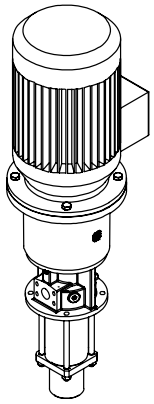
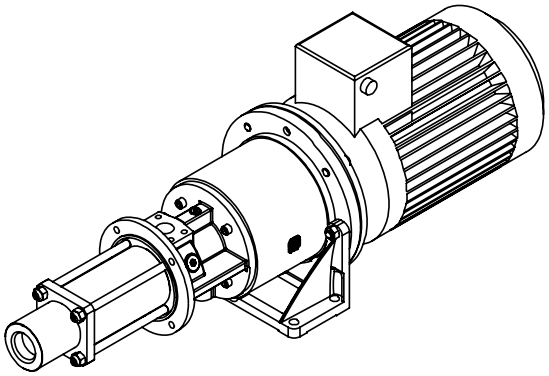
Operating instructions





# KRAL screw pumps.

## Series W

Mechanical seal/radial shaft seal

OIW 01en-GB
Edition 2024-10
Original instructions

# Table of contents

# 1 About this document

## 1.1 General information

These instructions form part of the product and must be kept for future reference. Furthermore please observe the associated documents.

## 1.2 Associated documents

- ☐ Declaration of conformity according to EU Directive 2006/42/EC
- ☐ Manufacturer's declaration according to EU Directive 2014/68/EU
- ☐ Data sheet of the pump
- ☐ Technical documentation of the supplied components

Additional documents for ATEX version

- ☐ Declaration of conformity according to EU Directive 2014/34/EU
- ☐ ATEX supplementary instructions for usage in potentially explosive areas

## 1.3 Target groups

The instructions are intended for the following persons:

- ☐ Persons who work with the product
- ☐ Operator-owners who are responsible for the use of the product

Persons who work with the product must be qualified. The qualification ensures that possible dangers and material damage that are connected to the activity are detected and avoided. These persons are qualified personnel who carry out the work properly due to their training, knowledge and experience and on the basis of the relevant provisions.

Information on the required qualification of the personnel is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

| Target group | Activity | Qualification |
|---|---|---|
| Transport personnel | Transporting, unloading, setting up | Qualified personnel for transport, mobile crane operators, crane operators, forklift operators |
| Fitter | Mounting, connection | Qualified personnel for mounting |
| Electrician | Electrical connection | Qualified personnel for electric installation |
| Trained personnel | Delegated task | Personnel trained by the operator-owner who know the task delegated to them and the possible dangers arising through improper behaviour. |

*Tab. 1: Target groups*

## 1.4 Symbols

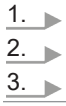
### 1.4.1 Danger levels

| | Signal word | Danger level | Consequences of non-observance |
|---|---|---|---|
|  | DANGER | Immediate threat of danger | Serious personal injury, death |
|  | WARNING | Possible threat of danger | Serious personal injury, invalidity |
|  | CAUTION | Potentially dangerous situation | Slight personal injury |
| | ATTENTION | Potentially dangerous situation | Material damage |

### 1.4.2 Danger signs

| | Meaning | Source and possible consequences of non-observance |
|---|---|---|
|  | Electrical voltage | Electrical voltage causes serious physical injury or death. |
|  | Raised load | Falling objects can result in serious physical injury or death. |
|  | Heavy load | Heavy loads can result in serious back problems. |
|  | Risk of slipping | Discharging pumped liquid and oils on the foundation or tread surfaces can cause falls with serious physical injury or death. |
|  | Flammable substances | Discharging pumped liquid and oils can be easily inflammable and can result in serious burns. |
|  | Hot surface | Hot surfaces can cause burns. |

### 1.4.3 Symbols in this document

| | Meaning |
|---|---|
|  | Warning personal injury |
|  | Safety instruction |
|  | Request for action |
|  | Multi-step instructions for actions |
| ⇨ | Action result |
|  | Cross-reference |

# 2 Safety

## 2.1 Proper use

- ☐ Use the pump solely for transporting lubricating liquids that are chemically neutral and that do not contain gas or solid components.
- ☐ Use the pump only within the operating limits specified on the rating plate and in the chapter "Technical data". In the case of operating data that do not agree with the specifications on the rating plate, please contact the manufacturer.
- ☐ The pump is designed specially for the operating pressure named by the customer. If the actual operating pressure deviates notably from this design pressure, damage to the pump can also arise within the specified operating limits. This applies both to notably higher as well as to notably lower operating pressures. Under no circumstances may the minimum pressure lie below 2 bar. In case of any doubt, please contact the manufacturer.

## 2.2 Foreseeable misuse

- ☐ Any use that extends beyond the proper use or any other use is misuse.
- ☐ The product is not suitable for pumping liquids outside the operational limits.
- ☐ Any bypassing or deactivation of safety equipment during operation is prohibited.

## 2.3 Obligations of the operator-owner

The operator-owner is the person who operates the product commercially or permits a third party to use it and who bears the legal responsibility for the product, the protection of the personnel and third parties during its operation.

The product is used in industrial applications. The operator-owner is therefore subject to the statutory obligations concerning occupational health and safety.

In addition to the safety instructions in these instructions, the regulations on safety, accident prevention and environmental protection respectively valid for the range of application of the product are to be observed.

## 2.4 Safety instructions

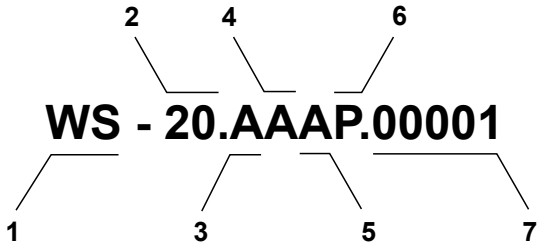
### 2.4.1 Fundamental safety instructions

**The following safety instructions must be observed strictly:**

- ☐ Read these operating instructions carefully and observe them.
- ☐ Read the operating instructions of the components carefully and observe them.
- ☐ Have work only carried out by qualified personnel/trained personnel.
- ☐ Wear personal protective equipment and work carefully.
- ☐ Pumped liquids can be subject to high pressure and can result in personal injury and damage to property in case of incorrect operation or damaged components.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic. Use corresponding protective equipment.
- ☐ Observe the associated data sheets and safety regulations when handling dangerous materials.
- ☐ Avoid skin contact with system parts carrying liquids at operating temperatures exceeding 60 °C.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations. Neutralize residues.
- ☐ Keep the mounting surfaces, scaffolding, ladders, lifting platforms and tools clean in order to prevent slipping or stumbling.
- ☐ If pressurized or energized components are damaged, shut down the pump immediately. Replace the components or pump.

# 3 Identification

## 3.1 Type code




1 Type
2 Size
3 Shaft seal
4 Material
5 Connecting part
6 Completion
7 Version index

*Fig. 1: Type code*

| Item | Classification | Description | |
|---|---|---|---|
| **1** | Type | WS | Pump with free shaft end/pump unit with SAE flange on pressure side |
| **2** | Size | | Corresponds to delivery rate in [l/min] at 1450 min-1 |
| **3** | Shaft seal | A | Standard mechanical seal |
| | | B | Mechanical seal of hard material |
| | | C | Standard radial shaft seal |
| | | D | Magnetic coupling |
| | | F | High-temperature radial shaft seal |
| | | X | Special design |
| **4** | Material | A | Pump housing GJS Tenifer, standard spindles |
| | | B | Pump housing plastic-coated, standard spindles |
| **5** | Connection part suction side | A | Axial pipe thread connection |
| | | B | Radial pipe thread connection |
| | | C | Axial pipe thread connection and suction pipe |
| | | X | Special design |
| 6 | Completion | P | Pump with free shaft end |
| | | F | Pump unit with pump bracket foot |
| | | V | Pump unit without pump bracket foot |
| | | M | Pump unit on motor base |
| 7 | Version index | | For internal administration |

*Tab. 2: Type code*

## 3.2 Rating plate

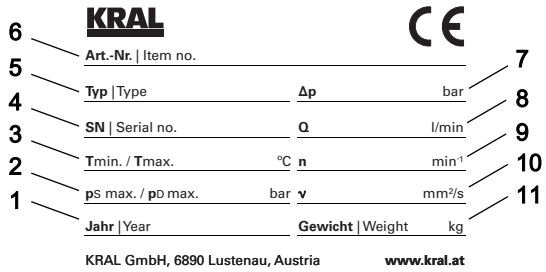



*Fig. 2: Rating plate*

1 Construction year
2 Max. allowable working pressure suction-side/Max. allowable working pressure pressure-side
3 Temperature range
4 Serial number
5 Type
6 Article number
7 Differential pressure
8 Nominal delivery rate
9 Rated speed
10 Nominal viscosity
11 Weight

# 4 Technical data

## 4.1 Operating limits

| Parameter | Unit | Size 15 – 20 | 32 – 42 | 55 – 85 | 105 – 118 | 160 – 210 | 235 – 275 |
|---|---|---|---|---|---|---|---|
| **Max. allowable working pressure** | [bar] | 120 | | | | | |
| **Max. temperature of the pumped liquid** GJS barrel housing | | | | | | | |
| ☐ Standard mechanical seal | [°C] | 150 | | | | | |
| ☐ Mechanical seal of hard material | [°C] | 180 | | | | | |
| ☐ Standard radial shaft seal | [°C] | 80 | | | | | |
| **Max. temperature of the pumped liquid** Plastic-coated barrel housing | [°C] | 60 | | | | | |
| **Min. temperature of pump materials** | [°C] | -10 | | | | | |
| **Ambient temperature min.– max.** | [°C] | -20… +50 | | | | | |
| **Viscosity min. – max.** | [$mm^2/s$] | 1 – 10000 | | | | | |
| **Max. speed** | | | | | | | |
| ☐ At 50 Hz | [$min^{-1}$] | 2900 | | | | | |
| ☐ At 60 Hz | [$min^{-1}$] | 3600 | | | | | |
| **Max. inlet pressure** | | | | | | | |
| ☐ Mechanical seal | [bar] | 6 | | | | | |
| ☐ Radial shaft seal | [bar] | 2 | | | | | |

*Tab. 3: Operating limits*

## 4.2 Required NPSH values

The required NPSH values of the pump depend on the size, the viscosity of the pumped liquid and the speed.

The NPSH values are available on the website of the manufacturer:

www.kral.at/en/screw-pumps

## 4.3 Sound pressure level

Guide values at 1 m distance, 1450 $min^{-1}$, 10 bar

| | Size 15 – 20 | 32 – 42 | 55 – 85 | 105 – 118 | 180 – 210 | 235 – 275 |
|---|---|---|---|---|---|---|
| | **Max. sound pressure level ±3 [dB(A)]** | | | | | |
| Pump (at 2900 $min^{-1}$) | 56 | 59 | 63 | 65 | 69 | 71 |
| Motor | | | | | | |
| ☐ At 40 bar | 62 | 68 | 74 | 74 | 72 | 78 |
| ☐ At 80 bar | 68 | 74 | 72 | 72 | 73 | 74 |
| Pump unit | | | | | | |
| ☐ At 40 bar | 63 | 69 | 75 | 75 | 74 | 79 |
| ☐ At 80 bar | 63 | 68 | 73 | 73 | 75 | 75 |

*Tab. 4: Sound pressure level*

### 4.4 Weights

The weight is specified on the rating plate.

# 5 Function description

## 5.1 Pump structure

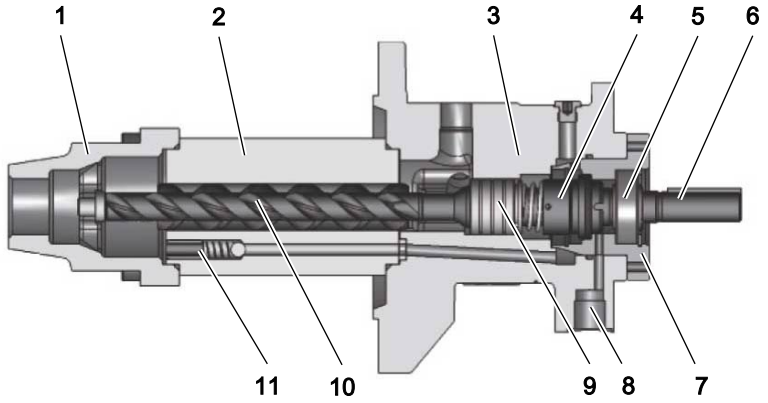



*Fig. 3: Pump structure*

| | | | |
|---|---|---|---|
| **1** | Suction cover | **7** | Place the seal housing |
| **2** | Pump housing | **8** | Leakage hole |
| **3** | Pressure housing | **9** | Balancing cylinder |
| **4** | Shaft seal | **10** | Idle screw |
| **5** | Ball bearing | **11** | Back-pressure valve |
| **6** | Main screw | | |

## 5.2 Pump unit structure

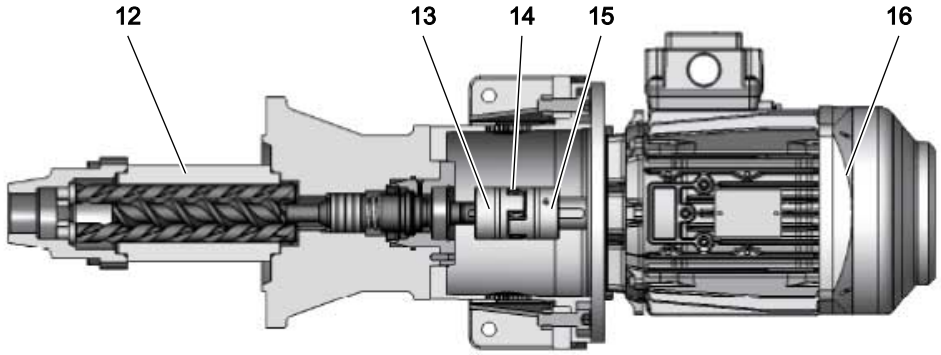



*Fig. 4: Pump unit structure*

| | | | |
|---|---|---|---|
| **12** | Pump | **15** | Motor-side coupling half |
| **13** | Pump-side coupling half | **16** | Motor |
| **14** | Remove the coupling intermediate ring | | |

## 5.3 Functional principle

Screw pumps are rotating displacement pumps. The displacement effect results from three rotating screws **6** and **10** and the enclosing pump housing **2**.

Radial support of the screw set is provided through the sliding contact in the pump housing that depends on lubrication by the pumped liquid. Screw pumps are therefore not suitable for dry running and can only be used up to specific pressure limits and viscosity limits. Due to the narrow gap dimensions, suspended solids cannot be pumped.

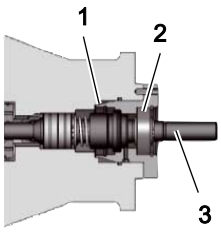
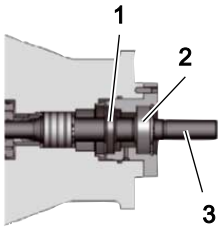
Axial support of the main screws is effected out by a lifetime-lubricated ball bearing **5**. Various shaft seals **4** are available for sealing the main screw at the outlet from the housing. In order to reduce the pressure at the shaft seal, a balancing cylinder **9** is mounted at the main screw.

The default direction of the rotation of the screw set is clockwise viewed from the motor **16** and is marked on the pump by an arrow.

## 5.4 Shaft seal

**The following types of shaft seals are used**

- ☐ Mechanical seal, standard or hard material
- ☐ Radial shaft seal, standard or high-temperature

| | | | |
|---|---|---|---|
| **Mechanical seal, standard, hard material**   | **1** | Mechanical seal | Mechanical seals are used as durable shaft seals in the standard version for liquids up to 150 °C. In the hard material version, temperatures up to 180 °C and also slightly abrasive liquids can be sealed through high-quality elastomers. Increased inlet pressures up to 6 bar are permissible. |
| | **2** | Ball bearing | |
| | **3** | Main screw | |
| **Radial shaft seal, standard or high-temperature**   | **1** | Radial shaft seal | Depending on the material used, radial shaft seals can be used for temperatures of up to 80 °C or 150 °C respectively. The used seal rings have one lip each used to seal against liquid outlet and air inlet. |
| | **2** | Ball bearing | |
| | **3** | Main screw | |

*Tab. 5: Seal variants*

## 5.5 Mechanical seal

The functional principle of the mechanical seal is based on forming a hydrodynamic film between the rotary seal ring and stationary seal ring of the mechanical seal. Forming this seal prevents dry friction between both components, meaning that stability of the film is of elemental importance for the functionality of the mechanical seal. Forming a liquid film however means that due to the differential pressure on the seal, liquid is always pushed through the gap filled with liquid. A correctly constructed mechanical seal therefore always has a low level of leakage.

This leakage level depends on various factors, mainly including size, rotation speed and differential pressure. A leakage of less than 10 drops/hour (≈ 0.5 $cm^3/h$) is normal and is no reason for replacing the mechanical seal.

The leakage hole **8** incorporated in the pressure housing is used to discharge this regular leakage quantity. If a mechanical seal is used, the drain must be kept clear through these holes. Dry running must be avoided at all costs, as the seal will overheat and be destroyed in a matter of minutes.

### 5.6 Back-pressure valve

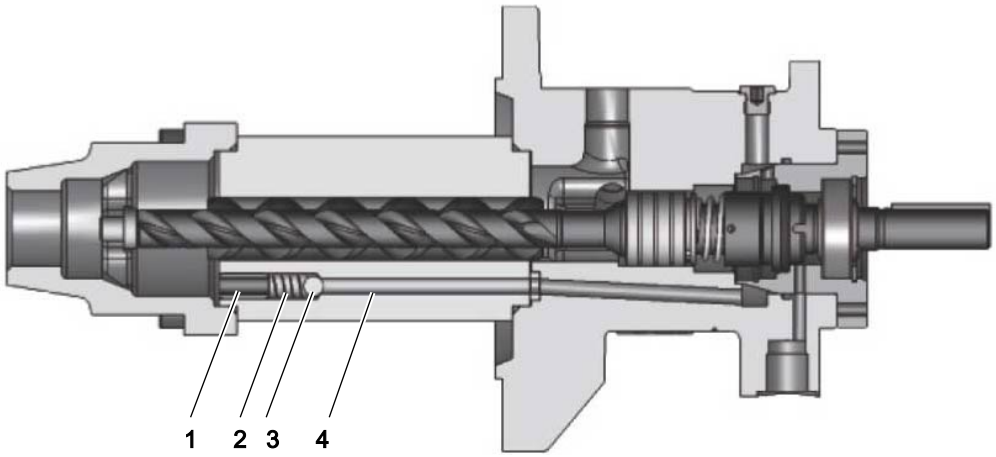



*Fig. 5: Back-pressure valve installation length*

| | | | |
|---|---|---|---|
| **1** | Adapter sleeve | **3** | Ball |
| **2** | Pressure spring | **4** | Leakage drainage |

Mechanical seals require constant lubrication by the pumped medium to ensure their function. This also requires a positive pressure difference between the liquid-filled inside of the seal and the atmosphere. To ensure this even when the pump is installed above the liquid level, a spring-loaded back-pressure valve is fitted in the relief line of the seal chamber.

## 6 Transportation, storage

### 6.1 Dangers during transportation

| **The following safety instructions must be observed:** |
|---|
| ☐ Have all work only carried out by authorized transport personnel. |
| ☐ Use intact and correctly dimensioned hoisting equipment. |
| ☐ Ensure that the means of transport is in a flawless state. |
| ☐ Ensure that the centre of gravity of the load is taken into consideration. |
| ☐ Do not stand under raised loads. |

### 6.2 Dangers during storage

| **The following safety instructions must be observed:** |
|---|
| ☐ Observe the storage conditions. |

### 6.3 Unpacking and checking the state of delivery

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |

1. ▶ Upon delivery check the pump/pump unit for damage during transportation.
2. ▶ Report damage during transportation immediately to the manufacturer.
3. ▶ Dispose of packaging material in accordance with the locally applicable regulations.

## 6.4 Transporting the pump/pump unit

| | |
|---|---|
| Personnel qualification: | ☐ Transport personnel |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective helmet<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Mobile crane, forklift, hoisting equipment |

**⚠ WARNING**

**Risk of injury and damage to equipment through falling and toppling parts.**

- ► Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ► Select the lift points for the hoisting equipment in accordance with the centre of gravity and the weight distribution.
- ► Use at least two load ropes.
- ► In the case of vertical transportation secure the motor against tippling.
- ► Do not stand under raised loads.

**ATTENTION**

**Damage to equipment through improper transportation.**

- ► Protect the pump against damage, heat, sunlight, dust and moisture.

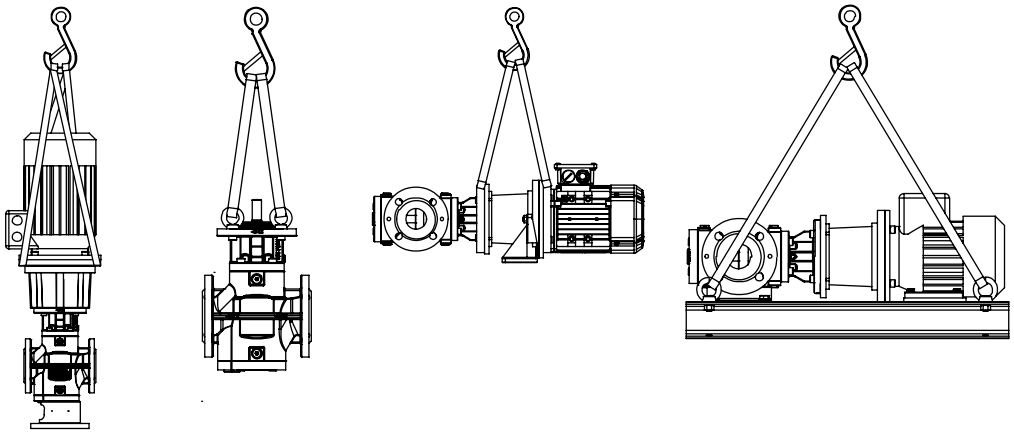


*Fig. 6: Fastening of hoisting equipment - principle diagrams*

1. ▶ Attach the hoisting equipment to the pump/pump unit and tighten. Ensure that the centre of gravity lies exactly under the crane hook.
2. ▶ Lift the pump/pump unit carefully and put it down shock-free.
3. ▶ Before loosening the transport belts ensure that the pump/pump unit is secured against tilting.

## 6.5 Storing the pump

During the test run, the internal components of the pump are wetted with test oil, which has a preservative effect. Pressure connection and suction connection are closed with protective caps. Unless otherwise specified, the outer surfaces of the pump are preserved with a single-coat PU-based two-component paint.

The preservative applied at the factory will protect the pump for about six weeks, if it is stored in a dry and clean location.

The manufacturer offers a long-term preservation for storage times of up to 60 months. The pump is additionally packed in hermetically sealing anti-corrosion paper.

| | |
|---|---|
| Personnel qualification: | ☐ Transport personnel |
| Aids: | ☐ Mobile crane, forklift, hoisting equipment |

**ATTENTION**

**Damage to equipment and corrosion if stored improperly and during longer standstills.**

- ► Protect the pump against damage, heat, sunlight, dust and moisture.
- ► Protect against corrosion during longer standstill.
- ► Observe measures for storing and preservation.

1. ► Store cool and dry and protect against sunlight.
2. ► Ensure that the anti-corrosion paper is not damaged.
3. ► Observe the intervals for preservation ↳ Preservation, Page 12.

# 7 Preservation

## 7.1 Preservation table

Preservation has to be carried out additionally under the following conditions:

| Type of delivery | Condition |
|---|---|
| Standard delivery | ☐ Storage time exceeding six weeks<br>☐ Unfavourable storage conditions such as high humidity, salty air, etc. |
| Delivery with long-term preservation | ☐ Opened or damaged packaging |

*Tab. 6: Conditions for additional preservation*

## 7.2 Preserving the inner surfaces

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Preservative (acid-free and resin-free oil) |

1. ► Open the packaging carefully. If the pump is protected additionally by anti-corrosion paper, ensure that it is not damaged.
2. ► Close the suction connection of the pump with a blind flange.
3. ► Pour the preservative into the pressure connection until it reaches approx. 2 cm under the rim, while slowly turning the main screw against the direction of rotation.
4. ► Close the pressure connection of the pump with a new blind flange.
5. ► Close the packaging carefully.
6. ► After about six months storage check the filling level of the preservative and if necessary top up.

## 7.3 Preserving the outer surfaces

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Calcium complex grease (for example TEVI-ER® GREASE WAWE 100 with adhesive additive)<br>☐ Castrol Rustilo DWX 21 or other preservative offering comparable protection |

1. Brush calcium complex grease corrosion protection (for example TEVIER® FETT WAWE 100 with adhesive additive) to the mounting surfaces.
2. Brush or spray preservative (for example Castrol Rustilo DWX 21) onto the process connections and remaining plain and unpainted parts.
3. At intervals of about six months check the preservation and if necessary repeat.

## 7.4 Removing the preservation

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Solvent<br>☐ Collection tank<br>☐ Steam-jet cleaning device with wax-dissolving additives |

**⚠ CAUTION**

**Risk of injury through discharging preservative.**

- ► Wear personal protective equipment during all the work.
- ► Collect any discharging preservative safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

1. Clean the outside of the pump with solvents, if necessary using a steam-jet cleaning device.
2. Remove the pressure-side blind flange carefully in order to reduce any pressure that may exist in the pump.
3. Drain the pump, collecting the preservative in a suitable vessel.
4. Remove the blind flange on the suction side.
5. To remove the residual preservative, flush the pump with the pumped liquid.

# 8 Installation, removal

## 8.1 Dangers during installation

**The following safety instructions must be observed strictly:**

- ☐ Have all work carried out only by authorized qualified personnel.
- ☐ Before installation ensure that the operating limits, NPSH values and ambient conditions are observed.
- ☐ Observe the tightening torques ↳ Appendix, Page 41.
- ☐ Ensure that all the components can be accessed and that maintenance work can be carried out easily.

## 8.2 Dangers during removing

**The following safety instructions must be observed strictly:**

- ☐ Have all work carried out only by authorized qualified personnel.
- ☐ Before beginning work, let the pump unit cool down to the ambient temperature.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Ensure that the collection tank for discharging pumped liquid is sufficiently large.

## 8.3 Installing the pump

The pumps can be used vertically in any position. Operation in a horizontal position requires that the pressure connection of the pump is directed upwards. The pumps can be supplied for dry and wet installation. A mounting flange is already provided for vertical wet installation.

**Note** Soiling in the pipe system impair the service life of the pump. If the pipe system is flushed using the pump during the initial commissioning, an additional commissioning filter has to be installed temporarily before the pump at the system (mesh width: 0.02 mm).

| | |
|---|---|
| Personnel qualification: | ☐ Transport personnel<br>☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective helmet<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Mobile crane, forklift, hoisting equipment |

**⚠ WARNING**

**Risk of injury and damage to equipment through falling and toppling parts.**

- ► Only fasten the pump on a stable load-bearing underground or stable load-bearing load support.
- ► Ensure that fastening elements and pipings are fastened sufficiently.

**ATTENTION**

**Damage to motor through discharging pumped liquid.**

- ► Do not install the pump above the motor.

**ATTENTION**

**Damage to device through impurity in the pipe system.**

- ► During welding work attach protective covers in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the pump.
- ► Ensure that a commissioning filter is installed when the pipe system is flushed and cleaned using the pump.

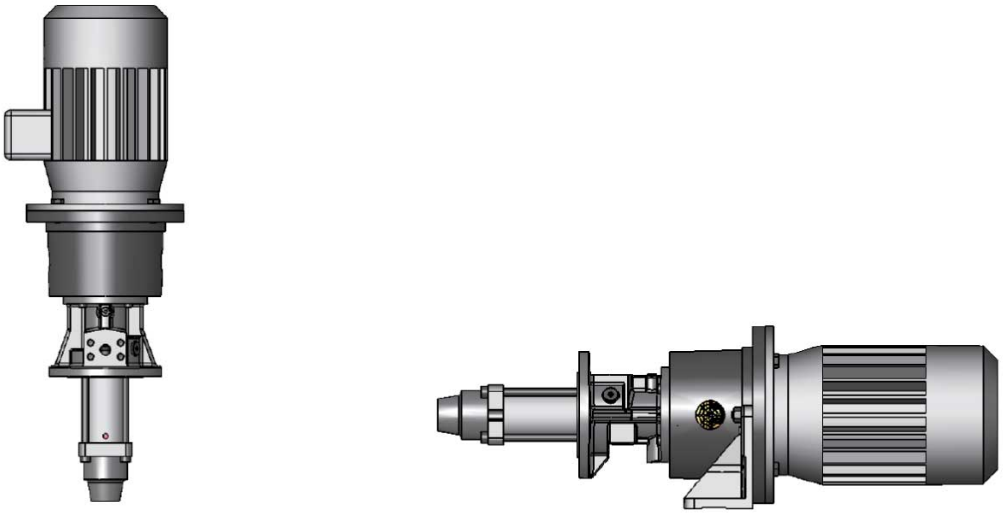


*Fig. 7: Vertical and horizontal installation*

Requirement:
- ✓ System protection: Safety valve in accordance with EN ISO 4126-1 installed in the pressure-side pipe system before the first shut-off device
- ✓ Pump protection: System-side overflow valve/safety valve installed.
- ✓ Pump connections protected against soiling, for example by using the protective cover mounted in the factory
- ✓ If required, hoisting equipment prepared

1. Bring the pump into the installation position, paying attention to the position of the motor and the pressure connection.
2. Fasten the pump with fastening elements securely on the underground.

## 8.4 Removing the pump

| | |
|---|---|
| Personnel qualification: | ☐ Transport personnel<br>☐ Fitter<br>☐ Electrician |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective helmet<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Mobile crane, forklift, hoisting equipment<br>☐ Collection tank |

**⚠ DANGER**

**Risk of death resulting from electric shock.**

- ► Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ► Observe the operating instructions of the electrical components.

**⚠ DANGER**

**Risk of death through emitted pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- ► Wear personal protective clothing during all the work. Ensure face protection.
- ► Before beginning work, let the pump unit cool down to the ambient temperature.
- ► Ensure that the pump is depressurized.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

Requirement:
- ✓ Pump unit cooled down to the ambient temperature
- ✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on

1. Close the pressure-side and suction-side shut-off devices.
2. Empty the pump at the lowest point. Collect the discharging pumped liquid in a collection tank.
3. Dismantle the pressure-side and suction-side connecting flanges.
4. Disconnect the pump unit from the pipe system and empty it. Collect any discharging pumped liquid.
5. Screw out the fastening elements used to fasten the pump.
6. Dismantle the pump unit on site or transport it to a suitable location ↳ Transportation, storage, Page 10.

# 9 Connection

## 9.1 Dangers during connection work

**The following safety instructions must be observed strictly:**

- ☐ Have all work on the pump and pipe system only carried out by authorized qualified personnel.
- ☐ Ensure that impurities cannot get into the pump and pipe system.
- ☐ Ensure that mechanical connections are mounted stress-free.
- ☐ Observe the tightening torques ↳ Appendix, Page 41.
- ☐ Have all the work on the electrical equipment only carried out by electricians.
- ☐ Before beginning work on the pump ensure that the electrical power supply is deenergized and is secured against being switched back on.
- ☐ If the insulation of the electrical cables or wires is damaged, disconnect the power supply immediately.

## 9.2 Connecting the pump to the pipe system

| | |
|---|---|
| Personnel qualification: | ☐ Transport personnel<br>☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Protective helmet<br>☐ Safety boots |
| Aids: | ☐ Mobile crane, forklift, hoisting equipment |

### ATTENTION

**Damage to device through impurity in the pipe system.**

- ► During welding work attach protective covers in front of the connecting flanges.
- ► Ensure when welding that welding beads and abrasive dust cannot get into the pipe system and the pump.
- ► Ensure that a commissioning filter is installed when the pipe system is flushed and cleaned using the pump.

### ATTENTION

**Damage to device through mechanical stress.**

- ► Ensure that the pump is mounted free of mechanical stresses in the pipe system.
- ► Observe the tightening torques.

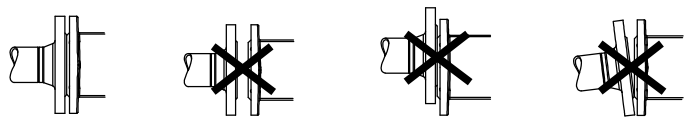


*Fig. 8: Connection to pipe system*

1. Turn the pump shaft or the fan impeller of the motor. This tests that the pump runs smoothly. If the pump shaft cannot be turned by hand, remedy the fault before installing the pump ↳ Troubleshooting, Page 35.
2. Before carrying out welding work mount a protective cover on the suction connection and pressure connection.
3. Place the piping in position and support the weight of the piping.
4. Check the linear, height and angular offset and correct if necessary.
   ⇨ If the screws tighten easily, this is a sure sign that the installation is stress-free.
5. Tighten the connecting screws crosswise with torque, Table of tightening torques ↳ Appendix, Page 41.

## 9.3 Insulating the pump

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Insulation material |

**⚠ WARNING**

**Hot surface.**

Touching of uninsulated hot surfaces results in burns.

► Insulate components and pipings in which hot liquids (> 60 °C) flow before commissioning.

→ Before commissioning, carefully insulate all potentially hot surfaces of the pump and the connected piping or provide suitable protection against accidental contact.

## 9.4 Assembling the pump and motor

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |

**ATTENTION**

**Damage to coupling and bearing through incorrect alignment of the coupling.**

► To guarantee a long service life of the coupling, align shaft ends exactly.

► After assembly check permissible displacement figures of the coupling according to table below.

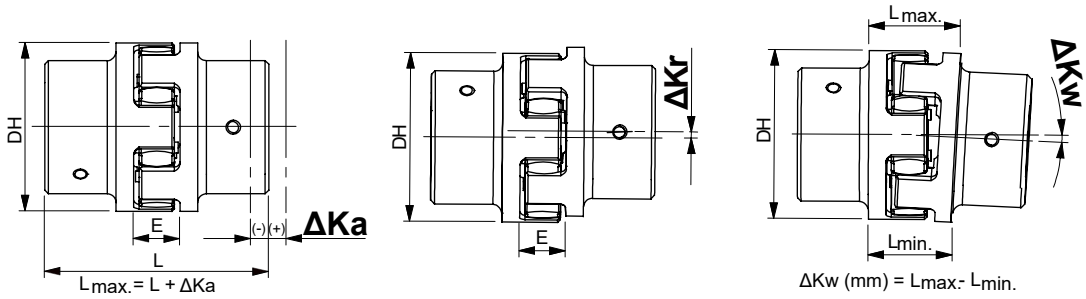



*Fig. 9: Coupling alignment measuring points*

| Outer diameter | Coupling distance | Max. axial displacement | Max. radial displacement | Max. angular displacement | |
|---|---|---|---|---|---|
| DH | E | ΔKa | ΔKr | ΔKw | |
| [mm] | [mm] | [mm] | [mm] | [°] | [mm] |
| 40 | 16 | -0.5/ +1.2 | 0.20 | 1.2 | 0.8 |
| 55 | 18 | -0.5/ +1.4 | 0.22 | 0.9 | 0.9 |
| 65 | 20 | -0.7/ +1.5 | 0.25 | 0.9 | 1.1 |
| 80 | 24 | -0.7/ +1.8 | 0.28 | 1.0 | 1.4 |
| 95 | 26 | -1.0/ +2.0 | 0.32 | 1.0 | 1.7 |
| 120 | 30 | -1.0/ +2.2 | 0.38 | 1.1 | 2.3 |
| 135 | 35 | -1.0/ +2.6 | 0.42 | 1.2 | 2.7 |
| 160 | 40 | -1.5/ +3.0 | 0.48 | 1.2 | 3.3 |

*Tab. 7: Limit values for aligning the shaft coupling*

1. Check the radial displacement **ΔKr** of the coupling using a hairline gauge and feeler gauge. Check several points along the periphery of the coupling.
2. Check the angular displacement **ΔKw** of the coupling using a hairline gauge.
3. Check the axial displacement **ΔKa** of the coupling using a slide gauge or feeler gauge.
4. If the limit values of the above table are exceeded, loosen the fastening of the pump or motor and move pump or motor in order to reduce the respective offset.

## 9.5 Connecting the pump unit to the power supply

| | |
|---|---|
| Personnel qualification: | ☐ Electrician |
| Aids: | ☐ Operating instructions of the motor<br>☐ Motor circuit diagram |

**⚠ DANGER**

**Risk of death resulting from electric shock.**

- ► Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- ► Before commissioning ensure correct grounding and equipotential bonding.
- ► Observe the operating instructions of the electrical components.

1. Ensure that the operating data on the rating plate of the motor agree with the operating data of the pump and with the local power supply.
2. Carefully earth the pump bracket foot, base frame or pedestal via the screwing.
3. Connect the motor in accordance with the operating instructions and circuit diagram in the motor terminal block.
4. When connecting the pump unit to the complete system continue equipotential bonding.

# 10 Operation

## 10.1 Dangers during operation

**The following safety instructions must be observed strictly:**

- ☐ Have all work carried out only by authorized qualified personnel.
- ☐ Before commissioning ensure that a safety valve has been installed in the pipe system on the pressure side before the first shut-off device.
- ☐ Before commissioning, make sure that the suction line and pump are filled.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic. Use corresponding protective equipment.
- ☐ Ensure that the pump station is only operated within the operating limits.
- ☐ Wear hearing protection if you work for a longer time directly at the pump.
- ☐ Ensure that the maximum permissible system pressure is not exceeded.
- ☐ Ensure that during cooling down or heating up the pump is only subjected to slow temperature changes.
- ☐ Ensure that existing safety equipment is not bypassed or activated during operation.
- ☐ Before decommissioning ensure that the electrical power supply is deenergized and is secured against being switched back on.

## 10.2 Commissioning

### 10.2.1 Cleaning the pipe system

**Note** Soiling in the pipe system impair the service life of the pump. If the pipe system is flushed using the pump during the initial commissioning, an additional commissioning filter has to be installed temporarily before the pump at the system.

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |

## ATTENTION

**Damage to equipment through additional pressure loss in the commissioning filter/commissioning strainer.**

- ► Calculate the flow resistance and determine the remaining pump intake.
- ► Monitor the suction-side pressure.
- ► Check the commissioning filter/commissioning strainer regularly.

Requirement:
✓ If required, commissioning filter installed (mesh width 0.02 mm)

1. ► Clean the complete pipe system before commissioning in order to protect the pump.
2. ► Flush the pipe system at least 50 – 100 hours.

### 10.2.2 Filling and venting the pump

**Possibilities**

There are two possible ways to fill the pump:
☐ Via the suction connection or pressure connection
☐ via the bypass connection

**Filling and venting the pump via the suction connection or pressure connection**

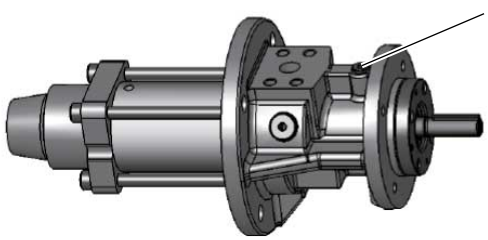
| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Collection tank |

## ⚠ DANGER

**Risk of death through discharging pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- ► Wear personal protective equipment during all the work. Ensure face protection.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.




**1** Vent hole

1. ► Open the screw plug of the vent hole **1** by a max. of 2 rotations so that air can escape during the filling process.
2. ► Open the suction-side or pressure-side shut-off device and fill the pump via the suction connection or pressure connection until pumped liquid is emitted at the vent hole **1**.
3. ► During the filling process turn the pump shaft or the fan impeller of the motor by hand to speed up the filling process:
   Filling via the suction connection: Turn the pump shaft in the direction of the arrow of the pump flange.
   Filling via the pressure connection: Turn the pump shaft against the direction of the arrow on the pump flange.
4. ► Retighten the screw plug of the vent hole **1**.

**Filling the pump via the bypass connection**

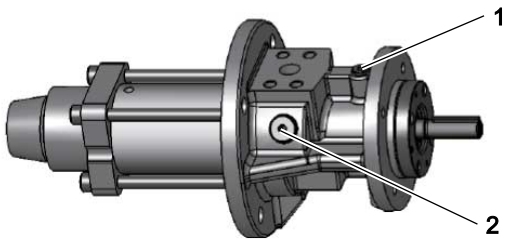
| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Collection tank |

**⚠ DANGER**

**Risk of death through discharging pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- ► Wear personal protective equipment during all the work. Ensure face protection.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.




**1** Vent hole
**2** Bypass connection

1. ► Open the screw plug of the vent hole **1** by a max. of 2 rotations so that air can escape during the filling process.
2. ► Remove the screw plug of bypass connection **2** and fill the pump via the bypass connection until the pumped liquid emerges at the bypass connection.
3. ► During the filling process turn the pump shaft or the fan impeller of the motor by hand to speed up the filling process:
   Filling via the suction connection: Turn the pump shaft in the direction of the arrow of the pump flange.
   Filling via the pressure connection: Turn the pump shaft against the direction of the arrow on the pump flange.
4. ► Tighten the screw plug of bypass connection **2** again.
5. ► Retighten the screw plug of the vent hole **1**.

### 10.2.3 Checking the direction of rotation

The direction of rotation is indicated by an arrow on the pump flange/pump housing. The direction of rotation of the motor specifies the direction of rotation of the pump. The fan impeller of the motor must rotate in the same direction in which the arrow for the direction of rotation on the pump flange points.

**Note** Standard direction of rotation: clockwise (viewed from the motor)

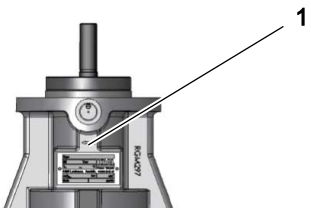
| | |
|---|---|
| Personnel qualification: | ☐ Fitter |

**ATTENTION**

**Dry running can damage pump equipment.**

- ► Ensure that the pump is filled properly.
- ► Switch the pump on for a maximum of one second and then off again immediately.

1. Switch on the power supply and then turn it off again immediately.




2. Compare the direction of rotation of the fan impeller with the arrow for the direction of rotation **1**.
3. If the directions do not match, swap the two electrical connection phases. Repeat Steps 1 and 2.

### 10.2.4 Commissioning the pump

| | |
|---|---|
| Personnel qualification: | ☐ Fitter<br>☐ Electrician |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Collection tank |

**⚠ DANGER**

**Risk of death resulting from bursting components and discharging pumped liquid.**

As a result of impermissibly high pressure, components can burst with high energy, for example through the pressure-side pipe system being shut off.

- ► Wear personal protective equipment during all the work.
- ► System protection: Before carrying out commissioning ensure that a safety valve is installed in the pressure-side pipe system at the system end.
- ► Pump protection: Ensure before commissioning that an integrated overflow valve or system-side overflow valve/safety valve is installed.

**⚠ WARNING**

**Risk of injury through emitted pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic.

- ► Wear personal protective clothing during all the work. Ensure face protection.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

**⚠ WARNING**

**Hot surface.**

Touching of uninsulated hot surfaces results in burns.

- ► Insulate components and pipings in which hot liquids (> 60 °C) flow before commissioning.

**⚠ WARNING**

**Danger of injury through rotating parts.**

- ► Ensure that the coupling protection is mounted.

## ATTENTION

**Dry running can damage pump equipment.**

► Ensure that the pump and the connected pipe system are filled properly.
► If the pump does not deliver after 10 – 15 seconds, abort commissioning.

Requirement:
✓ Pump unit set up correctly
✓ Coupling aligned correctly Connection, Page 16
✓ Connections connected sealingly
✓ Motor connected correctly
✓ Pipe system is free of impurities
✓ System protection: Safety valve in accordance with EN ISO 4126-1 installed in the pressure-side pipe system before the first shut-off device
✓ Pump protection: System-side overflow valve/safety valve installed.
✓ Pump filled with pumped liquid
✓ Shut-off devices in the suction line and pressure line opened

1. Turn the pump shaft or the fan impeller of the motor. This tests that the pump runs smoothly. If the pump shaft cannot be turned by hand, remedy the fault. Troubleshooting, Page 35
2. Switch on the pump unit.
   ⇨ The pump delivers when the pressure on the pressure side of the pump rises or a flow indicator at the system side triggers.
3. If the pump does not deliver after 10 – 15 seconds of operation, abort commissioning. Eliminate the cause for the fault and only then continue with commissioning. Take the information from the fault table into account Troubleshooting, Page 35.
4. Run the pump for a few minutes to allow the pipe system to vent fully.
   ⇨ The pipe system is fully vented when the pump operating noise is smooth and a pressure gauge on the pressure side shows no more fluctuations.

## 10.3 During operation

### 10.3.1 Checking the operating pressure

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |

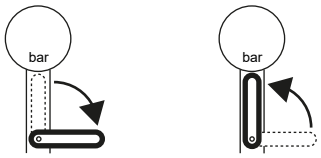



*Fig. 10: Pressure gauge shut-off valves closed/open - principle diagram*

## ATTENTION

**Leak in the pressure gauge through permanently opened pressure gauge shut-off valve.**

► Close the pressure gauge shut-off valve immediately after completing reading.

1. Open the pressure gauge shut-off valve.
2. Read the operating pressure and close the pressure gauge shut-off valve.

### 10.3.2 Monitoring the filter and/or strainer

**Note** The manufacturer recommends protecting the pump against soiling by means of a filter and/or strainer installed at the system end (mesh width 0.5 mm). The degree of soiling of the filter and/or the strainer can be monitored by means of a suction-side pressure gauge or a differential pressure indicator.

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |

1. After commissioning monitor the degree of soiling of the filter and/or strainer by means of a suction-side pressure gauge or a differential pressure indication.
2. Also check the filters/strainers in the event of a pressure drop on the suction side. Observe the dimensioning data of the manufacturer of the filters and/or strainers.
3. Check the suction-side pressure every two weeks during operation.
4. Regularly check the magnetic separator in the filter/strainer during operation and clean it if necessary.

### 10.3.3 Switching off the pump unit

| | |
|---|---|
| Personnel qualification: | ☐ Trained personnel |

**ATTENTION**

**Seal damage through pressurizing during standstill.**

► Ensure that the maximum permissible system pressure is not exceeded.

1. Switch off the motor.
2. Close the pressure-side shut-off device.

## 10.4 Decommissioning

### 10.4.1 Decommissioning the pump

Decommissioning is an operation interruption that requires different measures depending on the scope and duration of the interruption as well as the properties of the pumped liquid.

| | |
|---|---|
| Personnel qualification: | ☐ Fitter<br>☐ Electrician |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Collection tank |

**⚠ WARNING**

**Risk of injury through emitted pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic.

► Wear personal protective clothing during all the work. Ensure face protection.

► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

**ATTENTION**

**Damage to equipment through excessively fast temperature change.**

► Subject the pump only to slow temperature changes.

► Under no circumstances heat the pump with an open flame.

Carry out the following measures during operation interruptions:

| Scope of the operation interruption | Measure |
|---|---|
| ☐ Shutting down the pump for a longer period | ⟶ Depending on the pumped liquid |
| ☐ Draining the pump | ⟶ Close the pressure-side and suction-side shut-off devices. |
| ☐ Dismantling the pump | ⟶ Disconnect the motors from the power supply and secure against being switched back on. |
| ☐ Storing the pump | ⟶ Observe measures for storing and preservation ↳ Transportation, storage, Page 10. |

*Tab. 8: Measures during operation interruptions*

| Behaviour of the pumped liquid | Duration of the operation interruption | |
|---|---|---|
| | Short | Long |
| ☐ Solids sediment | ⟶ Rinse the pump. | ⟶ Rinse the pump. |
| ☐ Congealed/frozen<br>☐ No corrosive burden | ⟶ Heat or drain the pump. | ⟶ Drain the pump. |
| ☐ Congealed/frozen<br>☐ Corrosive burden | ⟶ Heat or drain the pump. | 1. ⟶ Drain the pump.<br>2. ⟶ Preserve the pump. |
| ☐ Remains liquid<br>☐ No corrosive burden | – | – |
| ☐ Remains liquid<br>☐ Corrosive burden | – | 1. ⟶ Drain the pump.<br>2. ⟶ Preserve the pump. |

*Tab. 9: Measures depending on the behaviour of the pumped liquid*

⟶ Drain the pump via the pressure line, suction line, vent screws and screw plugs.

## 10.5 Recommissioning

### 10.5.1 Recommissioning the pump

⟶ Depending on the extent and duration of the interruption of operation, carry out steps as for commissioning ↳ Commissioning, Page 18.

# 11 Maintenance

## 11.1 Dangers during maintenance

**The following safety instructions must be observed strictly:**

- ☐ Have all work carried out only by authorized qualified personnel.
- ☐ Before beginning work, let the pump unit cool down slowly to the ambient temperature. Avoid rapid temperature changes.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic. Use corresponding protective equipment.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Ensure that the collection tank for discharging pumped liquid is sufficiently large.
- ☐ Observe the operating instructions and data sheets of the components.

## 11.2 Required maintenance

The service life depends on the observance of the operating conditions of the pump and the requirements from the operating instructions of the components.

| Component | Required maintenance | Cycle |
|---|---|---|
| Filter/strainer (system side) | ☐ Check of the suction-side pressure | 2 weeks |
| Pump | ☐ Visual inspection<br>☐ Acoustic inspection | 4 weeks |
| Leakage vent hole | ☐ Visual inspection<br>☐ If required, clean | 4 weeks |

*Tab. 10: Required maintenance*

## 11.3 Ball bearing

The ball bearings used are lifetime lubricated. Maintenance is therefore not required. The manufacturer recommends renewing the ball bearings every 20,000 operating hours.

## 11.4 Maintaining the pump

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots<br>☐ Face protection |

**⚠ WARNING**

**Risk of injury through emitted pumped liquid.**

Pumped liquids can be hot, poisonous, combustible and caustic.

- ► Wear personal protective clothing during all the work. Ensure face protection.
- ► Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

1. ► Check the pump visually and acoustically every four weeks.
2. ► If there are signs of wear, eliminate the cause Servicing, Page 26.

## 11.5 Cleaning the leakage vent hole

The regular small amounts of leakage can result in deposits that can prevent free draining of further leakage liquids after a longer operating period.

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |

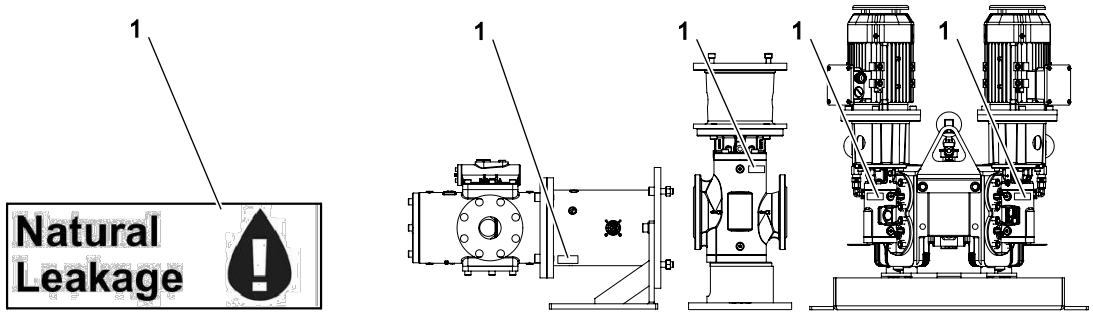



*Fig. 11: Leakage hole - schematic diagrams*

**Note** The leakage hole on the pump/pump station is marked with a sign **1**.

1. ► If a leakage vent line is connected, unscrew the leakage vent line.

2. ▶ To check the continuity of the leakage hole insert a flexible soft mandrel into the leakage hole.
3. ▶ If there is insufficient continuity, clean the leakage hole. If there is sufficient continuity, clean the leakage pipe.
4. ▶ If existing, reconnect the leakage vent line again.

# 12 Servicing

## 12.1 Dangers during servicing

**The following safety instructions must be observed strictly:**

- ☐ Have all work carried out only by authorized qualified personnel.
- ☐ Before beginning work on the pump ensure that the electrical power supply is deenergized and is secured against being switched back on.
- ☐ Before beginning work, let the pump unit cool down slowly to the ambient temperature. Avoid rapid temperature changes.
- ☐ Pumped liquids can be hot, poisonous, combustible and caustic. Use corresponding protective equipment.
- ☐ Ensure that the pump is depressurized and that shut-off devices are not operated uncontrolled.
- ☐ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ☐ Ensure that the collection tank for discharging pumped liquid is sufficiently large.
- ☐ Observe the tightening torques ↳ Appendix, Page 41.
- ☐ Observe the operating instructions and data sheets of the components.

## 12.2 Wear

### 12.2.1 Signs of wear

The following table lists signs of progressive wear of individual pump elements:

| Finding | Cause | Elimination |
|---|---|---|
| Increased running noises | Incipient damage to bearing | ▶ Replace the ball bearing. |
| Increased leaking | Incipient damage to seal | ▶ Replace the shaft seal. |
| Deposits at the shaft seal (only applies for mechanical seal) | Low-volatile liquids | ▶ Clean the mechanical seal. |
| Increased play in the coupling | Advanced wear of the coupling intermediate ring | ▶ Replace the coupling intermediate ring. |
| Reduction in the delivery rate or pressure under constant operating conditions | Advanced wear of screws and housing | ▶ Replace the pump. |

*Tab. 11: Signs of wear*

### 12.2.2 Shaft seal

Shaft seals are subject to natural wear that depends strongly on the respective conditions of use. General statements about the service life can therefore not be given.

**Mechanical seal**

In case of strong soiling through solidified or sticky leakage residues the manufacturer recommends that you dismantle the mechanical seal completely and clean it, together with the inner surfaces of the pump housing.

## 12.3 Replacing the coupling

### 12.3.1 Removing the coupling

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Extractor |

**⚠ WARNING**

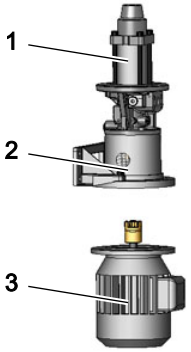
**Risk of injury and damage to equipment through falling and toppling parts.**

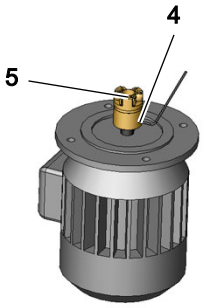
- ► Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ► Select the lift points for the hoisting equipment in accordance with the centre of gravity and the weight distribution.
- ► Use at least two load ropes.
- ► In the case of vertical transportation secure the motor against tippling.
- ► Do not stand under raised loads.

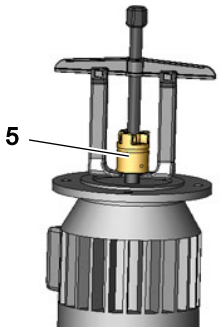
Requirement:

✓ Pump emptied

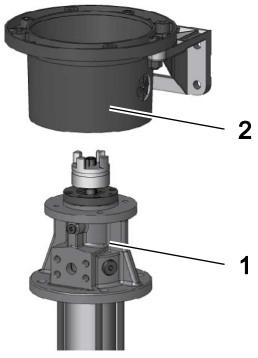
✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on

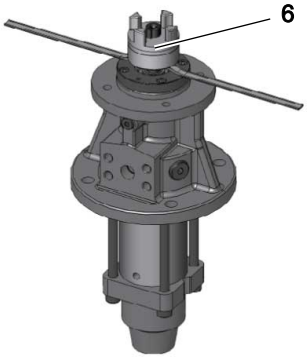


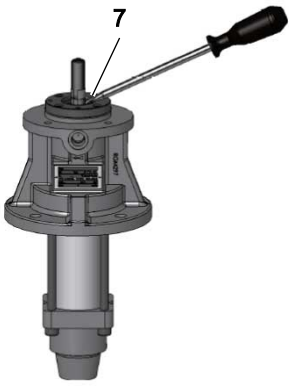




1. ► Remove the connecting screws between the motor **3** and pump bracket **2** and lift the pump **1** with pump bracket **2** from the motor **3**.
2. ► Loosen the fixing screw **4** at the motor-side coupling half **5**.
3. ► Remove the coupling intermediate ring and pull off the coupling half **5** using an extractor.




4. ► Remove the connecting screws between the pump **1** and pump bracket **2** and remove the pump bracket.

5. Loosen the fixing screw at the pump-side coupling half **6** and pull off the coupling half using a suitable tool.
6. Remove the distance sleeve **7** of the coupling from the shaft.

### 12.3.2 Installing the coupling

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Torque wrench<br>☐ Measuring stick<br>☐ Silicone oil |

**⚠ WARNING**

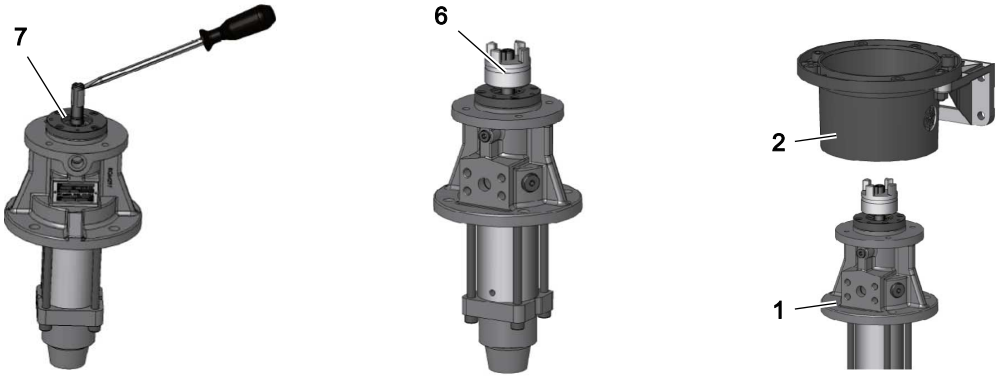
**Hot surface.**

Touching hot coupling halves results in burns.

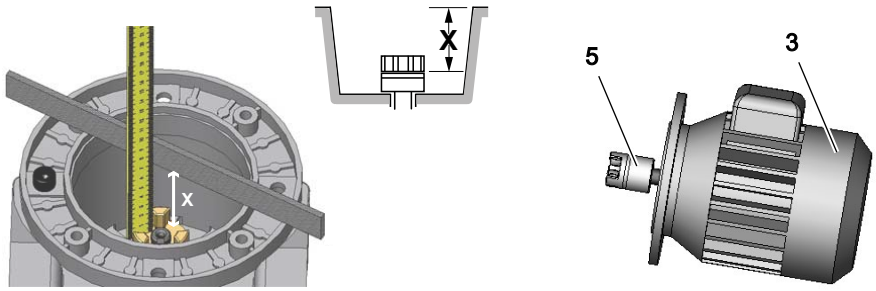
► Wear personal protective equipment during all the work. Be sure to wear protective gloves.

**Note** The coupling halves can be mounted more easily if they are heated to 80 °C – 100 °C.

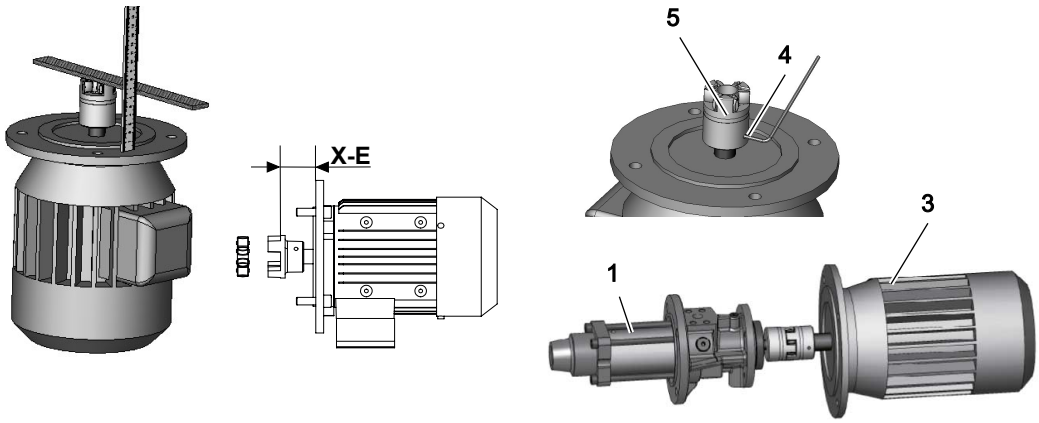
1. Oil the shaft of the pump with silicone oil.




2. Slide the distance sleeve **7** of the coupling onto the circlip of the ball bearing until it is flush.
3. Slide the pump-side coupling half **6** onto the shaft until it stops.
4. Tighten the fixing screw of the pump-side coupling half **6**.
5. Place the pump bracket **2** on the pump **1** and tighten the connecting screws.




6. Measure and write down the distance **X** between the face of the coupling claws and the connecting surface of the pump bracket.
7. Tighten the motor-side coupling half **5** on the shaft end of the motor **3**.



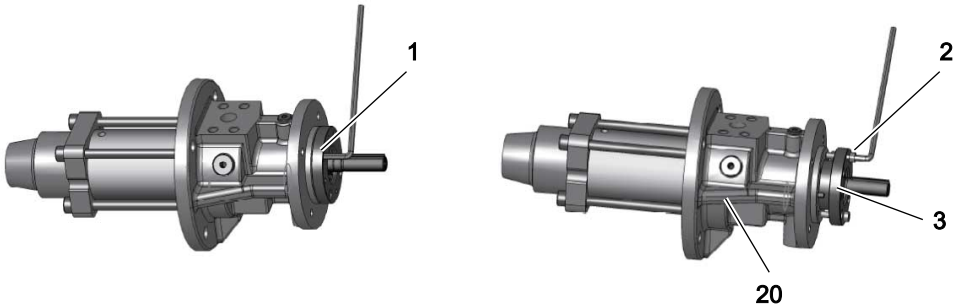

8. Check the distance between the face of the coupling teeth and the connecting surface of motor flange. The distance has to be adjusted to the value **X-E**, table Limit values for aligning the shaft coupling Connection, Page 16.
9. Tighten the fixing screw **4** on the motor-side coupling half **5** and insert the coupling intermediate ring.
10. Place the pump **1** with pump bracket **2** on the motor **3**.
11. Turn the pump slightly until the teeth of the pump-side coupling half mesh cleanly into the spaces of the coupling intermediate ring.
12. Tighten the connecting screws between the motor **3** and the pump bracket **2**.

## 12.4 Replacing the mechanical seal and ball bearing

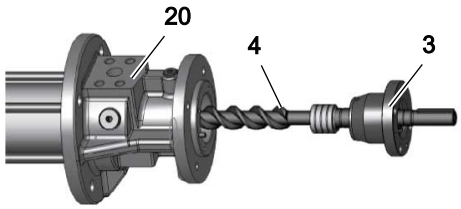
### 12.4.1 Removing the mechanical seal and ball bearing

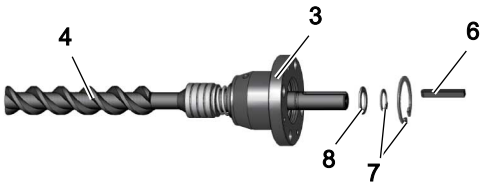
| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Tool set, mechanical seal Spare parts, Page 38<br>☐ Extractor |

Requirement:
✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on
✓ Coupling removed

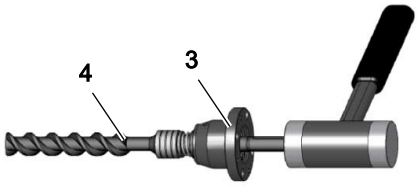



1. Remove the socket screws **1**.
2. Screw in the forcing elements **2**. In the process the seal housing **3** together with the main screw and mounted mechanical seal is pushed out of the pressure housing **20**.



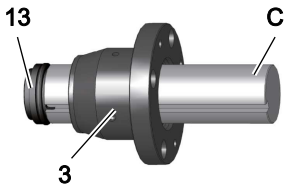




3. Remove the seal housing **3** together with the main screw **4** and mounted mechanical seal from the pressure housing **20**.
4. Remove the feather key **6**. Dismantle the circlips **7** and the supporting ring **8**.





5. Drive the main screw **4** out of the seal housing **3** with light blows from a soft hammer.
6. Remove the supporting ring **9**, the parts of the mechanical seal **10** and supporting ring **11** from the main screw **4**.


7. Pull the ball bearing **12** out of the seal housing **3** using a suitable extractor.
8. Press the stationary seal ring of the mechanical seal **13** with mounted O-ring out of the seal housing **3** using a mounting arbour **C**.

### 12.4.2 Installing the mechanical seal and ball bearing

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Tool set, mechanical seal Spare parts, Page 38<br>☐ Silicone grease<br>☐ Torque wrench |

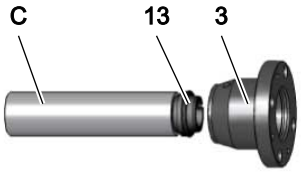
**⚠ WARNING**

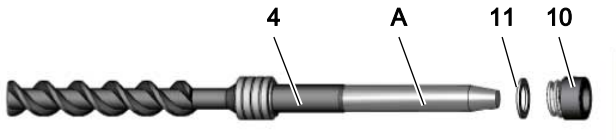
**Hot surface.**

Touching hot coupling halves results in burns.

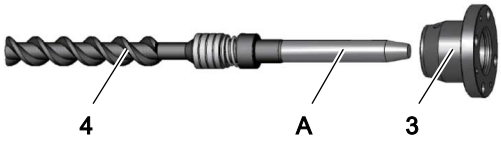
► Wear personal protective equipment during all the work. Be sure to wear protective gloves.

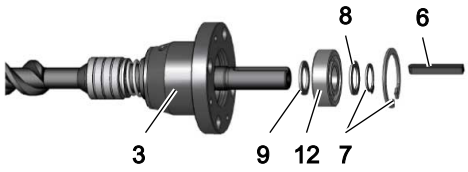
**Note** The coupling halves can be mounted more easily if they are heated to 80 °C – 100 °C.



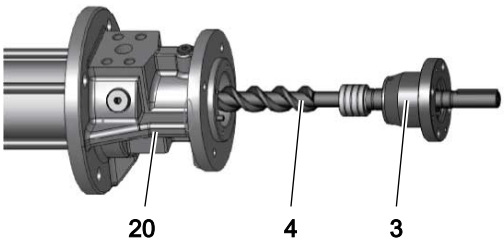



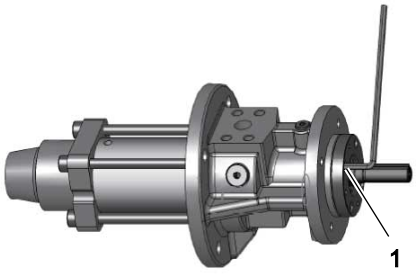

1. Press the stationary seal ring of the mechanical seal **13** with mounted O-ring into the stationary seal ring **3** using a mounting arbour **C**. Take the position of the recess for the spring ring into account.
2. Clean the main screw **4** carefully in the area of the mechanical seal and grease it. Slide the supporting ring **11** and remaining parts of the mechanical seal **10** onto the shaft by using the mounting sleeve **A**.




3. Slide the main screw **4** with mounted mechanical seal into the seal housing **3**. In the process use the mounting sleeve **A**.
4. Remove the mounting sleeve. Mount the supporting ring **9**. Press on the ball bearing **12**. Mount the supporting ring **8**, circlips **7** and feather key **6**.



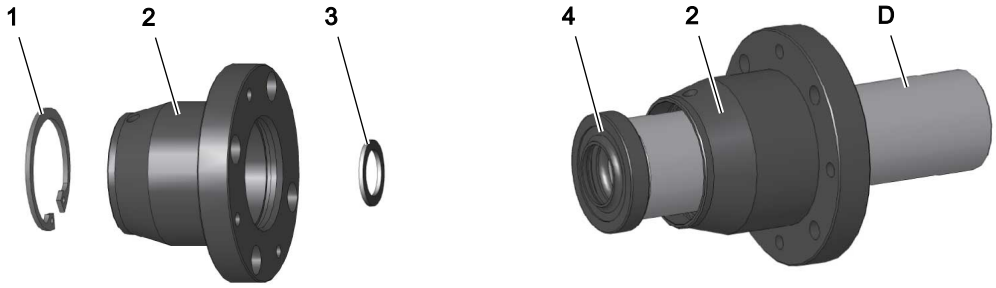

5. Carefully clean the sliding surfaces of the rotary seal ring and stationary seal ring in the pressure housing **20** using benzine and apply a drop of resin-free lubricating oil. Do not touch sliding surfaces after that anymore.
6. Insert the main screw **4** with pre-mounted seal housing **3** into the pressure housing **20**.
7. Tighten the socket screws **1**.

## 12.5 Replacing the radial shaft seal

### 12.5.1 Removing the radial shaft seal

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Tool set, radial shaft seal ↳ Spare parts, Page 38 |

Requirement:
- ✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on
- ✓ Coupling removed
- ✓ Ball bearing removed

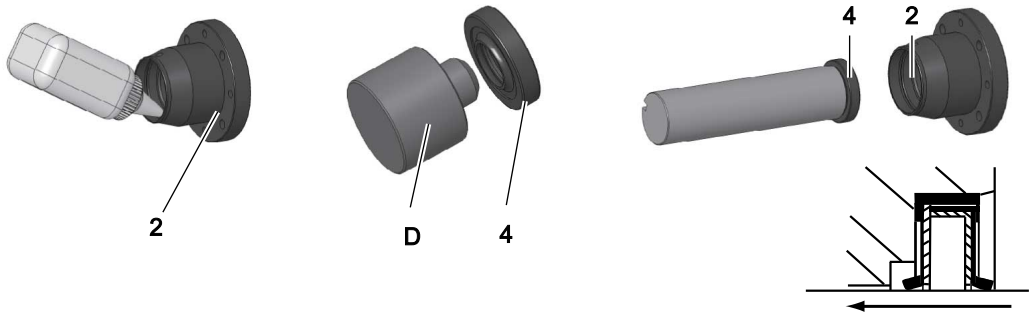



1. Remove the supporting ring **3** and circlip ring **1** out of the seal housing **2**.
2. Press the radial shaft seal ring **4** using the mounting arbour **D** out of the seal housing **2**. The seal ring is usually destroyed during dismantling.

### 12.5.2 Installing the radial shaft seal

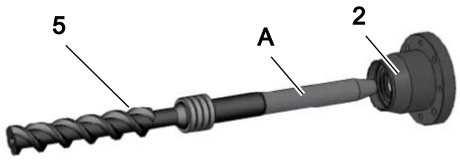
| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Tool set, radial shaft seal ↳ Spare parts, Page 38<br>☐ Thread sealant (for example Loctite 572)<br>☐ Molybdenum disulphide paste (for example Fenkart T4) |

**Note** The thread sealant serves during installation of the radial shaft seal as a lubricant, and after it has cured as an anti-rotation measure.




1. Carefully clean the contact surface of the radial shaft seal ring **4** in the seal housing **2**.
2. Apply thread sealant (for example Loctite 572). Ensure that no thread sealant comes into contact with the sealing lip.
3. Carefully press the radial shaft seal ring **4** using the mounting arbour **D** into the seal housing **2**. Take the mounting direction into account. In the case of excessive resistance apply additional thread sealant.

4. Ensure that the mounting arbour contacts the support of the seal ring **4** completely and that there are no sharp edges in the area of the sealing lip.
5. Remove the mounting arbour.
6. Fill the intermediate space of the radial shaft seal ring **4** with molybdenum disulphide paste ($MoS_2$).



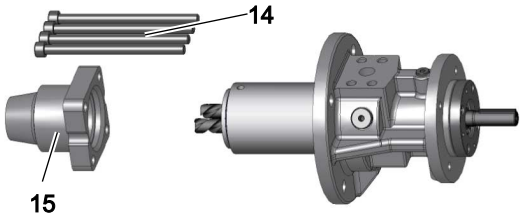

7. Slide the supporting ring **3** on the main screw **5**. Insert the main screw **5** into the seal housing **2** with pre-mounted radial shaft seal ring **4**, in the process use the mounting sleeve **A**.
8. Remove the mounting sleeve. Proceed as specified in "Installing the mechanical seal and ball bearing", steps 4, 6 and 7.

## 12.6 Replacing the screw set

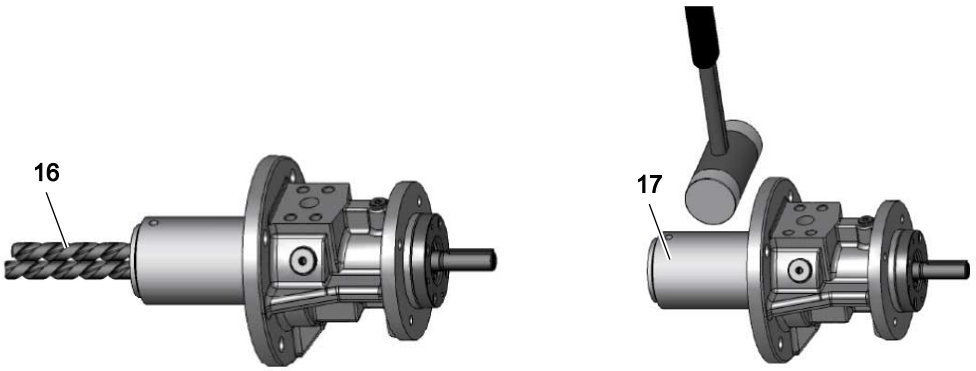
### 12.6.1 Removing the screw set

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Plastic hammer<br>☐ Extractor |

Requirement:
✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on
✓ Coupling removed

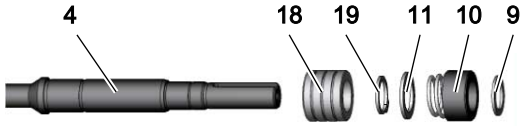



1. **Size15 – 42** (figure): Unscrew four socket screws **14** and remove the suction cover **15**.
**Size 55 – 118**: Remove the hexagon nuts and stud screws and take off the suction cover.




2. Remove the idle screws **16** from the pump housing **17**.
3. Loosen the pump housing **17** using light blows of a soft hammer and remove it.

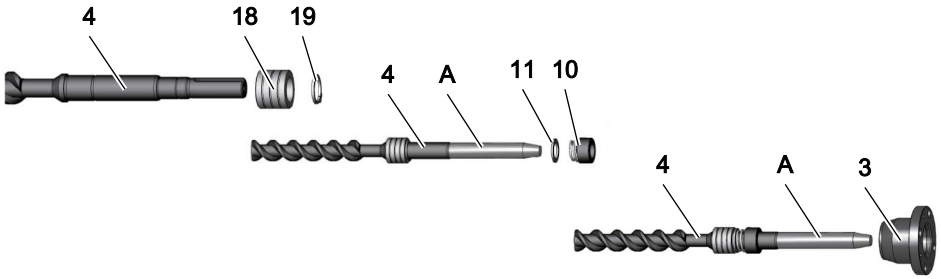
4. Removal steps, see "Removing the mechanical seal and ball bearing", steps 1 to 5.



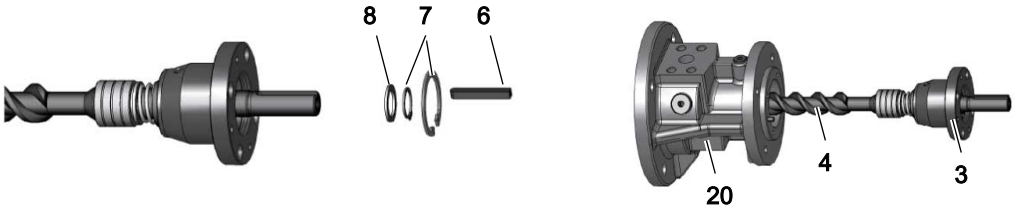

5. Remove the supporting ring **9**, the parts of the mechanical seal **10**, supporting ring **11**, circlip **19** and balancing cylinder **18** from the main screw **4**.

### 12.6.2 Installing the screw set

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Protective gloves<br>☐ Safety boots<br>☐ Tool set, mechanical seal Spare parts, Page 38<br>☐ Torque wrench |




1. Press the balancing cylinder **18** onto the main screw **4** and mount the circlip **19**.
2. Clean the main screw carefully in the area of the mechanical seal and grease it. Slide the supporting ring **11** and remaining parts of the mechanical seal **10** onto the shaft **4**. In the process use the mounting sleeve **A**.
3. Slide the main screw **4** with mounted mechanical seal into the seal housing **3**. In the process use the mounting sleeve **A**.




4. Remove the mounting sleeve. Mount the supporting ring **8**, circlips **7** and feather key **6**.
5. Carefully clean the sliding surfaces of the rotary seal ring and stationary seal ring in the pressure housing **20** using benzine and apply a drop of resin-free lubricating oil. Do not touch sliding surfaces after that anymore.
6. Insert the main screw **4** with pre-mounted seal housing **3** into the pressure housing **20**.


7. Tighten the socket screws **1**.
8. Slide the unit consisting of pressure housing **20** and main screw **4** into the pump housing **17**.

9. Insert the idle screws **16** into the pump housing **17**. Place on the suction cover **15**.
   **Size 15 – 42:** Tighten the socket screws **14**.
   **Sizes 55 – 118:** Mount and tighten the stud screws and hexagon nuts.

# 13 Disposal

## 13.1 Dismantling and disposing of the pump

| | |
|---|---|
| Personnel qualification: | ☐ Fitter |
| Personal protective equipment: | ☐ Work clothing<br>☐ Face protection<br>☐ Protective gloves<br>☐ Safety boots |
| Aids: | ☐ Solvents or industrial cleaners suitable for the pumped liquid<br>☐ Collection tank |

**⚠ WARNING**

**Danger of poisoning and environmental damage through residues.**

- ► Wear personal protective equipment during all the work. Ensure face protection.
- ► Before disposal collect any pumped or test liquid still present safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.
- ► Before disposing neutralize the residues.

Requirement:
- ✓ Disconnect the pump unit from the power supply and secure it against being switched back on
- ✓ Pump unit cooled down to the ambient temperature and disconnected from the pipe system
- ✓ Pump emptied completely
- ✓ Pump placed at a location suitable for dismantling

1. Dismantle the pump and disassemble it into its individual parts.
2. Clean residues of the pumped liquid from the individual parts.
3. Separate sealing elements made of elastomers and ceramics (SiC) from the pump and dispose of them in separately.
4. Recycle iron parts.

# 14 Troubleshooting

## 14.1 Possible faults

Faults can have different causes. The following tables list the symptoms of a fault, the possible causes and measures for troubleshooting.

| Identification | Fault |
|---|---|
| 1 | No pump suction |
| 2 | Delivery rate too low |
| 3 | Pump too loud |
| 4 | Motor overload |
| 5 | Uneven delivery rate |
| 6 | Pump has seized |
| 7 | Shaft seal leaks |

## 14.2 Troubleshooting

| Fault identification | | | | | | | Cause | Remedy |
|---|---|---|---|---|---|---|---|---|
| 1 | – | – | – | – | – | – | Pump suction line closed | |
| | | | | | | | | ⟶ Check the shut-off devices. If required, open. |
| 1 | 2 | 3 | – | 5 | – | – | Parts soiled (filter, suction line, suction valve, strainer) | |
| | | | | | | | | ⟶ Clean parts. |
| 1 | 2 | 3 | – | 5 | – | – | Suction head too high | |
| | | | | | | | | ⟶ Reduce the level difference.<br>-or-<br>Reduce the line length.<br>-or-<br>Increase the line cross-section.<br>-or-<br>Heat up the pumped liquid.<br>-or-<br>Install a filter / strainer with a larger mesh width. Ensure that the permissible mesh width is not exceeded. |
| 1 | – | 3 | – | – | – | – | Level in the intake container too low | |
| | | | | | | | | ⟶ Fill the intake container. |
| 1 | – | – | – | – | – | – | Too little pumped liquid in the pump | |
| | | | | | | | | ⟶ Fill the pump with pumped liquid. |
| 1 | – | – | – | – | – | – | Incorrect pump direction of rotation | |
| | | | | | | | | ⟶ Swop the two electrical connection phases Connection, Page 16. |
| – | – | – | 4 | – | – | – | Differential pressure too high | |
| | | | | | | | | ⟶ Reduce the differential pressure. |
| 1 | – | 3 | 4 | 5 | – | – | Viscosity of the pumped liquid too high | |
| | | | | | | | | ⟶ Increase the temperature of the pumped liquid.<br>-or-<br>Decrease the speed. |
| – | 2 | – | – | – | – | – | Viscosity of the pumped liquid too low | |
| | | | | | | | | ⟶ Reduce the temperature of the pumped liquid.<br>-or-<br>Increase the speed. |
| – | 2 | 3 | – | 5 | – | – | Airlock/gas in the pumped liquid | |
| | | | | | | | | 1. ⟶ Test the pipe system for air admission, replace leaking parts.<br>2. ⟶ Reduce the suction head.<br>-or-<br>Increase the inlet pressure. |
| – | 2 | – | 4 | – | – | – | Speed/frequency/voltage of the motor false | |
| | | | | | | | | 1. ⟶ Ensure that the motor frequency and voltage match the operating voltage.<br>2. ⟶ Ensure that the speed of the motor matches the rating plate of the pump. If necessary adjust the speed. |
| – | 2 | – | – | – | – | – | Advanced wear of the housing/screw set | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| – | – | – | – | – | – | 7 | Advanced wear of sealing surfaces | |
| | | | | | | | | ⟶ Replace the seal and check the pumped liquid for abrasive substances. If required, replace the filter/strainer.<br>-or-<br>Contact the manufacturer. |
| – | – | 3 | – | – | – | – | Coupling aligned incorrectly | |
| | | | | | | | | ⟶ Assemble the coupling and motor correctly Connection, Page 16 |
| – | – | 3 | – | – | – | – | Pump subject to mechanical stress | |
| | | | | | | | | ⟶ Connect the pump correctly to the pipe system Connection, Page 16. |

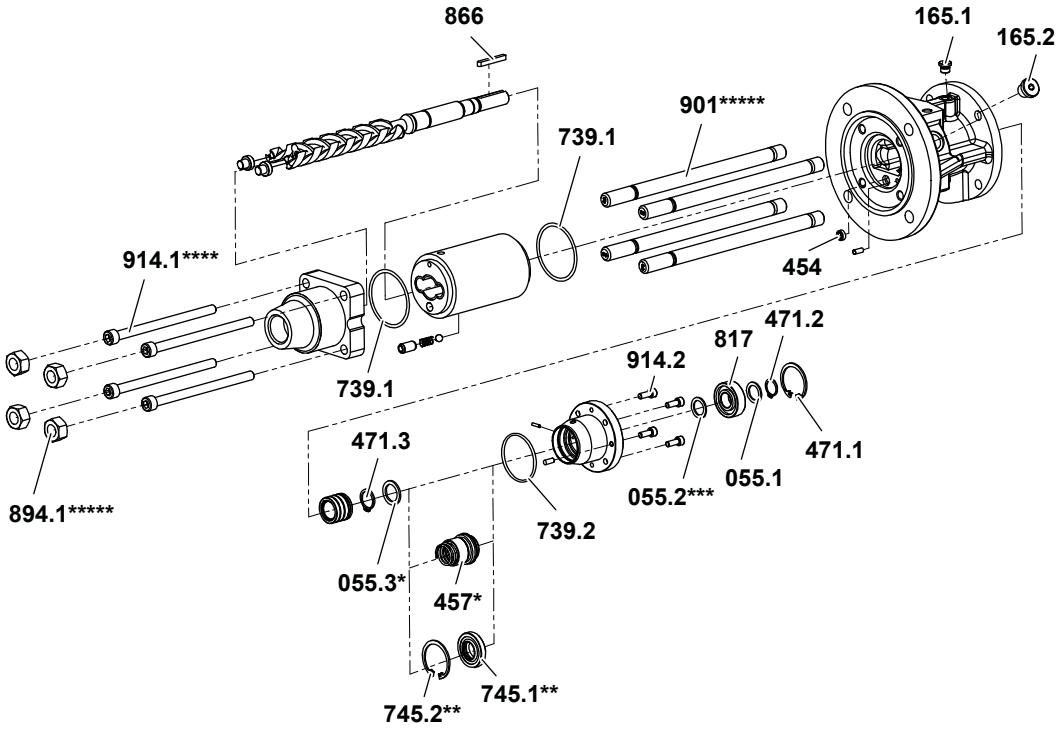
| Fault identification | | | | | | | Cause | Remedy |
|---|---|---|---|---|---|---|---|---|
| – | – | 3 | – | – | – | – | Vibrations/pulsations in the system | |
| | | | | | | | | ⟶ Bear the pump unit elastically.<br>-or-<br>Make the connections with hoses. |
| – | – | 3 | – | – | – | – | Flow speed in the pressure line or suction line too high | |
| | | | | | | | | ⟶ Set the flow speed in the pressure line so that it does not exceed 3 m/s.<br>-or-<br>Set the flow speed in the suction line so that it does not exceed 1 m/s.<br>-or-<br>Contact the manufacturer. |
| – | – | 3 | 4 | – | – | 7 | Ball bearing damaged | |
| | | | | | | | | ⟶ Replace the ball bearing Servicing, Page 26. |
| – | 2 | 3 | 4 | – | – | 7 | Superficial damage to pump parts coming into contact with the liquid | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| – | – | – | – | – | – | 7 | Shaft seal damaged through dry running | |
| | | | | | | | | ⟶ Replace the shaft seal Servicing, Page 26. |
| – | – | – | – | – | – | 7 | Inlet pressure too high | |
| | | | | | | | | 1. ⟶ Reduce the inlet pressure at the system side.<br>2. ⟶ Replace the shaft seal Servicing, Page 26. |
| – | – | – | – | – | – | 7 | Inlet pressure too low | |
| | | | | | | | | ⟶ Install a non-return valve at the pressure side. |
| – | – | – | – | – | – | 7 | Shaft seal is overloaded through thermal/chemical influences | |
| | | | | | | | | 1. ⟶ Check the maximum operating temperature.<br>2. ⟶ Check the suitability and resistance of the elastomers with regard to the pumped liquid.<br>-or-<br>Contact the manufacturer. |
| – | – | – | – | – | – | 7 | Overload of the shaft seal by pressure build-up during the heating process | |
| | | | | | | | | ⟶ Open the pressure-side/suction-side shut-off device in order to avoid a pressure build-up through heat expansion of the pumped liquid. |
| 1 | 2 | 3 | 4 | 5 | – | – | Cold start when delivering high-viscosity liquids | |
| | | | | | | | | ⟶ Install the heating system. |
| – | – | – | 4 | – | – | 7 | Foreign bodies in the pump | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| – | – | 3 | – | – | 6 | – | Differential pressure is too high and has overloaded the idle screws | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| – | – | 3 | – | – | 6 | – | Viscosity is too low and has overloaded the idle screws | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| 1 | 2 | 3 | 4 | – | – | 7 | Pump damaged through dry running | |
| | | | | | | | | ⟶ Contact the manufacturer. |
| 1 | – | – | – | – | – | – | Pump does not vent | |
| | | | | | | | | ⟶ Vent the pressure line at the highest point. |

*Tab. 12: Fault table*

# 15 Spare parts

## 15.1 Maintenance kit W

**Note** The maintenance kit contains only the numbered parts and is only supplied complete.
**W 15 - 118**

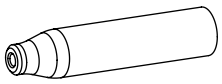
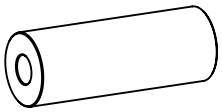



| Qty. | Item No. | Part | Qty. | Item No. | Part |
|---|---|---|---|---|---|
| 1 | **055.1** | Supporting ring | 2 | **739.1** | O-ring |
| 1 | **055.2*** ** | Supporting ring | 1 | **739.2** | O-ring |
| 1 | **055.3*** | Supporting ring | 1 | **745.1**** | Radial shaft seal ring |
| 1 | **165.1** | Screw plug | 1 | **745.2**** | Circlip |
| 1 | **165.2** | Screw plug | 1 | **817** | Ball bearing |
| 1 | **454** | Edge sealing ring | 1 | **866** | Feather key |
| 1 | **457*** | Mechanical seal | 4 | **894.1***** | Hexagon nut |
| 1 | **471.1** | Circlip | 4 | **901***** | Stud screw |
| 1 | **471.2** | Circlip | 4 | **914.1**** | Socket screw |
| 1 | **471.3** | Circlip | 4 | **914.2** | Socket screw |
| | | | | | |
| | * | Only for mechanical seal | | | |
| | ** | For radial shaft seal only | | | |
| | *** | For size 15 – 20 and 55 – 180 only | | | |
| | **** | For size 15 – 42 only | | | |
| | ***** | For size 55 – 118 only | | | |

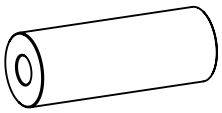
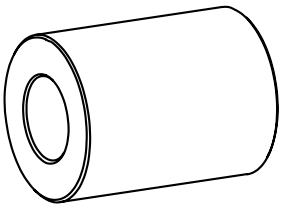
*Tab. 13: Maintenance kit W*

## 15.2 Tool sets

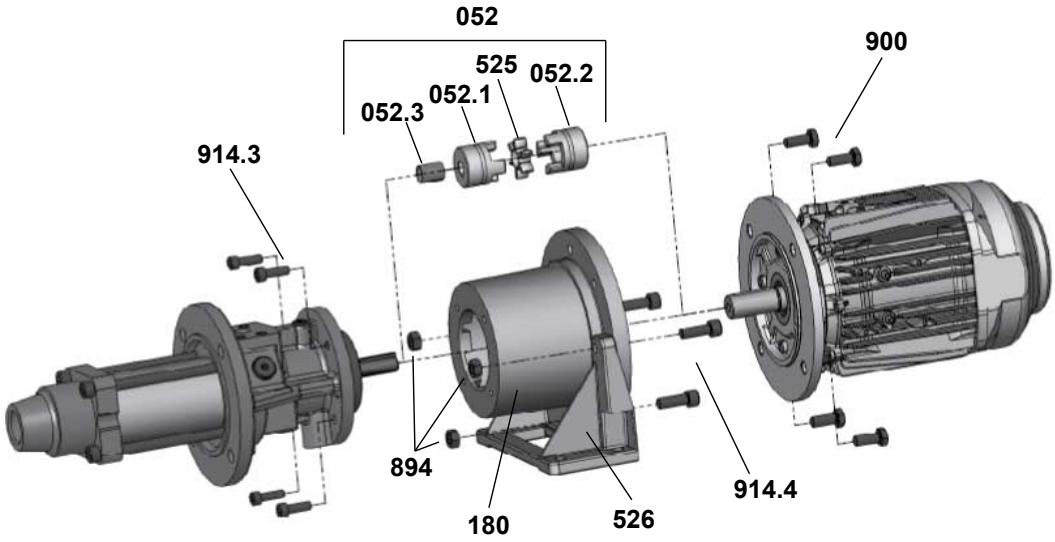
### 15.2.1 Mechanical seal L and W tool set

| | | Qty. | Part |
|---|---|---|---|
| C |  | 1 | Stationary seal ring mounting arbour |
| A |  | 1 | Mounting sleeve main screw |
| B |  | 1 | Ball bearing mounting sleeve |

### 15.2.2 Radial shaft seal L and W tool set

| | | Qty. | Part |
|---|---|---|---|
| D |  | 1 | Radial shaft seal ring mounting arbor |
| A |  | 1 | Mounting sleeve main screw |
| B |  | 1 | Ball bearing mounting sleeve |
| E |  | 1 | Positioning sleeve |

## 15.3 Completion




| Qty. | Item No. | Part | Qty. | Item No. | Part |
|---|---|---|---|---|---|
| 1 | **052** | Coupling | 4 | **900** | Hexagon screw |
| 1 | **180** | Pump bracket | 4 | **914.3** | Socket screw |
| 1 | **526** | Pump bracket foot | 3 | **914.4** | Socket screw |
| 3 | **894** | Hexagon nut | | | |

*Tab. 14: Completion*

# 16 Appendix

## 16.1 Tightening torques for screws with metric screw threads with and without wedge lock washers

**Note** In the case of galvanised screw plugs and screw plugs made of stainless steel the inner thread and outer thread have to be greased thorough before mounting in order to prevent threads from seizing.

**Note** The manufacturer recommends tightening screws with wedge lock washers according to the table three times after another with the same tightening torque

| Tightening torque [Nm] | | | | | | | |
|---|---|---|---|---|---|---|---|
| Screws with head contact surface | | | | | | | Countersunk screws |
| | | | | | Stainless steel screws A2 and A4 | | |
| Thread | 5.6 | 8.8 | 10.9 | 8.8+ Alu* | Property class 70 | Property class 80 | 8.8 |
| M 3 | 0.6 | 1.5 | – | 1.2 | 1.1 | 1.3 | 1.0 |
| M 4 | 1.4 | 3.0 | 4.1 | 2.3 | 2.0 | 2.3 | 2.0 |
| M 5 | 2.7 | 6.0 | 8.0 | 4.8 | 3.9 | 4.7 | 5.0 |
| M 6 | 4.7 | 10.3 | 14.0 | 7.6 | 6.9 | 8.0 | 9.0 |
| M 8 | 11.3 | 25.0 | 34.0 | 18.4 | 17.0 | 22.0 | 14.0 |
| M 10 | 23.0 | 47.0 | 68.0 | 36.8 | 33.0 | 43.0 | 36.0 |
| M 12 | 39.0 | 84.0 | 117 | 64.0 | 56.0 | 75.0 | 60.0 |
| M 14 | 62.0 | 133 | 186 | 101 | 89.0 | – | 90.0 |
| M 16 | 96.0 | 204 | 285 | 155 | 136 | 180 | 100 |
| M 18 | 133 | 284 | 390 | 224 | 191 | – | – |
| M 20 | 187 | 399 | 558 | 313 | 267 | 370 | 135 |
| M 24 | 322 | 687 | 960 | 540 | 460 | 605 | 360 |

*Tab. 15: Tightening torques metric screw thread*

*When screwing into aluminium, the tightening torque reduces by 20 % when the screw-in depth is less than double the thread diameter.

## 16.2 Tightening torques for screw plugs with thread measured in inches and elastomer seal

**Note** In the case of galvanised screw plugs and screw plugs made of stainless steel the inner thread and outer thread have to be greased thorough before mounting in order to prevent threads from seizing.

| Tightening torque [Nm] | |
|---|---|
| Thread | Galvanized + stainless steel |
| G 1/8" | 13.0 |
| G 1/4" | 30.0 |
| G 3/8" | 60.0 |
| G 1/2" | 80.0 |
| G 3/4" | 120 |
| G 1" | 200 |
| G 1 1/4" | 400 |
| G 1 1/2" | 450 |

*Tab. 16: Tightening torques with thread measured in inches*

## 16.3 Contents of the Declaration of Conformity

The products described in these instructions are machinery in the sense of the Directive 2006/42/EC. The original of the EC Declaration of Conformity is enclosed with the machinery at delivery.

The machinery fulfils all the relevant provisions of the following directives:

| Number | Name | Remark |
|---|---|---|
| 2006/42/EC | Machinery Directive | – |
| 2014/68/EU | Pressure Equipment Directive | – |
| 2014/30/EU | Directive on Electromagnetic Compatibility | Only for machinery with electrical components |
| 2014/35/EU | Low Voltage Directive | Only for machinery with electrical components |
| 2014/34/EU | Directive on Use in Potentially Explosive Areas (ATEX) | Only for machinery in ATEX version |

*Tab. 17: Directives observed*

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