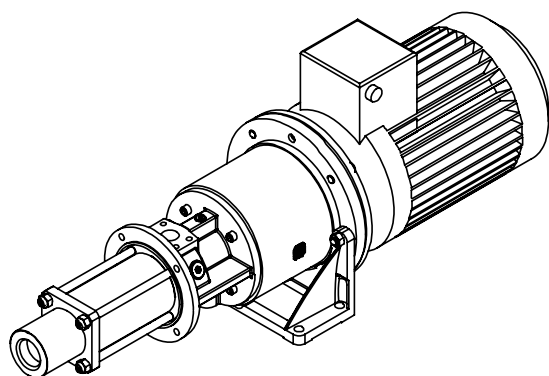
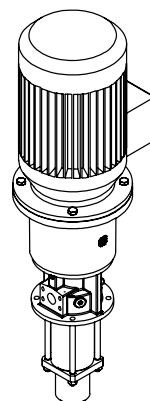




## Operation instructions

# KRAL



## KRAL screw pumps.

Series W

Mechanical seal/radial shaft seal

OIW 01en-GB  
Edition 2021-05  
Original instructions

<b>1 About this document</b>	<b>3</b>	10.2 Commissioning	17
1.1 General information	3	10.2.1 Cleaning the pipe system	17
1.2 Associated documents	3	10.2.2 Filling and venting the pump	18
1.3 Target groups	3	10.2.3 Checking the direction of rotation	19
1.4 Symbols	3	10.2.4 Commissioning the pump	20
1.4.1 Danger levels	3	10.3 During operation	21
1.4.2 Danger signs	4	10.3.1 Checking the operating pressure	21
1.4.3 Symbols in this document	4	10.3.2 Monitoring the filter and/or strainer	21
<b>2 Safety</b>	<b>4</b>	10.3.3 Switching off the pump unit	21
2.1 Proper use	4	10.4 Decommissioning	22
2.2 Foreseeable misuse	4	10.4.1 Decommissioning the pump	22
2.3 Obligations of the operator-owner	5	10.5 Recommissioning	23
2.4 Safety instructions	5	10.5.1 Recommissioning the pump	23
2.4.1 Fundamental safety instructions	5	<b>11 Maintenance</b>	<b>23</b>
<b>3 Identification</b>	<b>5</b>	11.1 Dangers during maintenance	23
3.1 Type code	5	11.2 Required maintenance	23
3.2 Rating plate	6	11.3 Ball bearing	23
<b>4 Technical data</b>	<b>6</b>	11.4 Maintaining the pump	23
4.1 Operating limits	6	11.5 Cleaning the connection leakage	24
4.2 Required NPSH values	7	<b>12 Servicing</b>	<b>24</b>
4.3 Sound pressure level	7	12.1 Dangers during servicing	24
4.4 Weights	7	12.2 Wear	24
<b>5 Function description</b>	<b>7</b>	12.2.1 Signs of wear	24
5.1 Pump structure	7	12.2.2 Shaft seal	25
5.2 Pump unit structure	8	12.3 Replacing the coupling	25
5.3 Functional principle	8	12.3.1 Removing the coupling	25
5.4 Shaft seal	8	12.3.2 Installing the coupling	26
5.5 Back pressure valve	9	12.4 Replacing the mechanical seal and ball bearing	27
<b>6 Transportation, storage</b>	<b>9</b>	12.4.1 Removing the mechanical seal and ball bearing	27
6.1 Dangers during transportation	9	12.4.2 Installing the mechanical seal and ball bearing	28
6.2 Dangers during storage	9	12.5 Replacing the radial shaft seal	29
6.3 Unpacking and checking the state of delivery	9	12.5.1 Removing the radial shaft seal	29
6.4 Transporting the pump/pump unit	9	12.5.2 Installing the radial shaft seal	30
6.5 Storing the pump	10	12.6 Replacing the screw set	31
<b>7 Preservation</b>	<b>11</b>	12.6.1 Removing the screw set	31
7.1 Preservation table	11	12.6.2 Installing the screw set	32
7.2 Preserving the inner surfaces	11	<b>13 Disposal</b>	<b>33</b>
7.3 Preserving the outer surfaces	11	13.1 Dismantling and disposing of the pump	33
7.4 Removing the preservation	12	<b>14 Troubleshooting</b>	<b>33</b>
<b>8 Installation, removal</b>	<b>12</b>	14.1 Possible faults	33
8.1 Dangers during installation	12	14.2 Troubleshooting	33
8.2 Dangers during removing	12	<b>15 Spare parts</b>	<b>36</b>
8.3 Installing the pump	12	15.1 Maintenance kit	36
8.4 Removing the pump	14	15.2 Tool sets	37
<b>9 Connection</b>	<b>15</b>	15.2.1 Tool set, mechanical seal	37
9.1 Dangers during connection work	15	15.2.2 Tool set, radial shaft seal	37
9.2 Connecting the pump to the pipe system	15	15.3 Completion	38
9.3 Insulating the pump	16	<b>16 Appendix</b>	<b>38</b>
9.4 Assembling the pump and motor	16	16.1 Tightening torques for screws with metric screw threads with and without wedge lock washers	38
9.5 Connecting the pump unit to the power supply	17	16.2 Tightening torques for screw plugs with thread measured in inches and elastomer seal	39
<b>10 Operation</b>	<b>17</b>	16.3 Contents of the Declaration of Conformity	39
10.1 Dangers during operation	17		

## 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

### 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







## 2 Safety

### 2.1 Proper use

#### 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

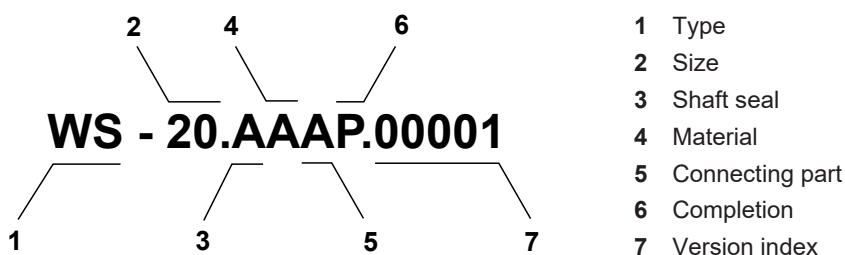


Fig. 1: Type code

Item	Classification	Description
1	Type	WS Pump with free shaft end/pump unit with SAE flange 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 Screw housing GJS Tenifer, standard screws
		B Screw housing plastic-coated, standard screws

## 4 Technical data

### 3.2 Rating plate

Item	Classification	Description
5	Connecting part suction side	A Pipe thread connection axial
		B Pipe thread connection radial
		C Pipe thread connection axial 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 engine mount
7	Version index	For internal administration

Tab. 2: Type code

### 3.2 Rating plate

6	<b>KRAL</b>	CE
5	Art.-Nr.   Item no.	7
4	Typ   Type	Δp bar
3	SN   Serial no.	Q l/min
2	Tmin. / Tmax. °C	n min <sup>-1</sup>
1	pS max. / pD max. bar	v mm <sup>2</sup> /s
	Jahr   Year	Gewicht   Weight kg
	KRAL GmbH, 6890 Lustenau, Austria <a href="http://www.kral.at">www.kral.at</a>	

Fig. 2: Rating plate

- 1 Construction year
- 2 Max. operating overpressure suction-side/Max. operating overpressure 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
<b>Max. operating overpressure</b>	[bar]	120				
<b>Max. temperature</b>						
Screw housing GJS						
<input type="checkbox"/> Standard mechanical seal	[°C]	150				
<input type="checkbox"/> Mechanical seal of hard material	[°C]	180				
<input type="checkbox"/> Standard radial shaft seal	[°C]	80				
<input type="checkbox"/> High-temperature radial shaft seal	[°C]	150				
<input type="checkbox"/> Magnetic coupling	[°C]	250				
<b>Max. temperature</b>	[°C]	60				
Screw housing plastic-coated						
<b>Min. temperature</b>	[°C]	-10				
Pump materials						
<b>Min. – max. viscosity</b>	[mm <sup>2</sup> /s]	1 – 10000				
<b>Speed max.</b>						
<input type="checkbox"/> At 50 Hz	[min <sup>-1</sup> ]	2900				
<input type="checkbox"/> At 60 Hz	[min <sup>-1</sup> ]	3600				

Parameter		Unit	Size					
			15 – 20	32 – 42	55 – 85	105 – 118	160 – 210	235 – 275
Max. inlet pressure								
<input type="checkbox"/>	Mechanical seal	[bar]	6					
<input type="checkbox"/>	Radial shaft seal	[bar]	2					
<input type="checkbox"/>	Magnetic coupling	[bar]	6					

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](http://www.kral.at/en/screw-pumps)

#### 4.3 Sound pressure level

Guide values at 1 m distance, 1450 min<sup>-1</sup>, 10 bar

	Size					
	15 – 20	32 – 42	55 – 85	105 – 118	180 – 210	235 – 275
<b>Max. sound pressure level ±3 [dB(A)]</b>						
Pump (at 2900 min <sup>-1</sup> )	56	59	63	65	69	71
Motor						
<input type="checkbox"/> At 40 bar	62	68	74	74	72	78
<input type="checkbox"/> At 80 bar	68	74	72	72	73	74
Pump unit						
<input type="checkbox"/> At 40 bar	63	69	75	75	74	79
<input type="checkbox"/> 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

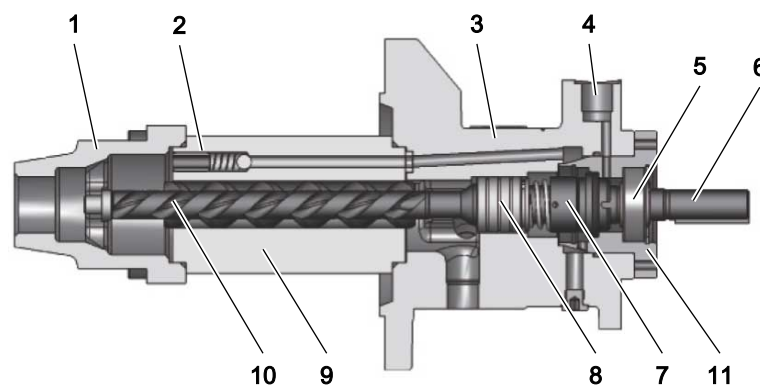


Fig. 3: Pump structure

1	Suction cover	7	Shaft seal
2	Back pressure valve	8	Balancing cylinder
3	Pressure housing	9	Pump housing
4	Connection leakage	10	Idle screw
5	Ball bearing	11	Seal housing
6	Main screw		

5 Function description

5.2 Pump unit structure

5.2 Pump unit structure

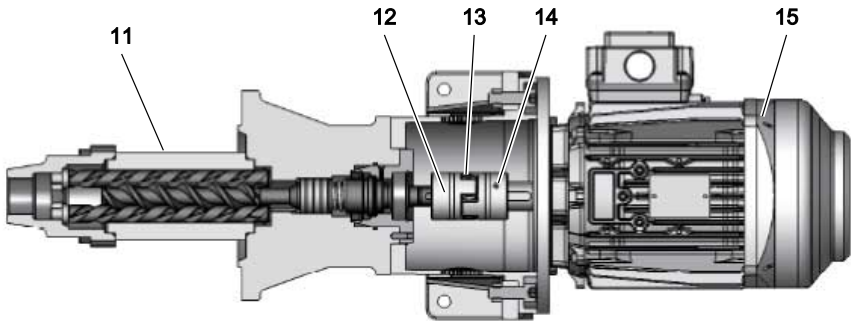


Fig. 4: Pump unit structure

- |    |                            |    |                          |
|----|----------------------------|----|--------------------------|
| 11 | Pump                       | 14 | Motor-side coupling half |
| 12 | Pump-side coupling half    | 15 | Motor                    |
| 13 | Coupling intermediate ring |    |                          |

5.3 Functional principle

Screw pumps are rotating displacement pumps. Their displacement effect results from three rotating screws **6** and **10** and the enclosing pump housing **9**.

Radial support of the screw set is effected 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 tolerances pumping of suspended solids is not possible.

Axial support of the main screws is effected out by a lifetime-lubricated ball bearing **5**. Various shaft seals **7** 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 **8** is mounted at the main screw.

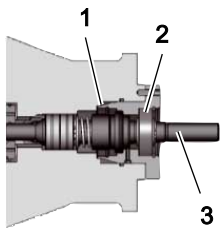
The default direction of the rotation of the screw set is clockwise viewed from the motor **15** and is marked on the pump by an arrow.

5.4 Shaft seal

The following types of shaft seals are used

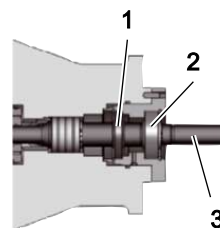
- ☐ Mechanical seal, standard or hard material
- ☐ Radial shaft seal, standard or high-temperature

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 Back pressure valve

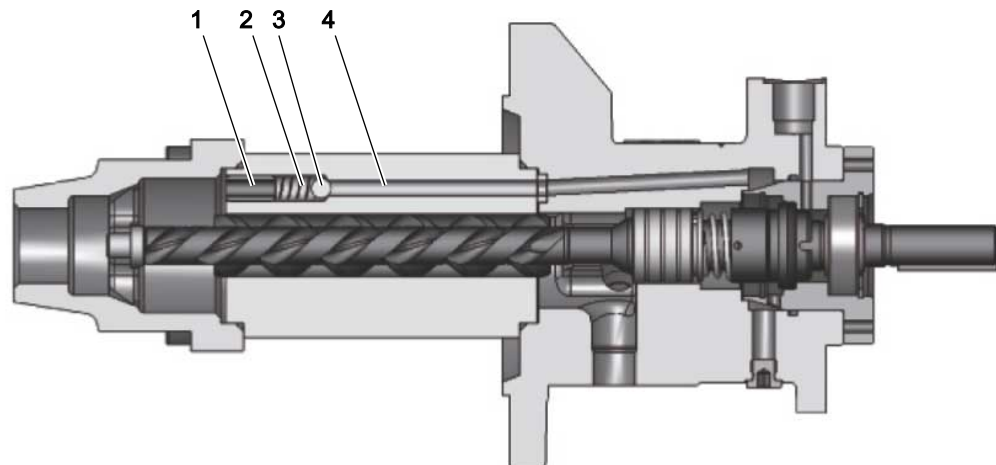


Fig. 5: Installation position of back pressure valve

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

To ensure the proper functioning of mechanical seals, they must be constantly lubricated by the pumped liquid. This also requires greater pressure on the liquid-filled inside of the seal than in the atmosphere. To ensure this even when the pump is installed above the liquid level, a spring-loaded back pressure valve is mounted 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:	<input type="checkbox"/> 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:	<input type="checkbox"/> Transport personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective helmet <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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 tipping.
- ▶ Do not stand under raised loads.

#### **ATTENTION**

##### **Damage to equipment through improper transportation.**

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

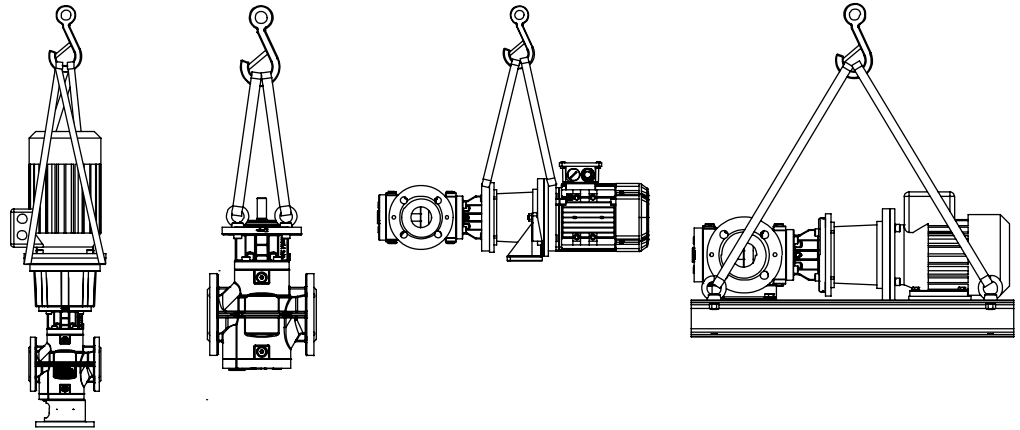


Fig. 6: Fastening of hoisting equipment - principle diagrams

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:	<input type="checkbox"/> Transport personnel
Aids:	<input type="checkbox"/> 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 11.

## 7 Preservation

### 7.1 Preservation table

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

Type of delivery	Condition
Standard delivery	<input type="checkbox"/> Storage time exceeding six weeks <input type="checkbox"/> Unfavourable storage conditions such as high humidity, salty air, etc.
Delivery with long-term preservation	<input type="checkbox"/> Opened or damaged packaging

Tab. 6: Conditions for additional preservation

### 7.2 Preserving the inner surfaces

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Calcium complex grease (for example TEVI-ER® GREASE WAVE 100 with adhesive additive) <input type="checkbox"/> Castrol Rustilo DWX 33 or other preservative offering comparable protection

1. ▶ Brush calcium complex grease corrosion protection (for example TEVIER® FETT WAVE 100 with adhesive additive) to the mounting surfaces.
2. ▶ Brush or spray preservative (for example Castrol Rustilo DWX 33) onto the process connections and remaining plain and unpainted parts.
3. ▶ At intervals of about six months check the preservation and if necessary repeat.

## 8 Installation, removal

### 7.4 Removing the preservation

#### 7.4 Removing the preservation

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvent <input type="checkbox"/> Collection tank <input type="checkbox"/> 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 38.
- ☐ 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 installation position. Operation in horizontal positioning requires that the pressure connection of the pump is oriented upward. The pumps can be supplied for dry well and wet well installation. A mounting flange is provided for vertical wet well installation.

**Notice** 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:	<input type="checkbox"/> Transport personnel <input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective helmet <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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**

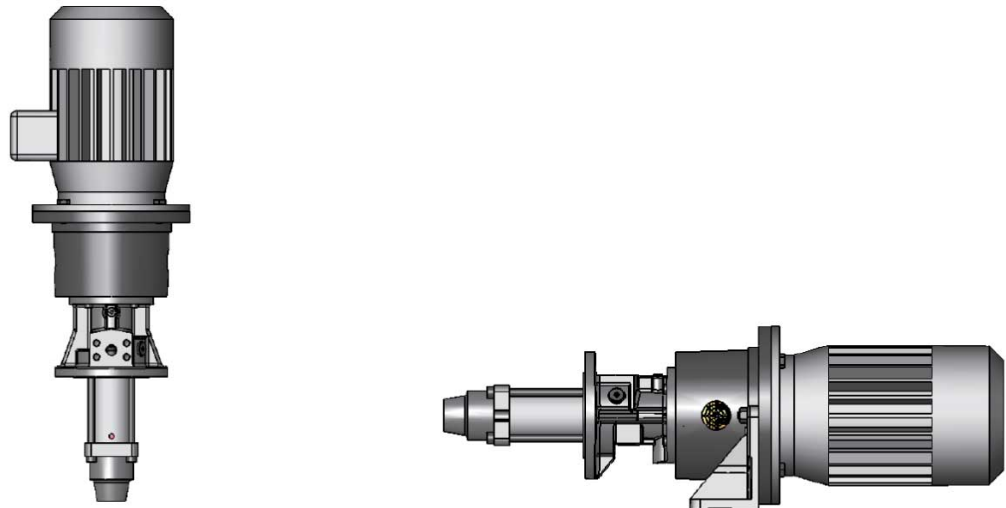
#### **Damage to motor through discharging pumped liquid.**

- ▶ 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 connections protected against soiling, for example by using the protective cover mounted in the factory
  - ✓ If required, hoisting equipment prepared
1. ➤ Bring the pump in the installation position, while taking the position of the motor and the pressure connection into account.
  2. ➤ Fasten the pump with fastening elements securely on the underground.

#### 8.4 Removing the pump

Personnel qualification:	<input type="checkbox"/> Transport personnel <input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective helmet <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Mobile crane, forklift, hoisting equipment <input type="checkbox"/> 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 9.

## 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 38.
- ☐ 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:	<input type="checkbox"/> Transport personnel <input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Protective helmet <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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.

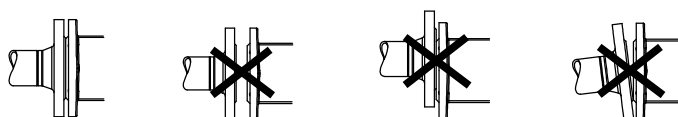


Fig. 8: Connection to pipe system

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 33.
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 38.

#### 9.3 Insulating the pump

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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 insulate all potentially hot surfaces of the pump and the connected piping carefully or equip them with suitable contact protection.

#### 9.4 Assembling the pump and motor

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> 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.

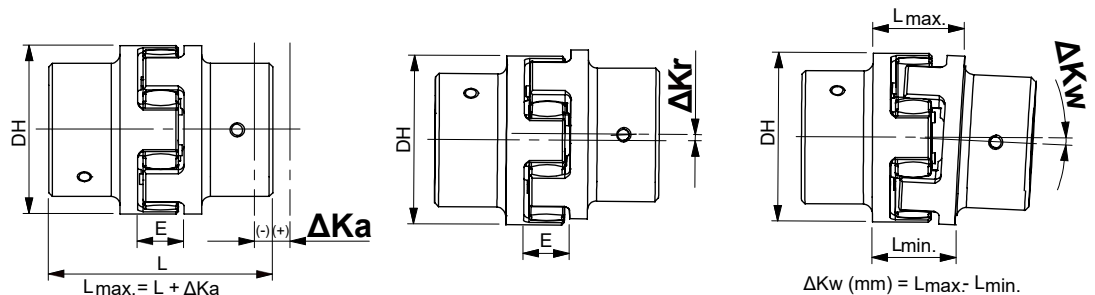


Fig. 9: Coupling alignment measuring points

Outer diameter DH [mm]	Coupling distance E [mm]	Max. axial displacement ΔKa [mm]	Max. radial displacement ΔKr [mm]	Max. angular displacement ΔKw [°]	
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  $\Delta K_r$  of the coupling using a hairline gauge and feeler gauge. Check several points along the periphery of the coupling.
2. ➤ Check the angular displacement  $\Delta K_w$  of the coupling using a hairline gauge.
3. ➤ Check the axial displacement  $\Delta K_a$  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:	<input type="checkbox"/> Electrician
Aids:	<input type="checkbox"/> Operating instructions of the motor <input type="checkbox"/> 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

**Notice** 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

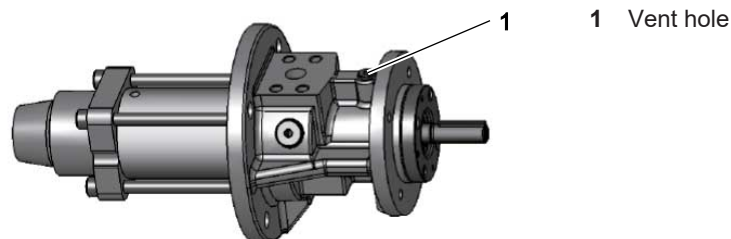


### **! DANGER**

#### 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. ▶ 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 suction connection: Turn the fan pump shaft in the direction of rotation of the motor.  
 Filling via pressure connection: Turn the pump shaft against the direction of rotation of the motor.
4. ▶ Retighten the screw plug of the vent hole **1**.

### Filling the pump via the bypass connection

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

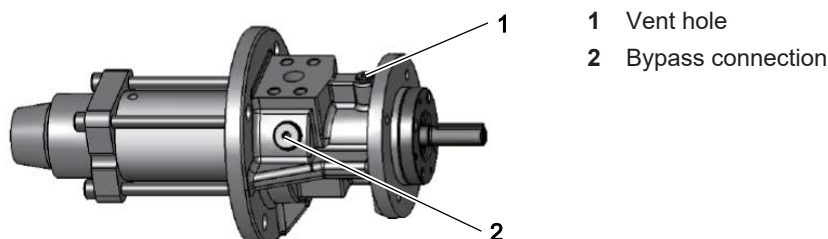


### **! DANGER**

#### **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. ➤ 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 the bypass connection **2** and fill the pump via the bypass connection until the pumped liquid is emitted at the bypass connection.
3. ➤ During the filling process turn the pump shaft or fan impeller of the motor by hand to speed up the filling process:
4. ➤ Retighten the screw plug of the bypass connection **2**.
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.

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

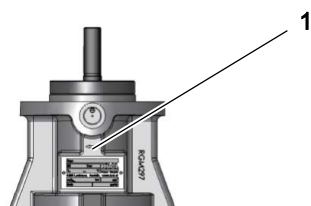
Personnel qualification:	<input type="checkbox"/> Fitter
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### **ATTENTION**

#### **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:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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: Before commissioning, ensure that a 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 15
- ✓ 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 filled with pumped liquid
- ✓ Shut-off devices in the suction line and pressure line opened

1. ➤ 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.
2. ➤ If the pump does not deliver after 10 – 15 seconds of operation, abort commissioning. Eliminate the cause of the fault and only then continue with commissioning. Take the information from the fault table into account ➤ Troubleshooting, Page 33.
3. ➤ 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-side pressure gauge shows no more fluctuations.

### 10.3 During operation

#### 10.3.1 Checking the operating pressure

Personnel qualification:	<input type="checkbox"/> Trained personnel
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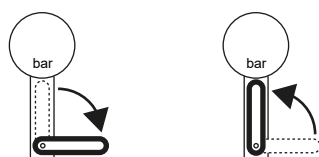


Fig. 10: Pressure gauge shut-off valves closed/open - principle diagram

#### 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

**Notice** 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:	<input type="checkbox"/> Trained personnel
--------------------------	--

1. ➤ After commissioning monitor the degree of contamination of the filter and/or strainer by means of a suction-side pressure gauge or a differential pressure indication.
2. ➤ Additionally check the filters and/or strainers at a pressure drop on the suction side. Observe the dimensioning data of the manufacturer of the filters/strainers.
3. ➤ Check the suction-side pressure every two weeks during running operation.

#### 10.3.3 Switching off the pump unit

Personnel qualification:	<input type="checkbox"/> Trained personnel
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#### 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:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> 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
<input type="checkbox"/> Shutting down the pump for a longer period	—▶ Depending on the pumped liquid
<input type="checkbox"/> Draining the pump	—▶ Close the pressure-side and suction-side shut-off devices.
<input type="checkbox"/> Dismantling the pump	—▶ Disconnect the motors from the power supply and secure against being switched back on.
<input type="checkbox"/> Storing the pump	—▶ Observe measures for storing and preservation ↪ Transportation, storage, Page 9.

Tab. 8: Measures during operation interruptions

Behaviour of the pumped liquid	Duration of the operation interruption	
	Short	Long
<input type="checkbox"/> Solids sediment	—▶ Rinse the pump.	—▶ Rinse the pump.
<input type="checkbox"/> Congealed/frozen <input type="checkbox"/> No corrosive burden	—▶ Heat or drain the pump.	—▶ Drain the pump.
<input type="checkbox"/> Congealed/frozen <input type="checkbox"/> Corrosive burden	—▶ Heat or drain the pump.	1. —▶ Drain the pump. 2. —▶ Preserve the pump.
<input type="checkbox"/> Remains liquid <input type="checkbox"/> No corrosive burden	—	—
<input type="checkbox"/> Remains liquid <input type="checkbox"/> Corrosive burden	—	1. —▶ Drain the pump. 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

→ Carry out all the steps as for the commissioning process, ↗ Commissioning, Page 17.

## 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
Pump	<input type="checkbox"/> Visual inspection <input type="checkbox"/> Acoustic inspection	4 weeks
Leakage vent hole	<input type="checkbox"/> Visual inspection <input type="checkbox"/> If required, clean	4 weeks
Filter/strainer (system side)	<input type="checkbox"/> Check of the suction-side pressure	2 weeks
Overflow valve	<input type="checkbox"/> Function test	≤ 5 years

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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots <input type="checkbox"/> 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 24.

## 12 Servicing

### 11.5 Cleaning the connection leakage

#### 11.5 Cleaning the connection leakage

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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

1. ➤ If a leakage vent line is connected, unscrew the leakage vent line.
2. ➤ To check the clearance of the leakage connection, insert a flexible soft arbour into the leakage connection.
3. ➤ If the clearance is insufficient, clean the leakage connection and, if existing, the leakage vent line.
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 38.
- ☐ 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Extractor



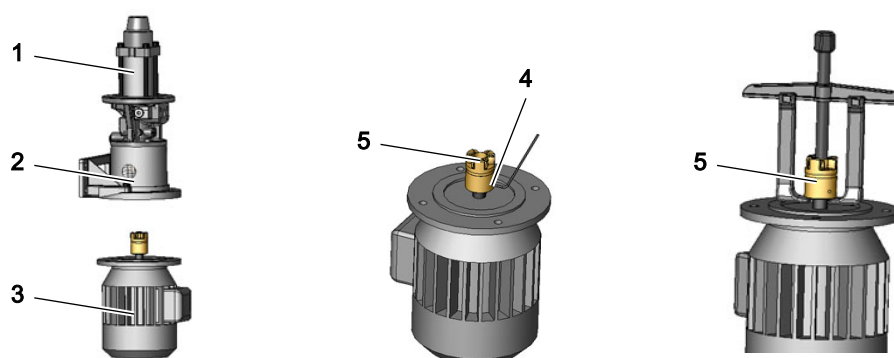
#### **WARNING**

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

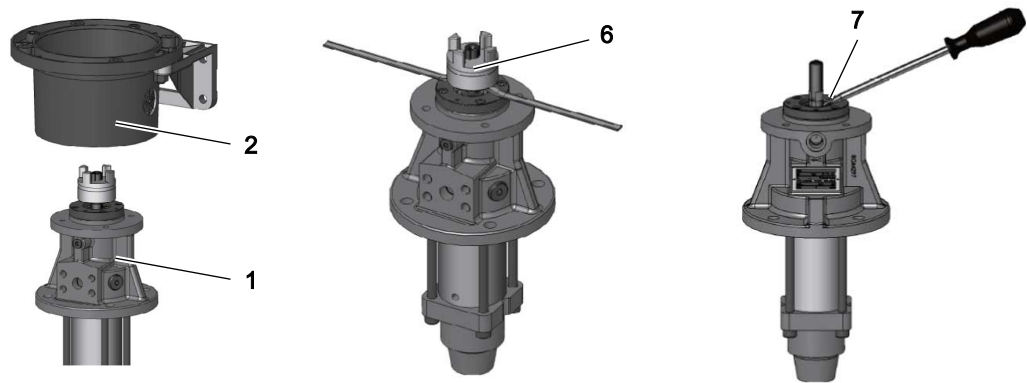
- ▶ Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ▶ Select the lift points for the hoisting equipment in accordance with the centre of gravity and the weight distribution.
- ▶ Use at least two load ropes.
- ▶ In the case of vertical transportation secure the motor against tipping.
- ▶ 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Torque wrench <input type="checkbox"/> Measuring stick <input type="checkbox"/> Silicone oil



#### **WARNING**

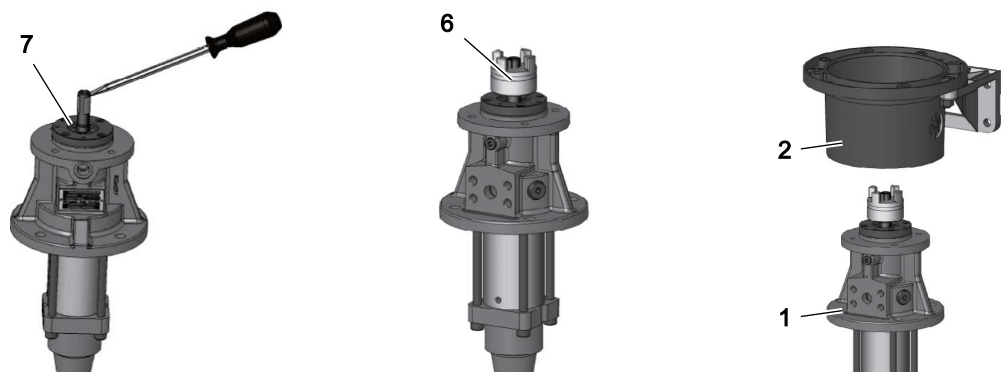
##### **Hot surface.**

Touching hot coupling halves results in burns.

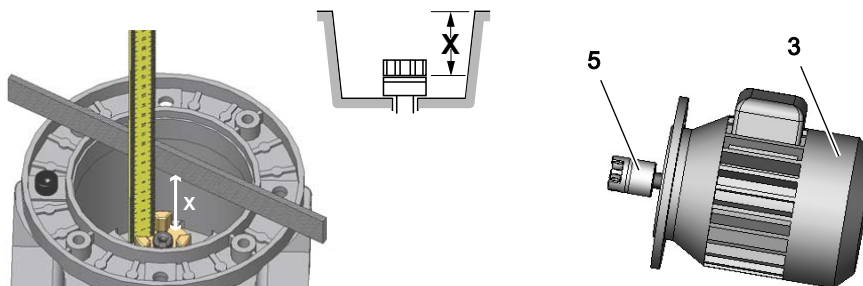
- Wear personal protective equipment during all the work. Be sure to wear protective gloves.

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

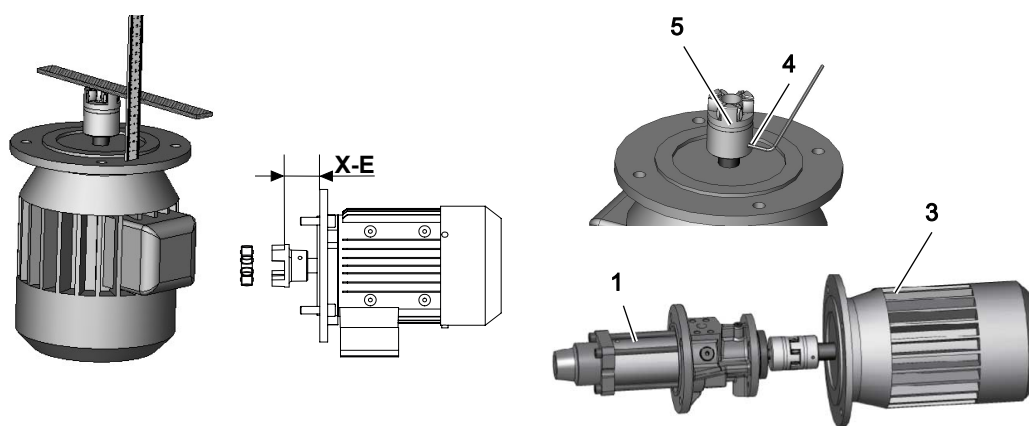
1. ➤ Oil the shaft of the pump with silicone oil.



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 15.
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**.

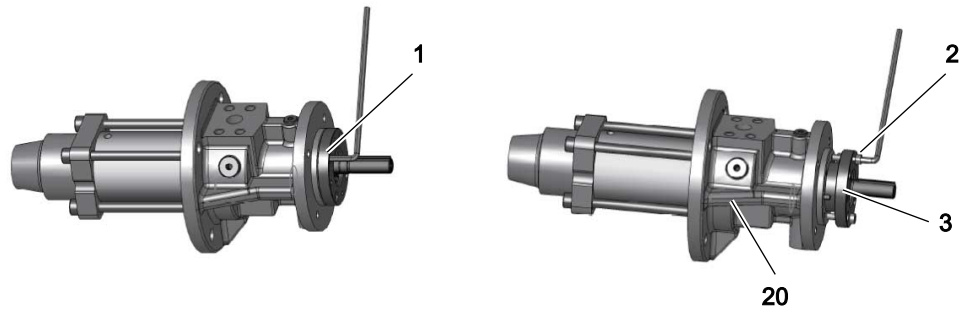
## 12.4 Replacing the mechanical seal and ball bearing

### 12.4.1 Removing the mechanical seal and ball bearing

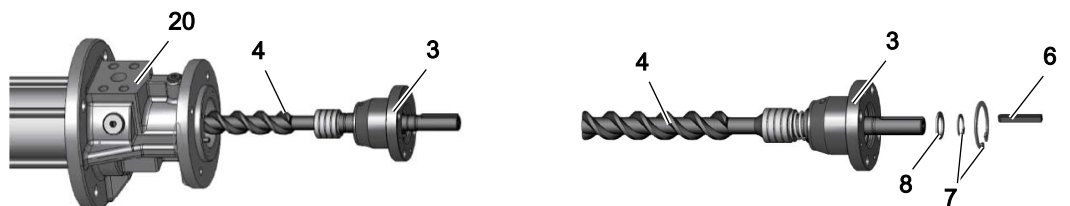
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Tool set, mechanical seal ↗ Spare parts, Page 36 <input type="checkbox"/> Extractor

#### Requirement:

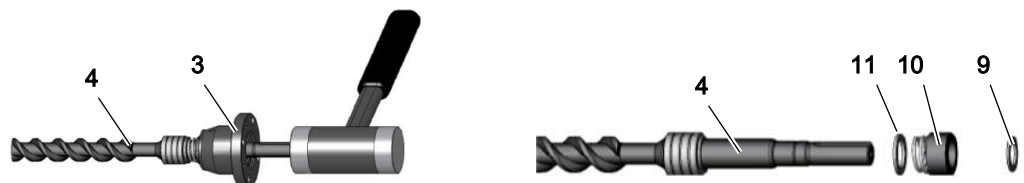
- ✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on
- ✓ Coupling removed



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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Tool set, mechanical seal ➤ Spare parts, Page 36 <input type="checkbox"/> Silicone grease <input type="checkbox"/> Torque wrench



### WARNING

#### Hot surface.

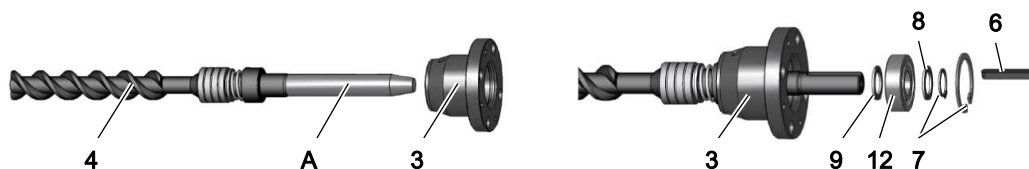
Touching hot coupling halves results in burns.

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

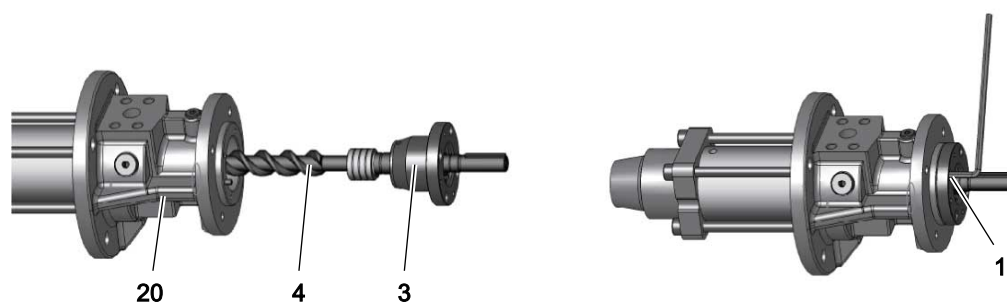
**Notice** The coupling halves can be mounted more easily if they are heated to 80 °C – 100 °C.



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

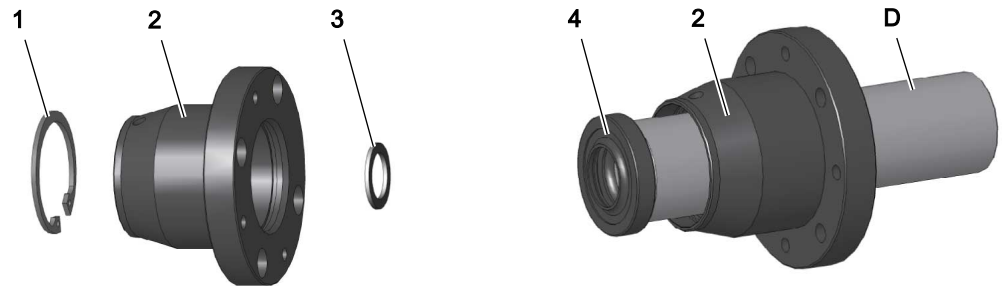
### 12.5.1 Removing the radial shaft seal

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Tool set, radial shaft seal ↗ Spare parts, Page 36

### 12.5 Replacing the radial shaft seal

Requirement:

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

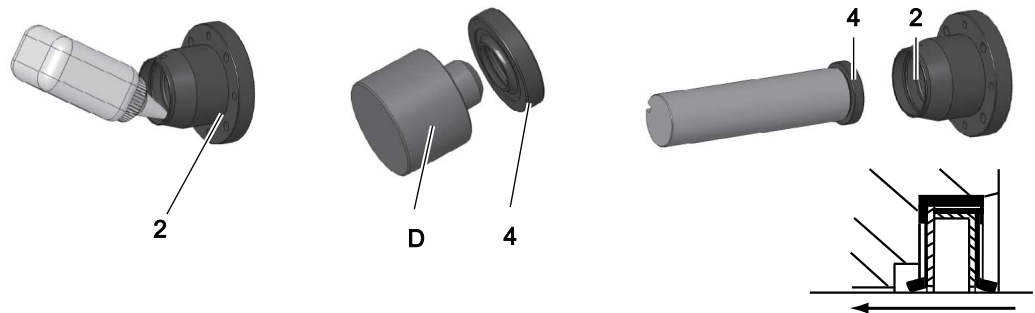


1. ➔ Remove the supporting ring 3 and circlip ring 1 out of the seal housing 2.
2. ➔ Press the radial shaft seal ring 4 using the mounting arbour D out of the seal housing 2. The seal ring is usually destroyed during dismantling.

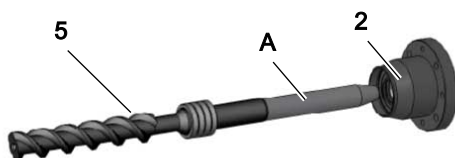
#### 12.5.2 Installing the radial shaft seal

Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Tool set, radial shaft seal ➔ Spare parts, Page 36 <input type="checkbox"/> Thread sealant (for example Loctite 572) <input type="checkbox"/> Molybdenum disulphide paste (for example Fenkart T4)

**Notice** 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 ( $\text{MoS}_2$ ).



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.

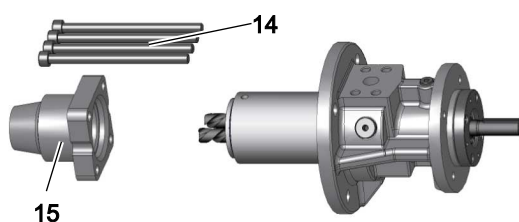
## 12.6 Replacing the screw set

### 12.6.1 Removing the screw set

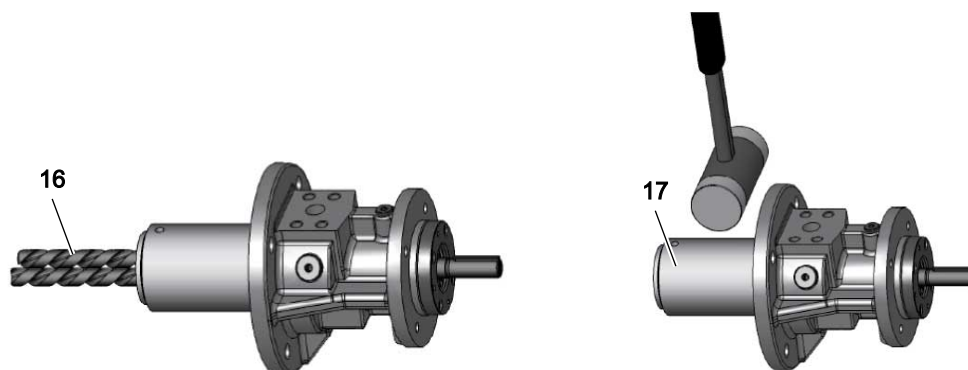
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Plastic hammer <input type="checkbox"/> Extractor

Requirement:

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



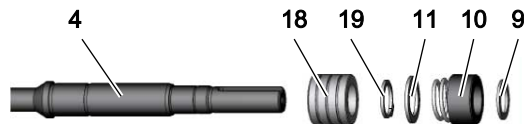
1. ➤ **Size 15 – 42 (figure):** Unscrew four socket screws 14 and remove the suction cover 15.  
**Size 55 – 118:** Remove the hexagon nuts and stud screws and take off the suction cover.



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.

## 12 Servicing

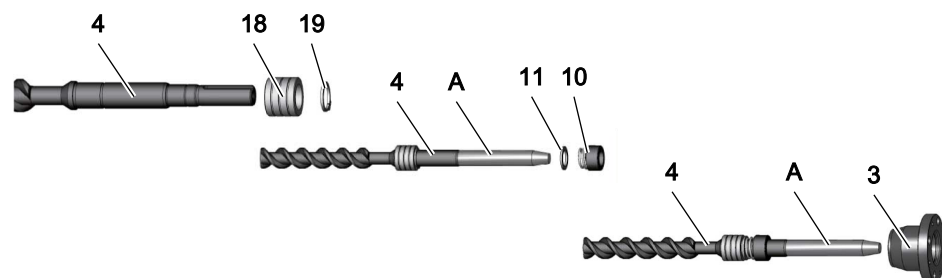
### 12.6 Replacing the screw set



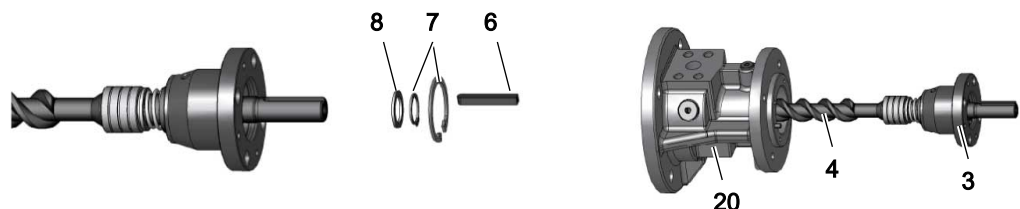
5. ➔ Remove the supporting ring 9, the parts of the mechanical seal 10, supporting ring 11, circlip 19 and balancing cylinder 18 from the main screw 4.

#### 12.6.2 Installing the screw set

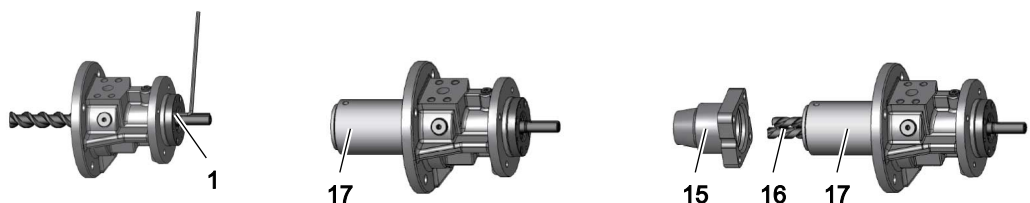
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots <input type="checkbox"/> Tool set, mechanical seal ↗ Spare parts, Page 36 <input type="checkbox"/> 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:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Solvents or industrial cleaners suitable for the pumped liquid <input type="checkbox"/> Collection tank



#### WARNING

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

- ▶ Wear personal protective clothing during all the work. Ensure face protection.
- ▶ Before disposal collect any pumped 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	
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.

## 14 Troubleshooting

### 14.2 Troubleshooting

Fault identification							Cause	Remedy
1	2	3	–	5	–	–	Suction head too high	<p>—&gt; Reduce the level difference.</p> <p>-or-</p> <p>Reduce the line length.</p> <p>-or-</p> <p>Increase the line cross-section.</p> <p>-or-</p> <p>Heat up the pumped liquid.</p> <p>-or-</p> <p>Install a filter / strainer with a larger mesh width. Ensure that the permissible mesh width is not exceeded.</p>
1	–	3	–	–	–	–	Level in the intake container too low	<p>—&gt; Fill the intake container.</p>
1	–	–	–	–	–	–	Too little pumped liquid in the pump	<p>—&gt; Fill the pump with pumped liquid.</p>
1	–	–	–	–	–	–	Incorrect pump direction of rotation	<p>—&gt; Swop the two electrical connection phases ↪ Connection, Page 15.</p>
–	–	–	4	–	–	–	Differential pressure too high	<p>—&gt; Reduce the differential pressure.</p>
1	–	3	4	5	–	–	Viscosity of the pumped liquid too high	<p>—&gt; Increase the temperature of the pumped liquid.</p> <p>-or-</p> <p>Decrease the speed.</p>
–	2	–	–	–	–	–	Viscosity of the pumped liquid too low	<p>—&gt; Reduce the temperature of the pumped liquid.</p> <p>-or-</p> <p>Increase the speed.</p>
–	2	3	–	5	–	–	Airlock/gas in the pumped liquid	<p>1. —&gt; Test the pipe system for air admission, replace leaking parts.</p> <p>2. —&gt; Reduce the suction head.</p> <p>-or-</p> <p>Increase the inlet pressure.</p>
–	2	–	4	–	–	–	Speed/frequency/voltage of the motor false	<p>1. —&gt; Ensure that the motor frequency and voltage match the operating voltage.</p> <p>2. —&gt; Ensure that the speed of the motor matches the rating plate of the pump. If necessary adjust the speed.</p>
–	2	–	–	–	–	–	Advanced wear of the housing/screw set	<p>—&gt; Contact the manufacturer.</p>
–	–	–	–	–	–	7	Advanced wear of sealing surfaces	<p>—&gt; Replace the seal and check the pumped liquid for abrasive substances. If required, replace the filter/strainer.</p> <p>-or-</p> <p>Contact the manufacturer.</p>
–	–	3	–	–	–	–	Coupling aligned incorrectly	<p>—&gt; Assemble the coupling and motor correctly ↪ Connection, Page 15</p>
–	–	3	–	–	–	–	Pump subject to mechanical stress	<p>—&gt; Connect the pump correctly to the pipe system ↪ Connection, Page 15.</p>
–	–	3	–	–	–	–	Vibrations/pulsations in the system	<p>—&gt; Bear the pump unit elastically.</p> <p>-or-</p> <p>Make the connections with hoses.</p>

Fault identification							Cause	Remedy
–	–	3	–	–	–	–	Flow speed in the pressure line or suction line too high	<div> <div>→</div> Set the flow speed in the pressure line so that it does not exceed 3 m/s.  -or-  Set the flow speed in the suction line so that it does not exceed 1 m/s.  -or-  Contact the manufacturer. </div>
–	–	3	4	–	–	7	Ball bearing damaged	<div> <div>→</div> Replace the ball bearing ↪ Servicing, Page 24. </div>
–	2	3	4	–	–	7	Superficial damage to pump parts coming into contact with the liquid	<div> <div>→</div> Contact the manufacturer. </div>
–	–	–	–	–	–	7	Shaft seal damaged through dry running	<div> <div>→</div> Replace the shaft seal ↪ Servicing, Page 24. </div>
–	–	–	–	–	–	7	Inlet pressure too high	<div> <div>1. →</div> Reduce the inlet pressure at the system side.  <div>2. →</div> Replace the shaft seal ↪ Servicing, Page 24. </div>
–	–	–	–	–	–	7	Inlet pressure too low	<div> <div>→</div> Install a non-return valve at the pressure side. </div>
–	–	–	–	–	–	7	Shaft seal is overloaded through thermal/chemical influences	<div> <div>1. →</div> Check the maximum operating temperature.  <div>2. →</div> Check the suitability and resistance of the elastomers with regard to the pumped liquid.  -or-  Contact the manufacturer. </div>
–	–	–	–	–	–	7	Overload of the shaft seal by pressure build-up during the heating process	<div> <div>→</div> Open the pressure-side/suction-side shut-off device in order to avoid a pressure build-up through heat expansion of the pumped liquid. </div>
1	2	3	4	5	–	–	Cold start when delivering high-viscosity liquids	<div> <div>→</div> Install the heating system. </div>
–	–	–	4	–	–	7	Foreign bodies in the pump	<div> <div>→</div> Contact the manufacturer. </div>
–	–	–	–	–	–	7	Differential pressure is too high and has overloaded the idle screws	<div> <div>→</div> Contact the manufacturer. </div>
–	–	–	–	–	–	7	Viscosity is too low and has overloaded the idle screws	<div> <div>→</div> Contact the manufacturer. </div>
1	2	3	4	–	–	7	Pump damaged through dry running	<div> <div>→</div> Contact the manufacturer. </div>
1	–	–	–	–	–	–	Pump does not vent	<div> <div>→</div> Vent the pressure line at the highest point. </div>

Tab. 12: Fault table

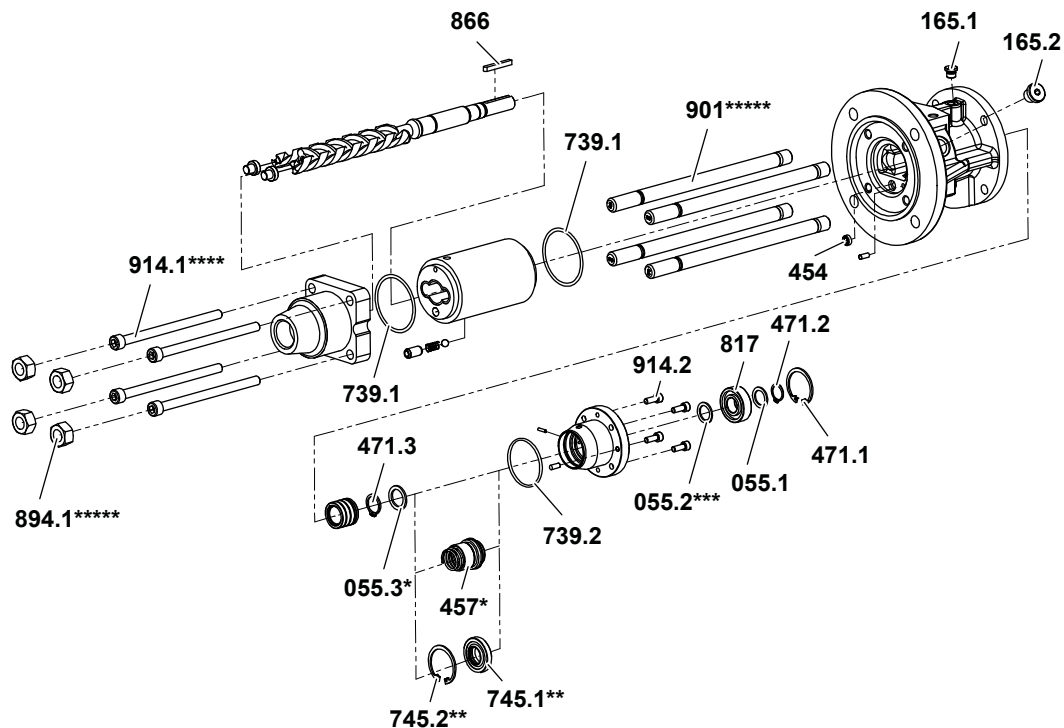
## 15 Spare parts

### 15.1 Maintenance kit

## 15 Spare parts

### 15.1 Maintenance kit


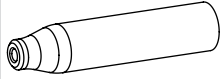
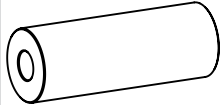
**Notice** The maintenance kit contains only the numbered parts and is only supplied complete.  
**W 15 – 118**




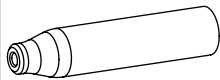

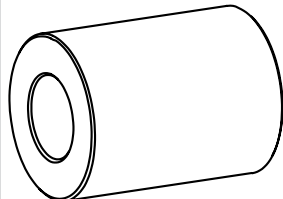
Qty.	Item No.	Part	Qty.	Item No.	Part
1	055.1	Supporting ring	2	739.1	O-ring
1	055.2***	Supporting ring	1	739.2	O-ring
1	055.3*	Supporting ring	1	745.1**	Radial shaft seal ring
1	165.1	Screw plug	1	745.2**	Circlip
1	165.2	Screw plug	1	817	Ball bearing
1	454	Edge sealing ring	1	866	Feather key
1	457*	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			
		** Only for radial shaft seal			
		*** Only for Size 15 – 20 and 55 – 180			
		**** Only for Size 15 – 42			
		***** Only for Size 55 – 118			

Tab. 13: Maintenance kit W 15 – 118

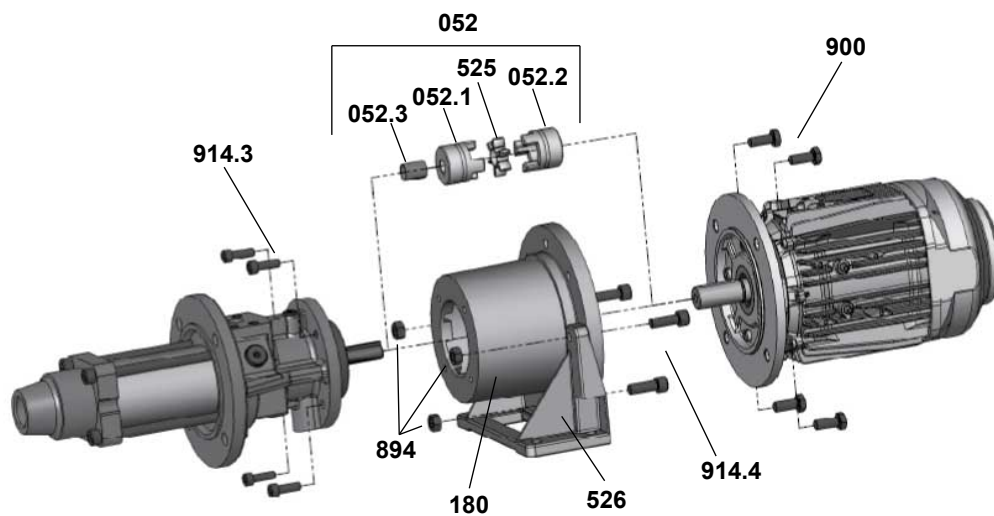
**15.2 Tool sets****15.2.1 Tool set, mechanical seal**

		Qty.	Part
<b>C</b>		1	Mounting arbour stationary seal ring
<b>A</b>		1	Mounting sleeve main screw
<b>B</b>		1	Mounting sleeve ball bearing

**15.2.2 Tool set, radial shaft seal**

		Qty.	Part
<b>D</b>		1	Mounting arbour radial shaft seal ring
<b>A</b>		1	Mounting sleeve main screw
<b>B</b>		1	Mounting sleeve ball bearing
<b>E</b>		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

**Notice** 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.

**Notice** 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

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

**Notice** 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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