

Wilo-EMU TR/TRE 216 ... 326-3



en Installation and operating instructions



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1 General information

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 Digital instructions

The digital version of the instructions is available on the following product page:
<https://qr.wilo.com/737>

1.3 Copyright

These installation and operating instructions have been copyrighted by Wilo. Content of any kind must not be reproduced, distributed or used by unauthorised persons for purposes of competition and shared with others.

1.4 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 example representation of the device.

1.5 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

Symbols

These instructions use the following symbols:



Danger of electric voltage



Danger of bacterial infection



Danger – explosive atmosphere



General warning symbol



Warning of cutting injuries



Warning of hot surfaces



Warning of high pressure



Warning of suspended loads



Personal protective equipment: wear a safety helmet



Personal protective equipment: wear foot protection



Personal protective equipment: wear hand protection



Personal protective equipment: wear safety harness



Personal protective equipment: wear mouth protection



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 to different construction parts, lifting equipment, wastewater facility basics
- 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 Personal protective equipment

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

Protective equipment: Transport, installation, removal and maintenance

- Safety shoes: Protection class S1 (uvex 1 sport S1)
- Protective gloves (EN 388): 4X42C (uvex C500)
- Safety helmet (EN 397): Conforms to standards, protection against lateral deformation (uvex pheos)
(If lifting equipment is used)

Protective equipment: Cleaning work

- Protective gloves (EN ISO 374-1): 4X42C + Type A (uvex protector chemical NK2725B)
- Safety goggles (EN 166): (uvex skyguard NT)
 - Labelling frame: W 166 34 F CE
 - Labelling disc: 0-0.0* W1 FKN CE
 - * Protection level according to EN 170 not relevant for this work.
- Breathing protection mask (EN 149): Half mask 3M series 6000 with filter 6055 A2

Article recommendations

The articles mentioned in brackets are recommendations. The articles can be replaced with an identical article according to the mentioned labellings!

2.4 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.

2.5 Monitoring devices

The following monitoring devices must be provided on-site:

Circuit breaker

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

Motor protection switch

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

Residual-current device (RCD)

- 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).

2.6 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!

2.7 Transport

- Locally applicable laws and regulations on work safety and accident prevention must be complied with.
- Demarcate and cordon off the working area.
- Keep unauthorised persons away from the working area.
- Always attach the lifting gear to the attachment points.
- Ensure that the lifting gear is securely attached.
- Observe packaging instructions:
 - Impact-resistant
 - Ensure that the product is properly fixed in place.
 - Protect it against dust, oil and moisture.

- 2.8 Installing/dismantling**
- Wear a safety harness.
 - Locally applicable laws and regulations on work safety and accident prevention must be complied with.
 - Demarcate and cordon off the working area.
 - Keep working area free from ice.
 - Remove objects lying around from the work area.
 - Keep unauthorised persons away from the working area.
 - If the weather conditions mean it is no longer possible to work safely, stop work.
 - Work must always be carried out by two persons.
 - When working at a height of more than 1 m (3 ft) above the ground, use scaffolding with a safety harness.
 - Ensure enclosed spaces have sufficient ventilation.
 - 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.
 - If there is a risk of explosion, do not carry out welding work or work with electrical devices.
 - Disconnect device from the mains and secure it against being switched on again without authorisation.
 - All rotating parts must stop.
 - Disinfect 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.
 - Propeller must not crash into fixtures or walls. Observe defined clearances in accordance with consulting documents.
 - Observe required water immersion. If water level varies significantly, use level monitoring.
 - 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.
 - Disinfect 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 seal housing is filled with white oil. The gear and the pre-chamber are filled with gear oil.
- Absorb leakages immediately.
 - If major leakages occur, contact customer service.
 - If the seal is defective, the oil enters the pumped fluid.
 - **Skin contact:** Rinse skin areas thoroughly with soap and water. If skin irritation occurs, consult a doctor.
 - **Contact with eyes:** Remove the contact lenses. Rinse eye thoroughly with water. If eye irritation occurs, consult a doctor.

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 Transportation and storage

3.1 Delivery

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

3.2 Transport



NOTICE

Transporting mixers without attachment points

Mixers for ground and wall fixation have no in-built frame and therefore no attachment point. Transport the mixer on the pallet to the installation site. Have one or two persons position the mixer at the installation site. Bear in mind the weight of the mixer!



Fig. 1: Attachment point

- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
- Attach the mixer to the attachment point.
- Protect the connection cable against water ingress.
- Only remove the outer packaging at the site of use to ensure that the mixer is not damaged during transport.
- Use tear-proof plastic sacks of sufficient size to package used mixers for transport in a leak-proof manner.

3.3 Use of lifting equipment

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 its functions properly before use!
 - 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!

3.4 Storage



DANGER

Danger due to fluids which are hazardous to health!

Danger of bacterial infection!

- Disinfect the mixer after removal.
- Observe the specifications of the work regulations.



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the propeller blades. There is a danger of cuts and similar injuries!

- Wear protective gloves!

CAUTION

Total damage from moisture ingress

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

- Securely position the mixer horizontally on a firm bearing surface.
- Secure the mixer against falling over and slipping.
- Do not set the mixer down on the propeller. In the case of larger propeller diameters, ensure an appropriate platform is provided.
- **CAUTION! Material damage! Propeller and shaft can be damaged.**
- Store the mixer for a maximum of one year. Contact 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 mixer from direct exposure to sunlight. Extreme heat can cause damage!
- Do not store the mixer in rooms in which welding work is carried out. The resulting gases or radiation can corrode the elastomer parts and coatings.
- Protect the connection cable against kinking and damage. Maintain a constant bend radius!
- Turn the propeller at regular intervals (twice a year). This prevents the bearings from jamming and renews the lubrication film on the mechanical seal. **NOTICE! Wear protective gloves!**

4 Application/use

4.1 Intended use

For homogenisation and flow generation in commercial areas of:

- Process sewage
- Sewage containing faeces

Comply with the specific dimensioning based on the operator requirements. Any other use deviating from this is regarded as non-compliant with the intended use.

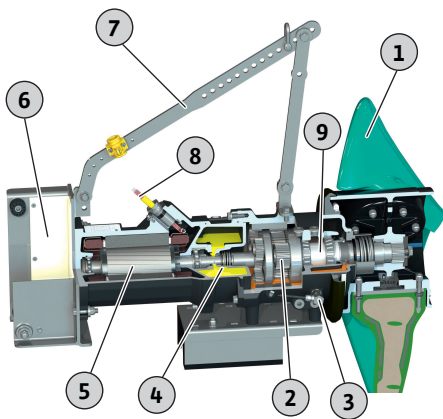
4.2 Improper use

The mixers must not be used in:

- Drinking water
- Non-Newtonian fluids
- Severely contaminated fluids containing hard components such as stone, wood, metals, etc.
- Highly flammable and explosive fluids in pure form

5 Product description

5.1 Construction



The submersible mixer consists of the following main components:

1	Propeller
2	Gear, 2-stage
3	Pencil electrode (optional)
4	Sealing chamber
5	Motor
6	Frame for lowering device
7	Handle grip
8	Connection cable
9	Pre-chamber

Fig. 2: Overview of the submersible mixer

5.1.1 Motor

Wilo-EMU TR ...

Surface-cooled submersible motor in three-phase current design with permanently lubricated und large-size rolling bearings. The motor winding is equipped with temperature monitoring. The motor heat is given off directly to the surrounding fluid via the motor housing. The connection cable is designed for heavy mechanical loads, sealed water pressure-tight against the fluid and is sealed longitudinally watertight. The connection cable has bare cable ends and is 10 m (33 ft) long as standard.

Wilo-EMU TRE ...

Surface-cooled submersible motor in three-phase current design with permanently lubricated und large-size rolling bearings. The motor winding is equipped with temperature monitoring. The motor heat is given off directly to the surrounding fluid via the motor housing. The connection cable is designed for heavy mechanical loads, sealed water pressure-tight against the fluid and is sealed longitudinally watertight. The connection cable has bare cable ends and is 10 m (33 ft) long as standard.

The submersible motor meets the IE3/IE4 motor efficiency class (according to IEC 60034-30). Motors of the motor efficiency class "IE4" have been specified as "E4" in the motor designation.

Technical data

Operating mode, immersed	S1
Operating mode, non-immersed	-
Fluid temperature	3 ... 40 °C (37 ... 104 °F)

Max. immersion depth	20 m (66 ft)
Protection class	IP68
Insulation class	H
Max. switching frequency	15/h

5.1.2 Gear

Two-stage planetary gear with exchangeable transmission. Gear bearings have been dimensioned large to absorb resulting stirring forces and not transfer these to the motor bearing.

5.1.3 Seal

The system is sealed by a 3-chamber system:

- Pre-chamber
- Gear chamber
- Sealing chamber

Pre-chamber

The high-volume pre-chamber has been filled with gear oil to absorb any leakage at the seal on the fluid side. A mechanical seal is used as the seal on the fluid side. A rotary shaft seal seals towards the gear chamber.

Gear chamber

The gear chamber has been filled with gear oil to guarantee continuous lubrication of the planetary gear and the gear bearings. A mechanical seal seals towards the sealing chamber.

Sealing chamber

The high-volume sealing chamber is filled with white oil and absorbs any leakage from the gear chamber. A rotary shaft seal seals towards the motor.

5.1.4 Propeller

2- or 3-bladed propeller made of solid or composite material with a nominal propeller diameter of 1600 mm to 2600 mm. Clogging-free propeller geometry design made possible by backward-curved incoming flow edge.

	TR/E 216 ...	TR/E 221 ...	TR/E 226-3 ...	TRE 312 ...	TR/E 316 ...	TR/E 321 ...	TR/E 326-3 ...
Nominal diameter in mm (in)	1600 (63)	2100 (83)	2600 (102)	1200 (47)	1600 (63)	2100 (83)	2600 (102)
Number of blades	2	2	2	3	3	3	3
Individual blades	•	•	•	•	•	•	•
Propeller pre-assembled	–	–	–	•	–	–	–
On-site propeller installation	•	•	•	–	•	•	•

• = standard, – = not available

5.1.5 Materials

	TR/E 216 ...	TR/E 221 ...	TR/E 226 ...	TRE 312 ...	TR/E 316 ...	TR/E 321 ...	TR/E 326-3 ...
Housing							
EN-GJL-250 (ASTM A48 Class 35/40B)	•	•	•	•	•	•	•
Seal, on the fluid side							

	TR/E 216 ...	TR/E 221 ...	TR/E 226 ...	TRE 312 ...	TR/E 316 ...	TR/E 321 ...	TR/E 326-3 ...
SiC/SiC	•	•	•	•	•	•	•
Seal, pre-/gear chamber							
FPM (FKM)	•	•	•	•	•	•	•
Seal, gear/sealing chamber							
SiC/SiC	•	•	•	•	•	•	•
Seal, sealing chamber/motor							
FPM (FKM)	•	•	•	•	•	•	•
Propeller hub							
EN-GJL-250 (ASTM A48 Class 35/40B)	•	•	•	–	•	•	•
1.4571 (AISI 316Ti)	–	–	–	•	–	–	–
Propeller							
GFK-VE (GFRP-VE)	•	•	•	–	•	•	•
PA6G	–	–	–	•	–	–	–

• = standard, – = not available

5.2 Monitoring devices

Overview of possible monitoring devices for submersible mixers **without Ex rating**:

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Motor compartment/sealing chamber	0	0	0	0	0	0	0
Pre-chamber (external pencil electrode)	0	0	0	0	0	0	0
Motor winding: Temperature limiter	•	•	•	•	•	•	•
Motor winding: Temperature controller and limiter	0	0	0	0	0	0	0

Key

– = not possible, 0 = optional, • = standard

Overview of possible monitoring devices for submersible mixers **with Ex rating**:

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Motor compartment/sealing chamber	–	–	–	–	–	–	–
Pre-chamber (external pencil electrode)	0	0	0	0	0	0	0
With ATEX approval							
Motor winding: Temperature limiter	0	0	0	0	0	0	0
Motor winding: Temperature controller and limiter	•	•	•	•	•	•	•

With FM-/CSA-Ex rating

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Motor winding: Temperature limiter	•	•	•	•	•	•	•
Motor winding: Temperature controller and limiter	o	o	o	o	o	o	o

Key

– = not possible, o = optional, • = standard

All the monitoring devices fitted must always be connected!

Monitoring the motor compartment and sealing chamber

The motor compartment monitoring protects the motor winding from short-circuits. Sealing chamber control detects fluid ingress from the gear chamber. In each case, the humidity is recorded by an electrode in the motor compartment and sealing chamber.

NOTICE! The Ex version does not feature this monitoring unit!

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 pre-chamber

The pre-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 mixer can therefore occur via the system controller.

5.3 Operation with frequency converter

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

5.4 Operation in an explosive atmosphere

Approval according to	TR 216 ...	TRE 216 ...	TR 221 ...	TRE 221 ...	TR 226-3 ...	TRE 226-3 ...	TRE 312 ...	TR 316 ...	TRE 316 ...	TR 321 ...	TRE 321 ...	TR 326-3 ...	TRE 326-3 ...
ATEX	o	o	o	o	o	o	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o	o	o	o	o	o	o
CSA-Ex	o	–	o	–	o	–	–	o	–	o	–	o	–

Legend

– = not available/possible, o = optional, • = standard

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

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

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

ATEX approval

The mixers are suitable for operation in potentially explosive atmospheres:

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

Mixers must not be used in zone 0!

FM approval

The mixers 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.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:

- Protection class: Explosion-proof
- Category: Class 1 Division 1

5.5 Rating plate

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

Rating plate designation	Value
P-Typ	Mixer type
M-Typ	Motor type
S/N	Serial number
MFY	Date of manufacture*
n	Speed
T	Max. fluid temperature
IP	Protection class
I _N	Rated current
I _{ST}	Starting current
I _{SF}	Rated current at service factor
P ₂	Rated power
U	Rated voltage
f	Frequency
Cos φ	Motor efficiency
SF	Service factor
OT _S	Operating mode: immersed
OT _E	Operating mode: non-immersed
AT	Starting mode
m	Weight

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

- JJJJ = year
- W = abbreviation for week
- ww = calendar week

5.6 Type key

Example: **Wilo-EMU TRE 326-3.24-6/16Ex**

EMU Submersible mixer, horizontal

TRE Series:

- TR: Mixer with standard asynchronous motor
- TRE: Mixer with IE3/IE4 asynchronous motor

3 Number of blades

26 x100 = nominal propeller diameter in mm

3 Model

- 24** Rated propeller speed in rpm
- 6** Number of poles
- 16** x10 = stator pack length in mm
- Ex** Ex-rated
- 5.7 Scope of delivery**
- Submersible mixer with connection cable
 - Propeller hub
 - Propeller blade
 - Accessories attached, depending on the installation type
 - Installation and operating instructions
- 5.8 Accessories**
- Lowering device
 - Auxiliary lifting device
 - Cable bollard to secure the hoist cable
 - Additional rope anchoring
 - Fixation sets with anchor bolts
- 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 to different construction parts, lifting equipment, wastewater facility basics
 - Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points
- 6.2 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.
 - Demarcate the working area.
 - Keep unauthorised persons away from the working area.
 - If the weather conditions (e.g. ice formation, strong wind) mean it is no longer possible to work safely, stop work.
 - Observe local sewage technology regulations for the operation of sewage systems.
 - 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.
- 6.3 Installation types**
- Flexible installation with lowering device as stand unit
- 6.4 Installation**



DANGER

Danger due to fluids hazardous to health during installation!

Ensure that the installation site is clean and disinfected during installation. If contact with fluids that are hazardous to health is possible, observe the following points:

- Wear protective equipment:
 - ⇒ sealed safety goggles
 - ⇒ mouth protection
 - ⇒ protective gloves
- Wipe up drips immediately.
- Observe the specifications of the work regulations.

**DANGER****Risk of fatal injury due to dangerous lone working practices!**

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously!

- Only carry out work with another person!

CAUTION**Material damage due to incorrect fixation**

Defective fixation may limit the functionality of the mixer or damage it.

- If the mixer is fixed to a concrete structure, use anchor bolts for fixation. Follow the manufacturer's installation instructions! Temperature specifications and hardening periods must be strictly observed.
- If the mixer is fixed to a steel structure, ensure that the structure is sufficiently strong. Use fixation materials with sufficient strength!
Use suitable materials to avoid electrochemical corrosion!
- Tighten all screwed connections. Observe torque specifications.

- Wear protective equipment! Observe the work regulations.
 - Protective gloves: 4X42C (uvex C500)
 - Safety shoes: Protection class S1 (uvex 1 sport S1)
 - Wear a safety harness.
 - 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
- Work must always be carried out by two persons.
- Demarcate the working area.
- Keep unauthorised persons away from the working area.
- From a working height of more than 1 m (3 ft) above the ground, use scaffolding with a safety harness.
- 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.
- Do not stay within the swivel range of the hoisting gear.
- 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.
- Observe minimum clearances to walls and any fixtures.

6.4.1 Maintenance tasks

After a storage period of more than 12 months, carry out the following maintenance tasks before installation:

- Rotate propeller.
See section "Rotating the propeller [▶ 32]".
- Oil change in sealing, gear and pre-chamber.
See section "Oil change [▶ 33]".

6.4.2 Installation with lowering device

The mixer is lowered into the basin using a lowering device. The lowering device's guide pipe safely guides the mixer to the duty point. The resultant reaction forces are transferred directly into the foundation via the lowering device. The foundation **must** be designed to bear this load!

CAUTION! Material damage due to incorrect accessories! Due to the high reaction forces, the mixer may only be operated with the manufacturer's accessories (lowering device and frame). If the mixer is ordered for installation with a lowering device, the frame comes pre-assembled. If the mixer is delivered without a frame, order the appropriate frame from customer service!

Preparatory tasks

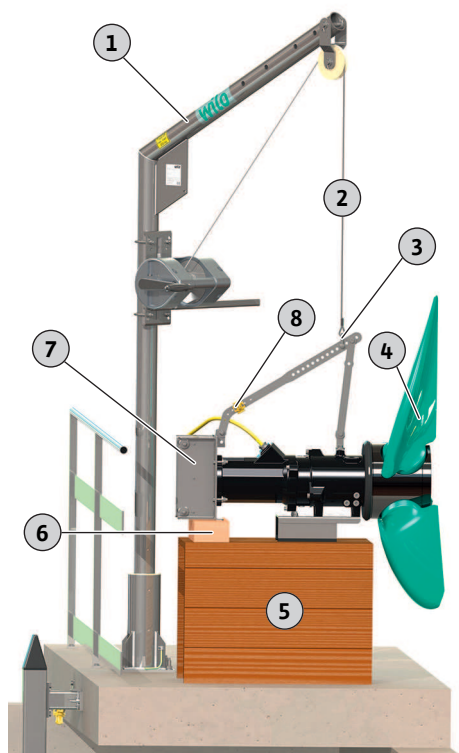


Fig. 3: Prepare the mixer

1	Hoisting gear
2	Lifting equipment
3	Shackle for attachment
4	Propeller
5	Platform for secure set-down
6	Supporting block for alignment
7	Frame
8	Cable brackets for strain relief

- ✓ Mixer set down and horizontal.
- ✓ Frame mounted on the mixer.
- ✓ Lowering device mounted in basin.
- ✓ Hoisting gear with sufficient bearing capacity is available.
 1. Attach lifting equipment to frame with a shackle.
 2. Mount the propeller. See separate installation instructions "Blade installation".
 3. Version with plastic rollers: Loosen linchpins and dismantle plastic rollers and quick-release axles.

NOTICE! Prepare components for further installation.
 4. Lay all connection cables.
 5. Mount the cable bracket for the cable anchoring on the edge of the basin.

CAUTION! In case of powerful flows in the basin, install the "additional rope anchoring"!

Lift the mixer and swivel it over the basin

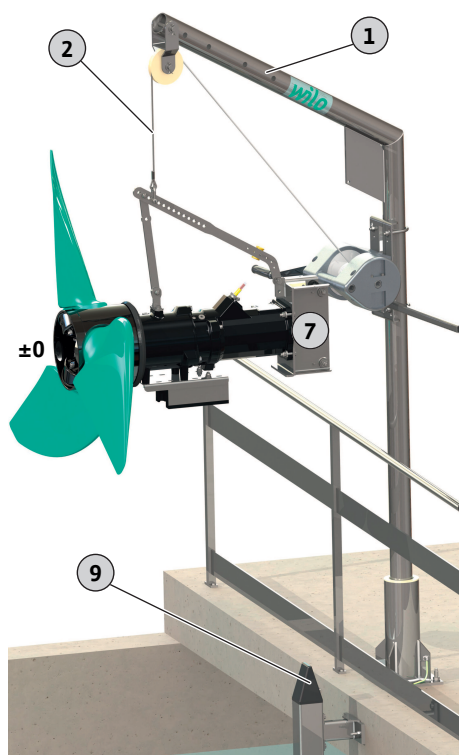


Fig. 4: Swivel the mixer over the basin

1	Hoisting gear
2	Lifting equipment
7	Frame
9	Guide pipe for lowering device

- ✓ Preparatory tasks completed.
 1. Lift mixer so that it can be swivelled safely over the railings.

NOTICE! The mixer must be suspended horizontally with the hoisting gear. If the mixer hangs at an angle to the hoisting gear, adjust the attachment point on the frame.
 2. Pivot the mixer over the basin.

NOTICE! The frame must be perpendicular to the guide pipe. If the frame is not perpendicular to the guide pipe, adjust the reach of the hoisting gear.

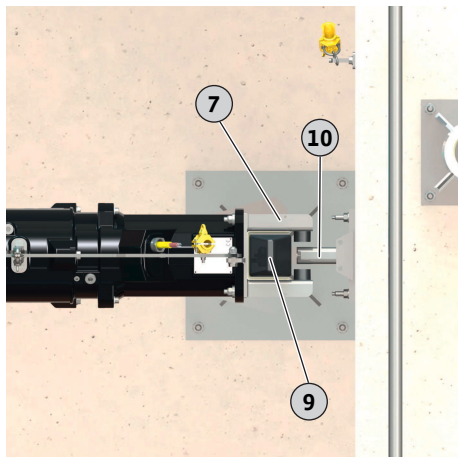


Fig. 5: Mixer on the lowering device

Mounting the mixer on the lowering device

7	Frame
9	Guide pipe for lowering device
10	Upper holder of the lowering device

- ✓ Mixer hangs horizontally.
- ✓ Frame perpendicular to the guide pipe.
- ✓ Cable bracket mounted on the edge of the basin.
 1. Slowly lower the mixer.
 2. Insert the guide pipe in the frame without tilting.

NOTICE! The guide rollers are in contact with the guide pipe.
 3. Version with quick-release axles:
Lower mixer until the frame is below the upper holder. Install the quick-release axles and plastic rollers and secure them with linchpins!

Completing installation

1	Hoisting gear
2	Lifting equipment
9	Guide pipe for lowering device
11	Connection cable

- ✓ Mixer mounted on the lowering device
 1. Slowly lower the mixer.
 - Hold the connection cable slightly taut when lowering it.
 - Do not damage the connection cable. Do not lead it directly over the edge of the basin!

NOTICE! Alternatively, anchoring can be done via a separate nylon rope. An anchoring set is included in the accessories for this purpose.
 2. Lower the mixer to the end of the guide pipe.
 3. Anchor the connection cable with the cable bracket on the edge of the basin.

► Installation is complete. Lay the connection cable and make the electrical connection.

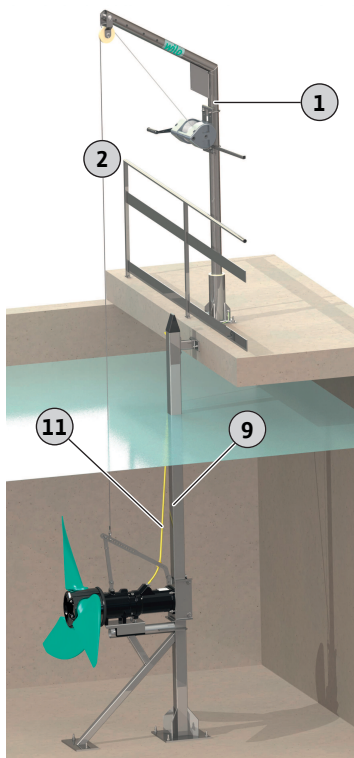


Fig. 6: Mixer set down on the stand unit

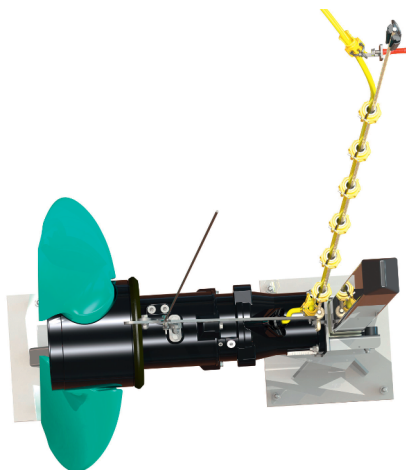


Fig. 7: Additional rope anchoring

Install additional rope anchoring

The additional rope anchoring protects the connection cable against damage in case of powerful flows in the basin. The rope anchoring consists of a 12 mm nylon rope (PA6) and a corresponding number of cable brackets. The quantity and size of the cable brackets depends on the order.

WARNING! Use the nylon rope and cable brackets only for anchoring the connection cable. They must never be used to secure heavy loads and/or third-party products!

NOTICE! Install the nylon rope in the length delivered. If the nylon rope is shortened, fuse the ends with a heat gun and secure against unravelling with heat-shrink tubing!

- ✓ The submersible mixer is completely installed.
- 1. Guide the nylon rope through a free eyelet on the frame and knot it securely.
- 2. Tension the nylon rope hand-tight (tensile force approx. 10...15 kg).
- 3. Securely attach the nylon rope to adequately dimensioned parts of the construction (e.g. railings, top holder etc.).
- 4. Attach the first cable bracket directly to the frame. Attach all the connection cables to the nylon rope using this bracket. **NOTICE! Do not tauten the connection cables! The connection cables must form a loop!**
- 5. Use the additional cable brackets to attach the connection cables to the nylon rope. Max. distance between the cable brackets: 1 m. **CAUTION! The nylon rope may stretch in the water. When the nylon rope is taut, the connection cables must sag approximately 10 cm!**

Mobile hoisting gear: Installing a cable bollard

If a mobile hoisting gear is used, install a cable bollard at the edge of the basin:

- Remove lifting equipment (e.g. wire rope) from the hoisting gear and secure to the cable bollard.
- Secure the connection cable edge of the basin to prevent it from falling.

CAUTION! If the connection cable leads over the edge of the basin, beware of potential abrasion. Sharp edges may damage the connection cable. Bevel the basin edge if necessary!

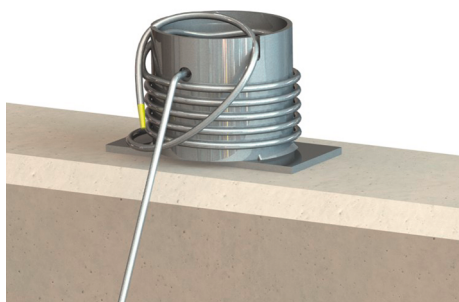


Fig. 8: Lifting equipment secured to a cable bollard

6.5 Electrical connection



DANGER

Risk of fatal injury due to electrical current!

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

- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!

**DANGER****Risk of explosion due to incorrect connection!**

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

- 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***

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

Motor protection switch

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

Residual-current device (RCD)

- 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

- Check the insulation resistance of the motor winding.
- Check the resistance of the temperature sensors.

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 strip**: 0 ohms (passage).
 - ⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.
 - ⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.

6.5.3 Connection of the three-phase AC motor

- ▶ Resistance checked. If the measured value deviates from the specification, consult the customer service.
- Connection cable with bare cable ends.
- The supplied connection diagram contains detailed information about the connection cable:
 - Cable version
 - Wiring diagram
- Connect the connection cable to the on-site control.

Wiring diagram of the direct starting power connection

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

Wiring diagram of the power connection for star-delta starting

U1, V1, W1	Mains connection (start of winding)
U2, V2, W2	Mains connection (end of winding)
PE (gn-ye)	Earth

6.5.4 Monitoring equipment connection

- 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.



DANGER

Risk of explosion due to incorrect connection!

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

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

Overview of possible monitoring devices for submersible mixers **without Ex rating:**

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Motor compartment/sealing chamber	o	o	o	o	o	o	o
Pre-chamber (external pencil electrode)	o	o	o	o	o	o	o
Motor winding: Temperature limiter	•	•	•	•	•	•	•
Motor winding: Temperature controller and limiter	o	o	o	o	o	o	o

Key

– = not possible, o = optional, • = standard

6.5.4.1 Motor compartment/sealing chamber monitoring

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

Wiring diagram

DK Electrode connection

The system must be deactivated when the threshold is reached!**6.5.4.2 Monitoring of motor winding****With bimetallic strips**

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!**6.5.4.3 Pre-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.**Note the additional information in the section on potentially explosive areas in the appendix!****6.5.5 Motor protection adjustment****6.5.5.1 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.

6.5.5.2 Star-delta activation

- 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

6.5.5.3 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 30 s.
- To avoid power dissipation, bypass the electronic starter (soft start) once normal operation is reached.

6.5.6 Operation with frequency converter

Operation on the frequency converter is permitted. Refer to the appendix for the corresponding requirements for the frequency converter and observe its contents! The following points must also be observed:

- Adjust the operating parameters of the frequency converter to the system parameters.
- Observe the treatment process. Silting or deposits may occur.
- Increased thrust can lead to higher loads on the attachment parts.

NOTICE! The operator is responsible for compliance with the treatment process!

7 Commissioning



NOTICE

Automatic activation after power cut

Depending on the process, the product is switched on and off using separate controls. The product may automatically switch on following power cuts.

7.1 Personnel qualifications

- Operation/control: Operating personnel, instructed in the functioning of the complete system

7.2 Operator responsibilities

- Provide installation and operating instructions by the mixer or at a place specially reserved for it.
- Make the installation and operating instructions available in a language the personnel can understand.
- Make 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 mixer is suitable for use under the specified operating conditions.

7.3 Direction of rotation monitoring

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

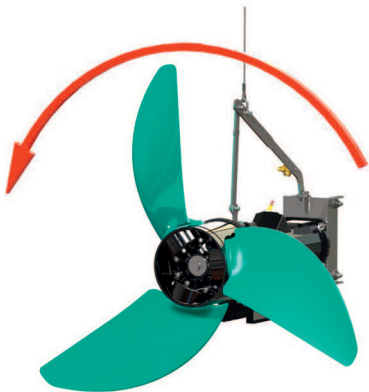


Fig. 9: Correct direction of rotation TR/E 216 to 326-3

Direction of rotation check

- ✓ Mains connection with clockwise rotating field present.
- ✓ Rotating field inspected by a qualified electrician.
- ✓ No persons are allowed in the working area of the mixer.
- ✓ Mixer securely installed.
WARNING! Do not hold the mixer in your hands! The high starting torque can lead to serious injuries!
- ✓ Propeller is visible.
 1. Activate the mixer. **Max. operation duration: 15 s!**
 2. Propeller direction of rotation:
 - View from front: The propeller rotates anti-clockwise (to the left).
 - View from rear: The propeller rotates clockwise (to the right).
- ▶ Direction of rotation correct.



Fig. 10: Correct direction of rotation TRE 312

NOTICE! Reverse direction of rotation for mixer type TRE 312! The mixer rotates clockwise when viewed from the front and anti-clockwise from the rear.

Incorrect direction of rotation

- If the direction of rotation is incorrect, change the connection as follows:
- Direct starting: swap two phases.
 - Star-delta starting: Swap connections of two windings (e.g. U1/V1 and U2/V2).

NOTICE! After changing this connection, check the direction of rotation again!

7.4 Operation in an explosive atmosphere

Approval according to	TR 216 ...	TRE 216 ...	TR 221 ...	TRE 221 ...	TR 226-3 ...	TRE 226-3 ...	TRE 312 ...	TR 316 ...	TRE 316 ...	TR 321 ...	TRE 321 ...	TR 326-3 ...	TRE 326-3 ...
ATEX	o	o	o	o	o	o	o	o	o	o	o	o	o
FM	o	o	o	o	o	o	o	o	o	o	o	o	o
CSA-Ex	o	-	o	-	o	-	-	o	-	o	-	o	-

Legend

- = not available/possible, o = optional, • = standard

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

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

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

ATEX approval

The mixers are suitable for operation in potentially explosive atmospheres:

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

Mixers must not be used in zone 0!

FM approval

The mixers 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.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:

- Protection class: Explosion-proof
- Category: Class I Division 1

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?
- Intermittent operation: Is the max. switching frequency complied with?
- Has the minimum water level above the propeller been defined and monitored?
- Min. fluid temperature can drop below 3 °C: Monitoring device with automatic deactivation installed?
- No installations within the direct rotary range of the propeller?

7.6 Switch on and off

The mixer must switch on and off using a separate operating point (on/off switch, switchgear) set by the customer.

- When the mixer starts, the rated current is exceeded for a short time.
- Current consumption continues to be slightly above the rated current during the start-up phase, until the flow in the basin increases.
- During operation, do not exceed the rated current any more.

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

7.7 During operation



WARNING

Risk of injury from rotating propeller!

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

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

Please regularly check the following points:

- Mixer free from deposits and encrustations.
- Connection cable is not damaged.
- Minimum water submersion ensured.
- Quiet and low-vibration running.
- Max. switching frequency not exceeded.
- Mains connection tolerances:
 - Operating voltage: $\pm 10\%$
 - Frequency: $\pm 2\%$
 - Current consumption between the individual phases: max. 5 %
 - Voltage difference between the individual phases: max. 1 %

Increased current consumption

Depending on the fluid and the flow, the current consumption may vary slightly. If current consumption is elevated for a longer period, this indicates a change in configuration. The cause for a change in conditions could be:

- A change in the viscosity and density of the fluid, e.g. caused by modified addition of polymers or precipitating agents. **CAUTION! This modification may cause a severely increasing power consumption and even overload the system!**
- Insufficient mechanical pre-cleaning, e.g. fibrous and abrasive content.
- Non-homogeneous flow conditions due to fixtures or deflections in the operating space.
- Vibrations due to blockage of the basin inlet/outlet and draining, modified air intake (aeration) or the combined effect of several mixers.

Check system configuration and take counter-measures. **CAUTION! Permanently increased current consumption causes increased wear on the mixer!** Contact customer service for further assistance.

Monitoring fluid temperature

The fluid temperature must not drop below 3 °C. A fluid temperature below 3 °C results in thickening of the fluid, which can result in fractures in the propeller. If the fluid temperature may fall below 3 °C, install an automatic temperature measurement device with advance warning and deactivation functions.

Monitoring minimum immersion

The propeller must not emerge from the fluid during operation. Minimum immersion specifications must be observed! If fluid levels fluctuate significantly, install a level monitoring device. If the fluid level drops below the minimum immersion level, switch off the mixer.

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 to different construction parts, lifting equipment, wastewater facility basics
- Lifting work: trained specialist for the operation of lifting devices
Lifting equipment, lifting gear, attachment points

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 mixer is deactivated but remains installed. This ensures that the mixer is always ready for operation.

- ✓ To protect the mixer from frost, ice and direct sunlight, immerse the mixer completely in the fluid.
- ✓ Minimum fluid temperature: +3 °C (+37 °F).

1. Switch off the mixer.
 2. Secure the operating point against being switched on again by unauthorised persons (e.g. lock main switch).
- The mixer has been decommissioned and can be dismantled.

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

- Ensure that the aforementioned requirements are maintained for the complete period of shutdown. If these requirements cannot be guaranteed, remove the mixer.
- 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 mixer after removal.
- Observe the specifications of the work regulations.



DANGER

Risk of fatal injury due to electrical current!

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

- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!



DANGER

Risk of fatal injury due to dangerous lone working practices!

Work in chambers and narrow rooms as well as work involving risk of falling are dangerous work. Such work may not be carried out autonomously!

- Only carry out work with another person!



WARNING

Risk of burns from hot surfaces!

The motor can get hot during operation. It may cause burns.

- Allow the motor to cool down to 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)
- Wear a safety harness.
- 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 Using a lowering device

- ✓ Mixer decommissioned.
- ✓ Protective equipment put on according to work regulations.
 1. Disconnect mixer from the mains.
 2. Disconnect and wind up the connection cable.
 3. Insert lifting equipment in hoisting gear.
 4. Slowly lift mixer and remove it from the basin. During the lifting procedure, detach the connection cable from the lifting equipment and wind it up.

DANGER! Mixer and connection cable come directly out of the fluid. Wear protective equipment according to work regulations!
 5. Swivel mixer and set it down on a firm surface.
- ▶ Removal is complete. Clean mixer and set-down location thoroughly, disinfect if required and store away.

8.4.2 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!
- ✓ Mixer removed.
 1. Ensure that the bare cable ends are packed in a watertight manner!
 2. Attach the lifting equipment to the attachment point.
 3. Lift the mixer approximately 30 cm (10 in) above the ground.
 4. Spray the mixer with clear water from top to bottom.
 5. Spray the propeller from all sides.
 6. Disinfect the mixer.
 7. Dispose of dirt residue on the ground, e.g. flush it into the sewer.
 8. Allow the mixer to dry.

9 Maintenance and repair

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 Oil types

White oil

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

CLP gear oil (ISO VG 220)

- Aral: Degol BG 220
- BP: Energol Gr-XP 220
- Shell: Omala S2 GX 220
- Tripol: FoodProof 1810/220 (USDA-H1 approved)

9.3.2 Grease

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

9.3.3 Filling quantities

- Pre-chamber: 1.00 l (34 US.fl.oz.)
- Gear chamber: 0.60 l (20 US.fl.oz.)
- Sealing chamber: 1.10 l (37 US.fl.oz.)

Stated filling quantities apply for described installation types. Refer to the enclosed data sheet for the filling quantities required for deviating installation types.

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

- Visual inspection of the connection cables
- Visual inspection of cable brackets and cable tensioning
- Visual inspection of the mixer
- Visual inspection of accessories
- Function test of monitoring devices
- Oil change

80000 operating hours or after 10 years

- Complete overhaul

9.4.2 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
- Highly corrosive or abrasive fluid
- Strongly gassing fluids
- Operation at an unfavourable duty point
- Unfavourable flow conditions (e.g. due to fixtures or aeration)

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 propeller blades. 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)
 - Safety goggles: uvex skyguard NT
- For detailed marking of frame and disc, see the section on “Personal protective equipment [▶ 7]”.
- The mixer 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.

CAUTION! Do not set the mixer down on the propeller! Provide an appropriate platform.

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

9.5.1 Recommended maintenance measures

Regular inspection of current 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.

Current consumption can provide an early indication of damage to or malfunctions in the mixer, which can then be rectified. Larger voltage fluctuations strain the motor winding and can cause breakdown. 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 Rotating the propeller

- ✓ Protective equipment used!
 - ✓ Mixer disconnected from mains.
1. Place mixer on a firm work surface in a horizontal position.

CAUTION! Do not place the mixer on the propeller! Use an appropriate platform for the propeller diameter.

2. Secure the mixer against falling over or slipping!
3. Grip the propeller carefully and rotate the propeller.

9.5.3 Visual inspection of the connection cable

Check connection cable for:

- Bubbles
- Cracks
- Scratches
- Abrasion
- Pinch points
- Changes caused by chemical corrosion

If the connection cable is damaged:

- Decommission the mixer 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 mixer.

9.5.4 Visual inspection of cable brackets and cable tensioning

Check cable brackets and anchoring for material fatigue and shrinkage.

- Replace worn or defective components immediately.

9.5.5 Visual inspection of the mixer

Check the housing and propeller for damage and wear. If there are defects, observe the following:

- Repair damaged coating. Order repair kits from the customer service.
- If components have worn, contact customer service!

9.5.6 Function test of the monitoring device

The mixer must be cooled down to ambient temperature to test resistances!

9.5.6.1 Test the resistor of the temperature sensor

✓ Ohmmeter available.

1. Measure the resistance.

⇒ Measured value **Bimetallic strip**: 0 ohms (passage).

⇒ Measured value **3x PTC sensor**: between 60 and 300 ohm.

⇒ Measured value **4x PTC sensor**: between 80 and 400 ohm.

▶ Resistance checked. If the measured value deviates from the specification, consult the customer service.

9.5.6.2 Check the resistance of the external electrode for pre-chamber monitoring

✓ 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.

9.5.7 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.

9.5.8 Oil 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.

9.5.8.1 Oil change: sealing, gear and pre-chamber

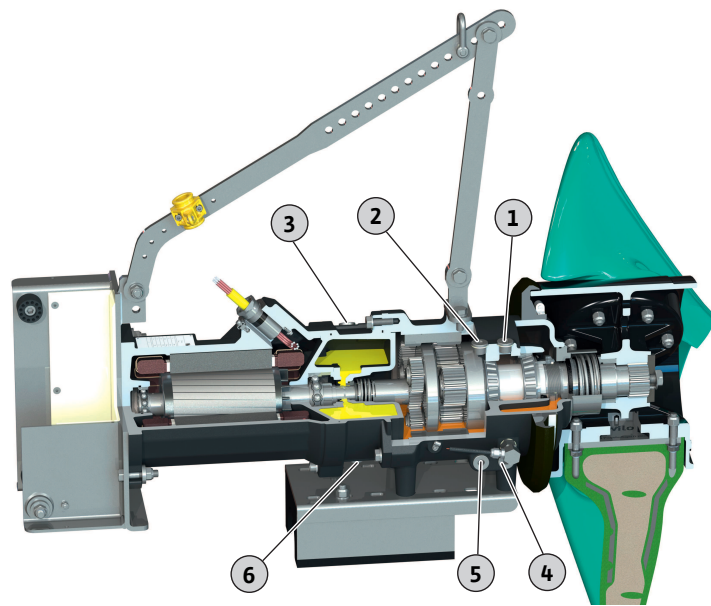


Fig. 11: Oil change

1	Pre-chamber filler hole
2	Gear chamber filler hole
3	Sealing chamber filler hole
4	Pre-chamber drain hole
5	Gear chamber drain hole
6	Sealing chamber drain hole

✓ Protective equipment used!

✓ Mixer removed, cleaned and disinfected.

1. Place mixer on a firm work surface in a horizontal position.

CAUTION! Material damage! Do not set the mixer down on the propeller! Always place the mixer on a platform.

2. Secure the mixer against falling over and slipping.

3. Position a suitable tank to collect the operating fluid.

4. Remove the screw plug from the filler hole:

⇒ 1 = pre-chamber

⇒ 2 = gear chamber

⇒ 3 = sealing chamber

5. Unscrew the screw plug of the drain hole and drain the operating fluid:

NOTICE! Flush the pre-, gear and sealing chamber to drain it completely.

⇒ 4 = pre-chamber

⇒ 5 = gear chamber

⇒ 6 = sealing chamber

6. 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!

7. Clean the drain hole screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft·lb)!**

8. Pour the operating fluid through the filler hole.

⇒ Comply with the specifications for the operating fluid type and quantity!

9. Clean the filler hole screw plug, replace the seal ring and screw it back in. **Max. tightening torque: 8 Nm (5.9 ft-lb)!**

10. Restore corrosion protection: Seal screw plug, e.g. with Sikaflex.

9.5.9 General overhaul

The following components are checked for wear and damage as part of general maintenance:

- Motor bearings
- Gear bearing and planetary gear speed
- Propeller
- Shaft sealings
- O-rings
- Connection cable
- Fitted accessories

Damaged components are replaced with original parts. This will ensure correct operation. The general overhaul is performed by the manufacturer or an authorised service centre.

9.6 Repairs



WARNING

Risk of injury from sharp edges!

Sharp edges can form on the propeller blades. 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)
 - Safety goggles: uvex skyguard NT
- For detailed marking of frame and disc, see the section on “Personal protective equipment [▶ 7]”.
- The mixer 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.

CAUTION! Do not set the mixer down on the propeller! Provide an appropriate platform.

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

For repair work, the following applies:

- Wipe up spillage quantities of fluid and operating fluid immediately!
- Always replace O-rings, gaskets and screw locking devices!
- Observe the tightening torques in the appendix!
- The use of force is strictly prohibited!

9.6.1 Instructions on using screw locking devices

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

- Thread-locking fluid
- Mechanical screw locking device

Always re-apply the screw locking device!

Thread-locking fluid

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

Mechanical screw locking device

The mechanical screw locking device consists of two Nord-Lock wedge lock washers. The screw connection is secured by a clamping force.

9.6.2 Which repair work may be carried out

- Replacement of the propeller
- Replacement of mechanical seal on the fluid side.
- Replace the handle grip.
- Replacement of the frame.

9.6.3 Propeller replacement

For all information on propeller blade replacement, please see the separate instructions for "Blade installation".

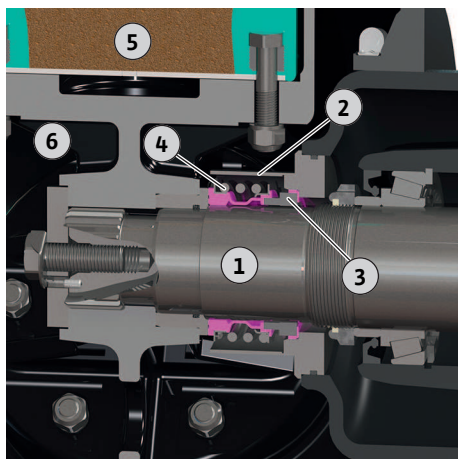
9.6.4 Replacing the mechanical seal on the fluid side

Fig. 12: Change of the mechanical seal on the fluid side

1	Shaft
2	Packing sleeve
3	Mechanical seal: Stationary ring
4	Mechanical seal: Spring
5	Propeller blade
6	Hub

- ✓ Mixer set down on a firm surface and secured.
- ✓ Tools are ready for use.
- ✓ Oil drained from the pre-chamber.
- ✓ Propeller (blade with hub) dismantled.

1. Remove the mechanical seal spring from the shaft.
 2. Carefully remove the packing sleeve using a rubber mallet.
 3. Push the stationary ring of the mechanical seal out of its seating and remove from the shaft.
 4. Clean the shaft and check for wear and corrosion. **WARNING! Contact customer service if the shaft has been damaged!**
 5. Lubricate the shaft using wetted water or detergent. **CAUTION! Do not use oil or grease as lubricants!**
 6. Press in a new stationary ring for the mechanical seal into the housing using an assembly unit. **CAUTION! Do not tilt the stationary ring when pushing it in. If the stationary ring is tilted or installed at an angle when it is pushed in, the stationary ring will fracture. The mechanical seal can then no longer be used!**
 7. Installing the packing sleeve: Coat the packing sleeve mating surface using Loctite 262 or 2701. Press on the packing sleeve in position using a rubber mallet.
 8. Install a new mechanical seal spring on the shaft.
 9. Mount the propeller.
- ▶ Mechanical seal is replaced. Top up oil in the pre-chamber.

9.6.5 Replacing the handle grip

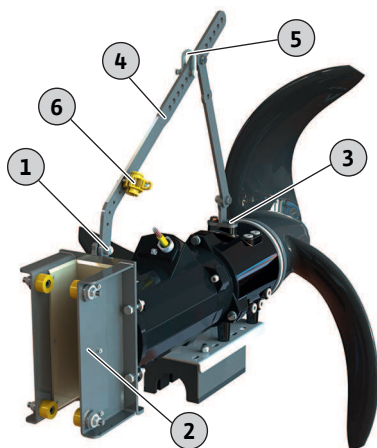


Fig. 13: Replacing the handle grip

1	1x Frame fixation material: Hexagon head screw, 2x washers, hexagon nut
2	Frame
3	2x mixer fixation material: Hexagon head screw, washer
4	Handle grip
5	Shackle
6	Cable bracket fixation: Washer, hexagon nut

✓ Mixer set down on a firm surface and secured.

✓ Tools are ready for use.

1. Disassembling cable brackets:

- Undo and unscrew the hexagon nut.
- Pull off the washer from the hexagon head screw.

2. Undoing the handle grip fixation on the frame:

- Undo and unscrew the hexagon nut.
- Pull off the washer from the hexagon head screw.
- Pull out the hexagon head screw.

3. Undoing the handle grip handle fixation on the mixer: Undo and unscrew the hexagon head screws.

4. Remove the handle grip.

5. Place a new handle grip and secure it to the frame using the fixation:

- Position the washer on the hexagon head screw.
- Insert the hexagon head screw through the frame and handle grip.
- Position the washer and screw on the hexagon nut.

NOTICE! Only slightly tighten the fixation! Do not fully tighten the handle grip!

6. Securing the handle grip on the mixer:

- Position the washer on the hexagon head screw.
- Coat the hexagon head screw with thread-locking fluid.
- Screw in the hexagon head screw and fully tighten it. Max. tightening torque: see appendix.

7. Compare the drilling pattern of both handle grip struts with the drilling pattern of the old handle grip. If necessary, adapt the drilling pattern of the new handle grip.

8. Securing the handle grip on the frame:

- Undo the hexagon nut.
- Coat the hexagon head screw with thread-locking fluid.
- Fully tighten the hexagon nut. Max. tightening torque: see appendix.

9. Installing cable brackets:

- Insert cable bracket into handle grip. **NOTICE! The cable must be routed in a small arc. Do not route the cable under tension!**
- Position the washers on the hexagon head screws.
- Screw on and fully tighten the hexagon nut. Max. tightening torque: see appendix.

10. Check the shackle position!

Attach the lifting equipment to shackles. The mixer must remain horizontal during lifting. Move shackles if the mixer tilts.

► Handle grip changed.

9.6.6 Replacing the frame

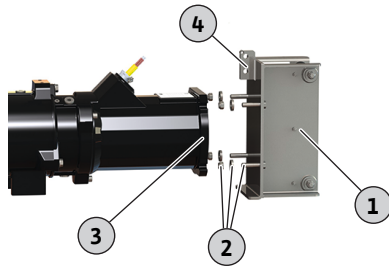


Fig. 14: Replacing the frame

1	Frame
2	4x frame fixation material: Hexagon head screw, washer, hexagon nut
3	Motor flange
4	Handle grip fixation: Hexagon head screw, 2x washers, hexagon nut

- ✓ Mixer set down on a firm surface and secured.
 - ✓ Motor supported in such a way that the frame can easily be changed.
 - ✓ Tools are ready for use.
1. Undo the handle grip fixation and pull out the hexagon head screw.
 2. Undo and unscrew the hexagon nut for frame attachment.
 3. Remove washers from the hexagon head screws.
 4. Remove the frame from the motor flange.
 5. Clean dirt from the motor flange, e.g. deposits, old sealing material.
 6. Remove hexagon head screws from the frame and insert them in the new frame.
 7. Coat the hexagon head screws with thread-locking fluid.
 8. Place the new frame on the motor flange.
 9. Place washers on the hexagon head screws.
 10. Attach and firmly tighten hexagon nuts. Max. tightening torque: see appendix.
 11. Apply corrosion protection (e.g. Sikaflex):
 - Sealing joint between motor flange and frame.
 - Fill slots on the motor flange up to the washer.
 12. Reattaching the handle grip to the frame:
 - Position the washer on the hexagon head screw.
 - Insert the hexagon head screw through the frame and handle grip.
 - Position the washer on the hexagon head screw.
 - Coat the hexagon head screw with thread-locking fluid.
 - Screw on and fully tighten the hex nut. Max. tightening torque: see appendix.
- Frame is changed.

10 Faults, causes and remedies



WARNING

Risk of injury from rotating propeller!

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

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

Fault: The mixer does not start up

1. Mains connection 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 technical specifications by a qualified electrician and reset the monitoring devices.
 - ⇒ Check that the propeller rotates easily, and clean the propeller and mechanical seal if necessary.

3. The sealing chamber control (optional) has broken the electric circuit (connection-related).

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

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

1. Motor protection switch set incorrectly.
 - ⇒ Have the setting of the trigger checked and corrected by a qualified electrician.
2. Increased current consumption due to major voltage drop.
 - ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the power grid operator.
3. The connection only has two phases.
 - ⇒ Have the connection checked and corrected by a qualified electrician.
4. Voltage differences between the phases are too great.
 - ⇒ Have the voltage of individual phases checked by a qualified electrician. Contact the power grid operator.
5. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
6. Increased current consumption due to clogging.
 - ⇒ Clean propeller and mechanical seal.
 - ⇒ Check the pre-treatment.
7. The density of the fluid is too high.
 - ⇒ Check unit design.
 - ⇒ Contact customer service.

Fault: Mixer runs, but system parameters are not reached

1. Propeller clogged.
 - ⇒ Clean propeller.
 - ⇒ Check the pre-treatment.
2. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
3. Signs of wear on propeller.
 - ⇒ Inspect propeller and replace if necessary.
4. The connection only has two phases.
 - ⇒ Have the connection checked and corrected by a qualified electrician.

Fault: Mixer does not run smoothly and is noisy

1. Improper duty point.
 - ⇒ Check fluid density and viscosity.
 - ⇒ Inspect system configuration, and contact customer service.
2. Propeller clogged.
 - ⇒ Clean propeller and mechanical seal.
 - ⇒ Check the pre-treatment.
3. The connection only has two phases.
 - ⇒ Have the connection checked and corrected by a qualified electrician.
4. Incorrect direction of rotation.
 - ⇒ Have the connection corrected by a qualified electrician.
5. Signs of wear on propeller.
 - ⇒ Inspect propeller and replace if necessary.
6. Motor bearings have worn.
 - ⇒ Inform customer service; send the mixer back to the factory for reconditioning.

Further steps for troubleshooting

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

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

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

11 Spare parts

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

12 Disposal**12.1 Oils and lubricants**

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

12.2 Protective clothing

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

12.3 Information on the collection of used electrical and electronic products

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

**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

Rust-free screws A2/A4			
Threaded	Tightening torque		
	Nm	kp m	ft·lb
M27	415	42.31	306
M30	565	57.61	417

If a Nord-Lock screw locking device is used, increase the tightening torque by 10 %!

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. Because of the additional heating caused by harmonics, the rated power of the motor should be around 10 % more than the power requirement of the mixer. For frequency converters 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 mixer operates across the entire control range without jerking or vibrating (without vibrations, resonance, oscillation). 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 less than the rated frequency (50 Hz or 60 Hz) is adjusted to the power requirement of the mixer. More recent 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! Higher frequencies are possible following consultation with customer service!**
- 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 mixer in an explosive atmosphere. All personnel must read this section. **This section applies only to Ex-rated mixers!**

13.3.1 Identification of Ex-rated mixers

For use in explosive atmospheres, the mixer must be marked as follows on the rating plate:
 → “Ex” symbol of the corresponding approval
 → Ex classification
 → Certification number (depending on the approval)
 The certification number, if required by the approval, is printed on the rating plate.

13.3.2 Protection class

The motor’s design version corresponds to the following protection classes:
 → Flameproof enclosure (ATEX)
 → Explosionproof (FM)
 → Flameproof enclosures (CSA-EX)

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 mixers are suitable for operation in potentially explosive atmospheres:
 → Device group: II
 → Category: 2, zone 1 and zone 2
Mixers must not be used in zone 0!

FM approval

The mixers 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.

CSA Ex rating

The mixers are suitable for operation in potentially explosive atmospheres:
 → Protection class: Explosion-proof
 → Category: Class 1 Division 1

13.3.4 Electrical connection



DANGER

Risk of fatal injury due to electrical current!

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

- Electrical work must be carried out by a qualified electrician!
- Observe local regulations!

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

Overview of possible monitoring devices for submersible mixers **with Ex rating:**

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Motor compartment/sealing chamber	–	–	–	–	–	–	–

	TR/TRE 216 ...	TR/TRE 221 ...	TR/TRE 226-3 ...	TRE 312 ...	TR/TRE 316 ...	TR/TRE 321 ...	TR/TRE 326-3 ...
Pre-chamber (external pencil electrode)	o	o	o	o	o	o	o
With ATEX approval							
Motor winding: Temperature limiter	o	o	o	o	o	o	o
Motor winding: Temperature controller and limiter	•	•	•	•	•	•	•
With FM-/CSA-Ex rating							
Motor winding: Temperature limiter	•	•	•	•	•	•	•
Motor winding: Temperature controller and limiter	o	o	o	o	o	o	o

Key

– = not possible, o = optional, • = standard

13.3.4.1 Monitoring of motor winding**DANGER****Risk of explosion due to overheating of the motor!**

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

The installed sensor specifies the trigger temperature as part of thermal motor monitoring. 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 **with anti-reactivation lock** 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 **anti-reactivation lock!**

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

Connection of the thermal motor monitoring

→ Connect the bimetallic strip using an evaluation relay. "CM-MSS" relay is recommended for this purpose.

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

→ Connect the PTC sensor via an evaluation relay. "CM-MSS" relay is recommended for this purpose.

→ If a frequency converter is used, connect the temperature sensor at the Safe Torque Off (STO). Deactivation on hardware side is thus ensured.

13.3.4.2 Pre-chamber monitoring (external electrode)

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

The threshold is 30 kOhm.

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

13.3.4.3 Frequency converter operation

- 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!**
- 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 Commissioning



DANGER

Risk of explosion when using non-Ex-rated mixers!

Risk of fatal injury due to explosion! Only use mixers which have Ex labelling on the rating plate within potentially explosive areas.

- The operator is responsible for defining the potentially explosive area.
- Only Ex-rated mixers may be used within potentially explosive areas.
- Mixers with an Ex rating must be labelled as such on the rating plate.
- Do not exceed the **max. fluid temperature!**
- According to DIN EN 50495, a safety device with SIL level 1 and hardware fault tolerance 0 must be provided for category 2.

13.3.6 Maintenance and repair

- Carry out maintenance tasks according to the regulations.
- Only carry out maintenance tasks 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 1 and 2 of DIN 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).

13.3.6.1 Repair of housing coating

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

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

13.3.6.2 Replacing the connection cable

Changing the connection cable is strictly prohibited!

13.3.6.3 Changing the mechanical seal

Changing the seal on the motor side is strictly prohibited!







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