping. In the case of channel impellers, the gap between the impeller and the suction port is an important factor for a constant efficiency. The larger the gap between the impeller and the suction port, the higher the losses in the delivery rate. The efficiency decreases and the danger of clogging increases. In order to ensure long and efficient operation of the hydraulics, an impeller wear ring and/or casing wear ring is installed depending on the impeller and the hydraulics.

→ Impeller wear ring

The impeller wear ring is attached to the channel impellers and protects the incoming flow edge of the impeller.

→ Casing wear ring

The casing wear ring is installed in the suction port of the hydraulics and protects the incoming flow edge in the centrifugal chamber.

The two components can be replaced easily when worn.

4.1.2 Motor

In the three-phase current version, self-cooling submersible motors are used as the drive. The motor can be used in continuous duty both immersed and non-immersed. Continuous duty is also possible in dry well installation. The roller bearings are permanently lubricated, which means they are maintenance-free. The connection cable has bare cable ends.

4.1.3 Cooling system

The motor has an active cooling system. For the cooling, the motor is filled with medicinal white oil. The coolant is circulated by an impeller. The impeller is driven by the motor shaft. The waste heat is transferred directly to the fluid via the cooling flange. The cooling system itself is not pressurised.

4.1.4 Seal

The seal for the fluid and the motor compartment is made via two mechanical seals. The two mechanical seals are arranged in two different ways:

- Version "G": two separate mechanical seals
- Version "K": two mechanical seals in a block seal cartridge made of stainless steel

The sealing chamber between the mechanical seals is filled with medicinal white oil and accommodates any possible leakage of the mechanical seal on the fluid side.

4.1.5 Material

The following materials are used in the standard version:

- Pump housing: EN-GJL-250 (ASTM A48 Class 35/40B)
- Impeller: EN-GJL-250 (ASTM A48 Class 35/40B)
- Motor housing: EN-GJL-250 (ASTM A48 Class 35/40B)
- Seal:
 - On motor side: SiC/SiC
 - Fluid side: SiC/SiC
 - Static: NBR (nitrile)

The precise details of the materials are shown in the respective configuration.

4.2 Monitoring devices

Overview of possible monitoring devices:

	FK 17.1	FK 202	FK 34	FK 42
Internal monitoring devices				
Motor compartment	–	–	•	•
Motor winding	•	•	•	•
Motor bearings	–	–	o	o
Sealing chamber	–	–	•	•
External monitoring units				
Sealing chamber	o	o	o	o

Key: – = not available/possible, o = optional, • = as standard

All the monitoring devices fitted must always be connected!

Monitoring of motor compartment

The motor compartment monitoring protects the motor winding from short-circuits. The moisture is measured by an electrode.

Monitoring of motor winding

The thermal motor monitoring protects the motor winding from overheating. Temperature limiting with bimetallic strip is fitted as standard.

As an option, the temperature can also be measured with a PTC sensor. The thermal motor monitoring can also be designed as temperature control. This allows the measurement of two temperatures. When the low temperature is reached, an automatic reactivation can be initiated after cooling the motor. When the high temperature is reached, the unit must deactivate with reactivation lock.

Internal monitoring of sealing chamber

This sealing chamber is equipped with an internal pencil electrode. The electrode registers fluid ingress through the mechanical seal on the fluid side. An alarm or deactivation of the pump can therefore take place by pump control.

External monitoring of the sealing chamber

The sealing chamber can be equipped with an external pencil electrode. The electrode registers fluid ingress through the mechanical seal on the fluid side. An alarm or deactivation of the pump can therefore take place by pump control.

Monitoring of motor bearing

The thermal monitoring of the motor bearing protects the roller bearings against overheating. Pt100 sensors are used for temperature measurement.

4.3 Operating modes

Operating mode S1: Continuous duty

The pump can operate continuously at the rated load without exceeding the permissible temperature.

Operating mode: Non-immersed operation

The “non-immersed operation” operating mode describes the possibility of the motor emerging during the drainage pumping sequence. This allows a further lowering of the water level as far as the upper edge of the hydraulics. Observe the following points during non-immersed operation:

- Operating mode: Continuous duty (S1).
- Max. fluid and ambient temperature: The max. ambient temperature corresponds to the max. fluid temperature shown on the rating plate.

4.4 Operation with frequency converter

Operation on the frequency converter is permitted. Refer to the appendix for the relevant requirements!

4.5 Operation in an explosive atmosphere

	FK 17.1	FK 17.1 ...-E3	FK 202	FK 34	FK 34 ...-E3	FK 42	FK 42 ...-E3
ATEX approval	o	o	-	-	-	-	-
FM approval	o	o	-	-	-	-	-
CSA-Ex approval	-	-	-	-	-	-	-

Key: - = not available/possible, o = optional, • = as standard

For use in explosive atmospheres, the pump must be marked as follows on the rating plate:

- “Ex” symbol of the corresponding approval
- Ex classification

For the relevant requirements, refer to the explosion protection chapter in the appendix of these installation and operating instructions!

ATEX approval

The pumps are suitable for operation in potentially explosive atmospheres:

- Device group: II
- Category: 2, zone 1 and zone 2

These pumps must not be used in zone 0!

FM approval

The pumps are suitable for operation in potentially explosive atmospheres:

- Protection class: Explosionproof
- Category: Class I, Division 1

Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

4.6 Rating plate

The following is an overview of the abbreviations and associated data on the rating plate:

Rating plate designation	Value
P-Typ	Pump type
M-Typ	Motor type
S/N	Serial number
Art.-No.	Article number
MFY	Date of manufacture*
Q_N	Volume flow duty point
Q_{max}	Max. volume flow
H_N	Delivery head duty point
H_{max}	Max. delivery head
H_{min}	Min. delivery head
n	Speed
T	Max. fluid temperature
IP	Protection class
I	Rated current
I_{ST}	Starting current
I_{SF}	Rated current at service factor
P_1	Power consumption

Rating plate designation	Value
P ₂	Rated power
U	Rated voltage
f	Frequency
Cos φ	Motor efficiency
SF	Service factor
OT _S	Operating mode: immersed
OT _E	Operating mode: non-immersed
AT	Starting mode
IM _{org}	Impeller diameter: original
IM _{korr}	Impeller diameter: corrected

*The date of manufacture is stated in accordance with ISO 8601: JJJJWww

→ JJJJ = year

→ W = abbreviation for week

→ ww = calendar week

4.7 Type key

Example: Wilo-EMU FA 30.93D + FK 34.1-6/33KE_x-E3

Wilo-Rexa SUPRA-M30-933A + FK 34.1-6/33KE_x-E3

Wilo-Rexa SOLID-T35-543A + FK 34.1-6/33KE_x-E3

Hydraulics type key "EMU FA"

FA	Sewage pump
30	x10 = nominal diameter of pressure connection
93	Internal performance coefficient
D	Impeller shape: W = vortex impeller E = single-channel impeller Z = two-channel impeller D = three-channel impeller V = four-channel impeller T = closed two-channel impeller G = half-open single-channel impeller

Hydraulics type key "Rexa SUPRA"

SUPRA	Sewage pump
M	Impeller shape: V = vortex impeller C = single-channel impeller M = multi-channel impeller
30	x10 = nominal diameter of pressure connection
93	Internal performance coefficient
3	Characteristic curve number
A	Material version: A = standard version B = corrosion protection 1 D = abrasion protection 1 X = special configuration

Hydraulics type key "Rexa SOLID"

SOLID	Sewage pump with SOLID impeller
T	Impeller shape: T = closed two-channel impeller G = semi-open single-channel impeller Q = half-open two-channel impeller
35	x10 = nominal diameter of pressure connection
54	Internal performance coefficient

Example: Wilo-EMU FA 30.93D + FK 34.1-6/33KEx-E3
 Wilo-Rexa SUPRA-M30-933A + FK 34.1-6/33KEx-E3
 Wilo-Rexa SOLID-T35-543A + FK 34.1-6/33KEx-E3

3	Characteristic curve number
---	-----------------------------

A	Material version: A = standard version B = corrosion protection 1 D = abrasion protection 1 X = special configuration
---	---

Motor type key

FK	Self-cooling motor, oil-filled
34	Size
1	Internal code figure
6	Number of poles
33	Package length in cm
K	Seal version
Ex	Ex-rated
E3	IE-efficiency class (derived from IEC 60034-30)

4.8 Scope of delivery

- Pump with free cable end
- Cable length per customer request
- Mounted accessories, e.g. external pencil electrode, pump support foot, etc.
- Installation and operating instructions

4.9 Accessories

- Suspension unit
- Pump support foot
- Special versions with Ceram coatings or special materials
- External pencil electrode for sealing chamber control
- Level control devices
- Fixation accessories and chains
- Switchgear, relays and plugs

5 Transportation and storage

5.1 Delivery

After receiving the shipment, this must be checked immediately for defects (damage, completeness). Defects must be noted on the freight documentation! Furthermore, defects must be notified to the transport company or the manufacturer immediately on the day of receipt of shipment. Subsequently notified defects can no longer be asserted.

5.2 Transport



WARNING

Standing under suspended loads!

Never allow anyone to stand under suspended loads! Danger of (serious) injuries caused by falling parts. Loads may not be carried over work places where people are present!



WARNING

Head and foot injuries due to a lack of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety shoes
- Safety helmet must be worn if lifting equipment are used!

**NOTICE****Use only properly functioning lifting equipment!**

Use only properly functioning lifting equipment to lift and lower the pump. Ensure that the pump does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

Only remove the outer packaging at the place of utilisation to ensure that the pump is not damaged during transport. Use tear-proof plastic sacks of sufficient size to package used pumps for transport in a leak-proof manner.

The following points must also be observed:

- Adhere to the applicable national safety regulations.
- Use legally specified and approved lifting gear.
- Select the lifting gear based on the existing conditions (weather, attachment point, load, etc.).
- Only attach the lifting gear to the attachment point. Fix with a shackle.
- Use lifting equipment with sufficient bearing capacity.
- The stability of the lifting equipment must be ensured during operation.
- When using lifting equipment, a second person must be present to coordinate the procedure if required (e.g. if the operator's field of vision is blocked).

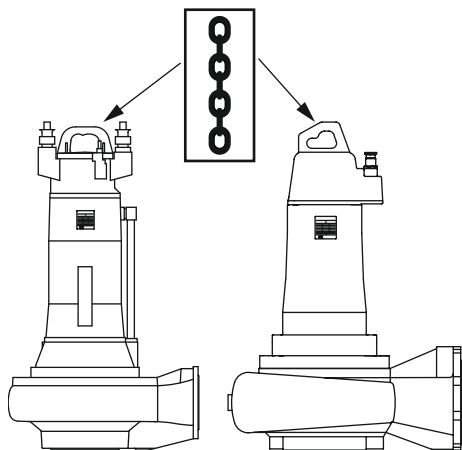


Fig. 2: Attachment point

5.3 Storage

**DANGER****Danger due to fluids hazardous to health!**

If the pump is used in fluids hazardous to health, decontaminate the pump after dismantling and before carrying out any other work! There is a risk of fatal injury! Observe the specifications in the work regulations! The operator must make sure that the personnel have received and read the work regulations!

**WARNING****Sharp edges on the impeller and suction port!**

Sharp edges can form on the impeller and suction port. There is danger of limbs being severed! Protective gloves must be worn to protect from cuts.

CAUTION**Total damage due to moisture ingress**

Moisture ingress in the power supply cable damages the power supply cable and the pump! Never immerse the end of the power supply cable in a fluid and firmly seal it during storage.

Newly supplied pumps can be stored for one year. Contact customer service to store the pump for more than one year.

The following must be observed for storage:

- Place the pump upright (vertical) on a firm bearing surface and **secure it against slipping and falling over!**
- The max. storage temperature is -15 °C to $+60\text{ °C}$ (5 °F to 140 °F) at a max. relative humidity of 90 %, non-condensing. Frost-proof storage at a temperature of 5 °C to 25 °C (41 °F to 77 °F) with relative humidity of 40 % to 50 % is recommended.

- Do not store the pump in rooms in which welding work is carried out. The resulting gases or radiation can corrode the elastomer parts and coatings.
- Seal the suction and pressure connection tightly.
- Protect power supply cables against kinking and damage.
- Protect the pump from direct sunlight and heat. Extreme heat can cause damage to the impellers and the coating!
- Impellers must be turned by 180 ° at regular intervals (3 – 6 months). This prevents locking of the bearings and renews the lubrication film of the mechanical seal.
WARNING! There is a risk of injury due to sharp edges on the impeller and suction port!
- Elastomer parts and the coating are subject to natural brittleness. Contact customer service if the pump must be stored for more than 6 months.

After storage, remove any dust and oil from the pump and check the coating for damage. Repair damaged coatings before further use.

6 Installation and electrical connection

6.1 Personnel qualifications

- Electrical work: A qualified electrician must carry out the electrical work.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.

6.2 Installation types

- Vertical stationary wet well installation with suspension unit
- Vertical portable wet well installation with pump support foot
- Vertical stationary dry well installation
- Horizontal stationary dry well installation
NOTICE! Horizontal installation is not possible, depending on type and performance. For this installation type, contact customer service!

6.3 Operator responsibilities

- Observe locally applicable accident prevention and safety regulations of trade associations.
- Observe all regulations for working with heavy loads and under suspended loads.
- Provide protective equipment and ensure that the protective equipment is worn by personnel.
- Observe local sewage technology regulations for the operation of sewage systems.
- Avoid pressure surges!
Pressure surges can occur in long pressure pipes with steep terrain. These pressure surges can lead to the destruction of the pump!
- Ensure the cooling time of the motor depending on the operating conditions and the size of the pump chamber.
- Structural components and foundations must be of sufficient stability in order to allow the device to be fixed securely and functionally. The operator is responsible for the provision and suitability of the structural component/foundation!
- Check that the available consulting documents (installation plans, design of the operating space, inflow conditions) are complete and correct.

6.4 Installation



DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.



WARNING

Hand and foot injuries due to lack of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Safety helmet must be worn if lifting equipment are used!

**NOTICE****Use only properly functioning lifting equipment!**

Use only properly functioning lifting equipment to lift and lower the pump. Ensure that the pump does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

- Prepare operating space/installation location as follows:
 - Clean, free of coarse solids
 - Dry well
 - Frost-free
 - Decontaminated
- Take immediate countermeasures if there is a build-up of toxic or suffocating gases!
- Attach the lifting gear to the attachment point using a shackle. Only use lifting gear which has been technically approved.
- Use lifting gear for lifting, lowering and transporting the pump. Never pull the pump by the power supply cable!
- It must be possible to attach lifting equipment safely. The storage place and the operating space/installation site must be accessible with the lifting equipment. The set-down location must have a solid bearing surface.
- The routed power supply cables must allow safe operation. Check whether the cable cross-section and the cable length are sufficient for the selected installation type.
- The corresponding IP class must be observed when using switchgear. Install the switchgear overflow-proof and outside potentially explosive areas!
- Avoid air intake into the fluid, use baffles or deflector plates for the inlet. Air which has entered the system can collect in the pipe system and lead to impermissible operating conditions. Air pockets must be removed via ventilation systems!
- A dry run of the pump is prohibited! Avoid air pockets in the hydraulics housing or in the pipe system. Ensure the water level never falls below the minimum. The installation of a dry-running protection is recommended!

6.4.1 Indications for double pump operation

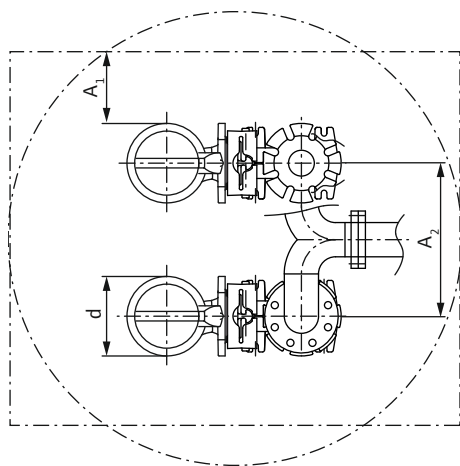


Fig. 3: Minimum distances

6.4.2 Maintenance tasks

If several pumps are used in an operating space, minimum distances between the pumps and the wall must be complied with. Here there is a difference in the distances depending on the type of system: Alternating operation or parallel operation.

d	Diameter hydraulics housing
A ₁	Minimum distance from the wall: – alternating operation: min. 0.3 × d – parallel operation: min. 1 × d
A ₂	Distance to pressure pipes – alternating operation: min. 1.5 × d – parallel operation: min. 2 × d

After a storage period of more than 6 months, carry out the following maintenance tasks before installation:

- Rotate the impeller.
- Check the oil in the motor compartment.
- Check the oil in the sealing chamber.

6.4.2.1 Rotate impeller



WARNING

Sharp edges on the impeller and suction port!

Sharp edges can form on the impeller and suction port. There is danger of limbs being severed! Protective gloves must be worn to protect from cuts.

- ✓ Pump is **not** connected to the mains!
 - ✓ Protective equipment has been put on!
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Carefully and slowly reach into the hydraulics housing through the pressure port and rotate the impeller.

6.4.2.2 Checking the oil in the motor compartment

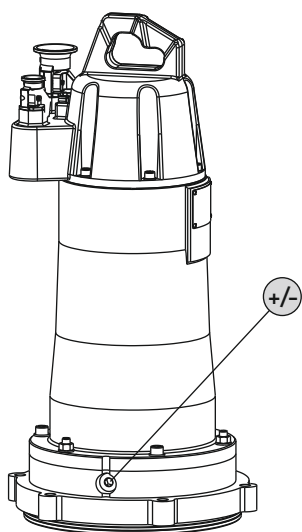


Fig. 4: Motor compartment: Check the oil

Motor FK 17.1

+/-	Fill/drain the oil in the motor compartment
-----	---

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Protective equipment has been put on.
1. Place the pump on a firm surface in a vertical position. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Position a suitable tank to collect the operating fluid.
 3. Unscrew screw plug and allow the operating fluid to drain out.
 4. Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse operating fluid.
 - ⇒ If the operating fluid is contaminated (black), fill with new operating fluid. Dispose of operating fluid in accordance with the local regulations!
 - ⇒ Notify the customer service if the operating fluid contains swarf!
 5. Pour the operating fluid in through the opening.
 - ⇒ Comply with the specifications for operating fluid type and quantity. When recycling the operating fluid, check the quantity and if required adjust it.
 6. Clean the screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

Motors FK 202, FK 34, FK 42

E	Venting
+	Fill the oil in the motor compartment
-	Drain the oil in the motor compartment

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Protective equipment has been put on.
1. Place the pump on a firm surface in a vertical position. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Position a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug (E).
 4. Unscrew the screw plug (+).
 5. Unscrew screw plug (-) and drain the operating fluid. If a shut-off ball cock is installed on the outlet opening, open the shut-off ball cock.
 6. Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse operating fluid.

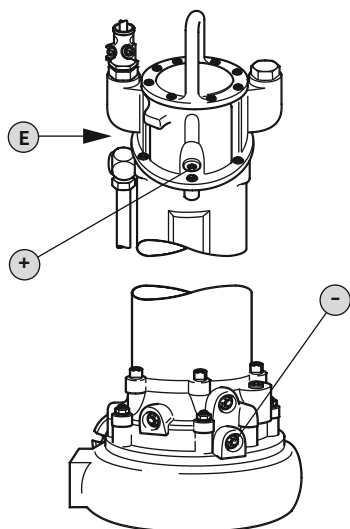


Fig. 5: Motor compartment: Check the oil

- ⇒ If the operating fluid is contaminated (black), fill with new operating fluid. Dispose of operating fluid in accordance with the local regulations!
 - ⇒ Notify the customer service if the operating fluid contains swarf!
7. If a shut-off ball cock is installed on the outlet opening, close the shut-off ball cock.
 8. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**
 9. Pour the new operating fluid in through the hole for the screw plug (+).
 - ⇒ Comply with the specifications for operating fluid type and quantity. When recycling the operating fluid, check the quantity and if required adjust it.
 10. Clean the screw plug (+) and (E), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

6.4.2.3 Check oil in the sealing chamber

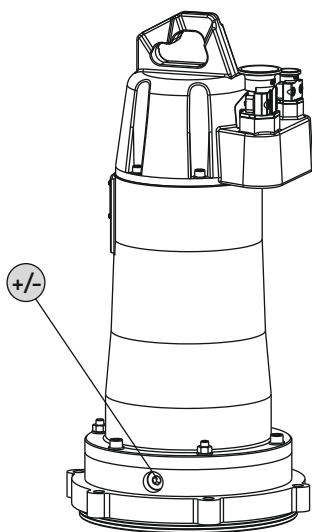


Fig. 6: Sealing chamber: Check the oil

Motor FK 17.1

+/-	Fill/drain the oil in the sealing chamber
-----	---

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Protective equipment has been put on.
1. Place the pump on a firm surface in a vertical position. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Position a suitable tank to collect the operating fluid.
 3. Unscrew screw plug and allow the operating fluid to drain out.
 4. Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse operating fluid.
 - ⇒ If the operating fluid is contaminated (black), fill with new operating fluid. Dispose of operating fluid in accordance with the local regulations!
 - ⇒ Notify the customer service if the operating fluid contains swarf!
 5. Pour the operating fluid in through the opening.
 - ⇒ Comply with the specifications for operating fluid type and quantity. When recycling the operating fluid, check the quantity and if required adjust it.
 6. Clean the screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

Motors FK 202, FK 34, FK 42

+	Fill the oil in the sealing chamber
-	Drain the oil in the sealing chamber

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Protective equipment has been put on!
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Place a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug (+).
 4. Unscrew screw plug (-) and drain the operating fluid. If a shut-off ball cock is installed on the outlet opening, open the shut-off ball cock.
 5. Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse operating fluid.
 - ⇒ If the operating fluid is contaminated (black), fill with new operating fluid. Dispose of operating fluid in accordance with the local regulations!
 - ⇒ Notify customer service if the operating fluid contains swarf!

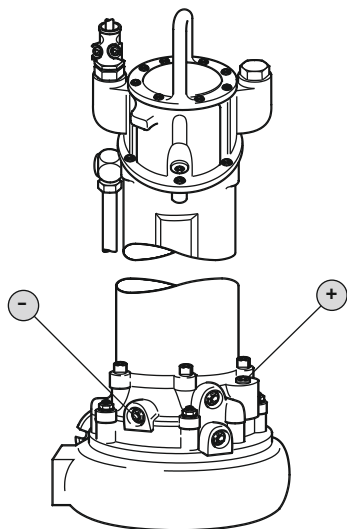


Fig. 7: Sealing chamber: Check the oil

6. If a shut-off ball cock is installed on the outlet opening, close the shut-off ball cock.
7. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
8. Pour the new operating fluid in through the hole for the screw plug (+).
⇒ Comply with the specifications for operating fluid type and quantity! When recycling the operating fluid, check the quantity and if required adjust it!
9. Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

6.4.3 Stationary wet well installation



NOTICE

Pumping problems due to water level being too low

If the fluid is lowered too much, separation of the volume flow may occur. Furthermore, air cushions may form in the hydraulic system, resulting in undesirable behaviour during operation. The minimum permissible water level must reach the upper edge of the hydraulics housing!

The pump is installed in the fluid for the wet well installation. For this, a suspension unit must be installed in the chamber. On the pressure side, the on-site pipe system is connected to the suspension unit and on the suction side to the pump. The connected pipe system must be self-supporting. The suspension unit must **not** support the pipe system!

Work steps

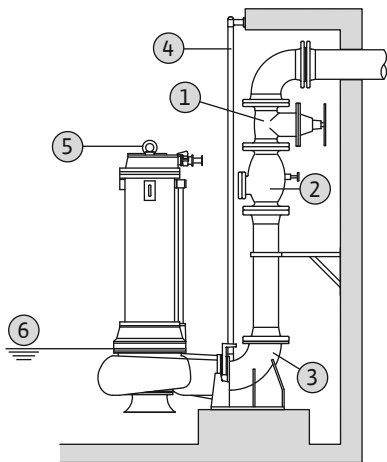


Fig. 8: Wet well installation, stationary

1	Gate valve
2	Non-return valve
3	Suspension unit
4	Guide pipe (provided by the customer)
5	Attachment point for the lifting equipment
6	Minimum water level

- ✓ Operating space/installation location is prepared for the installation.
 - ✓ Suspension unit and pipe system were installed.
 - ✓ Pump is prepared for operation on the suspension unit.
1. Use a shackle to attach the lifting equipment to the attachment point of the pump.
 2. Lift the pump, swivel it above the chamber opening and slowly lower the guide claw onto the guide pipe.
 3. Lower the pump until it sets on the suspension unit and is connected automatically. **CAUTION! Hold the power supply cables slightly taut when lowering the pump!**
 4. Loosen the lifting equipment from the lifting gear and secure it at the chamber outlet against falling.
 5. Have the power supply cables routed into the chamber by a qualified electrician and route it outside properly from the chamber.
- The pump is installed, the qualified electrician can make the electrical connection.

6.4.4 Portable wet well installation



WARNING

Risk of burns from hot surfaces!

Motor housing can become hot during operation. It may cause burns. Allow the pump to cool down at ambient temperature after switching it off!

**WARNING****Separation of pressure hose!**

Separation or movement of the pressure hose can lead to (serious) injuries. Securely attach the pressure hose to the outlet! Prevent buckling of the pressure hose.

**NOTICE****Pumping problems due to water level being too low**

If the fluid is lowered too much, separation of the volume flow may occur. Furthermore, air cushions may form in the hydraulic system, resulting in undesirable behaviour during operation. The minimum permissible water level must reach the upper edge of the hydraulics housing!

For portable installation, the pump must be equipped with a pump support foot. The pump support foot ensures minimum ground clearance in the suction area and enables secure footing if placed on a solid bearing surface. In this installation type, the pump can be installed anywhere in the operating space/installation site. A hard base must be used at the installation location to prevent sinking in case of soft bearing surfaces. A pressure hose is connected on the pressure side. If operated for longer periods of time, fix the pump firmly to the floor. This prevents vibration and ensures quiet and low-wearing running.

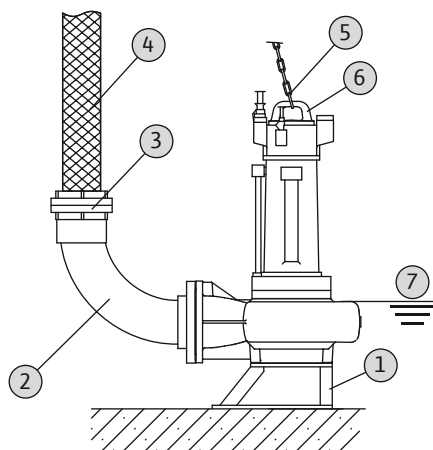


Fig. 9: Wet well installation, portable

Work steps

1	Pump support foot
2	Pipe elbow
3	Storz coupling
4	Pressure hose
5	Lifting equipment
6	Attachment point for the lifting equipment
7	Minimum water level

- ✓ Pump support foot mounted.
- ✓ Pressure connection prepared: Pipe elbow with hose connection or pipe elbow with Storz coupling mounted.
 1. Use a shackle to attach the lifting equipment to the attachment point of the pump.
 2. Lift the pump and lower it at the intended location (chamber, pit).
 3. Place the pump on a solid bearing surface. **CAUTION! Sinking must be prevented!**
 4. Lay the pressure hose and fasten it to a certain point (e.g. drainage).
DANGER! Separation or movement of the pressure hose can lead to (serious) injuries! Securely attach the pressure hose to the outlet.
 5. Lay the power supply cable properly. **CAUTION! Do not damage the power supply cable!**
- ▶ The pump is installed, the qualified electrician can make the electrical connection.

6.4.5 Stationary dry well installation

**NOTICE****Pumping problems due to water level being too low**

If the fluid is lowered too much, separation of the volume flow may occur. Furthermore, air cushions may form in the hydraulic system, resulting in undesirable behaviour during operation. The minimum permissible water level must reach the upper edge of the hydraulics housing!

In dry well installation, the operating space is divided into the collecting space and the machine room. In the collecting space, the fluid flows and is collected; the pump technology is installed in the machine room. The pump is installed in the machine room and connected to the pipe system on the suction and pressure side. Observe the following points for installation:

- The suction- and pressure-side pipe system must be self-supporting. The pump must not support the pipe system.
- Connect the pump to the pipe system ensuring that it is free of stress and vibrations. The use of elastic connection pieces (compensators) is recommended.
- The pump is not self-priming, in other words, the fluid must flow in either automatically or with supply pressure. The minimum level in the collecting space must be at the same height as the upper edge of the hydraulics housing!
- Max. ambient temperature: 40 °C (104 °F)

Work steps

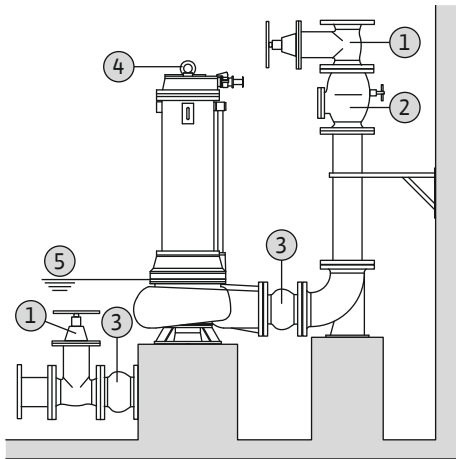


Fig. 10: Dry well installation

1	Gate valve
2	Non-return valve
3	Compensator
4	Attachment point for the lifting equipment
5	Minimum water level in collecting space

- ✓ Machine room/installation location is prepared for the installation.
- ✓ Pipe system has been properly installed and is self-supporting.
 1. Use a shackle to attach the lifting equipment to the attachment point of the pump.
 2. Lift the pump and position it in the machine room. **CAUTION! Hold the power supply cables slightly taut when positioning the pump!**
 3. Fasten pump to the foundation properly.
 4. Connect pump to the pipe system. **NOTICE! Ensure the connection is free of stress and vibrations. If required, use plastic connection pieces (compensators).**
 5. Loosen the lifting gear from the pump.
 6. Have the power supply cables installed in the machine room by a qualified electrician.
- ▶ The pump is installed, the qualified electrician can make the electrical connection.

6.4.6 Level control



DANGER

Risk of explosion due to incorrect installation!

If the level control is installed within a potentially explosive area, the signal transmitter must be connected via an Ex cut-off relay or a Zener barrier. There is a risk of explosion if connected incorrectly! Connection must be carried out by a qualified electrician.

With a level control device, the current fill levels are determined and the pump is switched on and off automatically depending on the fill levels. Fill levels are recorded by using different sensor types (float switches, pressure and ultrasound measurements or electrodes). The following must be observed when using a level control device:

- Float switches can move freely!
- The water level must **not fall below** the minimum permissible!
- The maximum switching frequency **must not be exceeded!**
- If the fill levels fluctuate strongly, a level control with two measuring points is recommended. This makes it possible to achieve larger differential gaps.

6.4.7 Dry-running protection

Dry-running protection must prevent the pump from operating without fluid and air from entering the hydraulics. The minimum permissible fill level must be determined with the help of a signal transmitter. Once the specified limit value is reached, the pump must be deactivated with an appropriate signal. Dry-running protection can expand the available level controls by an additional measuring point or function as an independent switch-off device. Depending on the system security, the pump can be restarted automatically or manually. Installation of dry-running protection is recommended for optimum operational reliability.

6.5 Electrical connection



DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.



DANGER

Risk of explosion due to incorrect connection!

- Always connect the pump to an electrical outlet outside the explosive area. If the connection must be made within the explosive area, then connection must be carried out in an Ex-rated housing (ignition protection class DIN EN 60079-0)! Non-observance may lead to fatal injury due to explosion!
- Connect the potential compensator to the earth terminal indicated. The earth terminal is installed in the area of the power supply cable. A cable cross-section in accordance with the locally applicable regulations must be used for the potential compensator.
- Connection must always be carried out by a qualified electrician.
- For the electrical connection, also note the additional information in the chapter on potentially explosive areas found in the appendix of these installation and operating instructions!

- The mains connection must match the specifications on the rating plate.
- Power supply on mains side for three-phase current motors with clockwise rotating field.
- Lay the connection cable in accordance with the locally applicable regulations and connect it according to the wire assignment.
- Connect the monitoring devices and check their function.
- Earth the device properly in accordance with applicable local regulations.

6.5.1 Fuse on mains side

Circuit breaker

The size and switching characteristics of the circuit breakers must conform to the rated current of the connected product. Observe local regulations.

Motor protection switch

Make provision for an on-site motor protection switch for devices without a plug! The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential triggering and anti-reactivation device in accordance with the local regulations. In case of sensitive mains, make provision for the installation on-site of other protective equipment (e.g. overvoltage, undervoltage or phase failure relay, etc.).

Residual-current device (RCD)

Comply with the regulations of the local energy supply company! The use of a residual-current device is recommended.

If persons come into contact with the device and conductive fluids, secure the connection **with** a residual-current device (RCD).

6.5.2 Maintenance tasks

Carry out the following maintenance tasks prior to installation:

- Check the insulation resistance of the motor winding.
- Test the resistance of the temperature sensor.
- Test the resistance of the pencil electrode (optionally available).

If the measured values differ from the specifications:

- Moisture may have penetrated into the motor or the connection cable.
- The monitoring device may be defective.

Contact customer service in the event of a fault.

6.5.2.1 Checking the insulation resistance of the motor winding

Use an insulation tester to measure the insulation resistance (measuring voltage = 1000 V). Observe the following values:

- At the time of initial commissioning: Insulation resistance may not be less than 20 MΩ.
- For further measurements: Value must be greater than 2 MΩ.

6.5.2.2 Test the resistor of the temperature sensor

Measure the resistor of the temperature sensors with an ohmmeter. The following measured values must be complied with:

- **Bimetallic strip**: Measured value = 0 ohms (continuity).
- **PTC sensor** (PTC thermistor): Measured value depends on the number of sensors installed. A PTC sensor has a cold resistance range of 20 to 100 ohms.
 - With **three** sensors in series, the measured value range is from 60 to 300 ohms.
 - With **four** sensors in series, the measured value range is from 80 to 400 ohms.
- **Pt100 sensor**: Pt100 sensors have a resistance value of 100 ohms at 0 °C (32 °F). Between 0 °C (32 °F) and 100 °C (212 °F), the resistance increases by 0.385 ohms per 1 °C (1.8 °F) increase. At an ambient temperature of 20 °C (68 °F), the resistance is 107.7 ohms.

6.5.2.3 Testing the resistor of the external electrode for sealing chamber control

Measure the resistor of the electrode with an ohmmeter. The measured value must approach “infinity”. For values ≤ 30 kOhm, if there is water in the oil – change the oil!

6.5.3 Three-phase motor connection

The three-phase current version is supplied with bare cable ends. Connection to the mains is established by connecting the power supply cables in the switchgear. Refer to the attached connection diagram for more precise details regarding the connection.

Electrical connection must always be carried out by a qualified electrician!

NOTICE! The individual wires are designated according to the connection diagram. Do not cut the wires! There is no additional assignment between the wiring diagram and connection diagram.

Wiring diagram of the power connections for direct activation

U, V, W	Mains connection
PE (green-yellow)	Earth

Wiring diagram of the power connections for star-delta starting

U1, V1, W2	Mains connection (start of winding)
U2, V2, W2	Mains connection (end of winding)
PE (green-yellow)	Earth

6.5.4 Monitoring equipment connection

Refer to the enclosed connection diagram for details regarding the connection and installation of the monitoring devices. **Electrical connection must always be carried out by a qualified electrician!**

NOTICE! The individual wires are designated according to the connection diagram. Do not cut the wires! There is no additional assignment between the wiring diagram and connection diagram.



DANGER

Risk of explosion due to incorrect connection!

If the monitoring devices are not connected correctly, there is a risk of fatal injury due to explosion in potentially explosive areas! Connection must always be carried out by a qualified electrician. If used in potentially explosive areas:

- Connect the thermal motor monitoring via an evaluation relay!
- Deactivation by the temperature limiter must be conducted with reactivation lock! It must only be possible to restart the unit when the unlock key has been actuated by hand!
- Connect the external electrode (e.g. sealing chamber control) via an evaluation relay with an intrinsically safe circuit!
- Note the additional information in the chapter on potentially explosive areas found in the appendix of these installation and operating instructions!

Overview of possible monitoring devices:

	FK 17.1	FK 202	FK 34	FK 42
Internal monitoring devices				
Motor compartment	–	–	•	•
Motor winding	•	•	•	•
Motor bearings	–	–	o	o
Sealing chamber	–	–	•	•
External monitoring units				
Sealing chamber	o	o	o	o

Key: – = not available/possible, o = optional, • = as standard

All the monitoring devices fitted must always be connected!

6.5.4.1 Motor compartment/sealing chamber monitoring

Connect the electrodes via an evaluation relay. Relay “NIV 101/A” is recommended for this. The threshold is 30 kOhm.

Wiring diagram	
DK	Electrode connection

The system must be deactivated when the threshold is reached!

6.5.4.2 Monitoring of motor winding

With bimetallic strips

Directly connect bimetallic strips to the switchgear or via an evaluation relay. Connection values: max. 250 V (AC), 2.5 A, cos φ = 1

Wiring diagram for bimetallic strip	
Temperature limiter	
20, 21	Bimetallic strip connection
Temperature controller and limiter	
21	High temperature connection
20	Centre terminal
22	Low temperature connection

With PTC sensor

Connect the PTC sensor via an evaluation relay. Relay “CM-MSS” is recommended for this. The threshold has been preset.

PTC sensor wiring diagram	
Temperature limiter	
10, 11	PTC sensor connection
Temperature controller and limiter	
11	High temperature connection
10	Centre terminal
12	Low temperature connection

Triggering status for temperature controller and limiter

Depending on the version of the thermal motor monitoring, the following triggering status must occur when the threshold value is reached:

- Temperature limiter (1 temperature circuit):
The system must be deactivated when the threshold is reached.
- Temperature controller and limiter (2 temperature circuits):
When the threshold for the low temperature is reached, the motor can deactivate with automatic reactivation. When the threshold for the high temperature limit is reached, the motor must deactivate with manual reactivation.

- Note the additional information in the section on potentially explosive areas in the appendix!**
- 6.5.4.3 Monitoring of motor bearing**
- Connect the Pt100 sensor via an evaluation relay. Relay “DGW 2.01G” is recommended for this. The threshold is 100 °C (212 °F).
- Wiring diagram**
- | | |
|--------|-------------------------|
| T1, T2 | Pt100 sensor connection |
|--------|-------------------------|
- When the threshold is reached, deactivation must take place!**
- 6.5.4.4 Sealing chamber monitoring (external electrode)**
- Connect the external electrode via an evaluation relay. Relay “NIV 101/A” is recommended for this. The threshold is 30 kOhm.
- Once the threshold is reached, a warning must be output or the unit must be switched off.**
-
- CAUTION**
- Connection of the sealing chamber control**
- If on reaching the threshold, there is only a warning, the pump could be irreparably damaged by the water ingress. Deactivation of the pump is always recommended!
-
- Note the additional information in the chapter on potentially explosive areas found in the appendix!**
- 6.5.5 Motor protection adjustment**
- Motor protection must be set depending on the selected activation type.
- 6.5.5.1 Direct activation**
- At full load, set the motor protection switch to the rated current (see rating plate). At partial load, it is recommended to set the motor protection switch 5 % above the current measured at the duty point.
- 6.5.5.2 Star-delta activation**
- The motor protection setting depends on the installation:
- Motor protection installed in the motor line: Set the motor protection to 0.58 x the rated current.
 - Motor protection installed in the mains supply cable: Set the motor protection to the rated current.
- The maximum start-up time in star connection is 3 seconds.
- 6.5.5.3 Soft starter**
- At full load, set the motor protection switch to the rated current (see rating plate). At partial load, it is recommended to set the motor protection switch 5 % above the current measured at the duty point. The following points must also be observed:
- Power consumption must always be below the rated current.
 - Complete starting and stopping within 30 s.
 - To avoid power dissipation, bypass the electronic starter (soft start) once normal operation is reached.
- 6.5.6 Operation with frequency converter**
- Operation on the frequency converter is permitted. Refer to the appendix for the relevant requirements!

7 Commissioning



WARNING

Foot injuries due to a lack of protective equipment!

Danger of (serious) injuries during work. Wear safety shoes!

- 7.1 Personnel qualifications**
- Electrical work: A qualified electrician must carry out the electrical work.
 - Operation/control: Operating personnel must be instructed in the functioning of the complete system.
- 7.2 Operator responsibilities**
- Providing installation and operating instructions by the pump or at a place specially reserved for it.

- Making the installation and operating instructions available in the language of the personnel.
- Making sure that the installation and operating instructions are read and understood by all personnel.
- All safety devices and emergency cut-outs on the system-side must be active and checked to ensure that they work properly.
- The pump is suitable for use under the specified operating conditions.

7.3 Direction of rotation check (for three-phase current motors only)

The pump is factory-checked and adjusted to the correct direction of rotation for a clockwise rotating field. Connection is made in accordance with the specifications in chapter "Electrical connection".

Direction of rotation check

A qualified electrician checks the rotating field at the mains connection with a rotating field-test device. For the correct direction of rotation, a clockwise rotating field must be available at the mains connection. The pump is **not** approved for operation with a counter-clockwise rotating field! **CAUTION! If the direction of rotation is checked with a test run, comply with the ambient and operating conditions!**

Incorrect direction of rotation

If the direction of rotation is incorrect, change the connection as follows:

- Swap two phases for motors with direct starting.
- Swap the connections of two windings (e.g. U1/V1 and U2/V2) for star-delta activation motors.

7.4 Operation in an explosive atmosphere



DANGER

Risk of explosion due to flying sparks in the hydraulics!

During operation the hydraulics must be flooded (completely filled with the fluid). If the volume flow is interrupted or the hydraulics emerges, air cushions can form in the hydraulics. If this happens, there is a risk of explosion, e.g. flying sparks due to static charge! Dry-running protection must ensure that the pump is deactivated at the appropriate level.

	FK 17.1	FK 17.1 ...-E3	FK 202	FK 34	FK 34 ...-E3	FK 42	FK 42 ...-E3
ATEX approval	o	o	-	-	-	-	-
FM approval	o	o	-	-	-	-	-
CSA-Ex approval	-	-	-	-	-	-	-

Key: - = not available/possible, o = optional, • = as standard

For use in explosive atmospheres, the pump must be marked as follows on the rating plate:

- "Ex" symbol of the corresponding approval
- Ex classification

For the relevant requirements, refer to the explosion protection chapter in the appendix of these installation and operating instructions!

ATEX approval

The pumps are suitable for operation in potentially explosive atmospheres:

- Device group: II
- Category: 2, zone 1 and zone 2

These pumps must not be used in zone 0!

FM approval

The pumps are suitable for operation in potentially explosive atmospheres:

→ Protection class: Explosionproof

→ Category: Class I, Division 1

Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

7.5 Before switching on

Check the following prior to activation:

→ Check whether the device has been installed properly and in accordance with the locally applicable regulations:

- Has the pump been earthed?
- Layout of power supply cable tested?
- Electrical connection made properly?
- Mechanical components attached correctly?

→ Check level control:

- Float switches can move freely?
- Switching level tested (pump on, pump off, minimum water level)?
- Additional dry-running protection installed?

→ Test operating conditions:

- Min./max. temperature of the fluid tested?
- Max. immersion depth tested?
- Operating mode defined depending on the minimum water level?
- Maximum switching frequency adhered to?

→ Check installation location/operating space:

- Pipe system on the pressure side free of deposits?
- Inlet or pump sump cleaned or free of deposits?
- All gate valves open?
- Minimum water level defined and monitored?

The hydraulics housing must be filled completely with the fluid and there must be no air cushions in the hydraulics. **NOTICE! Provide suitable venting devices if there is a risk of air cushions being formed in the system!**

7.6 Switching on and off

During the start process, the rated current is temporarily exceeded. During operation, the rated current may no longer be exceeded. **CAUTION! If the pump does not start, switch off the pump immediately. Remove the fault before reactivating the pump!**

Place pumps which are installed as portable pumps on a firm surface so they are level. If pumps have fallen over, place them upright again before activating them. Securely attach the pump with screws in case of difficult surfaces.

Pumps with free cable end

The pump must be switched on and off using a separate operating point (on/off switch, switchgear) provided by the customer.

Pump with attached plug

→ Three-phase current version: After inserting the plug into the socket, the pump is ready for operation. The pump is switched on and off with the ON/OFF switch.

Pump with attached float switch and plug

→ Three-phase current version: After inserting the plug into the socket, the pump is ready for operation. The pump is controlled via two switches on the plug:

- MANUAL/AUTO: Determines if the pump is switched on and off directly (MANUAL) or depending on the fill level (AUTO).
- ON/OFF: Switch pump on and off.

7.7 During operation**DANGER****Risk of explosion due to overpressure in the hydraulics!**

If the gate valves on the suction and pressure sides are closed during operation, the fluid in the hydraulics housing is heated up by the pumping movement. This heating creates a pressure of several bars in the hydraulics. The pressure can result in the pump exploding! Make sure that all gate valves are open during operation. Open closed gate valves immediately!

**WARNING****Amputation of limbs due to rotating components!**

No persons must be present in the work area of the pump! There is risk of (serious) injuries due to rotating components! No persons must be present in the work area of the pump during start-up or operation.

**WARNING****Risk of burns from hot surfaces!**

Motor housing can become hot during operation. It may cause burns. Allow the pump to cool down at ambient temperature after switching it off!

**NOTICE****Pumping problems due to water level being too low**

If the fluid is lowered too much, separation of the volume flow may occur. Furthermore, air cushions may form in the hydraulic system, resulting in undesirable behaviour during operation. The minimum permissible water level must reach the upper edge of the hydraulics housing!

When operating the pump, observe the locally applicable regulations on the following topics:

- Work safety
- Accident prevention
- Handling electrical machines

Strictly adhere to the responsibilities of the personnel specified by the operator. All personnel are responsible for ensuring that the responsibilities of the personnel and the regulations are observed!

Due to their design, centrifugal pumps have rotating parts that are easily accessible. Depending on the operating condition, sharp edges can develop on these parts. **WARNING! This can lead to cuts and limbs may be amputated and severed!** Check the following at regular intervals:

- Operating voltage (+/-10 % of the rated voltage)
- Frequency (+/-2 % of the rated frequency)
- Power consumption between individual phases (max. 5 %)
- Voltage difference between the individual phases (max. 1 %)
- Max. switching frequency
- Minimum water submersion depending on the operating mode
- Inlet: no air intake
- Level control device/dry-running protection: Switching points
- Quiet/low-vibration running
- All gate valves open

Operation in the limit range

The pump can briefly be operated in the limit range (max. 15 min/day). During operation in the limit range, expect relatively large deviations from the operating data. **NOTICE! Continuous duty in the limit range is prohibited! The pump is exposed to high wear and there is a greater risk of failure!**

The following parameters apply during operation in the limit range:

- Operating voltage (+/-10 % of the rated voltage)
- Frequency (+3/-5 % of the rated frequency)
- Power consumption between individual phases (max. 6 %)
- Voltage difference between the individual phases (max. 2 %)

8 Shut-down/dismantling

8.1 Personnel qualifications

- Operation/control: Operating personnel must be instructed in the functioning of the complete system.
- Electrical work: A qualified electrician must carry out the electrical work.
- Installation/dismantling: The technician must be trained in the use of the necessary tools and fixation materials for the relevant construction site.

8.2 Operator responsibilities

- Locally applicable accident prevention and safety regulations of trade associations.
- Observe regulations for working with heavy loads and under suspended loads.
- Provide the necessary protective equipment and make sure that the personnel wears it.
- Provide adequate aeration in closed rooms.
- Take immediate countermeasures if there is a build-up of toxic or suffocating gases!

8.3 Shut-down

The pump is deactivated during decommissioning, but remains installed. This ensures that the pump is always ready for operation.

- ✓ To protect the pump from frost and ice, always immerse the pump completely in the fluid.
- ✓ The temperature of the fluid must always be above +3 °C (+37 °F).
 1. Switch off the pump at the operating point.
 2. Secure the operating point against being switched on again by unauthorised persons (e.g. lock main switch).
 - ▶ The pump is out of operation and can now be dismantled.

If the pump remains installed after decommissioning, observe the following:

- Ensure that the prerequisites for decommissioning are maintained for the complete period of decommissioning. If these prerequisites cannot be guaranteed, dismantle the pump after decommissioning!
- For an extended period of decommissioning, carry out a 5-minute function test at regular intervals (monthly to quarterly). **CAUTION! A function test may only be carried out under the applicable operating conditions. A dry run is not permitted! Non-compliance can result in irreparable damage!**

8.4 Removal



DANGER

Danger due to fluids hazardous to health!

If the pump is used in fluids hazardous to health, decontaminate the pump after dismantling and before carrying out any other work! There is a risk of fatal injury! Observe the specifications in the work regulations! The operator must make sure that the personnel have received and read the work regulations!



DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.



DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.



WARNING

Risk of burns from hot surfaces!

Motor housing can become hot during operation. It may cause burns. Allow the pump to cool down at ambient temperature after switching it off!



NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the pump. Ensure that the pump does not become jammed during lifting and lowering. Do **not** exceed

the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

8.4.1 Stationary wet well installation

- ✓ Pump is decommissioned.
- ✓ Gate valves on the inlet and pressure side closed.
 1. Disconnect the pump from the mains.
 2. Attach the lifting equipment to the attachment point. **CAUTION! Never pull on the power supply cable! This damages the power supply cable!**
 3. Slowly raise the pump and lift above the guide pipes from the operating space. **CAUTION! The power supply cable can be damaged while lifting! Hold the power supply cable slightly taut when lifting!**
 4. Clean the pump thoroughly (see point "Cleaning and disinfecting"). **DANGER! Disinfect the pump when used in fluids hazardous to health!**

8.4.2 Stationary dry well installation

- ✓ Pump is taken out of operation.
- ✓ Gate valves on the inlet and pressure side closed.
 1. Disconnect the pump from the mains.
 2. Roll up the power supply cable and attach to the motor. **CAUTION! Do not damage the power supply cable when attaching! Look out for crushing and cable breakage.**
 3. Loosen the pipe system from the suction and discharge port. **DANGER! Fluids hazardous to health! Residues from the pumped fluid may still be present in the piping and hydraulics! Place collector tank, immediately wipe up drips and dispose of fluids properly.**
 4. Attach the lifting equipment to the attachment point.
 5. Loosen the pump from the foundation.
 6. Lift the pump slowly out of the pipework and place on a suitable set-down location. **CAUTION! The power supply cable may be squeezed and damaged when setting the pump down! Pay attention to the power supply cable when setting the pump down!**
 7. Clean pump thoroughly (see point "Cleaning and disinfecting"). **DANGER! Disinfect the pump when used in fluids hazardous to health!**

8.4.3 Portable wet well installation

- ✓ Pump is taken out of operation.
 1. Disconnect the pump from the mains.
 2. Roll up the power supply cable and place it over the motor housing. **CAUTION! Never pull on the power supply cable! This damages the power supply cable!**
 3. Loosen the pressure pipe from the pressure port.
 4. Attach the lifting equipment to the attachment point.
 5. Lift the pump from the operating space. **CAUTION! The power supply cable may be squeezed and damaged when setting the pump down! Pay attention to the power supply cable when setting the pump down!**
 6. Clean the pump thoroughly (see point "Cleaning and disinfecting"). **DANGER! Disinfect the pump when used in fluids hazardous to health!**

8.4.4 Clean and disinfect



DANGER

Danger due to fluids hazardous to health!

Danger to life if the pump is used in fluids hazardous to health! Decontaminate the pump before carrying out any further work! Wear the following protective equipment while performing cleaning tasks:

- Closed safety goggles
- Breathing mask
- Protective gloves

⇒ The equipment listed here is the minimum requirement, observe the specifications of the work regulations! The operator must make sure that the personnel have received and read the work regulations!

- ✓ Pump is dismantled.
- ✓ Contaminated cleaning water is disposed of in the sewer in accordance with local regulations.
- ✓ A disinfectant is provided for contaminated pumps.
 1. Attach the lifting equipment to the attachment point of the pump.
 2. Lift the pump approximately 30 cm (10 in) above the ground.
 3. Spray the pump with clear water from top to bottom. **NOTICE! An appropriate disinfectant must be used for contaminated pumps! Strictly observe the manufacturer's specifications concerning use!**
 4. To clean the impeller and the pump interior, guide the water jet inside via the pressure port.
 5. Flush all dirt residue onto the floor of the channel.
 6. Allow the pump to dry out.

9 Maintenance and repair



DANGER

Danger due to fluids hazardous to health!

If the pump is used in fluids hazardous to health, decontaminate the pump after dismantling and before carrying out any other work! There is a risk of fatal injury! Observe the specifications in the work regulations! The operator must make sure that the personnel have received and read the work regulations!



NOTICE

Use only properly functioning lifting equipment!

Use only properly functioning lifting equipment to lift and lower the pump. Ensure that the pump does not become jammed during lifting and lowering. Do **not** exceed the maximum bearing capacity of the lifting equipment! Check that lifting equipment is functioning properly before use!

- Always carry out maintenance tasks in a clean location with good lighting. It must be possible to position the pump safely and secure it.
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- Wear the following protective equipment while performing maintenance tasks:
 - Safety goggles
 - Safety shoes
 - Safety gloves

9.1 Personnel qualifications

- Electrical work: A qualified electrician must carry out the electrical work.

- Maintenance tasks: The technician must be familiar with the use of operating fluids and their disposal. In addition, the technician must have basic knowledge of mechanical engineering.
- 9.2 Operator responsibilities**
- Provide the necessary protective equipment and make sure that the personnel wears it.
 - Collect operating fluids in suitable tanks and dispose of properly.
 - Dispose of protective clothing used in accordance with regulations.
 - Use only original parts of the manufacturer. Use of parts other than the original parts releases the manufacturer from any liability.
 - Collect any leakage of fluid and operating fluid immediately and dispose of it according to the locally applicable guidelines.
 - Provide the tools required.
 - If flammable solvents and cleaning agents are used, open flames, naked lights and smoking are prohibited.

9.3 Labelling of the screw plugs

M	Motor compartment screw plugs
D	Sealing chamber screw plugs
K	Cooling system screw plugs
L	Leakage chamber screw plug
S	Condensation water chamber screw plug
F	Grease nipple screw plug

9.4 Operating fluid
9.4.1 Oil types

Medicinal white oil is filled into the sealing chamber ex-factory. The following oil types are recommended when changing the oil:

- Aral Autin PL*
- Shell ONDINA 919
- Esso MARCOL 52* or 82*
- BP WHITEMORE WOM 14*
- Texaco Pharmaceutical 30* or 40*

All oil types marked with “*” are approved for use with foods in accordance with “USDA-H1”.

9.4.2 Grease

Use the following greases:

- Esso Unirex N3
- Tripol Molub-Alloy-Food Proof 823 FM (with “USDA-H1” approval)

9.4.3 Filling quantities

Refer to the supplied configuration for the filling quantities.

9.5 Maintenance intervals

To ensure reliable operation, maintenance tasks must be carried out regularly. Depending on the real ambient temperatures, maintenance intervals different from those mentioned in the contract can be defined! If strong vibrations occur during operation, the pump and the installation must be checked regardless of the defined maintenance intervals.

9.5.1 Maintenance intervals for normal conditions

8000 operating hours or after 2 years at the latest

- Visual inspection of the connection cable
- Visual inspection of accessories
- Visual inspection of the coating and housing for wear
- Function test of monitoring devices
- Oil change
 - Motor compartment
 - Sealing chamber

NOTICE! If a sealing chamber control is installed, the oil is changed according to the indicator!

15000 operating hours or after 10 years at the latest

- General overhaul

9.5.2 Maintenance intervals for harsh conditions

Under harsh operating conditions, specified maintenance intervals must be shortened if required. Harsh operating conditions include:

- Fluids with long-fibre components
- Turbulent inlet (e.g. due to air intake, cavitation)
- Strongly corroding or abrasive fluids
- Heavily gas generating fluids
- Operation at an unfavourable duty point
- Pressure surges

When using pumps under hard conditions, it is recommended to sign a maintenance contract. Contact customer service.

9.6 Maintenance measures



WARNING

Sharp edges on the impeller and suction port!

Sharp edges can form on the impeller and suction port. There is danger of limbs being severed! Protective gloves must be worn to protect from cuts.



WARNING

Hand, foot or eye injuries due to the absence of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Closed safety goggles

The following pre-requisites must be fulfilled prior to starting maintenance measures:

- Pump cooled down to the ambient temperature.
- Pump cleaned thoroughly and disinfected (if required).

9.6.1 Recommended maintenance measures

Regular inspection of power consumption and the operating voltage in all three phases is recommended for smooth operation. In normal operation, these values remain constant. Slight fluctuations depend on the characteristics of the fluid. Power consumption can provide an early indication of damage or malfunctions in the impeller, bearings or motor, which can be rectified. Larger voltage fluctuations strain the motor winding and can cause the pump to break down. Regular inspections can therefore largely prevent major secondary damage and reduce the risk of total breakdown. In this regard, it is recommended to use remote monitoring for regular inspections.

9.6.2 Visual inspection of the connection cable

Check connection cable for:

- Bubbles
- Cracks
- Scratches
- Abrasion
- Pinch points

If damage is identified on the connection cable, decommission the pump immediately! Have the connection cable replaced by Wilo customer service. Only operate the pump up again once the damage has been properly remedied!

CAUTION! Water may penetrate into the pump due to the damaged connection cable! Water ingress leads to total failure of the pump.

9.6.3 Visual inspection of accessories

Accessories must be checked for:

- Correct fixation
- Smooth function
- Signs of wear, e.g. cracks caused by frequencies

Any defects detected must be repaired immediately or the accessories must be replaced.

9.6.4 Visual inspection of coatings and housing for wear

The coatings and housing parts must not show any signs of damage. If there are defects, the following must be observed:

- If the coating is damaged, it must be restored.
- Contact customer service if housing parts have worn out!

9.6.5 Function test of the monitoring device

To test resistances, the pump must be cooled down to the ambient temperature!

9.6.5.1 Test the resistor of the internal electrodes for motor compartment and sealing chamber control (FK 34 and FK 42 only)

The internal electrodes are switched in parallel. During testing, all the electrodes are measured together.

Measure the resistor of the electrodes with an ohmmeter. The measured value must approach "infinity". For values ≤ 30 kOhm, there is water in the motor compartment or the sealing chamber. Change the oil in the sealing chamber and measure again.

NOTICE! If the value is still ≤ 30 kOhm, contact customer service!

9.6.5.2 Test the resistor of the temperature sensor

Measure the resistor of the temperature sensors with an ohmmeter. The following measured values must be complied with:

- **Bimetallic strip:** Measured value = 0 ohms (continuity).
- **PTC sensor** (PTC thermistor): Measured value depends on the number of sensors installed. A PTC sensor has a cold resistance range of 20 to 100 ohms.
 - With **three** sensors in series, the measured value range is from 60 to 300 ohms.
 - With **four** sensors in series, the measured value range is from 80 to 400 ohms.
- **Pt100 sensor:** Pt100 sensors have a resistance value of 100 ohms at 0 °C (32 °F). Between 0 °C (32 °F) and 100 °C (212 °F), the resistance increases by 0.385 ohms per 1 °C (1.8 °F) increase. At an ambient temperature of 20 °C (68 °F), the resistance is 107.7 ohms.

9.6.5.3 Testing the resistor of the external electrode for sealing chamber control

Measure the resistor of the electrode with an ohmmeter. The measured value must approach "infinity". For values ≤ 30 kOhm, if there is water in the oil – change the oil!

9.6.6 Note for the use of shut-off ball cocks

If shut-off ball cocks are installed on the drain holes, observe the following points:

- Remove the screw plug before opening the shut-off ball cock.
- To drain the operating fluid, turn the lever to the direction of flow (parallel to the shut-off ball cock).
- To close the drain hole, turn the lever so it is at right angles to the direction of flow (to the shut-off ball cock).
- After closing the shut-off ball cock, screw in the screw plug again.

9.6.7 Oil change in the motor compartment



WARNING

Operating fluid under high pressure!

A pressure of **several bar can build up** in the motor! This pressure escapes when the screw plugs are **opened**. If screw plugs are opened without due caution, they can be ejected at high speed! To avoid injuries, observe the following instructions:

- Adhere to the prescribed sequence of work steps.
- Unscrew the screw plugs slowly, but never unscrew them completely. As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
- When the pressure has completely dissipated, fully unscrew the screw plugs.
- Wear closed safety goggles.



WARNING

Scalding from hot operating fluids!

Hot operating fluids can also spray out when pressure is released. This can result in scalding! To avoid injuries, the following instructions must be observed:

- Allow the motor to cool down to the ambient temperature before opening the screw plugs.
- Wear closed safety goggles or face protection and gloves.

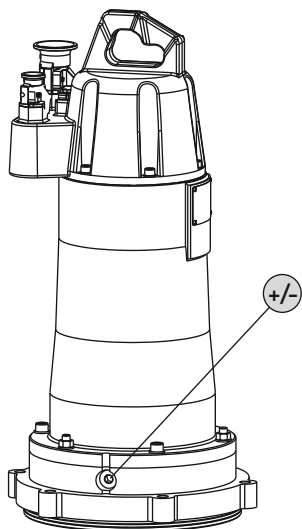


Fig. 11: Motor compartment: Oil change

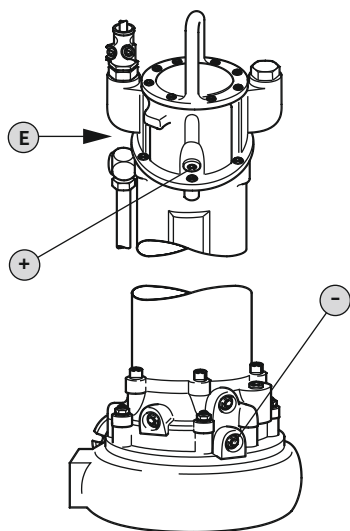


Fig. 12: Motor compartment: Oil change

Motor FK 17.1

+/-	Fill/drain the oil in the motor compartment
-----	---

- ✓ Protective equipment has been put on!
 - ✓ Pump has been dismantled and cleaned (decontaminated if required).
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Place a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug slowly, but do not unscrew it completely. **WARNING! Overpressure in the motor! Stop turning the screw plug further if hissing or whistling is audible! Wait until the pressure has completely dissipated.**
 4. After the pressure has dissipated, fully unscrew the screw plug and drain the operating fluid.
 5. Check the operating fluid: Notify customer service if an operating fluid contains metal chips!
 6. Pour the new operating fluid in through the opening.
 - ⇒ Comply with the specifications for operating fluid locations and quantity!
 7. Clean the screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm!**

Motors FK 202, FK 34 and FK 42

E	Venting
+	Fill the oil in the motor compartment
-	Drain the oil in the motor compartment

- ✓ Protective equipment has been put on.
 - ✓ Pump has been dismantled and cleaned (decontaminated if required).
1. Place the pump on a firm surface in a vertical position. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Position a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug (E) slowly, but do not unscrew it completely. **WARNING! Overpressure in the motor! Stop turning the screw plug further if hissing or whistling is audible! Wait until the pressure has completely dissipated.**
 4. After the pressure has dissipated, fully unscrew the screw plug (E).
 5. Unscrew the screw plug (+).
 6. Unscrew screw plug (-) and drain the operating fluid. If a shut-off ball cock is installed on the outlet opening, open the shut-off ball cock.
 7. Check the operating fluid: Notify the customer service if the operating fluid contains swarf!
 8. If a shut-off ball cock is installed on the outlet opening, close the shut-off ball cock.
 9. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
 10. Pour the new operating fluid in through the hole of the screw plug (+).
 - ⇒ Comply with the specifications for operating fluid type and quantity.
 11. Clean the screw plug (+) and (E), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

9.6.8 Oil change in sealing chamber



WARNING

Operating fluid under high pressure!

A pressure of **several bar can build up** in the motor! This pressure escapes when the screw plugs are **opened**. If screw plugs are opened without due caution, they can be ejected at high speed! To avoid injuries, observe the following instructions:

- Adhere to the prescribed sequence of work steps.
- Unscrew the screw plugs slowly, but never unscrew them completely. As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
- When the pressure has completely dissipated, fully unscrew the screw plugs.
- Wear closed safety goggles.



WARNING

Scalding from hot operating fluids!

Hot operating fluids can also spray out when pressure is released. This can result in scalding! To avoid injuries, the following instructions must be observed:

- Allow the motor to cool down to the ambient temperature before opening the screw plugs.
- Wear closed safety goggles or face protection and gloves.

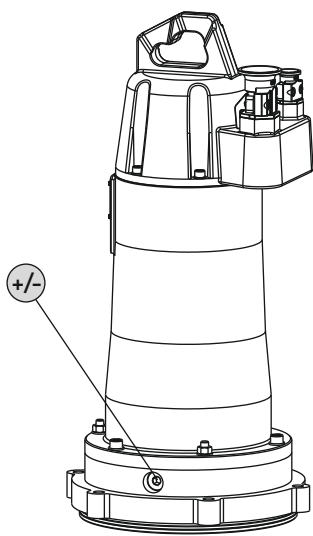


Fig. 13: Sealing chamber: Oil change

Motor FK 17.1

+/-	Fill/drain the oil in the sealing chamber
-----	---

- ✓ Protective equipment has been put on!
 - ✓ Pump has been dismantled and cleaned (decontaminated if required).
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Place a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug slowly, but do not unscrew it completely. **WARNING! Overpressure in the motor! Stop turning the screw plug further if hissing or whistling is audible! Wait until the pressure has completely dissipated.**
 4. After the pressure has dissipated, fully unscrew the screw plug and drain the operating fluid.
 5. Check the operating fluid: Notify customer service if an operating fluid contains metal chips!
 6. Pour the new operating fluid in through the opening.
 - ⇒ Comply with the specifications for operating fluid locations and quantity!
 7. Clean the screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm!**

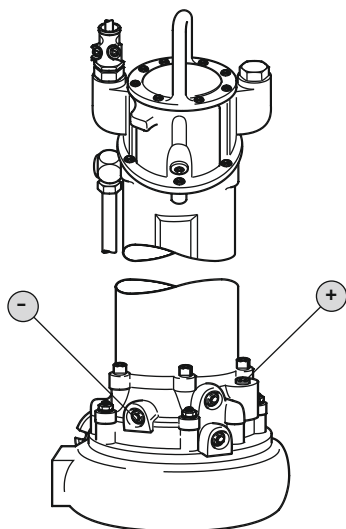


Fig. 14: Sealing chamber: Oil change

Motors FK 202, FK 34, FK 42

+	Fill the oil in the sealing chamber
-	Drain the oil in the sealing chamber

- ✓ Protective equipment has been put on!
 - ✓ Pump has been dismantled and cleaned (decontaminated if required).
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Ensure that the pump cannot fall over or slip away!**
 2. Place a suitable tank to collect the operating fluid.
 3. Unscrew the screw plug (+) slowly, but do not unscrew it completely. **WARNING! Overpressure in the motor! Stop turning the screw plug further if hissing or whistling is audible! Wait until the pressure has completely dissipated.**
 4. After the pressure has dissipated, fully unscrew the screw plug (+).
 5. Unscrew screw plug (-) and drain the operating fluid. If a shut-off ball cock is installed on the outlet opening, open the shut-off ball cock.
 6. Check the operating fluid: Notify customer service if the operating fluid contains swarf!
 7. If a shut-off ball cock is installed on the outlet opening, close the shut-off ball cock.
 8. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
 9. Pour the new operating fluid in through the hole of the screw plug (+).
⇒ Comply with the specifications for operating fluid type and quantity!
 10. Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

9.6.9 General overhaul

During the general overhaul, the motor bearings, shaft sealings, O-rings and power supply cables are checked for wear and damage. Damaged components are replaced with original parts. This will ensure correct operation.

The general overhaul is performed by the manufacturer or an authorised service centre.

9.7 Repairs



WARNING

Sharp edges on the impeller and suction port!

Sharp edges can form on the impeller and suction port. There is danger of limbs being severed! Protective gloves must be worn to protect from cuts.



WARNING

Hand, foot or eye injuries due to the absence of protective equipment!

Danger of (serious) injuries during work. Wear the following protective equipment:

- Safety gloves for protection against cuts
- Safety shoes
- Closed safety goggles

The following preconditions must be met prior to starting repair work:

- Pump cooled down to the ambient temperature.
- Pump is switched voltage-free and secured against being activated inadvertently.
- Pump cleaned thoroughly and disinfected (if required).

For repair work the following generally applies:

- Wipe up spillage quantities of fluid and operating fluid immediately!
- Always replace O-rings, gaskets and screw locking devices!
- Observe the tightening torques in the appendix!
- Never use force when carrying out this work!

9.7.1 Instructions on using screw locking devices

A screw locking device can be used on the screws. Screw locking is done at the factory using two different methods:

- Thread-locking fluid
- Mechanical screw locking device

Always re-apply the screw locking device!

Thread-locking fluid

Medium-strength thread-locking fluid (e.g. Loctite 243) is used for the liquid screw locking compound. This threadlocker can be loosened with increased force. If the thread-locking fluid cannot be loosened, then the compound must be heated to approx. 300 °C (572 °F). Clean the components thoroughly after dismantling.

Mechanical screw locking device

The mechanical screw locking device consists of two Nord-Lock wedge lock washers. The screw connection is secured by the clamping force. The Nord-Lock screw locking device must only be used on bolts with strength class 10.9 which have been coated with Geomet. **The use of stainless screws is prohibited!**

9.7.2 Which repair work may be carried out

- Changing the hydraulics housing.
- SOLID G- and Q impeller: Readjusting the suction port.

9.7.3 Changing the hydraulics housing



DANGER

Dismantling the impeller is prohibited!

Depending on the impeller diameter, the impeller must be removed for dismantling the hydraulics housing on some pumps. Before carrying out any work, check whether dismantling the impeller is necessary. If yes, notify customer service! The dismantling of the impeller must be carried out by customer service or an authorized specialist workshop.

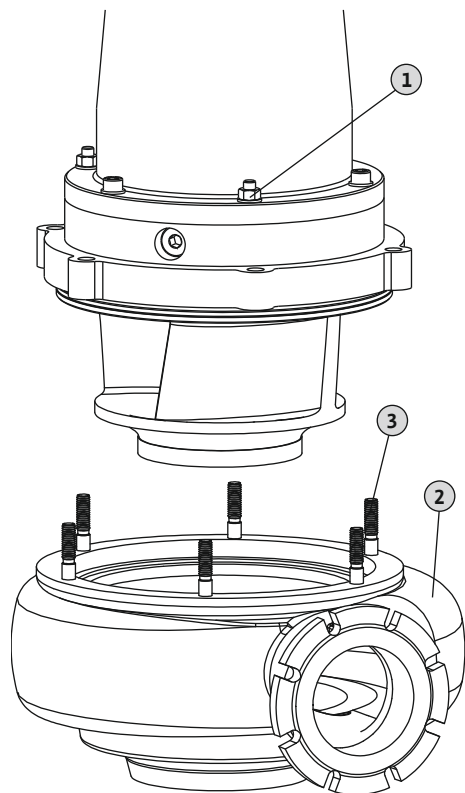


Fig. 15: Changing the hydraulics housing

1	Hexagon nuts for fixation of the motor/hydraulics
2	Hydraulics housing
3	Threaded bolt

- ✓ Lifting equipment with sufficient bearing capacity is present.
- ✓ Protective equipment has been put on.
- ✓ New hydraulics housing is ready.
- ✓ Impeller **must not** be dismantled!

1. Attach lifting equipment with suitable lifting gear to the attachment point of the pump.

2. Place the pump upright.

CAUTION! If the pump is placed down too quickly, the hydraulics housing at the suction port can be damaged. Place the pump down slowly on the suction port!
NOTICE! If the pump cannot be placed level on the suction port, use appropriate adjustment plates. In order for the motor to be lifted without any problem, the pump must be vertical.

3. Mark the motor/hydraulics position on the housing.

4. Loosen and remove hexagon nuts on the hydraulics housing.

5. Slowly lift the motor and pull it off the threaded bolts.

CAUTION! Lift the motor vertically and do not tilt! The threaded bolts will be damaged if tilted!

6. Swivel the motor over the new hydraulics housing.

7. Slowly drain the motor. Make sure that the motor/hydraulic markings match and the threaded bolts screw exactly into the holes.

8. Screw hexagon nuts and connect the motor to the hydraulics firmly. **NOTICE! Observe the tightening torques in the appendix!**

► Hydraulics housing changed. Pump can be reinstalled.

WARNING! If the pump is placed in temporary storage and the lifting equipment dismantled, secure the pump against falling over and slipping!

9.7.4 SOLID G- and Q impeller: Readjusting the suction port

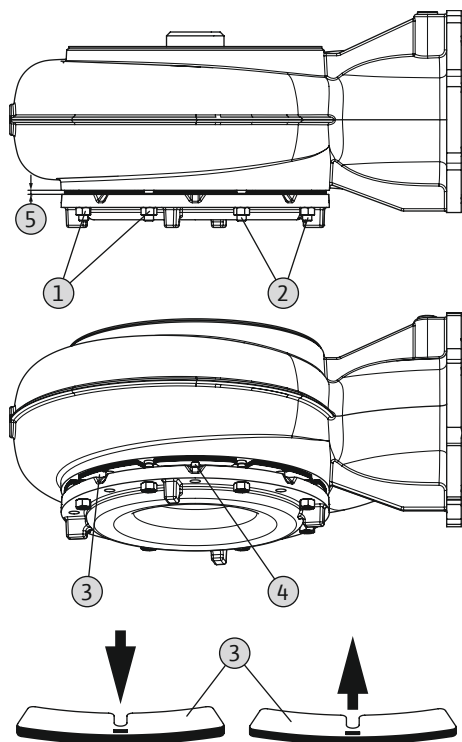


Fig. 16: SOLID G: Readjusting the gap

1	Hexagon nut for suction port attachment
2	Threaded bolt
3	Laminated core
4	Laminated core fastening screw
5	Gap between suction port and hydraulics housing

- ✓ Lifting equipment with sufficient bearing capacity is present.
 - ✓ Protective equipment has been put on.
1. Attach lifting equipment with suitable lifting gear to the attachment point of the pump.
 2. Lift the pump so that the pump is approx. 50 cm (20 in) above the ground.
 3. Loosen the hexagon nuts for fixation of the suction port. Unscrew the hexagon nut until the hexagon nut is flush with the threaded bolt.
WARNING! Risk of crushing fingers! The suction port can stick on the hydraulics housing due to encrustations and slide down suddenly. Loosen the nuts only in a crosswise manner and grasp them from the bottom. Wear protective gloves!
 4. Suction port is on the hexagon nuts. If the suction port sticks to the hydraulics housing, carefully loosen the suction port with a wedge!
 5. Clean the sliding surface and the screwed-on laminated cores and disinfect (if necessary).
 6. Loosen the screws from the laminated cores and remove the individual laminated cores.
 7. Slowly re-tighten the three hexagon nuts crosswise until the suction port is in contact with the impeller. **CAUTION! Only tighten the hexagon nuts by hand! If the hexagon nuts are excessively tightened, the impeller and the motor bearings may get damaged!**
 8. Measure the gap between the suction port and hydraulics housing.
 9. Adjust the laminated cores according to the measured dimensions and add another metal sheet.
 10. Unscrew the three hexagon nuts again until the hexagon nuts are flush with the threaded bolt.
 11. Reinsert the laminated cores and screw into place.
 12. Tighten the hexagon nuts crosswise until the suction port is flush with the laminated cores.
 13. Firmly tighten the hexagon nuts crosswise. **Observe the tightening torques in the appendix!**
 14. Reach into the suction port from below and turn the impeller. When the gap is correctly set, the impeller can be rotated. If the gap is too small, the impeller is difficult to rotate. Repeat setting. **WARNING! Danger of amputation of limbs! Sharp edges can form on the suction port and impeller. Wear safety gloves to protect against cuts!**
- Suction port correctly set. Pump can be reinstalled.

10 Faults, causes and remedies



DANGER

Danger due to fluids hazardous to health!

Danger of death in case of pumps with fluids hazardous to health! Wear the following protective equipment while performing the work:

- Closed safety goggles
- Breathing mask
- Protective gloves

⇒ The equipment listed here is the minimum requirement, observe the specifications of the work regulations! The operator must make sure that the personnel have received and read the work regulations!



DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.



DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously! A second person must be present for safety reasons.



WARNING

No persons are allowed to be present inside the working area of the pump!

Persons may suffer (serious) injuries while the pump is in operation! No persons may therefore be present inside the working area. If persons must enter the working area of the pump, the pump must be decommissioned and secured against being switched on again without authorisation.



WARNING

Sharp edges on the impeller and suction port!

Sharp edges can form on the impeller and suction port. There is danger of limbs being severed! Protective gloves must be worn to protect from cuts.

Fault: Pump does not start

1. Electricity supply interrupted or short-circuit/earth fault in the cable or motor winding.
 - ⇒ Have the connection and motor checked by a qualified electrician and replace if necessary.
2. Tripping of fuses, of the motor protection switch or the monitoring device
 - ⇒ Have the connection and the monitoring device checked by a qualified electrician and change it if necessary.
 - ⇒ Have the motor protection switches and fuses installed and adjusted according to the technical specifications by a qualified electrician and reset monitoring device.
 - ⇒ Check the impeller to make sure that it runs smoothly, clean the hydraulics if necessary.
3. The sealing chamber control (optional) has interrupted the electric circuit (connection-related)

- ⇒ See "Fault: Mechanical seal leakage, sealing chamber control reports a fault and switches the pump off".

Fault: Pump starts up, motor protection trips after short period

1. Motor protection switch set incorrectly.
 - ⇒ Have the adjustment of the trigger checked and corrected by a qualified electrician.
2. Increased power consumption due to major voltage drop.
 - ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the electricity distribution network.
3. There are only two phases at the connection.
 - ⇒ Have the connection checked and corrected by a qualified electrician.
4. Excessive differences in voltage between the phases.
 - ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the electricity distribution network.
5. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
6. Increased power consumption through jammed hydraulics.
 - ⇒ Clean the hydraulics and check the inlet.
7. The density of the fluid is too high.
 - ⇒ Contact customer service.

Fault: Pump runs, there is no volume flow

1. There is no fluid.
 - ⇒ Check the inlet, open all gate valves.
2. Inlet clogged.
 - ⇒ Check the inlet and remove clogging.
3. Hydraulics jammed.
 - ⇒ Clean the hydraulics.
4. Pipe system on the pressure side or pressure hose clogged.
 - ⇒ Remove clogging and replace the damaged components if necessary.
5. Intermittent operation.
 - ⇒ Check the switching system.

Fault: Pump starts, duty point is not reached

1. Inlet clogged.
 - ⇒ Check the inlet and remove clogging.
2. Slide valves on the pressure side closed.
 - ⇒ Open all gate valves completely.
3. Hydraulics jammed.
 - ⇒ Clean the hydraulics.
4. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
5. Air cushion in the pipe system.
 - ⇒ Vent the pipe system.
 - ⇒ If air cushions occur frequently: Locate and prevent the air intake, if required install ventilation systems at specified locations.
6. Pump pumping against excessive pressure.
 - ⇒ Open all gate valves on the pressure side completely.
 - ⇒ Check the impeller shape, use other impeller shapes if required. Contact customer service.
7. Signs of wear on the hydraulics.

- ⇒ Have the components (impeller, suction port, pump housing) checked and replaced by customer service.
- 8. Pipe system on the pressure side or pressure hose clogged.
 - ⇒ Remove clogging and replace the damaged components if necessary.
- 9. Strongly gassing fluid.
 - ⇒ Contact customer service.
- 10. There are only two phases at the connection.
 - ⇒ Have the connection checked and corrected by a qualified electrician.
- 11. Excessive decrease in the fill level during operation.
 - ⇒ Check supply/capacity of the system.
 - ⇒ Have the switching points of the level control checked and adjusted if necessary.

Fault: The pump does not run smoothly and is noisy

1. Improper duty point.
 - ⇒ Check the pump configuration and the duty point, contact customer service.
2. Hydraulics jammed.
 - ⇒ Clean the hydraulics.
3. Strongly gassing fluid.
 - ⇒ Contact customer service.
4. There are only two phases at the connection.
 - ⇒ Have the connection checked and corrected by a qualified electrician.
5. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
6. Signs of wear on the hydraulics.
 - ⇒ Have the components (impeller, suction port, pump housing) checked and replaced by customer service.
7. Motor bearings have worn.
 - ⇒ Inform customer service; send the pump back to the factory for overhauling.
8. Pump is installed under tension.
 - ⇒ Check installation, install rubber compensators if necessary.

Fault: Sealing chamber control reports fault or switches the pump off

1. Condensation water build-up due to extended storage or high temperature fluctuations.
 - ⇒ Operate the pump for a short period (max. 5 min.) without pencil electrode.
2. Increased leakage when running in new mechanical seals.
 - ⇒ Change the oil.
3. Pencil electrode cable is defective.
 - ⇒ Replace the pencil electrode.
4. Mechanical seal is defective.
 - ⇒ Inform customer service.

Further steps for troubleshooting

If the points listed here do not rectify the fault, contact customer service. Customer service can assist in the following ways:

- Telephone or written support.
- On-site support.
- Inspection and repair at the factory.

Costs may be incurred if you request customer services! Please contact customer services for more information.

11 Spare parts

Spare parts are ordered via customer service. To avoid return queries and incorrect orders, the serial or article number must always be supplied. **Subject to change without prior notice!**

12 Disposal

12.1 Oils and lubricants

Operating fluid must be collected in suitable tanks and disposed of in accordance with the locally applicable guidelines. Wipe up drips immediately!

12.2 Protective clothing

Used protective clothing must be disposed off in accordance with the locally applicable guidelines.

12.3 Information on the collection of used electrical and electronic products

Proper disposal and appropriate recycling of this product prevents damage to the environment and danger to your personal health.



NOTICE

Disposal in domestic waste is forbidden!

In the European Union, this symbol can appear on the product, the packaging or the accompanying documentation. It means that the electrical and electronic products in question must not be disposed of along with domestic waste.

To ensure proper handling, recycling and disposal of the used products in question, please note the following points:

- Only hand over these products at designated, certified collecting points.
- Observe the locally applicable regulations!

Please consult your local municipality, the nearest waste disposal site, or the dealer who sold the product to you for information on proper disposal. Further recycling information at www.wilo-recycling.com.

13 Appendix

13.1 Tightening torques

Rust-free screws A2/A4

Threaded	Tightening torque		
	Nm	kp m	ft·lb
M5	5.5	0.56	4
M6	7.5	0.76	5.5
M8	18.5	1.89	13.5
M10	37	3.77	27.5
M12	57	5.81	42
M16	135	13.77	100
M20	230	23.45	170
M24	285	29.06	210
M27	415	42.31	306
M30	565	57.61	417

Geomet-coated screws (strength 10.9) with Nord-Lock washer

Threaded	Tightening torque		
	Nm	kp m	ft·lb
M5	9.2	0.94	6.8
M6	15	1.53	11
M8	36.8	3.75	27.1
M10	73.6	7.51	54.3
M12	126.5	12.90	93.3

Geomet-coated screws (strength 10.9) with Nord-Lock washer			
Threaded	Tightening torque		
	Nm	kp m	ft-lb
M16	155	15.81	114.3
M20	265	27.02	195.5

13.2 Operation with frequency converter

The motor in series design (confirming to IEC 60034-17) can be operated with a frequency converter. Contact customer service if the rated voltage is over 415 V/50 Hz or 480 V/60 Hz. Because of the additional heating caused by harmonics, the rated power of the motor must be around 10 % more than the power requirement of the pump. For frequency converters with a low-harmonic output, it may be possible to reduce the 10 % power reserve. A reduction of the harmonic waves is achieved with output filters. The frequency converter and filter must be compatible.

The configuration of the frequency converter depends on the rated motor current. Care must be taken to ensure that the pump operates without jerking or vibration, especially in the lower speed range. Otherwise, the mechanical seals can leak or be damaged. The flow rate in the pipe must also be observed. If the flow rate is too low, the greater the risk is of solids depositing in the pump and piping. A minimum flow rate of 0.7 m/s (2.3 ft/s) with a pumping pressure of 0.4 bar (6 psi) is recommended.

It is important that the pump operates across the entire control range without vibrations, resonance, oscillation or excessive noise. Increased motor noise caused by the harmonics of the power supply is normal.

During parameterisation of the frequency converter, observe the setting of the quadratic pump curve (U/f curve) for pumps and fans! The U/f curve ensures that the output voltage at frequencies less than the rated frequency (50 Hz or 60 Hz) is adjusted to the power requirement of the pump. Newer frequency converters feature an automatic power optimisation function – this automation achieves the same effect. For the frequency converter setting, refer to its installation and operating instructions.

Faults with the motor monitoring may occur on motors operated with a frequency converter depending on the type used and installation conditions present. The following measures can help to reduce or avoid these faults:

- Keeping within the limit values stated in IEC 60034-25 for overvoltages and rise speed. Output filters may need to be installed.
- Vary the pulse frequency of the frequency converter.
- In the event of a fault on the internal sealing chamber control, use the external double-rod electrode.

The following construction measures can also help to reduce or prevent faults:

- Separate power supply cables for the main and control cable (depending on the motor size).
- When laying, ensure there is adequate clearance between the main and control cable.
- Using shielded power supply cables.

Summary

- Continuous duty up to rated frequency (50 Hz or 60 Hz), observing the minimum flow velocity.
- Observe additional measures with regard to EMC regulations (choice of frequency converter, using filters, etc.).
- Never exceed the rated current or rated speed of the motor.
- It must be possible to connect the motor's own temperature monitoring (bimetallic strip or PTC sensor).

13.3 Ex rating

This section contains further information on the operation of the pump in an explosive atmosphere. All personnel must read this section. **This section applies only to Ex-rated pumps!**

13.3.1 Identification of Ex-rated pumps

For use in explosive atmospheres, the pump must be marked as follows on the rating plate:

- "Ex" symbol of the corresponding approval
- Ex classification

- Certification number (depending on the approval)
The certification number, if required by the approval, is printed on the rating plate.

13.3.2 Protection class

The motor's design version corresponds to the following protection classes:

- Flameproof enclosure (ATEX)
- Explosionproof (FM)

In order to limit the surface temperature, the motor must be equipped with at least one temperature limiter (1-circuit temperature monitoring). It may also be equipped with a temperature controller (2-circuit temperature monitoring).

13.3.3 Intended use



DANGER

Explosion due to pumping of explosive fluids!

Pumping of highly flammable and explosive fluids (gasoline, kerosene, etc.) in pure form is strictly prohibited. There is a risk of fatal injury due to explosion! The pumps are not designed for these fluids.

ATEX approval

The pumps are suitable for operation in potentially explosive atmospheres:

- Device group: II
- Category: 2, zone 1 and zone 2

These pumps must not be used in zone 0!

FM approval

The pumps are suitable for operation in potentially explosive atmospheres:

- Protection class: Explosionproof
- Category: Class I, Division 1

Notice: If the cabling is carried out according to Division 1, installation in Class I, Division 2 is also permitted.

13.3.4 Electrical connection



DANGER

Risk of death due to electrocution!

Improper conduct when carrying out electrical work can lead to death due to electric shock! Electrical work must be carried out by a qualified electrician in accordance with the locally applicable regulations.

- Always connect the pump to an electrical outlet outside the explosive area. If the connection must be made within the explosive area, then the connection must be carried out in an Ex-rated housing (ignition protection class according to DIN EN 60079-0)! Non-observance may lead to fatal injury due to explosion! Connection must always be carried out by a qualified electrician.
- All monitoring devices outside the "spark-proof areas" must be connected via an intrinsically safe circuit (e.g. Ex-i relay XR-4...).
- The voltage tolerance may not be higher than max. $\pm 10\%$.

Overview of possible monitoring devices:

	FK 17.1
Motor compartment	-
Motor winding	•
Sealing chamber	o
Motor bearings	-

Key: - = not available/possible, o = optional, • = as standard

All the monitoring devices fitted must always be connected!

13.3.4.1 Monitoring of motor winding



DANGER

Risk of explosion due to overheating of the motor!

If the temperature limiter is connected incorrectly, there is a risk of explosion due to overheating of the motor! Always connect the temperature limiter to a manual re-activation lock. This means that a “release button” must be manually activated!

The motor is equipped with a temperature limit (1-circuit temperature monitoring). As an option, the motor can be fitted with a temperature control and limit function (2-circuit temperature monitoring).

Depending on the version of the thermal motor monitoring, the following triggering status must occur when the threshold value is reached:

→ Temperature limiter (1 temperature circuit):

When the threshold is reached, deactivation **with reactivation lock** must take place!

→ Temperature controller and limiter (2 temperature circuits):

When the threshold for the low temperature is reached, the motor can deactivate with automatic reactivation. When the threshold for the high temperature is reached, the motor must deactivate **with reactivation lock!**

CAUTION! Motor damage due to overheating! In the event of automatic reactivation, comply with the specifications for the maximum switching frequency and switching break!

Connection of the thermal motor monitoring

→ Connect the bimetallic strip via an evaluation relay. Relay “CM-MSS” is recommended for this. The threshold is preset.

Connection values: max. 250 V(AC), 2.5 A, $\cos \varphi = 1$

→ Connect the PTC sensor via an evaluation relay. Relay “CM-MSS” is recommended for this. The threshold is preset.

13.3.4.2 Sealing chamber monitoring (external electrode)

→ Connect the external pencil electrode via an Ex-rated evaluation relay! Relay “XR-4...” is recommended for this.

The threshold is 30 kOhm.

→ The connection must be made using an intrinsically safe circuit!

13.3.4.3 Frequency converter operation

→ Type of converter: Pulse-width modulation

→ Continuous duty: 30 Hz up to rated frequency (50 Hz or 60 Hz). Comply with the minimum flow velocity!

→ Min. switching frequency: 4 kHz

→ Max. overvoltages on the terminal board: 1350 V

→ Output current on the frequency converter: max. 1.5 times rated current

→ Max. overload time: 60 s

→ Torque applications: quadratic pump curve

Speed/torque curves required are available on request!

→ Observe additional measures with regard to EMC regulations (choice of frequency converter, filters, etc.).

→ Never exceed the rated current or rated speed of the motor.

→ It must be possible to connect the motor’s own temperature monitoring (bimetallic strip or PTC sensor).

→ If the temperature class is marked as T4/T3, temperature class T3 applies.

13.3.5 Commissioning



DANGER

Risk of explosion when using non Ex-rated pumps!

Pumps without Ex rating may not be used in potentially explosive areas! There is a risk of fatal injury due to explosion! Only use pumps which have the appropriate Ex labelling on the rating plate within potentially explosive areas.

**DANGER****Risk of explosion due to flying sparks in the hydraulics!**

During operation the hydraulics must be flooded (completely filled with the fluid). If the volume flow is interrupted or the hydraulics emerges, air cushions can form in the hydraulics. If this happens, there is a risk of explosion, e.g. flying sparks due to static charge! Dry-running protection must ensure that the pump is deactivated at the appropriate level.

**DANGER****There is a risk of explosion if dry-running protection is connected incorrectly!**

If the pump is operated within an explosive atmosphere, the dry-running protection must have a separate signal transmitter (redundant protection of the level control). Pump deactivation must be performed with a manual reactivation lock!

- The operator is responsible for defining the potentially explosive area.
- Only pumps with corresponding Ex rating may be used within a potentially explosive area.
- Pumps with Ex rating must be labelled on the rating plate.
- Do not exceed the **maximum fluid temperature!**
- Dry running of the pump must be prevented! Ensure on-site (dry-running protection) that emerging of the hydraulics is prevented.
According to DIN EN 50495, a safety device with SIL level 1 and hardware fault tolerance 0 must be provided for category 2.

13.3.6 Maintenance and repair

- Carry out maintenance tasks according to the regulations.
- Only carry out maintenance tasks mentioned in these installation and operating instructions.
- The spark-proof gaps may **only** be repaired according to the manufacturer's design specifications. It is **not** permitted to carry out repairs according to the values in tables 1 and 2 of DIN EN 60079-1.
- Only use screw plugs as stipulated by the manufacturer, that at least correspond to a strength class of 600 N/mm² (38.85 long tons-force/inch²).

13.3.6.1 Repair of housing coating

The paint layer can become electrostatically charged in case of thicker coats. **DANGER! Risk of explosion! In explosive atmospheres, a discharge can cause an explosion!**

If the housing coating has to be repaired, the maximum coat thickness is 2 mm (0.08 in)!

13.3.6.2 Changing the mechanical seal

Changing the seal on the fluid and motor side is strictly prohibited!

13.3.6.3 Replacing the connection cable

Changing the connection cable is strictly prohibited!



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