

Wilo Motor FKT 20.2, 27.1, 27.2: EMU FA, Rexa SUPRA, Rexa SOLID



en Installation and operating instructions



Table of contents

1 General.....	4	8 Shut-down/dismantling	32
1.1 About these instructions	4	8.1 Personnel qualifications	32
1.2 Copyright	4	8.2 Operator responsibilities	32
1.3 Subject to change.....	4	8.3 Shut-down	32
1.4 Exclusion from warranty and liability.....	4	8.4 Removal	32
2 Safety.....	4	9 Maintenance and repair	34
2.1 Identification of safety instructions	4	9.1 Personnel qualifications	34
2.2 Personnel qualifications.....	6	9.2 Operator responsibilities	34
2.3 Electrical work	6	9.3 Operating fluid	35
2.4 Monitoring devices	6	9.4 Maintenance intervals.....	36
2.5 Fluids hazardous to health	7	9.5 Maintenance measures.....	37
2.6 Permanent magnet motor	7	9.6 Repairs.....	41
2.7 Transport.....	7	10 Faults, causes and remedies	43
2.8 Installing/dismantling.....	7	11 Spare parts.....	45
2.9 During operation	7	12 Disposal	45
2.10 Maintenance tasks.....	8	12.1 Oils and lubricants	45
2.11 Operating fluid	8	12.2 Water-glycol mixture.....	45
2.12 Operator responsibilities	8	12.3 Protective clothing.....	46
3 Application/use	9	12.4 Information on the collection of used electrical and elec- tronic products.....	46
3.1 Intended use.....	9	13 Appendix	46
3.2 Improper use.....	9	13.1 Tightening torques.....	46
4 Product description	9	13.2 Frequency converter operation	46
4.1 Design.....	9	13.3 Ex rating	47
4.2 Digital Data Interface	11		
4.3 Monitoring devices	11		
4.4 Operating modes	12		
4.5 Operation with frequency converter	12		
4.6 Operation in an explosive atmosphere	13		
4.7 Rating plate	13		
4.8 Type key	14		
4.9 Scope of delivery.....	15		
4.10 Accessories	15		
5 Transportation and storage.....	15		
5.1 Delivery.....	15		
5.2 Transport.....	16		
5.3 Use of lifting equipment.....	16		
5.4 Storage	16		
6 Installation and electrical connection	17		
6.1 Personnel qualifications.....	17		
6.2 Installation types	17		
6.3 Operator responsibilities	17		
6.4 Installation	18		
6.5 Electrical connection.....	23		
7 Commissioning.....	29		
7.1 Personnel qualifications.....	29		
7.2 Operator responsibilities	29		
7.3 Direction of rotation check for three-phase AC motor	29		
7.4 Operation in an explosive atmosphere	29		
7.5 Before switching on.....	30		
7.6 Switch on and off.....	30		
7.7 During operation.....	30		

1 General

1.1 About these instructions

These instructions form part of the product. Compliance with the instructions is essential for correct handling and use:

- Read the instructions carefully before all activities.
- Keep the instructions in an accessible place at all times.
- Observe all product specifications.
- Observe the markings on the product.

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

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1.3 Subject to change

Wilo shall reserve the right to change the listed data without notice and shall not be liable for technical inaccuracies and/or omissions. The illustrations used may differ from the original and are intended as an exemplary representation of the product.

1.4 Exclusion from warranty and liability

Wilo shall specifically not assume any warranty or liability in the following cases:

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

2 Safety

This section contains basic information about the individual stages in the life cycle of the pump. Failure to observe this information leads to:

- Danger to persons
- Danger to the environment
- Property damage
- Loss of claims for damages

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

Identifying cross references

The name of the section or table is in inverted commas [“ ”]. The page number follows in square brackets [].

Symbols

These instructions use the following symbols:



Danger caused by electric voltage



Danger of bacterial infection



Danger caused by strong magnetic field



Danger of explosion



Danger caused by explosive atmosphere



General warning symbol



Warning – risk of cutting injuries



Warning – hot surfaces



Warning – high pressure



Warning – suspended loads



Personal protective equipment: wear a safety helmet



Personal protective equipment: wear safety footwear



Personal protective equipment: wear protective gloves



Personal protective equipment: wear face mask



Personal protective equipment: wear safety goggles



Working alone is prohibited! A second person must be present.



Useful information

2.2 Personnel qualifications

- Personnel have been instructed on locally applicable regulations governing accident prevention.
- Personnel have read and understood the installation and operating instructions.
- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation and pipework in wet well and dry well installation, lifting equipment, basic knowledge of wastewater facilities
- Maintenance work: trained sewage technology professional
Application/disposal of operating fluids used, basic engineering knowledge (installation/dismantling)
- Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points

Children and persons with limited abilities

- Persons under the age of 16: Use of this product is prohibited.
- Persons under the age of 18: Supervise them during use of the product (supervisor)!
- Persons with limited physical, sensory or mental capacities: Use of this product is prohibited!

2.3 Electrical work

- Electrical work must be carried out by a qualified electrician.
- Disconnect device from the mains and secure it against being switched on again without authorisation.
- Observe applicable local regulations when connecting to the mains power supply.
- Comply with the requirements of the local energy supply company.
- Train personnel on how to make electrical connections.
- Train personnel on the options for switching off the device.
- Observe the technical information in these installation and operating instructions as well as on the rating plate.
- Earth the device.
- Observe provisions 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 special measures into account (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

- Design the power and switching characteristics of the circuit breakers according to the rated current of the connected product.
- Observe local regulations.

Motor protection switch

- Product without plug: install a motor protection switch!
The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential trip and reactivation lock according to local regulations.
- Instable mains supply systems: if necessary, install further protective devices on-site (e.g. overvoltage, undervoltage or phase failure relays, etc.).

Residual-current device (RCD)

- Install a residual-current device (RCD) in accordance with the regulations of the local energy supply company.
- If people can come into contact with the device and conductive fluids, install a residual-current device (RCD).

2.5 Fluids hazardous to health

Hazardous germs form in sewage or in stagnant water. There is a danger of bacterial infections!

- Wear protective equipment!
- Clean and disinfect the product thoroughly after removal!
- Inform all persons about the pumped fluid and the danger it poses!

2.6 Permanent magnet motor

Permanent magnet motors are driven by a permanently magnetised rotor. Please note the following when using permanent magnet motors:

• Magnet and magnetic field

There is no risk from magnets and the magnetic field as long as the motor housing is closed. Persons with a pacemaker are also not at any particular risk. Screw plugs can be undone for maintenance purposes without hesitation. Do not open the motor housing! Only customer service staff are permitted to work on an open motor!

• Generator operation

The motor generates an inductive voltage if the rotor is driven without electrical energy (e.g. when the fluid returns). In this case, the connection cable is live. Once the pump has been connected, energy is fed back into the connected frequency converter. Implement the following options to prevent destruction of the frequency converter and motor as a result of overvoltage:

- Feed back input energy into the supply network.
- Dissipate input energy using a brake resistor.

2.7 Transport

- Locally applicable laws and regulations on work safety and accident prevention must be complied with.
- Always carry the product by the handle!
- Always attach the lifting gear to the attachment points.
- Ensure that the lifting gear is securely attached.

2.8 Installing/dismantling

- Locally applicable laws and regulations on work safety and accident prevention must be complied with.
- Disconnect device from the mains and secure it against being switched on again without authorisation.
- All rotating parts must stop.
- Ensure enclosed spaces have sufficient ventilation.
- When working in enclosed spaces, a second person must be present for safety reasons.
- Toxic or asphyxiating gases may build up in enclosed spaces or buildings. Observe protective measures in accordance with work regulations, e.g. carry a gas detector with you.
- Clean the device thoroughly.
- If the product has been used in fluids that are hazardous to health, disinfect the product!

2.9 During operation

- Demarcate and cordon off the working area.
- No persons are allowed in the working area during operation.
- Depending on the process, the product is activated and deactivated using separate controls. The product may automatically be activated following power cuts.
- If the motor emerges, the motor housing can heat up to above 40 °C (104 °F).
- Superior must be informed immediately of any faults or irregularities.

- The product must be switched off immediately if faults occur.
- Never reach into the suction port. The rotating parts can crush and sever limbs.
- Open all gate valves in the inlet and pressure pipe.
- Ensure minimum water submersion by using dry-running protection.
- Sound-pressure level depends on several factors (installation, duty point, etc.). Measure the current noise level under operating conditions. Wear hearing protection at noise levels of 85 dB(A) and over. Demarcate the working area!

2.10 Maintenance tasks

- Disconnect device from the mains and secure it against being switched on again without authorisation.
- Clean the device thoroughly.
- If the product has been used in fluids that are hazardous to health, disinfect the product!
- Carry out maintenance work in a clean, dry and well-lit place.
- Only carry out maintenance tasks described in these installation and operating instructions.
- Only original parts of the manufacturer may be used. The use of any non-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.

2.11 Operating fluid

The following operating fluids are used:

- White oil
- Water-glycol mixture P35
The water-glycol mixture is categorised in water-polluting class 1 according to VwVwS 1999.

General remarks

- Absorb leakages immediately.
- If major leakages occur, contact customer service.
- If the seal is defective, the operating fluid enters the pumped fluid.

First aid measures

- **Skin contact**
 - Rinse skin areas thoroughly with soap and water.
 - If skin irritation occurs, consult a doctor.
 - In case of contact with open skin, consult a doctor!
- **Eye contact**
 - Remove the contact lenses.
 - Rinse eye thoroughly with water.
 - If eye irritation occurs, consult a doctor.
- **Inhalation**
 - Remove from the contact area!
 - Create air exchange!
 - If the respiratory tract becomes irritated or there is dizziness or nausea, consult a doctor immediately!
- **Ingestion**
 - Consult a doctor **immediately!**
 - **Do not** induce vomiting!

2.12 Operator responsibilities

- Provide installation and operating instructions in a language which the personnel can understand.
- Make sure that the personnel have received the required training for the specified work.
- Provide protective equipment. Ensure that the protective equipment is worn by personnel.
- Ensure that safety and information signs mounted on the device are always legible.
- Train the personnel on how the system operates.
- Fit dangerous components within the system with an on-site guard.
- Demarcate and cordon off the working area.

- Measure the noise level. At noise levels of 85 dB(A) and over, wear hearing protection. Demarcate the working area!

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 highly inflammable and explosive fluids (e.g. petrol, paraffin, etc.) in their pure form poses a risk of fatal injury due to explosion!

- The pumps are not designed for these fluids.
- The pumping of highly inflammable and explosive fluids is prohibited.

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

- Drinking water
- Fluids containing hard components (such as stones, wood, metal, etc.)
- Fluids containing high 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 intended use.

4 Product description

4.1 Design

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

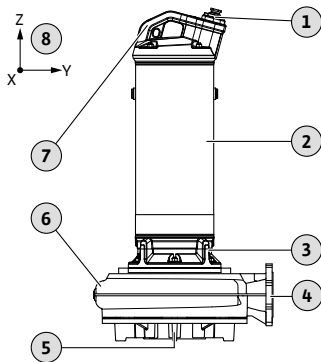


Fig. 1: Sample illustration

1	Connection cable inlet
2	Motor with cooling shroud
3	Sealing/bearing housing
4	Pressure port
5	Suction port
6	Hydraulics housing
7	Attachment point/handle
8	Coordinate system: Vibration sensor in Digital Data Interface

4.1.1 Hydraulics

Centrifugal hydraulics with different impeller shapes, horizontal flange connection on the pressure side, 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 impellers, closed or half open

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 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 neck 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.
- **Neck ring**
The neck ring is installed in the suction port of the hydraulics and protects the incoming flow edge in the centrifugal chamber.

If worn, customer service can simply replace both components.

4.1.2 Motor

Self-cooling asynchronous or permanent magnet motor as three-phase current version. An active cooling system takes care of cooling. The motor can be used for continuous duty both immersed and non-immersed, also as part of dry well installation. The connection cable has bare cable ends.

Motor fittings overview

	Asynchronous motor		Permanent magnet motor
	FKT 20.2	FKT 27.x	FKT 20.2...-P
Design type	Asynchronous	Asynchronous	Synchronous
Max. efficiency category (based on IEC 60034)	IE3	IE3	IE5
Operation with frequency converter	o	o	! (Wilo-EFC)
Digital Data Interface	o	–	•
Immersed operating mode	S1	S1	S1
Non-immersed operating mode	S1	S1	S1
Dry well installation operating mode	S1	S1	S1
Upper rolling bearings: permanently lubricated, low-maintenance	•	•	•
Lower rolling bearings: permanently lubricated, low-maintenance	•	•	•
Connection cable sealed as longitudinally watertight	•	•	•

! = Required/mandatory, • = Standard, o = Optional, – = Not available

4.1.3 Seal

Different methods are used for the seal to the fluid and the motor compartment:

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

The cooling system version is one of two types, depending on the motor size:

- FKT 20.2: The sealing chamber and the cooling system form a one-chamber system. The sealing chamber and the cooling system are filled with P35 coolant.
- FKT 27.x: The sealing chamber and the cooling system form a two-chamber system. The sealing chamber is filled with medicinal white oil and the cooling system is filled with P35 coolant.

Leakage from the seal is caught in the sealing chamber or leakage chamber:

- The sealing chamber accommodates any possible leakage of the seal on the fluid side.
- The leakage chamber accommodates any possible leakage of the seal on the motor side. The leakage chamber is empty ex works.

4.1.4 Cooling system

The motor has an active cooling system with separate cooling circuit. The water-glycol mixture P35 is used as coolant. Coolant circulation is performed 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 is not pressurised when in cold state.

4.1.5 Material

The following materials are used in the standard version:

- Pump housing: grey cast iron
- Impeller: grey cast iron
- Motor housing: grey cast iron
- Seal on the motor side:
 - "G" = Carbon/ceramic or SiC/SiC
 - "K" = SiC/SiC
- Seal on the fluid side: SiC/SiC
- Static seal: FKM (ASTM D 1418) or NBR (nitrile)

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

4.2 Digital Data Interface



NOTICE

Note the instructions for the Digital Data Interface!

Read the separate instructions for the Digital Data Interface and comply with them.

The Digital Data Interface is a communication module with integrated web server that has been integrated in the motor. It is accessed and controlled in an Internet browser using a graphical user interface. The user interface enables easy pump configuration, control and monitoring. Different sensors may have been installed in the pump for this purpose. External signal transmitters may also input additional system parameters in the control. The Digital Data Interface is capable of the following, depending on the system mode:

- Pump monitoring.
- Controlling the pump with a frequency converter.
- Controlling the complete system with up to four pumps.

4.3 Monitoring devices

Overview of monitoring devices

	Asynchronous motor			Permanent magnet motor
	FKT 20.2	FKT 20.2 + DDI	FKT 27.x	FKT 20.2...-P + DDI
Internal monitoring devices				
Digital Data Interface (DDI)	—	•	—	•
Terminal/motor compartment Humidity	•	—	•	—
Motor winding: Bimetal	—	—	—	—
Motor winding: PTC	•	• (+ 1...3x Pt100)	•	• (+ 1...3x Pt100)
Motor bearings: Pt100	o	o	o	o
Sealing chamber: conductive sensor	—	—	—	—
Sealing chamber: capacitive sensor	—	—	—	—
Leakage chamber: Float switch	•	—	•	—
Leakage chamber: capacitive sensor	—	•	—	•
Oscillation sensor	—	•	—	•
External monitoring devices				
Sealing chamber: conductive sensor	—	—	o	—

• = Standard, — = Not available, o = Optional

All the monitoring devices fitted must always be connected!

4.3.1 Motor without Digital Data Interface

Monitoring the terminal room and motor compartment

The terminal room and motor compartment monitoring protects the motor terminals and winding from short-circuits. An electrode in both the terminal room and the motor compartment measures the moisture content.

Motor winding monitoring

Thermal motor monitoring protects the motor winding from overheating. A temperature limiter with a bimetallic strip is fitted as standard. Once the activation temperature has been reached, deactivation with reactivation lock must take place.

Optionally, the temperature can also be measured using a PTC sensor. Thermal motor monitoring can also be designed as temperature control. This allows two temperatures to be measured. Once the low activation temperature has been reached, an automatic reactivation can be initiated after the motor has cooled down. The unit is forced to deactivate with reactivation lock once the high activation temperature has been reached.

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.

Leakage chamber monitoring

The leakage chamber is equipped with a float switch. The float switch registers fluid ingress through the mechanical seal on the motor 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.

4.3.2 Motor with Digital Data Interface



NOTICE

Note the instructions for the Digital Data Interface!

Read the separate instructions for the Digital Data Interface and comply with them.

The Digital Data Interface evaluates all available sensors. Use the graphical user interface of the Digital Data Interface to display current values and set the limit parameters. A warning message or alarm signal is output upon exceeding the limit parameters.

The motor winding is also equipped with PTC sensors. To guarantee a hardware deactivation, connect the PTC sensors at the input "Safe Torque Off (STO)" of the frequency converter.

4.4 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.

4.5 Operation with frequency converter

4.5.1 Asynchronous motor

It is possible to operate asynchronous motors at the frequency converter. The frequency converter must feature the following connections at a minimum:

- Bimetallic strip and PTC sensor
- Moisture probe
- Pt100 sensor (if motor bearing monitoring is available!)

Refer to section entitled "Frequency converter operation [► 46]" for additional requirements and comply with these!

If the motor features a Digital Data Interface, also guarantee the following prerequisites:

- Network: Ethernet 10BASE-T/100BASE-TX, IP-based
- Protocol support: Modbus TCP/IP

Refer to the separate instructions for the Digital Data Interface for detailed requirements!

4.5.2 Permanent magnet motor

Guarantee the following conditions when operating permanent magnet motors:

- Frequency converter with connection for PTC sensor
- Network: Ethernet 10BASE-T/100BASE-TX, IP-based
- Protocol support: Modbus TCP/IP

Refer to the separate instructions for the Digital Data Interface for detailed requirements!

Permanent magnet motors have been approved for operation with the following frequency converters:

- Wilo-EFC

Other frequency converters on request!

4.6 Operation in an explosive atmosphere

	Asynchronous motor		Permanent magnet motor
	FKT 20.2	FKT 27.x	FKT 20.2...-P
IECEx approval	o	–	o
ATEX approval	o	o	o
FM approval	o	o	o
CSA-Ex approval	–	–	–

Key

– = Not available/possible, o = Optional, • = Standard

Identification of Ex-rated pumps

The pump is labelled as follows on the rating plate for use in explosive atmospheres:

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

Observe the explosion protection section!

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.

4.7 Rating plate

The following section provides 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

Rating plate designation	Value
I	Rated current
I_{ST}	Starting current
I_{SF}	Rated current at service factor
P_1	Power consumption
P_2	Rated power
U	Rated voltage
U_{EMF}	Inductive voltage
f	Frequency
f_{op}	Max. operating frequency
$\cos \varphi$	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

4.8 Type key

Type keys vary between individual hydraulics. The following section lists individual type keys.

4.8.1 Hydraulics type key: EMU FA

Example: Wilo-EMU FA 15.52-245E	
FA	Sewage pump
15	x10 = Nominal diameter of pressure connection
52	Internal performance coefficient
245	Original impeller diameter (for standard variants only, omitted for configured pumps)
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

4.8.2 Hydraulics type key: Rexa SUPRA

Example: Wilo-Rexa SUPRA-V10-736A	
SUPRA	Sewage pump
V	Impeller shape: V = Vortex impeller C = Single-channel impeller M = Multi-channel impeller
10	x10 = Nominal diameter of pressure connection
73	Internal performance coefficient
6	Characteristic curve number

Example: Wilo-Rexa SUPRA-V10-736A

A	Material version: A = Standard version B = Corrosion protection 1 D = Abrasion protection 1 X = Special configuration
---	-----------------------------------------------------------------------------------------------------------------------------------

4.8.3 Hydraulics type key: Rexa SOLID**Example: Wilo-Rexa SOLID-Q10-768A**

SOLID	Sewage pump with SOLID impeller
Q	Impeller shape: T = Closed two-channel impeller G = Half-open single-channel impeller Q = Half-open two-channel impeller
10	x10 = Nominal diameter of pressure connection
76	Internal performance coefficient
8	Characteristic curve number
A	Material version: A = Standard version B = Corrosion protection 1 D = Abrasion protection 1 X = Special configuration

4.8.4 Motor type key: FKT motor**Example: FKT 20.2M-4/32GX-P5**

FKT	Self-cooling motor with separate cooling circuit
20	Size
2	Configuration version
M	Shaft design
4	Number of poles
32	Package length in cm
G	Seal version
X	Ex-rated
P	Motor design: – None = Standard asynchronous motor – E = Highly efficient asynchronous motor – P = Permanent magnet motor
5	IE efficiency class (based on IEC 60034-30): None = IE0 to IE2 3 = IE3 4 = IE4 5 = IE5

4.9 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

4.10 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, check it immediately for defects (damage, completeness).
- Defects must be noted on the freight documentation.

5.2 Transport

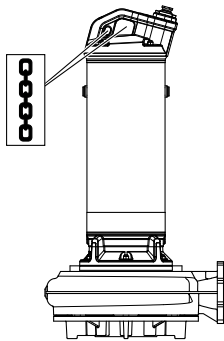


Fig. 2: Slings point

5.3 Use of lifting equipment

- Defects must be notified to the transport company or the manufacturer on the day of receipt of shipment.
- Subsequently notified defects can no longer be asserted.
- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500 wet)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
- Carry the pump by the handle!
- Protect the connection cable against water ingress. Do not immerse attached plugs in the pumped fluid.
- 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 the used pump for transport in a leak-proof manner.

If lifting equipment (lifting device, crane, chain hoist ...) is used, observe the following points:

- Wear a safety helmet according to EN 397!
- Comply with local regulations on the use of lifting equipment.
- The technically correct use of the lifting equipment is the operator's responsibility!
- **Lifting gear**
 - Use legally specified and approved lifting gear.
 - Select lifting gear based on the attachment point.
 - Attach lifting gear to the attachment point according to local regulations.
- **Lifting equipment**
 - Check for proper function before use!
Only use properly functioning lifting equipment!
 - Sufficient bearing capacity.
 - Ensure stability during use.
- **Lifting operation**
 - Do not jam the product when lifting and lowering it.
 - Do not exceed the max. permissible bearing capacity!
 - If necessary (e.g. blocked view), assign a second person to coordinate.
 - No one should stand under suspended loads!
 - Do not move loads over workplaces where persons are present!

5.4 Storage



DANGER

Danger due to fluids which are hazardous to health!

Danger of bacterial infection!

- Disinfect the pump after removal!
- Observe the specifications of the work regulations!



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the impeller and suction port. There is a danger of cuts and similar injuries!

- Wear protective gloves!

CAUTION

Permanent magnet motors: Connection wire may be live!

Turning the rotor may mean a voltage applies at the connection wires. Insulate connection wires and do not short circuit!

CAUTION

Total damage due to moisture ingress

The ingress of moisture into the connection cable damages the cable and the pump! Never immerse the ends of the connection cable in fluid. Seal them tightly during storage.

- Place the pump upright (vertical) on a firm bearing surface.
- Secure the pump against falling over and slipping!
- Store the pump for a maximum of one year. Consult the customer service before storing the device for more than one year.
- Storage conditions:
 - Maximum: –15 to +60 °C (5 to 140 °F), max. humidity: 90 %, non-condensing.
 - Recommended: 5 to 25 °C (41 to 77 °F), relative humidity: 40 to 50 %.
 - Protect the pump from direct exposure to sunlight. Extreme heat can cause damage!
- Do not store the pump in rooms where 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 the connection cable against kinking and damage. Maintain a constant bend radius!
- Impellers must be turned by 180° at regular intervals (3 – 6 months). This prevents the bearings from jamming and renews the lubrication film on the mechanical seal. **NOTICE! Wear protective gloves!**

6 Installation and electrical connection

6.1 Personnel qualifications

- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation and pipework in wet well and dry well installation, lifting equipment, basic knowledge of wastewater facilities

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.
- Observe all regulations for working with heavy loads and under suspended loads.
- Provide protective equipment. 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 in a secure and functional manner. The operator is responsible for the provision and suitability of the structural component/foundation!
- Check that the available consulting documents (installation plans, installation location, inflow conditions) are complete and accurate.

**DANGER****Permanent magnet motors: Risk of fatal injury caused by inductive voltage!**

The motor generates an inductive voltage if the rotor is driven without electrical energy (e.g. when the fluid returns). In this case, the connection cable is live. There is a risk of fatal injury caused by electric shock! Earth the connection cable prior to making the connection and dissipate inductive voltage!

**DANGER****Danger of death 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!

- Only carry out work with another person!

- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500 wet)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Safety helmet: EN 397 Conforms to standards, protection against lateral deformation (uvex pheos)
(When using lifting equipment)
- Prepare the installation site:
 - Clean, free of coarse solids
 - Dry
 - Frost-free
 - Disinfected
- Toxic or asphyxiating gases may build up during work:
 - Observe protective measures in accordance with work regulations (gas measurement, carry a gas detector with you).
 - Ensure adequate ventilation.
 - If toxic or asphyxiating gases accumulate, leave the workplace immediately!
- Install lifting equipment: even surface, clean, firm base. Warehouse and installation location must be easily accessible.
- Attach chain or wire rope to handle/attachment point with a shackle. Only use lifting gear that has been technically approved.
- All connection cables must be laid properly. The connection cables must not pose any risk (i.e. tripping, damage during operation). Check whether the cable cross-section and the cable length are sufficient for the selected installation type.
- Installation of switchgear: Observe information in the manufacturer's instructions (IP class, overflow-proof, potentially explosive atmospheres)!
- Avoid air intake into the fluid. Use baffles or deflector plates at the inlet. Install the ventilation systems!
- Do not allow the pump to run dry! Avoid air pockets. Do not go below the minimum water level. Installation of dry-running protection is recommended!

6.4.1 Indications for double pump operation

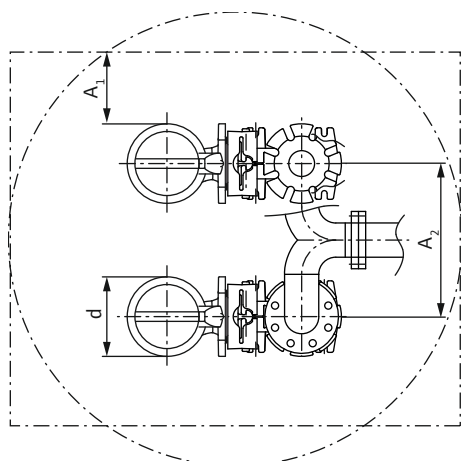


Fig. 3: Minimum distances

6.4.2 Maintenance tasks

6.4.2.1 Rotate impeller

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. $0.3 \times d$ – parallel operation: min. $1 \times d$
A ₂	Distance to pressure pipes – alternating operation: min. $1.5 \times d$ – parallel operation: min. $2 \times d$

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

- Rotate the impeller.
- Check the coolant.
- Check the oil in the sealing chamber (FKT 27.x only).



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the impeller and suction port. There is a danger of cuts and similar injuries!

- Wear protective gloves!

Small pumps (up to DN 100 pressure port)

- ✓ The pump is **not** connected to the mains!
 - ✓ Use protective equipment!
1. Place the pump on a firm surface in a horizontal position. **WARNING! Risk of hands being crushed. Make sure that the pump cannot fall over or slip!**
 2. Slowly and carefully reach into the hydraulics housing from below and rotate the impeller.

Large pumps (from DN 150 pressure port)

- ✓ The pump is **not** connected to the mains!
 - ✓ Use protective equipment!
1. Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Make sure that the pump cannot fall over or slip!**
 2. Carefully and slowly reach into the hydraulics housing through the pressure port and rotate the impeller.

6.4.2.2 Check the coolant

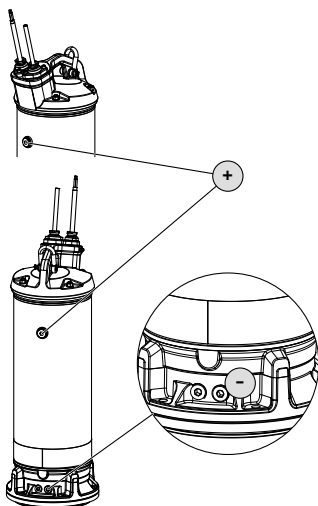


Fig. 4: Cooling system: Check the FKT 20.2 coolant

FKT 20.2 motor

+	Add/bleed the coolant
-	Drain the coolant

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Use protective equipment!
- Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Make sure that the pump can not fall over or slip!**
 - Position a suitable reservoir to collect the operating fluid.
 - Unscrew the screw plug (+).
 - Unscrew the screw plug (-) and drain the operating fluid. If a ball valve is installed at the outlet opening, open the ball valve to drain.
NOTICE! Rinse to completely bleed the cooling system.
 - Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse the operating fluid.
 - ⇒ If the operating fluid is contaminated (cloudy/dark), add new operating fluid. Dispose of the operating fluid in accordance with local regulations!
 - ⇒ Notify customer service if the operating fluid contains metal swarf!
 - If a ball valve is installed on the outlet opening, close the ball valve.
 - Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**
 - Pour new operating fluid in through the hole for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity! When re-cycling the operating fluid, check the quantity and adjust it, if required!
 - Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

FKT 27.x motor

+	Add/bleed the coolant
-	Drain the coolant

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Use protective equipment!
- Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Make sure that the pump can not fall over or slip!**
 - Position a suitable reservoir to collect the operating fluid.
 - Unscrew the screw plug (+).
 - Unscrew the screw plug (-) and drain the operating fluid. If a ball valve is installed at the outlet opening, open the ball valve to drain.
NOTICE! Rinse to completely bleed the cooling system.
 - Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse the operating fluid.
 - ⇒ If the operating fluid is contaminated (cloudy/dark), add new operating fluid. Dispose of the operating fluid in accordance with local regulations!
 - ⇒ Notify customer service if the operating fluid contains metal swarf!
 - If a ball valve is installed on the outlet opening, close the ball valve.
 - Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**
 - Pour new operating fluid in through the hole for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity! When re-cycling the operating fluid, check the quantity and adjust it, if required!
 - Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

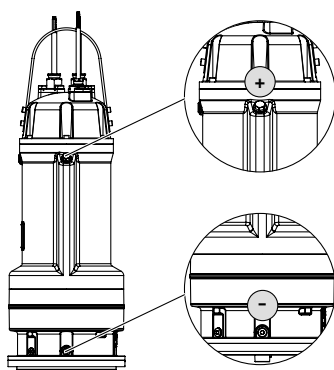


Fig. 5: Cooling system: Check the FKT 27.1/27.2 coolant

6.4.2.3 Check the oil in the sealing chamber

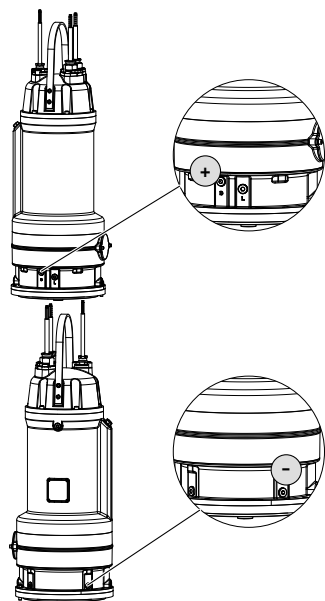


Fig. 6: Sealing chamber: Check the oil

FKT 27.x motor

+	Add the oil to the sealing chamber
-	Drain the oil from the sealing chamber

- ✓ Pump is **not** installed.
 - ✓ Pump is **not** connected to the mains.
 - ✓ Use protective equipment!
- Place the pump upright on a firm surface. **WARNING! Risk of hands being crushed. Make sure that the pump can not fall over or slip!**
 - Position a suitable reservoir to collect the operating fluid.
 - Unscrew the screw plug (+).
 - Unscrew the screw plug (-) and drain the operating fluid. Open the ball valve if a ball valve has been installed at the outlet opening.
NOTICE! Vacuum the oil or rinse the sealing chamber to fully drain the system.
 - Check the operating fluid:
 - ⇒ If the operating fluid is clear, reuse the operating fluid.
 - ⇒ If the operating fluid is contaminated (black), fill with new operating fluid. Dispose of the operating fluid in accordance with local regulations!
 - ⇒ If there is water in the operating fluid, fill with new operating fluid. Dispose of the operating fluid in accordance with local regulations!
 - ⇒ Notify customer service if the operating fluid contains metal swarf!
 - If a ball valve is installed on the outlet opening, close the ball valve.
 - Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**
 - Pour new operating fluid in through the hole for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity! When re-cycling the operating fluid, check the quantity and adjust it, if required!
 - 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

The pump is installed in a pump chamber or basin. A suspension unit is installed to connect the pump to the pressure pipe. The on-site pressure pipe is connected to the suspension unit. The pump is connected to the suspension unit via a coupling connection.

The pressure pipe must meet the following requirements:

- The connected pressure pipe is self-supporting. The pressure pipe must **not** be supported by the suspension unit!
- The pressure pipe must not be smaller than the pump's discharge connection.
- All prescribed valves (gate valves, backflow preventers ...) are present.
- Pressure pipe laid frost-proof.
- Ventilation systems (e.g. air vent valves) installed. Air pockets in the pump and in the pressure pipe can lead to delivery problems.

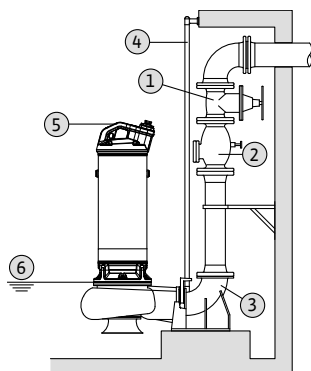


Fig. 7: Stationary wet installation

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

- ✓ Place of use prepared.
 - ✓ Suspension unit installed.
 - ✓ Coupling connection mounted on the pump.
- Use a shackle to attach the lifting equipment to the attachment point on the pump.
 - Lift the pump and swing it over the opening of the pump chamber.
 - Slowly drain the pump and thread the guide pipes into the coupling connection.
 - Lower the pump until it sets on the suspension unit and is connected automatically.
CAUTION! Hold the connection cables slightly taut when lowering the pump!

6.4.4 Portable wet well installation

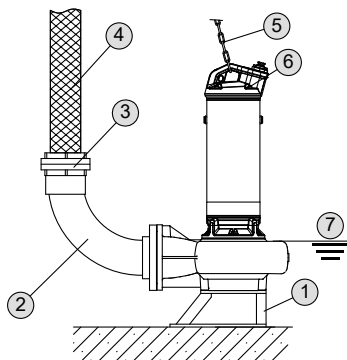


Fig. 8: Wet installation, portable

5. Loosen the lifting gear from the lifting equipment and secure it against falling at the pump chamber outlet.
 6. Correctly route the connection cables and lead them out of the pump chamber. **CAUTION! Do not damage the connection cables!**
 - No chafing or kinking.
 - Do not immerse the cable end in the fluid.
 - Observe the bending radii.
- Pump installed, make the electrical connection.

Attach the pump support foot (available separately as an accessory) to the pump. The pump support foot allows the pump to be positioned anywhere at the place of use. A pressure hose is connected on the discharge side.

- Use a hard surface or underlay at the place of use to prevent sinking on a soft bearing surface.
- If the pump is used at the same location for a longer period of time, bolt the pump support foot to the floor. This reduces vibrations and enables quiet operation.

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

- ✓ Place of use prepared.
 - ✓ Pump support foot mounted.
 - ✓ Discharge connection prepared: Hose connection or Storz coupling fitted.
 - ✓ Soft bearing surface: solid surface available.
1. Use a shackle to attach the lifting equipment to the attachment point on the pump.
 2. Lift and align the pump at the installation location.
 3. Place the pump on a firm bearing surface. Avoid sinking!
 4. Secure the pump against moving and falling over: Bolt the pump support foot to the floor.
 5. Lay the pressure hose and fasten it properly at the appropriate place (e.g. drainage).
 6. Correctly route the connection cables. **CAUTION! Do not damage the connection cables!**
 - No chafing or kinking.
 - Do not immerse the cable end in the fluid.
 - Observe the bending radii.
- Pump installed, 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.

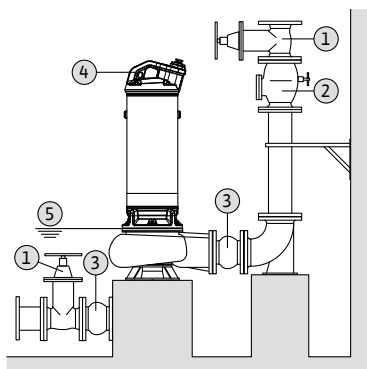


Fig. 9: Dry well installation

- 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

1	Gate valve
2	Non-return valve
3	Compensator
4	Attachment point for 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 on the pump.
 2. Lift the pump and position it in the machine room. **CAUTION! Hold the connection cable slightly taut when positioning the pump!**
 3. Secure 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 connection cable installed in the machine room by a qualified electrician. **NOTICE! Do not damage the connection cable (no kinks, note the bend radius)!**
 - The pump is installed, the qualified electrician can make the electrical connection.

6.4.6 Level control

Provide a level control on site for level-dependent control of the pump.



DANGER

Risk of explosion due to incorrect installation!

If the level control device is installed within a potentially explosive atmosphere, there is a risk of explosion if the level control device is connected incorrectly!

- Always have connection carried out by a qualified electrician.
- Signal transmitter must be connected via an Ex cut-off relay or a Zener barrier.

6.4.7 Dry-running protection

Dry-running protection prevents the pump from being operated without fluid and air from entering the hydraulics. For this purpose, the minimum permissible fill level is monitored using an external control. When the minimum fill level is reached, the pump is switched off. Furthermore, depending on the control, a visual and acoustic alarm is triggered.

The dry-running protection can be integrated into existing controls as an additional measuring point. Alternatively, the dry-running protection can also work as a stand-alone shut-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

Danger of death due to electrical current!

Improper conduct when carrying out electrical work can lead to death due to electric shock!

- Before all electrical work, disconnect the product from the mains and secure it against being switched on again without authorisation.
- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!



DANGER

Risk of explosion due to incorrect connection!

If the pump is used inside potentially explosive atmospheres, there is a risk of fatal injury from explosion if the connection is incorrect! If used in potentially explosive atmospheres:

- The connection must always be carried out by a qualified electrician.
- Always connect the pump to an electrical outlet outside the explosive area. If the connection must be established within explosive atmospheres, the connection must be carried out in an Ex-rated housing (ignition protection class according to DIN EN 60079-0)!
- Connect the equipotential bonding conductor to the earth terminal indicated. The earth terminal is installed in the area near the connection cables. Use cable cross-sections as per locally applicable regulations for the equipotential bonding conductor.
- Connect thermal motor monitoring using an Ex-certified evaluation relay.
- The temperature limit deactivation must take place with a reactivation lock. Reactivation must only be possible if an unlock button has been pressed manually!
- Connect the external pencil electrode via an Ex-approved evaluation relay with an intrinsically safe circuit.
- Observe the further information in the explosion protection section for the electrical connection!

- Mains connection corresponds to the information on the rating plate.
- Power supply on mains side with clockwise rotating field for three-phase AC motors (3~ motor).
- Route the connection cables according to the local regulations and connect them according to the wire assignment.
- Connect **all** of the monitoring devices and check their function.
- Secure the earthing in accordance with the local regulations.

6.5.1 Fuse on mains side

Circuit breaker

- Design the power and switching characteristics of the circuit breakers according to the rated current of the connected product.
- Observe local regulations.

Motor protection switch

- Product without plug: install a motor protection switch!
The minimum requirement is a thermal relay/motor protection switch with temperature compensation, differential trip and reactivation lock according to local regulations.
- Instable mains supply systems: if necessary, install further protective devices on-site (e.g. overvoltage, undervoltage or phase failure relays, etc.).

Residual-current device (RCD)

- Install a residual-current device (RCD) in accordance with the regulations of the local energy supply company.
- If people can come into contact with the device and conductive fluids, install a residual-current device (RCD).

6.5.2 Maintenance tasks

6.5.2.1 Checking the insulation resistance of the motor winding

- ✓ Insulation tester 1000 V
- 1. Check the insulation resistance.
 - ⇒ Measured value at initial commissioning: $\geq 20 \text{ M}\Omega$.
 - ⇒ Measured value at interval measurement: $\geq 2 \text{ M}\Omega$.
 - Insulation resistance checked. If the measured values deviate from the specifications, consult the customer service.

6.5.2.2 Test the resistor of the temperature sensor

- ✓ Ohmmeter available.
- 1. Measure the resistance.

- ⇒ Measured value **Bimetallic sensor**: 0 ohms (passage).
- ⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.
- ⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.
- ⇒ Measured value **Pt100 sensor*** at 20 °C (68 °F) motor temperature: 107.7 ohm.
- Resistance checked. If the measured value deviates from the specification, consult the customer service.

*Calculation of measured values for Pt100 sensor

The measured value of the Pt100 sensor is dependent on the motor temperature.

1. Measure motor temperature, e.g. 20 °C (68 °F).
2. Calculation of resistance.
 - ⇒ Resistance Pt100 sensor: 100 ohm at 0 °C (32 °F).
 - ⇒ Resistance per 1 °C (1.8 °F): 0.385 ohm between 0 °C (32 °F) and 100 °C (212 °F).
 - ⇒ Calculation: $100 \text{ ohm} + 20 \text{ °C} \times 0.385 \text{ ohm} = 107.7 \text{ ohm}$
 - Resistance calculated for Pt100 sensor.

6.5.3 Asynchronous motor power connection

The three-phase current version is supplied with bare cable ends. Connection to the mains is made by connecting the connection 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 starting

U, V, W	Mains connection
PE (gn-ye)	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 (gn-ye)	Earth

6.5.4 Permanent magnet motor power connection

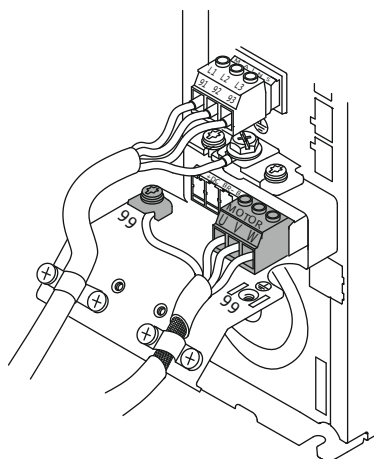


Fig. 10: Pump connection: Wilo-EFC

Wilo-EFC frequency converter

Terminal	Wiring diagram
96	U
97	V
98	W
99	Earth (PE)

Insert the motor connection cables into the frequency converter through the threaded cable gland. Connect the wires as per the connection diagram.

NOTICE! Widely position cable shielding!

6.5.5 Digital Data Interface connection



NOTICE

Note the instructions for the Digital Data Interface!

Read the separate instructions for the Digital Data Interface and comply with them.

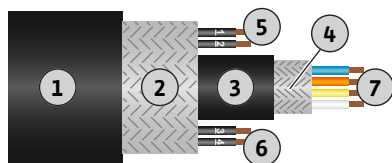


Fig. 11: Hybrid cable diagram

Description

A hybrid cable is used as the control cable. The hybrid cable merges two cables in one:

- Signal cable for control voltage and winding monitor
- Network cable

Pos.	Wire no/colour	Description
1		Outer cable sheath
2		Outer cable shielding
3		Inner cable sheath
4		Inner cable shielding
5	1 = + 2 = -	Connection wires for Digital Data Interface power supply. Operating voltage: 24 VDC (12–30 V FELV, max. 4.5 W)
6	3/4 = PTC	PTC sensor connection wires in the motor winding. Operating voltage: 2.5 to 7.5 VDC
7	White (wh) = RD+ Yellow (ye) = TD+ Orange (og) = TD- Blue (bu) = RD-	Prepare the network cable and install the supplied RJ45 plug.

The connection of the Digital Data Interface depends on the selected system mode and other system components. Note installation suggestions and connection variants in the instructions for the Digital Data Interface.

NOTICE! Widely position cable shielding!

6.5.6 Monitoring equipment connection

Overview of monitoring devices

	Asynchronous motor			Permanent magnet motor
	FKT 20.2	FKT 20.2 + DDI	FKT 27.x	FKT 20.2...-P + DDI
Internal monitoring devices				
Digital Data Interface (DDI)	–	•	–	•
Terminal/motor compartment Humidity	•	–	•	–
Motor winding: Bimetal	–	–	–	–
Motor winding: PTC	•	• (+ 1...3x Pt100)	•	• (+ 1...3x Pt100)
Motor bearings: Pt100	o	o	o	o
Sealing chamber: conductive sensor	–	–	–	–
Sealing chamber: capacitive sensor	–	–	–	–
Leakage chamber: Float switch	•	–	•	–
Leakage chamber: capacitive sensor	–	•	–	•
Oscillation sensor	–	•	–	•
External monitoring devices				
Sealing chamber: conductive sensor	–	–	o	–

• = Standard, – = Not available, o = Optional

All the monitoring devices fitted must always be connected!

Motor with Digital Data Interface



NOTICE

Note the instructions for the Digital Data Interface!

Read the separate instructions for the Digital Data Interface and comply with them.

The Digital Data Interface evaluates all available sensors. Use the graphical user interface of the Digital Data Interface to display current values and set the limit parameters. A warning message or alarm signal is output upon exceeding the limit parameters.

The motor winding is also equipped with PTC sensors. To guarantee a hardware deactivation, connect the PTC sensors at the input "Safe Torque Off (STO)" of the frequency converter.

Motor without Digital Data Interface

- Refer to the attached connection diagram for more precise details regarding the version.
- 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.

6.5.6.1 Monitoring of terminal room/motor compartment

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!

6.5.6.2 Monitoring of motor winding

With bimetallic strips

Connect the bimetallic strips directly to the switchgear or via an evaluation relay. Connection values: max. 250 V (AC), 2.5 A, $\cos \varphi = 1$

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. "CM-MSS" relay is recommended for this purpose.

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
----	----------------------------

Trigger status for temperature controller and limiter

The installed sensor specifies the trigger temperature as part of thermal motor monitoring using bimetallic or PTC sensors. Depending on the thermal motor monitoring version, the following triggering status must occur when the trigger temperature is reached:

- Temperature limiter (1 temperature circuit):
The unit must be deactivated once the trigger temperature has been reached.
- Temperature controller and limiter (2 temperature circuits):
Once the trigger temperature for the low temperature is reached, the motor can deactivate with automatic reactivation. Upon reaching the trigger temperature for the high temperature limit, the motor must deactivate with manual reactivation.

Note the additional information in the section on potentially explosive areas described in the appendix!

6.5.6.3 Leakage chamber monitoring

The float switch is equipped with a potential-free normally closed contact. The switching capacity can be found in the supplied connection diagram.

Wiring diagram

K20, K21 Float switch connection

When the float switch is activated, a warning must be issued or deactivation must take place.

6.5.6.4 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!

6.5.6.5 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

Trigger status for sealing chamber monitoring

The pencil electrode detects water ingress into the sealing chamber. The threshold value is reached when a certain amount of water is present in the oil. An alarm is triggered or the pump is switched off via the evaluation relay:

- The pump may be a total loss if only an alarm occurs.
- Recommendation: Always switch off the pump!

Note the additional information in the chapter on potentially explosive areas found in the appendix!

6.5.7 Motor protection adjustment

6.5.7.1 Direct activation

- **Full load**
Set the motor protection to the rated current according to the rating plate.
- **Partial load operation**
Set the motor protection to 5 % above the current measured at the duty point.

6.5.7.2 Star-delta starting

- The motor protection setting depends on the installation:
 - Motor protection in the motor line: Set the motor protection to 0.58 x rated current.
 - Motor protection installed in the mains supply cable: Set the motor protection to the rated current.
- The maximum start-up time in the star connection: 3 s

6.5.7.3 Soft starter

- **Full load**
Set the motor protection to the rated current according to the rating plate.
- **Partial load operation**
Set the motor protection to 5 % above the current measured at the duty point.

Please observe the following points:

- Current consumption must always be below the rated current.
- Complete starting and stopping within 10 s.
- To avoid power dissipation, bypass the electronic starter (soft start) once normal operation is reached.

6.5.8 Operation with frequency converter

6.5.8.1 Asynchronous motor

It is possible to operate asynchronous motors at the frequency converter. The frequency converter must feature the following connections at a minimum:

- Bimetallic strip and PTC sensor
- Moisture probe
- Pt100 sensor (if motor bearing monitoring is available!)

Refer to section entitled "Frequency converter operation [► 46]" for additional requirements and comply with these!

If the motor features a Digital Data Interface, also guarantee the following prerequisites:

- Network: Ethernet 10BASE-T/100BASE-TX, IP-based
- Protocol support: Modbus TCP/IP

Refer to the separate instructions for the Digital Data Interface for detailed requirements!

6.5.8.2 Permanent magnet motor

Guarantee the following conditions when operating permanent magnet motors:

- Frequency converter with connection for PTC sensor
- Network: Ethernet 10BASE-T/100BASE-TX, IP-based
- Protocol support: Modbus TCP/IP

Refer to the separate instructions for the Digital Data Interface for detailed requirements!

Permanent magnet motors have been approved for operation with the following frequency converters:

- Wilo-EFC

Other frequency converters on request!

7 Commissioning



NOTICE

Automatic activation after power cut

Depending on the process, the product is activated and deactivated using separate controls. The product may automatically be activated following power cuts.

7.1 Personnel qualifications

- Operation/control: Operating personnel, 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 AC motor

The pump has been checked and adjusted to the correct direction of rotation at the factory. To allow 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!

- **Check** the direction of rotation.
Check the rotating field at the mains connection with a rotating-field testing device.
- **Correct** the direction of rotation.
If the direction of rotation is incorrect, change the connection as follows:
 - Direct starting: swap two phases.
 - Star-delta starting: Swap the connections of two windings (e.g. U1/V1 and U2/V2).

7.4 Operation in an explosive atmosphere



DANGER

Risk of explosion due to flying sparks in the hydraulics!

The hydraulics must be completely filled with pumped fluid during operation. If air cushions form in the hydraulics, there is a risk of explosion due to sparking!

- Prevent air intake into the fluid. Install deflector plate at inlet.
- Do not allow the hydraulics to emerge. Switch off the pump at the appropriate level.
- Install additional dry-running protection.
- Carry out dry-running protection with a reactivation lock.

	Asynchronous motor		Permanent magnet motor
	FKT 20.2	FKT 27.x	FKT 20.2...-P
IECEX approval	o	–	o
ATEX approval	o	o	o
FM approval	o	o	o
CSA-Ex approval	–	–	–

Key

– = Not available/possible, o = Optional, • = Standard

Identification of Ex-rated pumps

The pump is labelled as follows on the rating plate for use in explosive atmospheres:

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

Observe the explosion protection section!**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:

- Has the electrical connection been carried out in accordance with regulations?
 - Has the connection cable been routed safely?
 - Can the float switch move freely?
 - Accessories attached correctly?
 - Temperature of the pumped fluid observed?
 - Immersion depth observed?
 - Are the pressure pipe and pump sump free of deposits?
 - All gate valves in the pressure pipe open?
 - Are ventilation systems present in the pressure pipe?
- Air pockets in the pump and in the pressure pipe can lead to delivery problems.

7.6 Switch on and off

- When the pump starts, the rated current is exceeded for a short time.
- During operation, do not exceed the rated current any more.

CAUTION! Material damage! If the pump does not start, switch off the pump immediately. Motor failure! Remove the fault first before reactivation.

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

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

Risk of injury from rotating components!

No persons are allowed to be present in the working area of the pump. There is a risk of injury!

- Demarcate and cordon off the working area.
- If there are no persons in the working area, activate the pump.
- If persons enter the working area, switch off the pump immediately.



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!

CAUTION

Do not allow the pump to dry run!

Dry running of the pump is prohibited. When the minimum delivery level is reached, switch off the pump. Dry running may destroy the seal and cause the pump to be irreparably damaged.



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!

Please regularly check the following points:

- Inlet quantity corresponds to the pump delivery rate.
- The level control device and dry-running protection work correctly.
- Minimum water coverage ensured.
- Connection cable is not damaged.
- Pump free from deposits and encrustations.
- No air intake in the pumped fluid.
- All gate valves open.
- Quiet and low-vibration running.
- Max. switching frequency not exceeded.
- Mains connection tolerances:
 - Operating voltage: $\pm 5\%$
 - Frequency: $\pm 2\%$
 - Current consumption between the individual phases: max. 5%
 - Voltage difference between the individual phases: max. 1%

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 tolerances apply during operation in the limit range:

- Operating voltage: $\pm 10\%$
- Frequency: $\pm 3\%$
- Current 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, instructed in the functioning of the complete system
- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Installation/dismantling work: trained sewage technology professional
Fixation and pipework in wet well and dry well installation, lifting equipment, basic knowledge of wastewater facilities

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, but remains installed. This ensures that the pump is always ready for operation.

- ✓ Completely immerse the pump in the fluid to protect the pump from frost and ice.
 - ✓ Minimum fluid temperature: +3 °C (+37 °F).
1. Switch off the pump.
 2. Secure the operating point against being switched on again by unauthorised persons (e.g. lock main switch).
 - ▶ The pump is decommissioned.

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

- Ensure that the aforementioned requirements are maintained for the complete period of shutdown. Remove the pump if meeting these requirements cannot be guaranteed!
- For an extended period of shutdown, carry out a function test at regular intervals:
 - Period: monthly to quarterly
 - Running time: 5 minutes
 - Only run a function test in valid operating conditions!

8.4 Removal



DANGER

Danger due to fluids which are hazardous to health!

Danger of bacterial infection!

- Disinfect the pump after removal!
- Observe the specifications of the work regulations!



DANGER

Danger of death due to electrical current!

Improper conduct when carrying out electrical work can lead to death due to electric shock!

- Before all electrical work, disconnect the product from the mains and secure it against being switched on again without authorisation.
- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!



DANGER

Danger of death 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!

- Only carry out work with another person!



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!

Wear the following protective equipment while performing the work:

- Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Protective gloves: 4X42C (uvex C500 wet)
 - Safety helmet: EN 397 Conforms to standards, protection against lateral deformation (uvex pheos)
- (When using lifting equipment)

If contact with hazardous fluid occurs during work, wear the following additional protective equipment:

- Safety goggles: uvex skyguard NT
 - Labelling frame: W 166 34 F CE
 - Labelling disc: 0–0.0* W1 FKN CE
- Breathing protection: Half mask 3M series 6000 with filter 6055 A2

The protective equipment specified is the minimum requirement. Observe the specifications of the work regulations!

* Protection level according to EN 170 not relevant for this work.

8.4.1 Stationary wet well installation

- ✓ Pump is decommissioned.
 - ✓ Gate valves on the inlet and pressure sides are closed.
1. Disconnect the pump from the mains.
 2. Attach the lifting equipment to the attachment point.
 3. Slowly raise the pump and lift it over the guide pipes out of the operating space. **CAUTION! Do not damage the connection cable! Hold the connection cables slightly taut when lifting!**
 4. Coil up the connection cables and attach them to the motor.
 - Do not kink.
 - Do not crush.
 - Observe the bending radii.
 5. Thoroughly clean the pump (see section “Cleaning and disinfecting”).

8.4.2 Portable wet well installation

- ✓ Pump has been decommissioned.
1. Disconnect the pump from the mains.
 2. Coil up the connection cables and attach them to the motor.
 - Do not kink.
 - Do not crush.
 - Observe the bending radii.
 3. Loosen the pressure pipe from the pressure port.
 4. Attach the lifting equipment to the attachment point.
 5. Lift the pump out of the operating space. **CAUTION! Do not damage the connection cable! Pay attention to the connection cable when setting down the pump!**
 6. Thoroughly clean the pump (see section “Cleaning and disinfecting”).

8.4.3 Stationary dry well installation

- ✓ Pump has been decommissioned.
 - ✓ Gate valves on the inlet and discharge sides are closed.
1. Disconnect the pump from the mains.
 2. Coil up the connection cables and attach them to the motor.
 - Do not kink.
 - Do not crush.
 - Observe the bending radii.
 3. Loosen the pipeline system from the suction and discharge port.
 - Place collector tank.
 - Wipe up drips.
 - Dispose of fluids properly.

DANGER! Contact with fluids that are hazardous to health! Wear protective equipment!

4. Attach the lifting accessory to the slinging point.
5. Undo the pump from the foundation.
6. Lift the pump slowly out of the pipework and place it on a suitable surface. **CAUTION! Do not damage the connection cable! Pay attention to the connection cable when setting down the pump!**
7. Thoroughly clean the pump (see section "Cleaning and disinfecting").

8.4.4 Clean and disinfect

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Breathing protection: Half mask 3M series 6000 with filter 6055 A2
 - Protective gloves: 4X42C + Type A (uvex protector chemical NK2725B)
 - Safety goggles: uvex skyguard NT
 - Use of disinfectants:
 - Use strictly according to the manufacturer's instructions!
 - Wear protective equipment according to the manufacturer's instructions!
 - Dispose of rinsing water in accordance with the local regulations, e.g. feed it into the sewer!
- ✓ Pump removed.
1. Ensure that the plug or bare cable ends are packed and stored in a watertight manner!
 2. Attach the lifting equipment to the attachment point on the pump.
 3. Lift the pump approximately 30 cm (10 in) above the ground.
 4. Spray the pump with clean water from top to bottom.
 5. Guide the water jet inwards through the discharge port to clean the impeller and pump interior.
 6. Disinfect the pump.
 7. Dispose of dirt residue on the ground, e.g. flush it into the sewer.
 8. Allow the pump to dry out.

9 Maintenance and repair



DANGER

Permanent magnet motors: Risk of fatal injury with an open motor housing caused by a strong magnetic field!

Opening the motor housing suddenly exposes a strong magnetic field! This magnetic field may lead to severe injuries. This magnetic field may cause death to persons with electronic implants (pacemakers, insulin pump, etc.). Do not open the motor housing! Only customer service staff are permitted to work on an open motor!



DANGER

Permanent magnet motors: Risk of fatal injury caused by inductive voltage!

The motor generates an inductive voltage if the rotor is driven without electrical energy (e.g. when the fluid returns). In this case, the connection cable is live. There is a risk of fatal injury caused by electric shock! Earth the connection cable prior to making the connection and dissipate inductive voltage!

9.1 Personnel qualifications

- Electrical work: qualified electrician
Person with appropriate technical training, knowledge and experience who can identify and prevent electrical hazards.
- Maintenance work: trained sewage technology professional
Application/disposal of operating fluids used, basic engineering knowledge (installation/dismantling)

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. The use of any non-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, fire, naked flames and smoking are prohibited.
- Document maintenance tasks in the system's inspection list.

9.3 Operating fluid

9.3.1 Filling quantities

Motor type	Sealing chamber		Cooling system	
	White oil		P35 coolant	
Motor FKT 20.2 ... / ... G				
FKT 20.2 ... : Size 17 to 22	–	–	9.0 l	304 US.fl.oz.
FKT 20.2 ... : Size 24 to 33	–	–	11.0 l	372 US.fl.oz.
Motor FKT 20.2 ... / ... K				
FKT 20.2 ... : Size 17 to 22	–	–	8.5 l	288 US.fl.oz.
FKT 20.2 ... : Size 24 to 33	–	–	10.5 l	355 US.fl.oz.
FKT 27.x motor				
FKT 27.1 ...	3.9 l	132 US.fl.oz.	14.5 l	490 US.fl.oz.
FKT 27.2 ...	6.5 l	220 US.fl.oz.	17.5 l	592 US.fl.oz.

9.3.2 Coolant P35

The coolant P35, is a water-glycol mixture consisting of 35 % "Fragol Zitrec FC" concentrate and 65 % demineralised/distilled water. To top up or fill the cooling system, it is only permitted for the named concentrates to be used at the specified ratios.

CAUTION

Damage to the motor due to incorrect concentrate or mixing ratio!

The motor may be destroyed if other concentrates are used! If the mixing ratio differs, this means that frost and corrosion protection is not guaranteed! Use only the concentrates listed in the ratio 35:65.

Concentrate	Fragol Zitrec FC	Pekasol L	Propylene glycol ²⁾
Status	Currently used	Alternative	Alternative
Technical data			
Basic	Propane-1,2-diol		
Colour	Colourless	Yellowish	Colourless
Degree of purity	96 %	–	98 %
Density	1.051 g/ml (8.771 lb/US.liq.gal.)	1.050 g/cm ³ (8.762 lb/US.liq.gal.)	1.051 g/ml (8.771 lb/US.liq.gal.)
Boiling point	164 °C (327 °F)	185 °C (365 °F)	188 °C (370 °F)
pH value	9.9	7.5 – 9.5	–
Water	max. 5 %	–	0.20 %
Nitrite-free	•	•	•
Amine-free	•	•	•
Phosphate-free	•	•	•
Silicate-free	•	•	•
Approvals			
Water-polluting class ¹⁾	1	1	1

Concentrate	Fragol Zitrec FC	Pekasol L	Propylene glycol ²⁾
FDA	•	–	–
HT1	•	–	–
Afssa	•	–	–

¹⁾ in accordance with VwVwS 1999. When disposing of these media, comply with the corresponding local guidelines for propanediol and propylene glycol!

²⁾ Suitable for medical applications

9.3.3 Oil types

- ExxonMobile: Marcol 52
- ExxonMobile: Marcol 82
- Total: Finavestan A 80 B (NSF-H1 certified)

9.3.4 Grease

- Esso: Unirex N3
- Tripol: Molub-Alloy-Food Proof 823 FM (USDA-H1 approved)

9.4 Maintenance intervals

- Regularly carry out maintenance tasks.
- Contractually adjust maintenance intervals depending on the actual environmental conditions. Contact customer service.
- If strong vibrations occur during operation, check the installation.

9.4.1 Maintenance intervals for normal conditions

8000 operating hours or after 2 years at the latest

	Visual inspection of the connection cables	Visual inspection of accessories	Visual inspection of the coating and the housing	Function test of monitoring devices	Coolant replacement	Sealing chamber oil change*	Draining the leakage chamber*
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Asynchronous motors

FKT 20.2	•	•	•	•	•	–	•
FKT 27.x	•	•	•	•	•	•	•

Permanent magnet motors

FKT 20.2...-P	•	•	•	•	•	–	0
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Key

• = Carry out maintenance measures, 0 = Carry out maintenance measure as instructed, – = Maintenance measure omitted

* Note information in "Deviating maintenance intervals"!

15000 operating hours or after 10 years at the latest

- Complete overhaul

9.4.2 Deviating maintenance intervals

Motors without Digital Data Interface

It is possible to install external sealing chamber control (pencil electrode) in motors without Digital Data Interface. Change the oil as instructed if this monitoring type has been installed!

Motors with Digital Data Interface

In motors with Digital Data Interface the sealing and/or leakage chamber is monitored by capacitive sensors. The Digital Data Interface outputs a warning once the predefined threshold has been reached. Carry out the corresponding maintenance measure if this warning is displayed.

9.4.3 Maintenance intervals for harsh conditions

Under the following operating conditions, shorten the specified maintenance intervals in consultation with the customer service:

- Fluids with long-fibre components
- Turbulent inlet (e.g. due to air entry, cavitation)
- Highly corrosive or abrasive fluids
- Strongly gassing fluids
- Operation at an unfavourable duty point
- Pressure surges

If there are harsh operating conditions, it is recommended to conclude a maintenance contract.

9.5 Maintenance measures



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the impeller and suction port. There is a danger of cuts and similar injuries!

- Wear protective gloves!

Before starting maintenance work, meet the following requirements:

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Protective gloves: 4X42C (uvex C500 wet)
 - Safety goggles: uvex skyguard NT

For detailed marking of frame and disc, see the section on “Personal protective equipment”.

- The pump has been thoroughly cleaned and disinfected.
- Motor must have cooled down to the ambient temperature.
- Workplace:
 - Clean, good lighting and ventilation.
 - Firm and stable work surface.
 - Secured against falling over and slipping.

NOTICE! Only perform the maintenance work described in these installation and operating instructions.

9.5.1 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.

9.5.2 Visual inspection of the connection cable

Check connection cable for:

- Bubbles
- Cracks
- Scratches
- Abrasion
- Pinch points

If the connection cable is damaged:

- Decommission the pump immediately!
- Have the connection cable replaced by the customer service!

CAUTION! Material damage! Damaged connection cables cause water to enter the motor. Water in the motor leads to total damage of the pump.

9.5.3 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.

9.5.4 Visual inspection of the coatings and housings

Coatings and housings must not show any damage. If there are defects, observe the following:

- Repair damaged coating. Order repair kits from the customer service.
- If housings are worn out, consult the customer service!

9.5.5 Function test of the monitoring device

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

9.5.5.1 Test the resistor of the temperature sensor

- ✓ Ohmmeter available.
- 1. Measure the resistance.
 - ⇒ Measured value **Bimetallic sensor**: 0 ohms (passage).
 - ⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.
 - ⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.
 - ⇒ Measured value **Pt100 sensor*** at 20 °C (68 °F) motor temperature: 107.7 ohm.
 - Resistance checked. If the measured value deviates from the specification, consult the customer service.

*Calculation of measured values for Pt100 sensor

The measured value of the Pt100 sensor is dependent on the motor temperature.

1. Measure motor temperature, e.g. 20 °C (68 °F).
2. Calculation of resistance.
 - ⇒ Resistance Pt100 sensor: 100 ohm at 0 °C (32 °F).
 - ⇒ Resistance per 1 °C (1.8 °F): 0.385 ohm between 0 °C (32 °F) and 100 °C (212 °F).
 - ⇒ Calculation: 100 ohm + 20 °C × 0.385 ohm = 107.7 ohm
 - Resistance calculated for Pt100 sensor.

9.5.5.2 Test the resistor for the internal electrodes for terminal room/motor compartment monitoring

All electrodes are connected in parallel. The resistance of all electrodes is measured during the check.

- ✓ Ohmmeter available.
- 1. Measure the resistance.
 - ⇒ Measured values “infinite (∞)”: Monitoring device OK.
 - ⇒ Measured value ≤ 30 kOhm: Water in the terminal or motor compartment. Contact customer service!
 - Resistance checked.

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

- ✓ Ohmmeter available.
- 1. Measure the resistance.
 - ⇒ Measured values “infinite (∞)”: Monitoring device OK.
 - ⇒ Measured value ≤ 30 kOhm: Water in oil. Change oil.
 - Resistance checked. If the measured value still deviates after the oil change, consult customer service.

9.5.6 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.

9.5.7 Oil change in the sealing chamber



WARNING

Operating fluid under pressure!

High pressure can build up in the motor! This pressure is released when the screw plugs are **opened**.

- If screw plugs are opened without due caution, they can be ejected at high speed!
- Hot operating fluid may spray out!
 - Wear protective equipment!
 - Allow the motor to cool down to ambient temperature before carrying out any work!
 - Adhere to the prescribed sequence of work steps!
 - Unscrew the screw plugs slowly.
 - As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
 - Only when the pressure has been completely released, fully unscrew the screw plug.

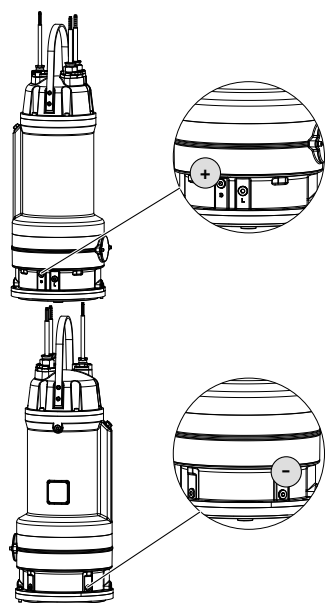


Fig. 12: Sealing chamber: Oil change

FKT 27.x motor

+	Add the oil to the sealing chamber
-	Drain the oil from the sealing chamber

- ✓ Protective equipment used!
 - ✓ Pump has been removed, cleaned and disinfected.
1. Place the pump on a firm work surface in a vertical position.
 2. Secure the pump against falling over and slipping!
 3. Position a suitable tank to collect the operating fluid.
 4. Unscrew the screw plug (+) slowly.
 5. Once the pressure has dissipated, fully unscrew the screw plug (+).
 6. Unscrew the screw plug (-) and drain the operating fluid. If a ball valve is installed at the outlet opening, open the ball valve.
- NOTICE! Rinse to completely drain the sealing chamber.**
7. Check the operating fluid:
 - ⇒ Operating fluid clear: Operating fluid can be reused.
 - ⇒ Operating fluid contaminated (black): fill with new operating fluid.
 - ⇒ Operating fluid milky/cloudy: Water in oil. Minor leakage through the mechanical seal is normal. If the ratio of oil to water is less than 2:1, the mechanical seal may be damaged. Change the oil and check again four weeks later. If water is again present in the oil during the second check, contact customer service!
 - ⇒ Metal chips in the operating fluid: Contact the customer service!
 8. If a ball valve is installed on the outlet opening, close the ball valve.
 9. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**
 10. Fill the new operating fluid through the opening for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity!
 11. Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

9.5.8 Coolant change



WARNING

Operating fluid under pressure!

High pressure can build up in the motor! This pressure is released when the screw plugs are **opened**.

- If screw plugs are opened without due caution, they can be ejected at high speed!
- Hot operating fluid may spray out!
 - Wear protective equipment!
 - Allow the motor to cool down to ambient temperature before carrying out any work!
 - Adhere to the prescribed sequence of work steps!
 - Unscrew the screw plugs slowly.
 - As soon as the pressure escapes (audible whistling or hissing of air), stop turning the screw plug any further!
 - Only when the pressure has been completely released, fully unscrew the screw plug.

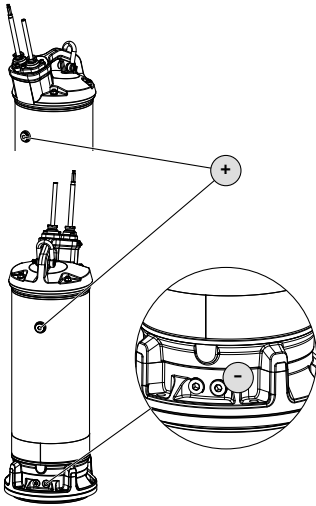


Fig. 13: Cooling system: FKT 20.2: coolant change

FKT 20.2 motor

+	Add/bleed the coolant
-	Drain the coolant

- ✓ Protective equipment used!
 - ✓ Pump has been removed, cleaned and disinfected.
1. Place the pump on a firm work surface in a vertical position.
 2. Secure the pump against falling over and slipping!
 3. Position a suitable tank to collect the operating fluid.
 4. Unscrew the screw plug (+) slowly.
 5. Once the pressure has dissipated, fully unscrew the screw plug (+).
 6. Unscrew the screw plug (-) and drain the operating fluid. If a ball valve is installed on the outlet opening, open the ball valve.
 7. Check the operating fluid:
 - ⇒ Operating fluid clear: Operating fluid can be reused.
 - ⇒ Operating fluid contaminated (cloudy/dark); fill with new operating fluid.
 - ⇒ Metal chips in the operating fluid: Contact the customer service!
 8. Rinse the cooling system with clean water.
 9. If a ball valve is installed on the outlet opening, close the ball valve.
 10. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
 11. Fill the new operating fluid through the opening for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity!
 12. Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

FKT 27.x motor

+	Add/bleed the coolant
-	Drain the coolant

- ✓ Protective equipment used!
 - ✓ Pump has been removed, cleaned and disinfected.
1. Place the pump on a firm work surface in a vertical position.
 2. Secure the pump against falling over and slipping!
 3. Position a suitable tank to collect the operating fluid.
 4. Unscrew the screw plug (+) slowly.
 5. Once the pressure has dissipated, fully unscrew the screw plug (+).
 6. Unscrew the screw plug (-) and drain the operating fluid. If a ball valve is installed on the outlet opening, open the ball valve.
 7. Check the operating fluid:
 - ⇒ Operating fluid clear: Operating fluid can be reused.
 - ⇒ Operating fluid contaminated (cloudy/dark); fill with new operating fluid.
 - ⇒ Metal chips in the operating fluid: Contact the customer service!
 8. Rinse the cooling system with clean water.
 9. If a ball valve is installed on the outlet opening, close the ball valve.
 10. Clean the screw plug (-), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**
 11. Fill the new operating fluid through the opening for the screw plug (+).
 - ⇒ Comply with the specifications for the operating fluid type and quantity!
 12. Clean the screw plug (+), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

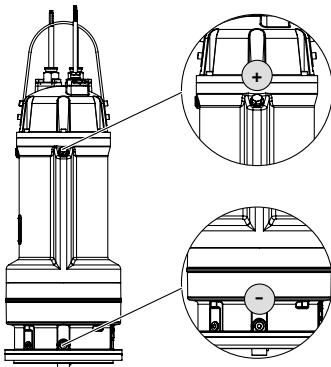


Fig. 14: Cooling system: FKT 27.1/27.2: coolant change

9.5.9 Drain the leakage chamber

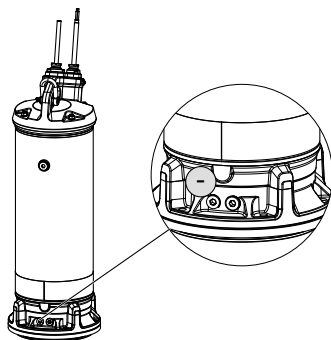


Fig. 15: FKT 20.2: draining the leakage chamber

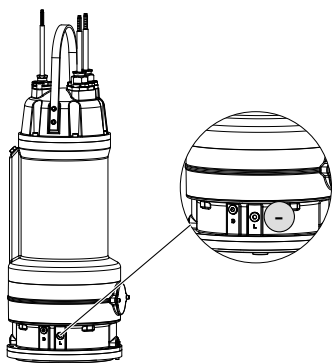


Fig. 16: FKT 27.1/27.2: draining the leakage chamber

9.5.10 General overhaul

9.6 Repairs

FKT 20.2 motor

– Drain the leakage

- ✓ Protective equipment used!
 - ✓ Pump has been removed, cleaned and disinfected.
1. Place the pump on a firm work surface in a vertical position.
 2. Secure the pump against falling over and slipping!
 3. Position a suitable tank to collect the operating fluid.
 4. Unscrew the screw plug (–) slowly.
 5. Once the pressure has dissipated, fully unscrew the screw plug (–) and drain the operating fluid.
 6. Clean the screw plug (–), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

FKT 27.x motor

– Drain the leakage

- ✓ Protective equipment used!
 - ✓ Pump has been removed, cleaned and disinfected.
1. Place the pump on a firm work surface in a vertical position.
 2. Secure the pump against falling over and slipping!
 3. Position a suitable tank to collect the operating fluid.
 4. Unscrew the screw plug (–) slowly.
 5. Once the pressure has dissipated, fully unscrew the screw plug (–) and drain the operating fluid.
 6. Clean the screw plug (–), replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

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

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



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the impeller and suction port. There is a danger of cuts and similar injuries!

- Wear protective gloves!

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

- Wear protective equipment! Observe the work regulations.
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Protective gloves: 4X42C (uvex C500 wet)
 - Safety goggles: uvex skyguard NT
- For detailed marking of frame and disc, see the section on “Personal protective equipment”.
- The pump has been thoroughly cleaned and disinfected.
 - Motor must have cooled down to the ambient temperature.
 - Workplace:
 - Clean, good lighting and ventilation.
 - Firm and stable work surface.
 - Secured against falling over and slipping.

NOTICE! Only carry out the repair work described in these installation and operating instructions.

For repair work, the following applies:

9.6.1 Instructions on using screw locking devices

- 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!
- The use of force is strictly prohibited!

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!

9.6.2 Which repair work may be carried out

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

9.6.3 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.

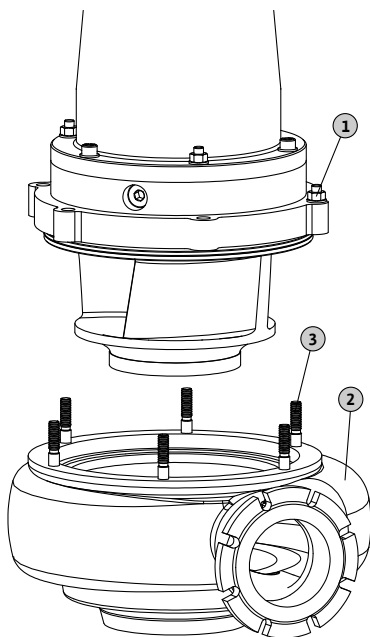


Fig. 17: Changing the hydraulics housing

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

- ✓ Lifting equipment with sufficient bearing capacity is available.
 - ✓ Protective equipment is used.
 - ✓ 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. Position the pump upright.

CAUTION! The hydraulics housing will be damaged if the pump is put down too quickly. Set the pump down slowly on the suction port!

NOTICE! If the pump cannot be placed level on the suction port, use appropriate adjustment plates. The pump must be positioned vertically to be able to lift the motor without issues.
 3. Mark the motor/hydraulics position on the housing.
 4. Undo and remove hexagon nuts at the motor flange.
 5. Slowly lift the motor and pull it off the hydraulics housing.

CAUTION! Lift the motor vertically and do not tilt! Threaded bolts are damaged if the unit is tilted!
 6. Insert a new seal ring at the motor flange.
 7. Swivel the motor over the new hydraulics housing.
 8. Slowly lower the motor. Make sure that the motor/hydraulic markings match and the threaded bolts screw exactly into the drilled holes.
 9. Screw hexagon nuts and connect the motor to the hydraulics firmly. **NOTICE! Observe the tightening torques stated in the appendix!**

► Hydraulics housing changed. Pump can be reinstalled.

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

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

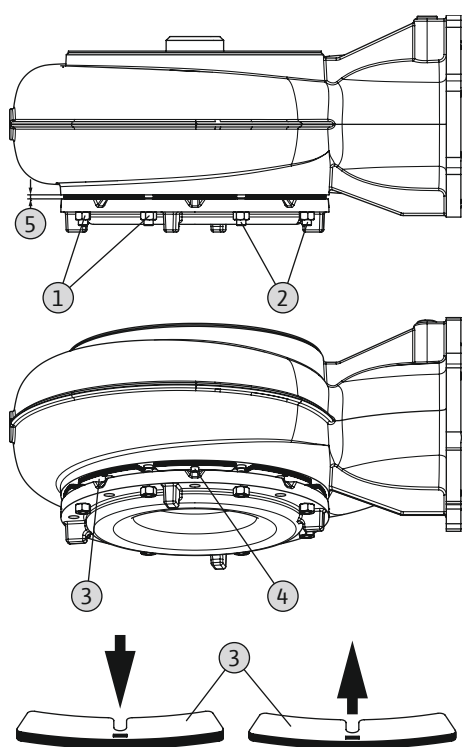


Fig. 18: SOLID G: Readjusting the gap

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



WARNING

Risk of injury from rotating components!

No persons are allowed to be present in the working area of the pump. There is a risk of injury!

- Demarcate and cordon off the working area.
- If there are no persons in the working area, activate the pump.
- If persons enter the working area, switch off the pump immediately.

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.
 - ⇒ Completely open all gate valves.
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.
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. The connection only has two phases.
⇒ 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 fluids must be collected in suitable containers and disposed of in accordance with the locally applicable guidelines. Wipe up drips immediately!

12.2 Water-glycol mixture

The operating fluid complies with Water Hazard Class 1 of the German Administrative Regulation of Substances Hazardous to Water (VwVwS). When disposing of it, the locally applicable guidelines (e.g. DIN 52900 on propanediol and propylene glycol) must be observed.

12.3 Protective clothing

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

12.4 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 prohibited!

In the European Union this symbol may be included 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.

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

- Hand over these products at designated, certified collection points only.
- 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. See www.wilo-recycling.com for more information about recycling.

Subject to change without prior notice!

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
M16	155	15.81	114.3
M20	265	27.02	195.5

13.2 Frequency converter operation

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 above 415 V/50 Hz or 480 V/60 Hz. Plan the rated power of the motor to be approx. 10% higher than the power requirement of the pump due to the additional heating caused by harmonics. For frequency con-

verters with a low-harmonic output, it is possible to reduce the 10 % power reserve. Harmonic waves are reduced by means of output filters. Synchronise the frequency converter and the filter with each other!

The configuration of the frequency converter depends on the rated motor current. Make sure that the pump operates without jerks and vibrations (without oscillations, resonances, pendulum torques) across the entire control range. Otherwise, the mechanical seals may leak or be damaged. Pay attention to the flow rate in the piping. If the flow rate is too low, there is an increased danger of deposits in the connected 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.

Make sure that the pump operates without jerks and vibrations (without oscillations, resonances, pendulum torques) across the entire control range. Otherwise, the mechanical seals may leak or be damaged. 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 characteristic curve (U/f characteristic curve) for submersible motors! The U/f characteristic curve ensures that the output voltage at frequencies below the rated frequency (50 Hz or 60 Hz) is adjusted to the power requirement of the pump. Newer models of 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.

Motor monitoring faults may occur if the motor is operated with a frequency converter. The following measures can reduce or avoid these faults:

- Keeping within the limit values stated in IEC 60034–25 for overvoltage and rise speed. If necessary, install output filters.
- Vary the pulse frequency of the frequency converter.
- In the event of a fault in the internal sealing chamber monitoring, use the external double-rod electrode.

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

- Separate connection cables for the main and control cable (depending on the motor size).
- Keep an adequate distance between main and control cable during routing.
- Use shielded connection cables.

Summary

- Min./max. frequency during continuous duty:
 - Asynchronous motors: 30 Hz up to rated frequency (50 Hz or 60 Hz)
 - Permanent magnet motors: 30 Hz up to the stated maximum frequency as per rating plate
- **NOTICE! The maximum frequency may be below 50 Hz!**
 - Comply with the minimum flow velocity!
- Observe additional measures with regard to EMC regulations (choice of frequency converter, using filters, etc.).
- Do not exceed the rated current or rated speed of the motor.
- Connection for 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

The pump is labelled as follows on the rating plate for use in explosive atmospheres:

- “Ex” symbol of the corresponding approval
- Ex classification
- Certification number (depending on the approval)

If required by the approval, the certification number 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

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 – motor without Digital Data Interface



DANGER

Danger of death due to electrical current!

Improper conduct when carrying out electrical work can lead to death due to electric shock!

- Before all electrical work, disconnect the product from the mains and secure it against being switched on again without authorisation.
- Electrical work must be carried out by a qualified electrician!
- Observe local 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 made in an Ex-rated housing (ignition protection class EN 60079-0)! Non-compliance may lead to danger of death from explosion! The connection must always be made 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 monitoring devices

	Asynchronous motor	
	FKT 20.2	FKT 27.x
Internal monitoring devices		
Digital Data Interface (DDI)	–	–
Terminal/motor compartment Humidity	•	•
Motor winding: Bimetal	–	–
Motor winding: PTC	•	•
Motor bearings: Pt100	o	o
Sealing chamber: conductive sensor	–	–
Sealing chamber: capacitive sensor	–	–
Leakage chamber: Float switch	•	•
Leakage chamber: capacitive sensor	–	–
Oscillation sensor	–	–
External monitoring devices		
Sealing chamber: conductive sensor	–	o

• = Standard, – = Not available, o = Optional

All the monitoring devices fitted must always be connected!

13.3.4.1 Monitoring of terminal room/motor compartment

The connection is made as described in the “Electrical connection” section.

13.3.4.2 Thermal motor monitoring



DANGER

Risk of explosion due to overheating of the motor!

If the thermal motor monitoring is connected incorrectly there is a risk of explosion due to overheating of the motor!

- Thermal motor monitoring deactivation must take place with a reactivation lock!
Reactivation must only be possible if an unlock button has been manually actuated!

- Connect thermal motor monitoring via an Ex-approved evaluation relay (e.g. "CM-MSS").
- If a frequency converter is used, connect the thermal motor monitoring to the Safe Torque Off (STO). Deactivation on hardware side is thus ensured.

The threshold value for thermal motor monitoring is determined by the built-in sensor. Depending on the version of the thermal motor monitoring, the following triggering status must arise:

- Temperature limiter (1 temperature circuit)
If the threshold value is reached, deactivation must take place **with a reactivation lock!**
- Temperature control (2 temperature circuits)
 - Deactivation with automatic reactivation can occur if the low temperature threshold is reached.
CAUTION! Motor damage due to overheating! If automatic reactivation takes place, comply with the specifications for max. switching frequency and switching break!
 - If the high temperature threshold is reached, deactivation must take place **with a reactivation lock!**

13.3.4.3 Leakage chamber monitoring

Connect the float switch using an evaluation relay! "CM-MSS" relay is recommended for this purpose.

13.3.4.4 Monitoring of motor bearing

The connection is made as described in the "Electrical connection" section.

13.3.4.5 External pencil electrode

- Connect pencil electrode via an Ex-approved evaluation relay (e. g. "XR-4 ...").
- Make connection with intrinsically safe circuit!

13.3.4.6 Frequency converter operation

- Converter type: Pulse-width modulation
- Min./max. frequency during continuous duty:
 - Asynchronous motors: 30 Hz up to rated frequency (50 Hz or 60 Hz)
 - Permanent magnet motors: 30 Hz up to the stated maximum frequency as per rating plate
NOTICE! The maximum frequency may be below 50 Hz!
 - Comply with the minimum flow velocity!
- Min. switching frequency: 4 kHz
- Max. overvoltage at the terminal board: 1350 V
- Output current at the frequency converter: max. 1.5 times rated current
- Max. overload time: 60 s
- Torque applications: quadratic pump curve or automatic energy optimisation procedure (e.g. VVC+)
Required speed/torque curves are available on request!
- Observe additional measures with regard to EMC regulations (choice of frequency converter, filters, etc.).
- Do not 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 Electrical connection – motor with Digital Data Interface



NOTICE

Note the instructions for the Digital Data Interface!

Read the separate instructions for the Digital Data Interface and comply with them.

The Digital Data Interface evaluates all available sensors. Use the graphical user interface of the Digital Data Interface to display current values and set the limit parameters. A warning message or alarm signal is output upon exceeding the limit parameters.

The motor winding is also equipped with PTC sensors. To guarantee a hardware deactivation, connect the PTC sensors at the input “Safe Torque Off (STO)” of the frequency converter.

The connection of the Digital Data Interface depends on the selected system mode and other system components. Note installation suggestions and connection variants in the instructions for the Digital Data Interface.

13.3.6 Commissioning



DANGER

Risk of explosion if incorrect pumps are used!

There is a risk of fatal injury from explosion if non-approved pumps are used in potentially explosive atmospheres!

- Only use approved pumps inside potentially explosive atmospheres.
- Check the Ex labelling on the rating plate.



DANGER

Risk of explosion due to flying sparks in the hydraulics!

The hydraulics must be completely filled with pumped fluid during operation. If air cushions form in the hydraulics, there is a risk of explosion due to sparking!

- Prevent air intake into the fluid. Install deflector plate at inlet.
- Do not allow the hydraulics to emerge. Switch off the pump at the appropriate level.
- Install additional dry-running protection.
- Carry out dry-running protection with a reactivation lock.



DANGER

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

Provide dry-running protection inside potentially explosive atmospheres!

- Implement dry-running protection with a separate signal transmitter (redundant fuse for level control).
- Deactivation of the pump must take place with a manual reactivation lock.

- The operator is responsible for defining the potentially explosive area.
 - Only use pumps with the appropriate Ex rating within potentially explosive atmospheres.
 - Do not exceed the **max. fluid temperature!**
 - Do not allow the pump to dry run! The customer must take appropriate precautions (e.g. dry-running protection) to prevent the hydraulics from emerging.
- Provide the following safety device in accordance with EN 50495 for category 2:

- SIL Level 1
- Hardware fault tolerance 0

13.3.7 Maintenance and repair

- Carry out maintenance tasks according to the regulations.
- Only carry out maintenance tasks described in these installation and operating instructions.

- The spark-proof gaps must **only** be repaired according to the manufacturer's design specifications. Carrying out repairs according to the values in tables 2 and 3 of EN 60079-1 is **not** permitted.
- Only use screws as stipulated by the manufacturer, which at a minimum correspond to a strength class of 600 N/mm² (38.85 long tons-force/inch²).

13.3.7.1 Repair of housing coating

If the housing coating has to be repaired, the maximum coat thickness is 2 mm (0.08 in)! The paint layer can become electrostatically charged in cases of thicker coats.

DANGER! Risk of explosion! A discharge can cause an explosion in explosive atmospheres!

13.3.7.2 Changing the mechanical seal

Fluid and motor seals may only be replaced by customer service or a certified workshop.

13.3.7.3 Replacing the connection cable

Damaged connection cables may only be replaced by customer service or a certified workshop.



1. The first step is to identify the main topic of the document. This is usually found in the title or the first paragraph.

2. The second step is to identify the main points of the document. These are usually found in the body paragraphs.

3. The third step is to identify the supporting details of the document. These are usually found in the body paragraphs.

4. The fourth step is to identify the conclusion of the document. This is usually found in the last paragraph.

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6. The sixth step is to identify the main points of the document. These are usually found in the body paragraphs.

7. The seventh step is to identify the supporting details of the document. These are usually found in the body paragraphs.

8. The eighth step is to identify the conclusion of the document. This is usually found in the last paragraph.

9. The ninth step is to identify the overall message of the document. This is usually found in the title or the first paragraph.

10. The tenth step is to identify the main points of the document. These are usually found in the body paragraphs.

11. The eleventh step is to identify the supporting details of the document. These are usually found in the body paragraphs.

12. The twelfth step is to identify the conclusion of the document. This is usually found in the last paragraph.

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14. The fourteenth step is to identify the main points of the document. These are usually found in the body paragraphs.

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16. The sixteenth step is to identify the conclusion of the document. This is usually found in the last paragraph.

17. The seventeenth step is to identify the overall message of the document. This is usually found in the title or the first paragraph.

18. The eighteenth step is to identify the main points of the document. These are usually found in the body paragraphs.

19. The nineteenth step is to identify the supporting details of the document. These are usually found in the body paragraphs.

20. The twentieth step is to identify the conclusion of the document. This is usually found in the last paragraph.

21. The twenty-first step is to identify the overall message of the document. This is usually found in the title or the first paragraph.

22. The twenty-second step is to identify the main points of the document. These are usually found in the body paragraphs.

23. The twenty-third step is to identify the supporting details of the document. These are usually found in the body paragraphs.

24. The twenty-fourth step is to identify the conclusion of the document. This is usually found in the last paragraph.

25. The twenty-fifth step is to identify the overall message of the document. This is usually found in the title or the first paragraph.

26. The twenty-sixth step is to identify the main points of the document. These are usually found in the body paragraphs.

27. The twenty-seventh step is to identify the supporting details of the document. These are usually found in the body paragraphs.

28. The twenty-eighth step is to identify the conclusion of the document. This is usually found in the last paragraph.

29. The twenty-ninth step is to identify the overall message of the document. This is usually found in the title or the first paragraph.

30. The thirtieth step is to identify the main points of the document. These are usually found in the body paragraphs.









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