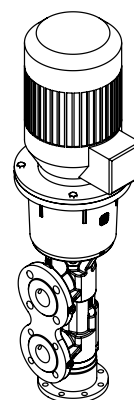
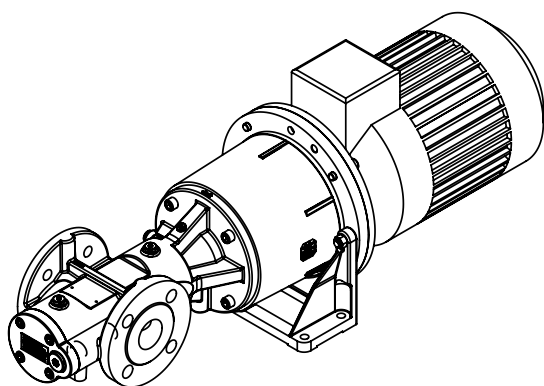
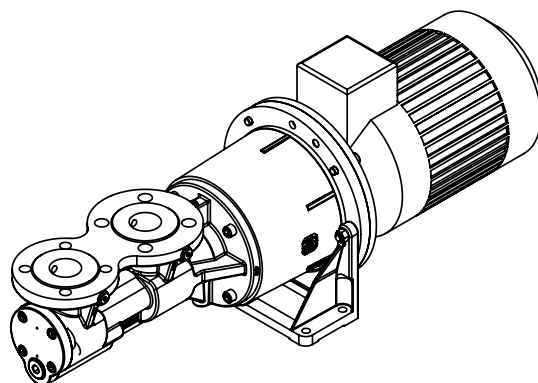
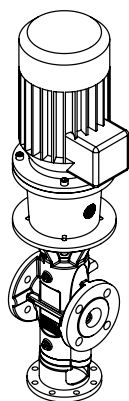




Operating instructions

KRAL



KRAL screw pumps.

Series L

Mechanical seal/radial shaft seal

OIL 01en-GB
Edition 2024-06
Original instructions

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1 About this document

1.1 General information

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

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.

3 Identification

2.3 Obligations of the operator-owner

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.☐☐☐☐☐☐☐☐☐

3 Identification

3.1 Type code

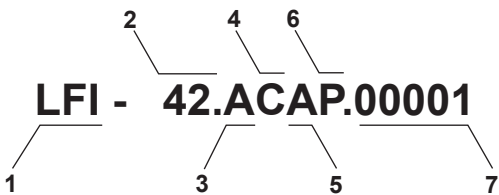


Fig. 1: Type code

Item	Classification	Description	
1	Type	LFI	<div><input type="checkbox"/> Pump with free shaft end</div> <div><input type="checkbox"/> Pump with inline flanges PN25/PN63</div> <div><input type="checkbox"/> Pump unit with or without pump bracket foot</div>
		LFT	<div><input type="checkbox"/> Pump with free shaft end</div> <div><input type="checkbox"/> Pump with overhead flanges PN25/PN63</div> <div><input type="checkbox"/> Pump unit with or without pump bracket foot</div>
		LFM	<div><input type="checkbox"/> Pump with free shaft end</div> <div><input type="checkbox"/> Pump with overhead flanges PN6/PN40</div> <div><input type="checkbox"/> Pump unit with or without pump bracket foot</div>
		LFW	<div><input type="checkbox"/> Pump with free shaft end</div> <div><input type="checkbox"/> Pump with overhead flanges PN25/PN40</div> <div><input type="checkbox"/> Pump unit with or without pump bracket foot</div>

Item	Classification	Description
		<div>LVI</div> <input type="checkbox"/> Pump with free shaft end and pedestal <input type="checkbox"/> Pump with inline flanges PN25/PN63 <input type="checkbox"/> Pump unit on pedestal for vertical mounting
		<div>LVT</div> <input type="checkbox"/> Pump with free shaft end and pedestal <input type="checkbox"/> Pump with overhead flanges PN25/PN63 <input type="checkbox"/> Pump unit on pedestal for vertical mounting
2	Size	Corresponds to delivery rate in [l/min] at 1450 min ⁻¹
3	Shaft seal	<div>A</div> Standard mechanical seal <div>B</div> Mechanical seal of hard material <div>C</div> Standard radial shaft seal <div>D</div> Magnetic coupling <div>F</div> High-temperature radial shaft seal <div>H</div> Mechanical seal balanced <div>X</div> Special design
4	Pressure stage overflow valve	<div>B</div> Pressure stage 17.0– 39.9 bar <div>C</div> Pressure stage 40.0– 64.0 bar <div>X</div> Special design
5	Heating	<div>A</div> Without heating <div>B</div> Electrical heating system <div>C</div> Fluid heating system <div>X</div> Special design
6	Completion	<div>P</div> Pump with free shaft end <div>F</div> Pump unit with pump bracket foot <div>V</div> Pump unit without pump bracket foot
7	Version index	For internal administration

Tab. 2: Type code

3.2 Rating plate

6	KRAL	CE	7
5	Art.-Nr. Item no.		8
4	Typ Type	Δp bar	9
3	SN Serial no.	Q l/min	10
2	Tmin. / Tmax.	°C n min ⁻¹	11
1	pS max. / pD max.	bar v mm ² /s	
	Jahr Year	Gewicht Weight kg	
	KRAL GmbH, 6890 Lustenau, Austria		www.kral.at

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

4 Technical data

4.1 Operating limits

Parameter		Unit	Size 5 – 85
Max. operating overpressure			
<input type="checkbox"/>	Pump with flange PN25/PN63	[bar]	63
<input type="checkbox"/>	Pump with flange PN6/PN40	[bar]	40
<input type="checkbox"/>	Pump with flange PN25/PN40	[bar]	40
Max. temperature of the pumped liquid			
<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
Min. temperature of pump materials		[°C]	-10
Min. – max. ambient temperature		[°C]	-20 ... 50
Viscosity min. – max.		[mm²/s]	1.5 – 10000
Max. speed			
<input type="checkbox"/>	At 50 Hz	[min⁻¹]	2900
<input type="checkbox"/>	At 60 Hz	[min⁻¹]	3500
Max. inlet pressure			
<input type="checkbox"/>	Standard mechanical seal	[bar]	6
<input type="checkbox"/>	Mechanical seal of hard material	[bar]	6
<input type="checkbox"/>	Mechanical seal balanced Model LFI/LFT/LFW/LVI/LVT Model LFM	[bar]	20 6
<input type="checkbox"/>	Standard radial shaft seal	[bar]	6
<input type="checkbox"/>	High-temperature radial shaft seal	[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

4.3 Sound pressure level

Guide values at 1 m distance, 1450 min⁻¹, 20 bar

	Size	
	5 – 54	55 – 84
Max. sound pressure level ±3 [dB(A)]		
Pump	58.0	59.0
Motor	62.0	62.0
Pump unit	63.5	64.0

Tab. 4: Sound pressure level

4.4 Weights

The weight is specified on the rating plate.

4.5 Accessories

Note The technical data of the accessories are specified separately ↗ Accessories, Page 41.

5 Function description

5.1 Pump structure

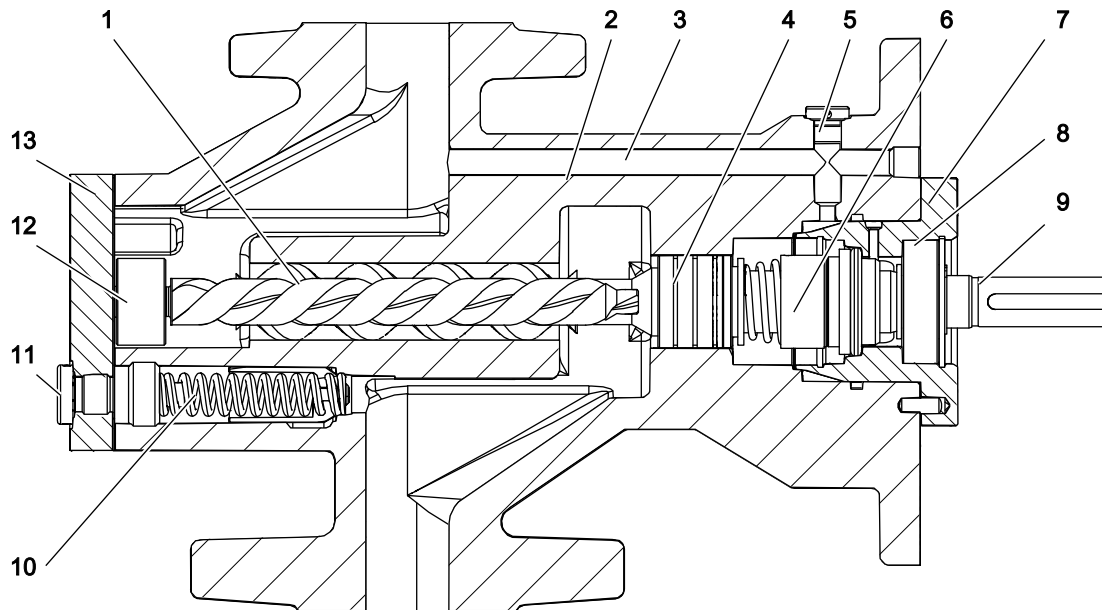


Fig. 3: Pump structure

- | | | | |
|---|------------------------------|----|-----------------------------|
| 1 | Idle screw | 8 | Ball bearing |
| 2 | Pump housing | 9 | Shaft end pump (main screw) |
| 3 | Relief line | 10 | Overflow valve |
| 4 | Balancing cylinder | 11 | Screw plug |
| 5 | Screw plug | 12 | Balancing bush |
| 6 | Shaft seal (mechanical seal) | 13 | End cover |
| 7 | Seal housing | | |

5.2 Pump unit structure

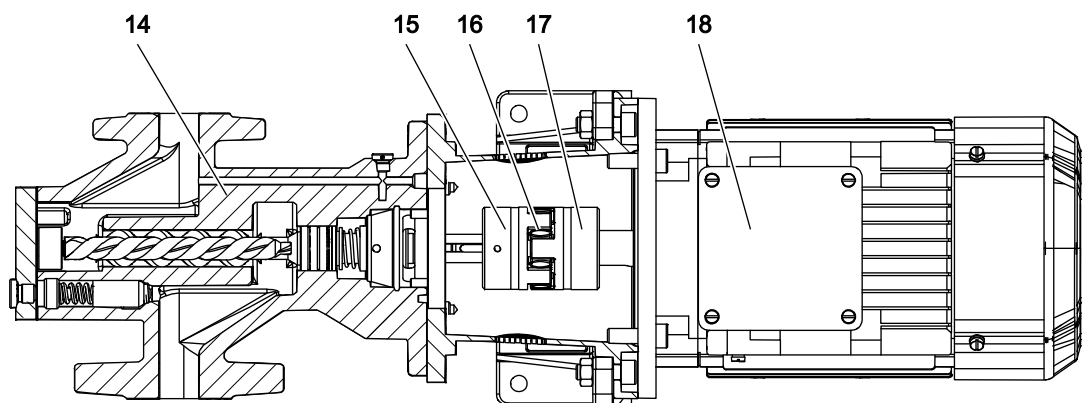


Fig. 4: Pump unit structure

- | | | | |
|----|----------------------------|----|--------------------------|
| 14 | Pump | 17 | Motor-side coupling half |
| 15 | Pump-side coupling half | 18 | Motor |
| 16 | Coupling intermediate ring | | |

5 Function description

5.3 Functional principle

5.3 Functional principle

Screw pumps are rotating displacement pumps. The displacement effect results from three rotating screws **1** and **9** and the enclosing pump housing **2**.

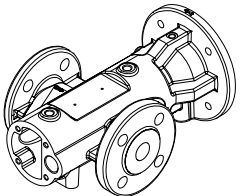
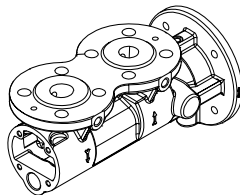
Radial support of the screw set is provided through the sliding contact in the pump housing that depends on lubrication by the pumped liquid. Screw pumps are therefore not suitable for dry running and can only be used up to specific pressure limits and viscosity limits. Due to the narrow gap dimensions,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

Axial support of the main screw **9** is effected by a lifetime-lubricated ball bearing **8**. Various shaft seals **6** 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 **4** is mounted at the main screw. The idle screws also have an axial thrust relief through balancing bushes **12** at the suction-side end of the screws and core drilled holes to the pressure chamber. The sealing chamber is connected to the suction chamber via a relief line **3**. An integrated overflow valve **10** protects against excessive pressure that could cause housing parts to burst.

The default direction of the rotation of the screw set is clockwise viewed from the motor **18** and is marked on the pump flange by an arrow.

The flow direction is marked on the pump housing by two arrows.

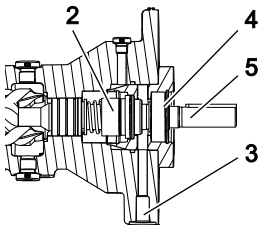
5.4 Housing variants

Housing	Type	Description
	LFI/LVI	Flange arrangement: Inline flange PN25/PN63
	LFT/LVT	Flange arrangement: Overhead flange PN25/PN63
	LFW	Flange arrangement: Overhead flange PN25/PN40
	LFM	Flange arrangement: Overhead flange PN6/PN40

Tab. 5: Housing variants

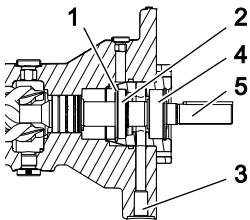
5.5 Shaft seal

- The following types of shaft seals are used:
- ☐ Mechanical seal standard or hard material
 - ☐ Mechanical seal with quench
 - ☐ Radial shaft seal standard or high-temperature

**Mechanical seal standard/
hard material**

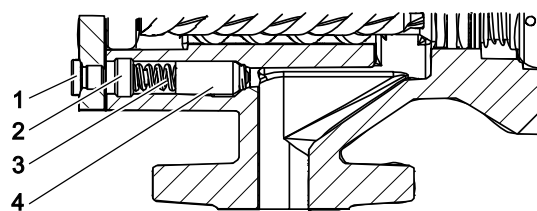
- 2 Mechanical seal
- 3 Leakage vent hole
- 4 Ball bearing
- 5 Main screw

The lubrication of the mechanical seal **2** inevitably results in a low leak, that as a rule vaporises and is therefore not noticed. However, at low-volatile liquids such as heavy fuel oil the leak becomes visible. The integrated leakage vent holes **3** allow draining of this leakage. The drainage through these holes has to be kept free. Dry running must be avoided at all costs, as the seal will overheat and be destroyed in a matter of minutes.

**Radial shaft seal standard/high-
temperature**

- 1 Circlip
- 2 Radial shaft seal ring
- 3 Leakage vent hole
- 4 Ball bearing
- 5 Main screw

Depending on the material used, radial shaft seals can be used for temperatures of up to 80 °C or 150 °C respectively. The used radial shaft seal rings **2** each have a lip used to seal again liquid outlet and air inlet.

5.6 Overflow valve

- 1 Screw plug
- 2 Adjusting screw
- 3 Pressure spring
- 4 Valve body

Fig. 5: Overflow valve

The integrated overflow valve ensures that very high pressures that could result in housing parts bursting do not arise.

The overflow valve is purely there as a safety element for the pump and should not be used for control or regulation purposes such as maintaining pressure. If the valve is kept open for too long under adverse operating conditions (high differential pressures and/or low viscosities) it will only take a few minutes for the overflow valve and the valve seating to become damaged. As a result, the overflow valve will leak permanently and there will be a corresponding reduction in the delivery rate. In addition to this, circulation through the overflow valve for too long results in excess heating of the pump. This reduces viscosity and can ultimately lead to pump failure.

It therefore has to be ensured through a safety valve at the system that the maximum allowable working pressure always lies under the opening pressure of the overflow valve.

Note The opening pressure of the overflow valve is set to 110% of the differential pressure in the factory.

The overflow valve is accessible through a screw plug **1** and can be adjusted from the outside ↪ During operation, Page 24.

Note ☐ A function test of the overflow valve at least every 5 years is essential for the safe operation ↪ During operation, Page 24.

☐ Scope and if necessary shorter test intervals must be specified by the operator-owner in accordance with the requirements and national provisions (for example Austrian Ordinance of Safety and Health (BetrSichV)).

☐ The first function test must take place directly after the commissioning.

☐ After longer downtimes (> 4 weeks) the function of the overflow valve must be tested again.

6 Transportation, storage

6.1 Dangers during transportation

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.

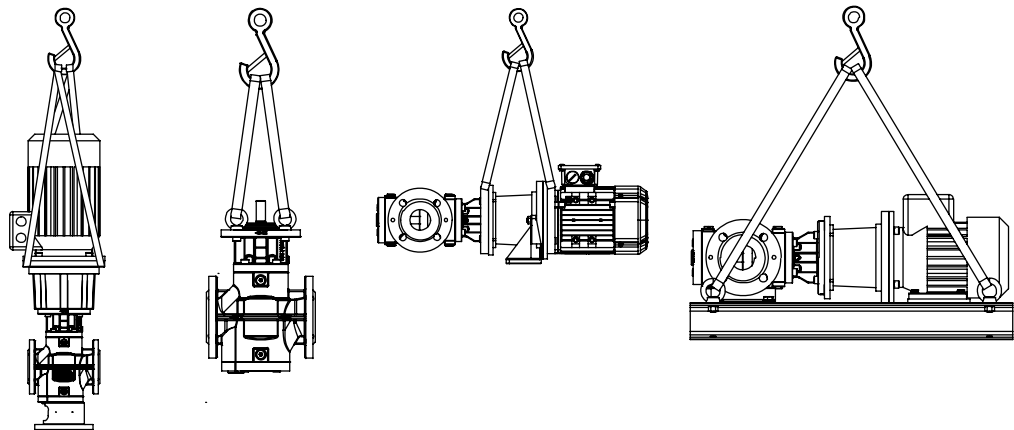


Fig. 6: Fastening of hoisting equipment - principle diagrams

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 14.

7 Preservation

7.1 Preservation table

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.

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 53.
- ☐ 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 operated in horizontal and vertical installation position.

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:	<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.

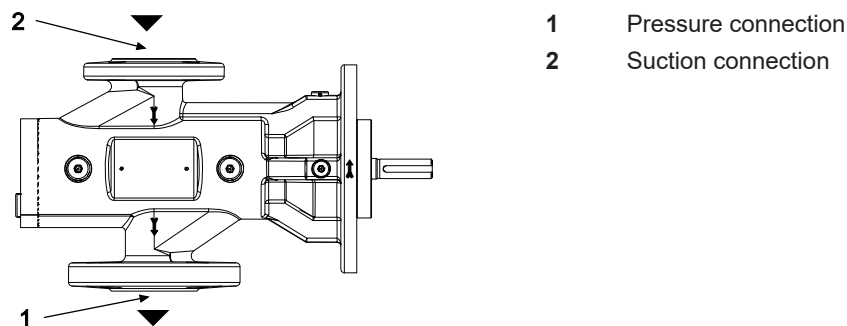


Fig. 7: Flow direction

Requirement:

- ✓ Pump protection: Integrated overflow valve or 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 in the installation position, while observing the position of the motor and the arrows for the flow direction on the pump housing (1 pressure connection, 2 suction connection).
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 12.

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 53.
- ☐ 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.

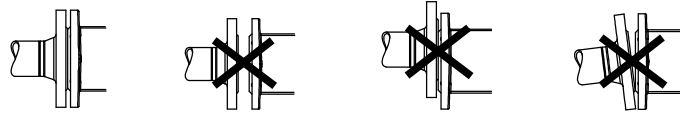


Fig. 8: Connection to pipe system

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 38.
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 53.

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 ($> 60\text{ °C}$) 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:	<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.

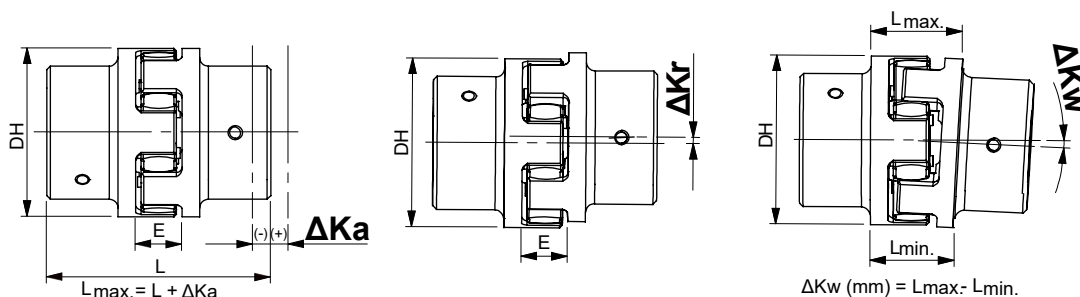


Fig. 9: Coupling alignment measuring points

Outer diameter DH [mm]	Coupling distance E [mm]	Max. axial displacement ΔKa [mm]	Max. radial displacement ΔKr [mm]	Max. angular displacement ΔKw [°]	[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:	<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

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:	<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 vent holes

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"/> Protective helmet <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots

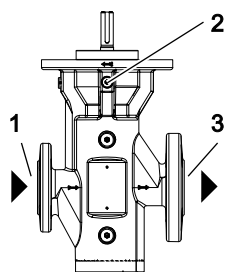


DANGER

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 Suction connection
- 2 Seal housing vent hole
- 3 Pressure connection

1. ➔ Open the screw plug of the vent hole seal housing 2 by a max. of two 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 1 or pressure connection 3 until pumped liquid is emitted at the vent hole seal housing.
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 seal housing.

Filling and venting the pump via the vent hole

Note Filling the pump via the vent hole only makes sense in the horizontal mounting position.

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

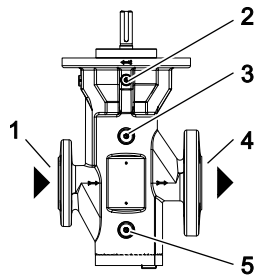


WARNING

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 Suction connection
- 2 Seal housing vent hole
- 3 Pressure-side vent hole
- 4 Pressure connection
- 5 Suction-side vent hole

Fig. 10: Vent holes

Requirement:

✓ Shut-off devices of the suction line and pressure line closed

1. ➤ Open the screw plug of the vent hole seal housing **2** by a max. of two rotations so that air can escape during the filling process.
2. ➤ Remove the screw plug of the vent hole suction-side **5** or vent hole pressure-side **3**.
3. ➤ Fill the pump via the vent hole suction-side or the vent hole pressure-side until the pumped liquid is emitted at the vent hole seal housing.
4. ➤ While filling, turn the pump shaft or the motor fan impeller manually in order to speed up the filling process:
Filling via vent hole on the suction side: Turn the pump shaft in the direction of the arrow on the pump flange.
Filling via vent hole on the pressure side: Turn the pump shaft against the direction of the arrow on the pump flange.
5. ➤ Retighten the screw plug of the vent hole seal housing and the vent hole suction-side or vent hole pressure-side.

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)

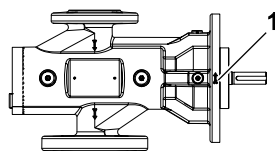
Personnel qualification: ☐ Fitter

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
☐ Electrician

Personal protective equipment: ☐ Work clothing
☐ Face protection
☐ Protective gloves
☐ 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 17
 - ✓ 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: Integrated overflow valve or 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 38
 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 38.
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.
5. ➤ Checking overflow valve functions ↪ During operation, Page 24.

10.3 During operation

10.3.1 Checking the operating pressure

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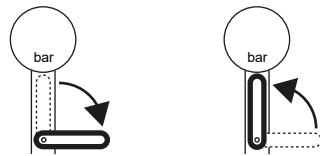


Fig. 11: Pressure gauge shut-off valves closed/open - principle diagram

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:	<input type="checkbox"/> Trained personnel
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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 Adjusting the overflow valve

Personnel qualification:	<input type="checkbox"/> Fitter
Aids:	<input type="checkbox"/> Allen key

Note The opening pressure of the overflow valve is set to 110% of the differential pressure in the factory.

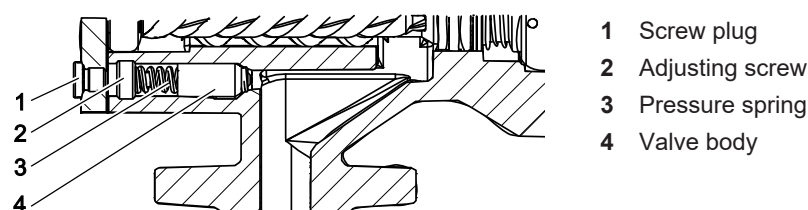


Fig. 12: Overflow valve



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.

Requirement:

- ✓ Pressure-side pressure gauge installed

1. ▶ Switch on the pump unit and remove the screw plug **1** of the overflow valve.
2. ▶ Increase the supply pressure step-by-step to check the opening pressure of the overflow valve. Keep an eye on the pressure gauge and make sure that the operating limits are observed.
⇒ The opening pressure is reached, when the displayed pressure falls.
3. ▶ Turn the adjusting screw **2** to set the opening pressure:
Turning clockwise: Increase the opening pressure
Turning counter-clockwise: Reduce the opening pressure
4. ▶ Repeat Steps 2 and 3 until the desired opening pressure is reached.
5. ▶ Tighten the screw plug **1** again.

10.3.4 Test the overflow valve

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



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.

Requirement:

- ✓ Function test necessary ↪ Maintenance, Page 27
- ✓ Pressure-side pressure gauge installed

1. ▶ Switch on the pump unit.
2. ▶ Gradually increase the delivery pressure downstream of the pump using a valve/ball valve etc. Keep an eye on the pressure gauge and make sure that the operating limits are observed.
⇒ The response pressure of the overflow valve is reached as soon as the displayed pressure drops briefly.
⇒ Flow noises change.
⇒ Overflow valve opens and closes at short intervals.
3. ▶ Close the valve/ball valve downstream of the pump completely.
⇒ 100% of the delivery volume now circulates via the overflow valve.
4. ▶ Keep an eye on the pressure gauge and make sure that the operating limits are observed.
5. ▶ Maintain the operating state for a maximum of 30 s.
6. ▶ Open the valve/ball valve completely again after the pump.
7. ▶ Switch off the pump unit.

10.3.5 Switching off the pump unit

Personnel qualification:	<input type="checkbox"/> 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:	<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 12.

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	—► Heat or drain the pump.	—► Drain the pump.
<input type="checkbox"/> No corrosive burden		
<input type="checkbox"/> Congealed/frozen	—► Heat or drain the pump.	1. ► Drain the pump.
<input type="checkbox"/> Corrosive burden		2. ► Preserve the pump.
<input type="checkbox"/> Remains liquid	—	—
<input type="checkbox"/> No corrosive burden		
<input type="checkbox"/> Remains liquid	—	1. ► Drain the pump.
<input type="checkbox"/> Corrosive burden		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 20.

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)	<input type="checkbox"/> Check of the suction-side pressure	2 weeks
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
Overflow valve	<input type="checkbox"/> ↪ Operation, Page 20 functional 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.

12 Servicing

11.4 Maintaining the pump

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.

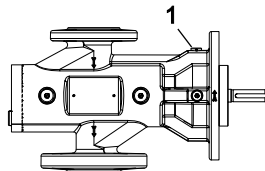
- ▶ Wear personal protective clothing during all the work. Ensure face protection.
- ▶ Collect any discharging pumped liquid safely and dispose of it in an environmentally compatible manner in accordance with the applicable local regulations.

1. ▶ Check the pump visually and acoustically every four weeks.
2. ▶ If there are signs of wear, eliminate the cause ↪ Servicing, Page 28.

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:	<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 permeability of the leakage vent hole **1** insert a flexible soft arbour into the leakage vent hole.
3. ▶ In case of insufficient permeability clean the leakage vent hole and if existing the leakage vent line.
4. ▶ If existing, reconnect the leakage vent line again.

12 Servicing

12.1 Instruction videos

You can also watch the instruction videos at <https://www.kral.at/en/services/pump-services/instruction-videos/>.

12.2 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 53.
- ☐ Observe the operating instructions and data sheets of the components.

12.3 Wear

12.3.1 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

12.3.2 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.

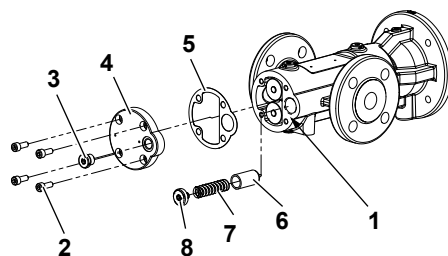
12.4 Replacing the overflow valve

12.4.1 Removing the overflow valve

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

12 Servicing

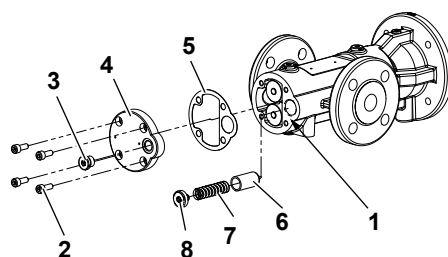
12.5 Replacing the coupling



1. ➤ Remove the screw plug **3** and socket screws **2**.
2. ➤ Remove the end cover **4** and flat gasket **5** from the pump housing **1**.
3. ➤ Carefully screw out the adjusting screw **8** and remove the pressure spring **7** and valve body **6** from the pump housing.

12.4.2 Installing the overflow valve

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



1. ➤ Clean the fitting surface carefully and bond a new flat gasket **5** to the fitting surface.
2. ➤ Insert the valve body **6**, pressure spring **7** into the pump housing **1** and secure the pressure spring with the adjusting screw **8**.
3. ➤ Position the end cover **4** and tighten the socket screws **2** with torque.
4. ➤ Set the overflow valve ⚙ During operation, Page 24.

12.5 Replacing the coupling

12.5.1 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



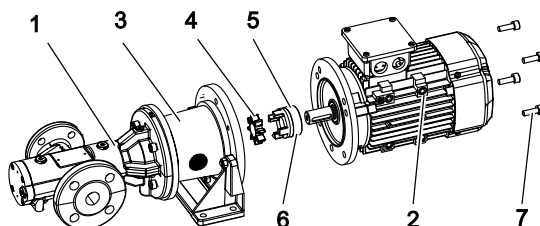
⚠ WARNING

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

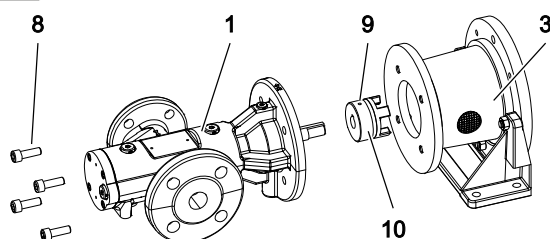
- ▶ Use intact and correctly dimensioned hoisting equipment in accordance with the total weight to be transported.
- ▶ Select the lift points for the hoisting equipment in accordance with the centre of gravity and the weight distribution.
- ▶ Use at least two load ropes.
- ▶ In the case of vertical transportation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

Requirement:

- ✓ Pump unit disconnected from the electrical power supply, deenergized and secured against being switched back on
- ✓ Suction connection and pressure connection protected against soiling through protective cover



1. ➤ Remove the socket screws 7 between the motor 2 and pump bracket 3 and lift pump 1 with pump bracket from the motor.
2. ➤ Loosen the fixing screw 6 at the motor-side coupling half 5.
3. ➤ Remove the coupling intermediate ring 4 and pull off the coupling half 5 using an extractor.



4. ➤ Remove the socket screws 8 between the pump and pump bracket and remove the pump bracket.
5. ➤ Loosen the fixing screw 9 at the pump-side coupling half 10 and pull off the coupling half using an extractor.

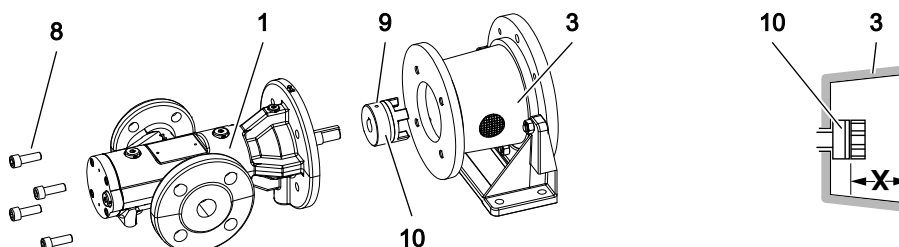
12.5.2 Installing the coupling

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"/> Measuring stick <input type="checkbox"/> Silicone oil

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

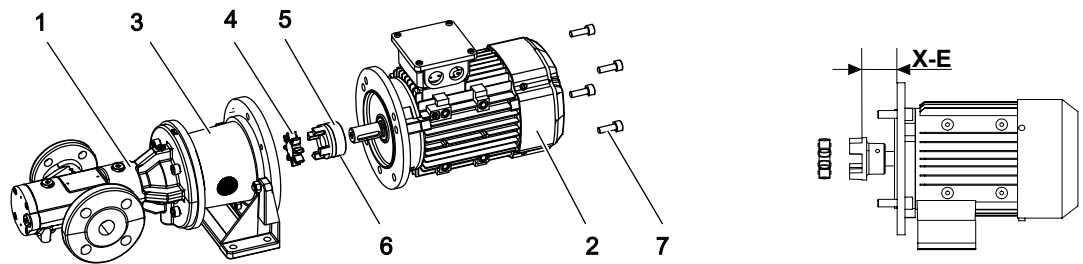
Requirement:

- ✓ Suction connection and pressure connection protected against soiling through protective cover



1. ➤ Oil the shaft of the pump 1 with silicone oil.
2. ➤ Ensure that the fixing screw 9 of the pump-side coupling half 10 is loosened.
3. ➤ Slide the pump-side coupling half onto the shaft until it stops.
4. ➤ Tighten the fixing screw of the pump-side coupling half.
5. ➤ Place the pump bracket 3 onto the pump and tighten the socket screws 8 crosswise with torque.
6. ➤ Measure and write down the distance X between the face of the coupling claws and the connecting surface of the pump bracket 3.

12.6 Replacing the ball bearing



7. ➤ Ensure that the fixing screw 6 at motor-side coupling half 5 is loosened.
8. ➤ Slide the motor-side coupling half onto the shaft end of the motor 2.
9. ➤ Check the distance between the face of the coupling teeth and the connecting surface of the motor flange and adjust to the value **X - E**, see table "Limit values for aligning the shaft coupling" ➤ Connection, Page 17.
10. ➤ Tighten the fixing screw on the motor-side coupling half and insert the coupling intermediate ring 4.
11. ➤ Place the pump with the pump bracket on the motor.
12. ➤ Turn the pump slightly until the teeth of the pump-side coupling half mesh into the spaces of the coupling intermediate ring.
13. ➤ Tighten the socket screws 7 between the motor and pump bracket crosswise with torque.

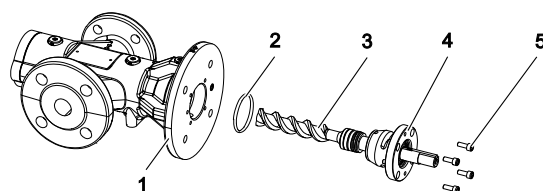
12.6 Replacing the ball bearing

12.6.1 Removing the ball bearing

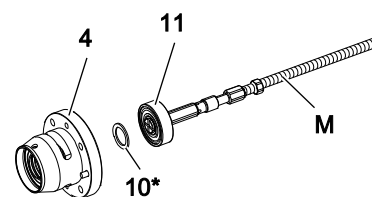
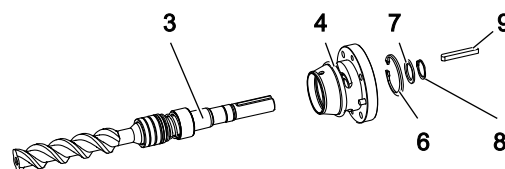
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Forcing screws <input type="checkbox"/> Plastic hammer <input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

Requirement:

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



1. ➤ Remove the socket screws 5 and screw in two forcing screws.
2. ➤ Pull the seal housing 4 together with the main screw 3 out of pump housing 1.
3. ➤ Remove the O-ring 2 from the pump housing.



4. ➤ Remove the feather key 9.
5. ➤ Remove the circlip 8, supporting ring 7 and circlip 6.
6. ➤ Press the main screw from the seal housing.
7. ➤ Pull the ball bearing 11 out of the seal housing using an extractor **M**.
8. ➤ **Size 5 – 26 and 55 – 85:** Remove the supporting ring 10*.
9. ➤ Carefully remove the residues of the flat gasket from the seal housing.

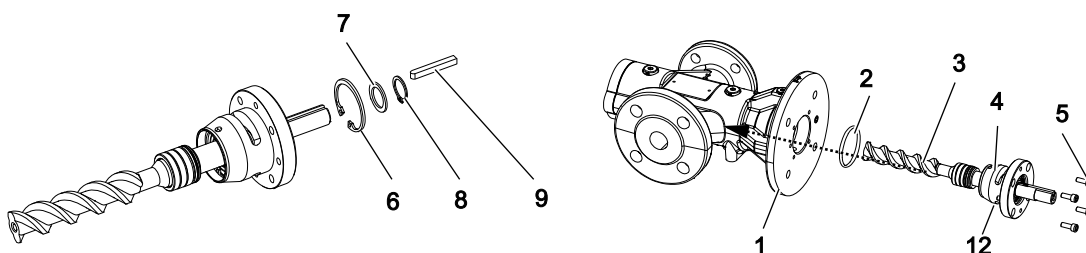
12.6.2 Installing the ball bearing – mechanical seal version

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 44

Note For secure mounting the manufacturer recommends the mounting tool from the tool set. The tool set is available from the manufacturer ↗ Spare parts, Page 44.



1. ➤ Clean the fitting surfaces carefully.
2. ➤ **Size 5 – 26 and 55 – 85:** Insert the supporting ring 10 into the seal housing 4.
3. ➤ Press the ball bearing 11 into the seal housing.
4. ➤ Press the main screw 3 into the seal housing until it stops. In the process use the mounting sleeve ball bearing B.
5. ➤ Remove the mounting sleeve ball bearing.



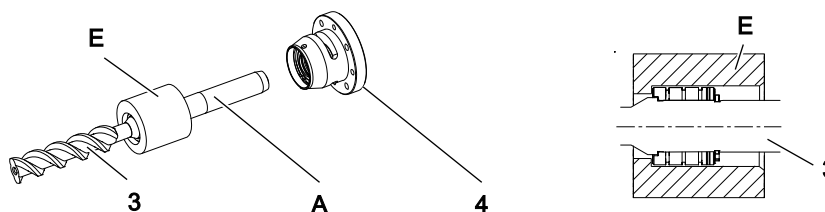
6. ➤ Mount the circlip 6, supporting ring 7, shaft circlip 8 and feather key 9.
7. ➤ Lightly grease the O-ring 2 and insert into the groove in the pump housing 1.
8. ➤ Slide the seal housing together with the main screw into the pump housing until the main screw engages into the idle screws. While doing so take the position of the straight pin 12 into account and turn the main screw.
9. ➤ Tighten the socket screws 5 with torque.

12.6.3 Installing the ball bearing – radial shaft seal version

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 44

Note For secure mounting the manufacturer recommends the mounting tool from the tool set. The tool set is available from the manufacturer ↗ Spare parts, Page 44.

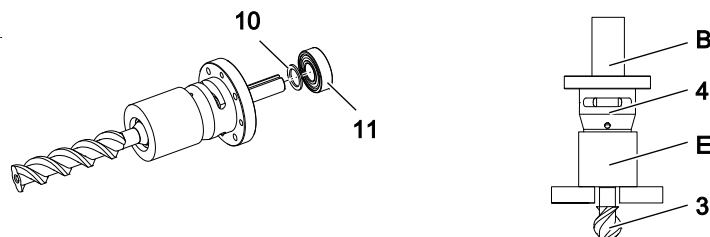
1. ➤ Clean the fitting surfaces carefully.



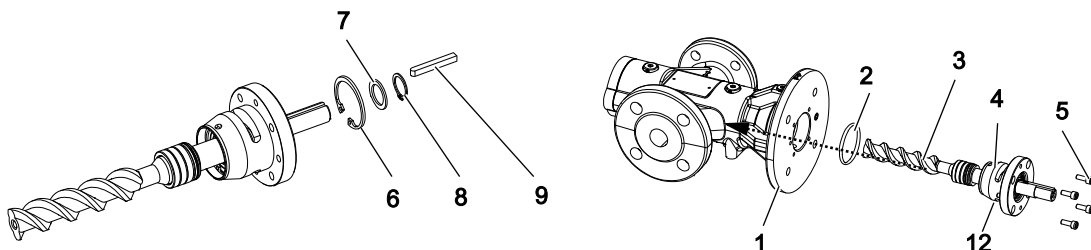
2. ➤ Slide the positioning sleeve E and the mounting sleeve main screw A onto the main screw 3, and slide the main screw into the seal housing 4.

12.7 Replacing the mechanical seal

3. ➤ Remove the mounting sleeve main screw.



4. ➤ **Size 5 – 26 and 55 – 85:** Slide the supporting ring 10 onto the main screw.
 5. ➤ Slide the ball bearing 11 onto the main screw.
 6. ➤ Press the ball bearing onto the main screw. In the process use the mounting sleeve ball bearing B and positioning sleeve E.
 7. ➤ Remove the mounting sleeve ball bearing and the positioning sleeve.



8. ➤ Mount the circlip 6, supporting ring 7, shaft circlip 8 and feather key 9.
 9. ➤ Lightly grease the O-ring 2 and insert into the groove in the pump housing 1.
 10. ➤ Slide the seal housing together with the main screw into the pump housing until the main screw engages into the idle screws. While doing so take the position of the straight pin 12 into account and turn the main screw.
 11. ➤ Tighten the socket screws 5 with torque.

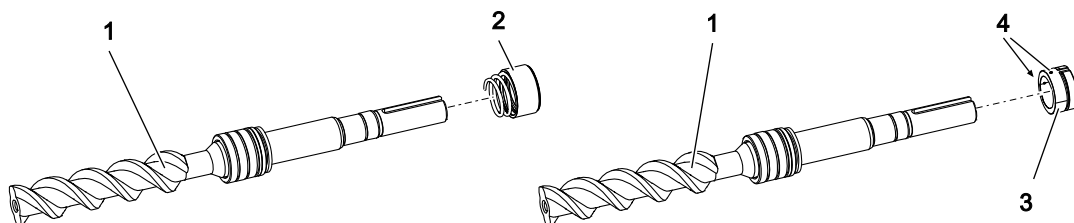
12.7 Replacing the mechanical seal

12.7.1 Removing the mechanical seal

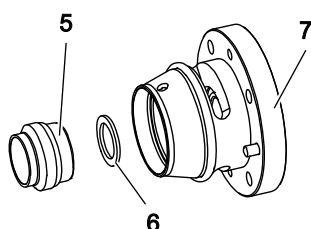
Personnel qualification:	<input type="checkbox"/> Fitter
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety boots
Aids:	<input type="checkbox"/> Plastic hammer <input type="checkbox"/> Extractor
Aids:	<input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

Requirement:

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



1. ➔ **Standard mechanical seal** (figure on the left): Pull the rotary seal ring **2** with spring from the main screw **1**
-or-
Mechanical seal of hard material/balanced (figure on the right): Loosen the threaded pins **4**. Pull the rotary seal ring **3** and associated parts of the mechanical seal from the main screw **1**.



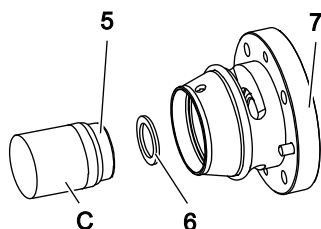
2. ➔ Push the stationary seal ring **5** together with the O-ring out of the seal housing **7**.
3. ➔ **Size 5 – 26 and 55 – 85:** Remove the supporting ring **6** from the seal housing.
4. ➔ Carefully remove the residues of the flat gasket from the seal housing.
5. ➔ Clean the leakage vent hole and interior of the seal housing with industrial cleaner ➔ Maintenance, Page 27.

12.7.2 Installing the mechanical 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, mechanical seal ➔ Spare parts, Page 44 <input type="checkbox"/> Silicone grease

Requirement:

- ✓ Leakage vent hole, seal housing and fitting surfaces cleaned




1. ➔ Lightly grease the O-ring of the stationary seal ring **5**.
2. ➔ **Size 5 – 26 and 55 – 85:** Press the supporting ring **6** into the seal housing **7**.
3. ➔ Press the stationary seal ring with O-ring into the seal housing using the mounting arbour **C**. Take the position of the recess for the dowel pin (anti-rotation screw).



4. ➔ Clean the main screw **1** carefully in the area of the mechanical seal and grease it.
5. ➔ Slide mounting sleeve main screw **A** onto the main screw.
6. ➔ **Standard mechanical seal** (figure on the left): Slide the rotary ring **2** with spring onto the main screw.
-or-
Mechanical seal of hard material/balanced (figure on the right): Slide the rotary seal ring **3** and associated parts of the mechanical seal onto the main screw and tighten the threaded pins **4**.
7. ➔ Remove the mounting sleeve main screw. Clean the sliding surfaces of the mechanical seal carefully and grease lightly with silicone grease.

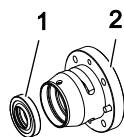
12.8 Replacing the radial shaft seal

12.8.1 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 44


Requirement:

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

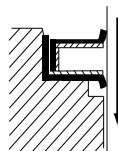
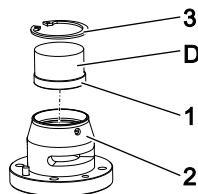


➡ Press the radial shaft seal ring 1 out of the seal housing 2.

12.8.2 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 44 <input type="checkbox"/> Thread sealant (for example Loctite 572) <input type="checkbox"/> 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 1 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 with the mounting arbour D into the seal housing. 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 completely and that there are no sharp edges in the area of the sealing lip.
5. ➡ Remove the mounting arbour and circlip 3.
6. ➡ Fill the intermediate space of the radial shaft seal ring 1 with molybdenum disulphide paste (MoS_2).

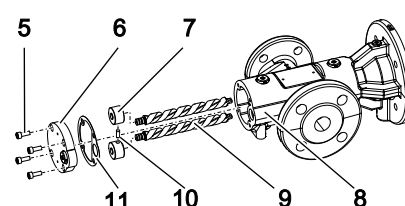
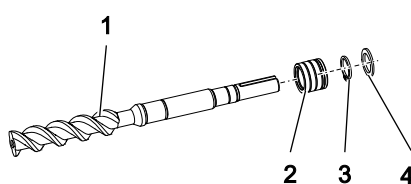
12.9 Replacing the screw set

12.9.1 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
- ✓ Ball bearing removed
- ✓ Mechanical seal or radial shaft seal removed

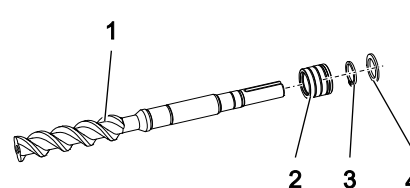
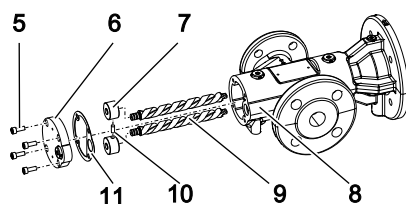


1. ➤ **Mechanical seal version:** Pull the supporting ring 4 from the main screw 1.
2. ➤ Pull the circlip 3 and the balancing cylinder 2 from the main screw.
3. ➤ Remove the socket screws 5 at the end cover 6 and take off the end cover.
4. ➤ Remove the balancing bushes 7, straight pin 10 and idle screws 9 from the pump housing 8.
5. ➤ Carefully remove the residues of the flat gasket 11 from the end cover and pump housing.

12.9.2 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 or radial shaft seal ➤ Spare parts, Page 44

1. ➤ Carefully clean the fitting surfaces, grease the O-rings lightly.



2. ➤ Insert the idle screws 9 in the pump housing 8.
3. ➤ Mount the balancing bushes 7 and straight pin 10.
4. ➤ Bond the new flat gasket 11 onto the pump housing, place on the end cover 6 and tighten the socket screws 5 with torque.
5. ➤ Press the balancing cylinder 2 onto the main screw and mount the shaft circlip 3.
6. ➤ **Mechanical seal version:** Mount the supporting ring 4.
For further mounting see the chapter "Installing the mechanical seal" and "Installing the ball bearing – mechanical seal version".
7. ➤ **Radial shaft seal version:**
For further mounting see the chapter "Installing the radial shaft seal" and "Installing the ball bearing - radial shaft seal version".

13 Disposal

13.1 Dismantling and disposing of the pump

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 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.

Identifica- Fault tion	
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	<div> <div></div> <div>→ Check the shut-off devices. If required, open.</div> </div>
1	2	3	–	5	–	–	Parts soiled (filter, suction line, suction valve, strainer)	<div> <div></div> <div>→ Clean parts.</div> </div>
1	2	3	–	5	–	–	Suction head too high	<div> <div></div> <div> → Reduce the level difference. -or- Reduce the line length. -or- Increase the line cross-section. -or- Heat up the pumped liquid. -or- Install a filter / strainer with a larger mesh width. Ensure that the permissible mesh width is not exceeded. </div> </div>
1	–	3	–	–	–	–	Level in the intake container too low	<div> <div></div> <div>→ Fill the intake container.</div> </div>
1	–	–	–	–	–	–	Too little pumped liquid in the pump	<div> <div></div> <div>→ Fill the pump with pumped liquid.</div> </div>
1	–	–	–	–	–	–	Incorrect pump direction of rotation	<div> <div></div> <div>→ Swap the two electrical connection phases ↻ Connection, Page 17.</div> </div>
–	–	–	4	–	–	–	Differential pressure too high	<div> <div></div> <div>→ Reduce the differential pressure.</div> </div>
1	–	3	4	5	–	–	Viscosity of the pumped liquid too high	<div> <div></div> <div> → Increase the temperature of the pumped liquid. -or- Decrease the speed. </div> </div>
–	2	–	–	–	–	–	Viscosity of the pumped liquid too low	<div> <div></div> <div> → Reduce the temperature of the pumped liquid. -or- Increase the speed. </div> </div>
–	2	3	–	5	–	–	Airlock/gas in the pumped liquid	<div> <div></div> <div> 1. → Test the pipe system for air admission, replace leaking parts. 2. → Reduce the suction head. -or- Increase the inlet pressure. </div> </div>
–	2	–	4	–	–	–	Speed/frequency/voltage of the motor false	<div> <div></div> <div> 1. → Ensure that the motor frequency and voltage match the operating voltage. 2. → Ensure that the speed of the motor matches the rating plate of the pump. If necessary adjust the speed. </div> </div>
–	2	3	–	5	–	–	Overflow valve opens during normal operation	<div> <div></div> <div>→ Set the opening pressure to 110% of the differential pressure ↻ During operation, Page 24.</div> </div>
–	2	–	–	5	–	–	Overflow valve leaks	<div> <div></div> <div>→ Contact the manufacturer.</div> </div>
–	2	–	–	–	–	–	Advanced wear of the housing/screw set	<div> <div></div> <div>→ Contact the manufacturer.</div> </div>

14 Troubleshooting

14.2 Troubleshooting

Fault identification							Cause	Remedy
–	–	–	–	–	–	7	Advanced wear of sealing surfaces	<div> <div>—></div> <div>Replace the seal and check the pumped liquid for abrasive substances. If required, replace the filter/strainer.</div> </div> <div> <div>–or–</div> <div>Contact the manufacturer.</div> </div>
–	–	3	–	–	–	–	Coupling aligned incorrectly	<div> <div>—></div> <div>Assemble the coupling and motor correctly ↗ Connection, Page 17</div> </div>
–	–	3	–	–	–	–	Pump subject to mechanical stress	<div> <div>—></div> <div>Connect the pump correctly to the pipe system ↗ Connection, Page 17.</div> </div>
–	–	3	–	–	–	–	Vibrations/pulsations in the system	<div> <div>—></div> <div>Bear the pump unit elastically.</div> </div> <div> <div>–or–</div> <div>Make the connections with hoses.</div> </div>
–	–	3	–	–	–	–	Flow speed in the pressure line or suction line too high	<div> <div>—></div> <div>Set the flow speed in the pressure line so that it does not exceed 3 m/s.</div> </div> <div> <div>–or–</div> <div>Set the flow speed in the suction line so that it does not exceed 1 m/s.</div> </div> <div> <div>–or–</div> <div>Contact the manufacturer.</div> </div>
–	–	3	4	–	–	7	Ball bearing damaged	<div> <div>—></div> <div>Replace the ball bearing ↗ Servicing, Page 28.</div> </div>
–	2	3	4	–	–	7	Superficial damage to pump parts coming into contact with the liquid	<div> <div>—></div> <div>Contact the manufacturer.</div> </div>
–	–	–	–	–	–	7	Shaft seal damaged through dry running	<div> <div>—></div> <div>Replace the shaft seal ↗ Servicing, Page 28.</div> </div>
–	–	–	–	–	–	7	Inlet pressure too high	<div> <div>1. —></div> <div>Reduce the inlet pressure at the system side.</div> </div> <div> <div>2. —></div> <div>Replace the shaft seal ↗ Servicing, Page 28.</div> </div>
–	–	–	–	–	–	7	Inlet pressure too low	<div> <div>—></div> <div>Install a non-return valve at the pressure side.</div> </div>
–	–	–	–	–	–	7	Shaft seal is overloaded through thermal/chemical influences	<div> <div>1. —></div> <div>Check the maximum operating temperature.</div> </div> <div> <div>2. —></div> <div>Check the suitability and resistance of the elastomers with regard to the pumped liquid.</div> </div> <div> <div>–or–</div> <div>Contact the manufacturer.</div> </div>
–	–	–	–	–	–	7	Overload of the shaft seal by pressure build-up during the heating process	<div> <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> </div>
1	2	3	4	5	–	–	Cold start when delivering high-viscosity liquids	<div> <div>—></div> <div>Install the heating system.</div> </div>
–	–	–	4	–	–	7	Foreign bodies in the pump	<div> <div>—></div> <div>Contact the manufacturer.</div> </div>
–	–	3	–	–	6	–	Differential pressure is too high and has overloaded the idle screws	<div> <div>—></div> <div>Contact the manufacturer.</div> </div>
–	–	3	–	–	6	–	Viscosity is too low and has overloaded the idle screws	<div> <div>—></div> <div>Contact the manufacturer.</div> </div>
1	2	3	4	–	–	7	Pump damaged through dry running	<div> <div>—></div> <div>Contact the manufacturer.</div> </div>
1	–	–	–	–	–	–	Pump does not vent	<div> <div>—></div> <div>Vent the pressure line at the highest point.</div> </div>

Tab. 12: Fault table

15 Accessories

15.1 Heating

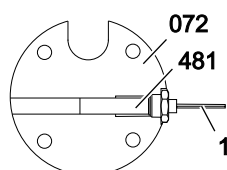
15.1.1 Possible types of heating

The pump can optionally be equipped with a heating system. The manufacturer recommends a heating system at high-viscosity pumped liquids that do not flow sufficiently if not heated. This can result in excessive wattage or in problems arising through cavitation or sealing.

Possible types of heating:

- ☐ Electrical heating system
- ☐ Fluid heating system
- ☐ Special heating system

15.1.2 Electrical heating system



- 072** Heating cover
- 481** Heating element
- 1** Connecting cable

Fig. 13: Electrical heating system

The electrical heating system consists of a heating element **481** that is integrated in a heating cover **072** attached additionally to the end cover. The output of the heating element corresponds to the radiation losses and convection losses of the pump in the required temperature range so that overheating is not possible.

Size 5 – 85

1 heating element	
1 heating cover	
4 socket screws	

Tab. 13: Scope of delivery of electrical heating system

Operating data

Parameter	Unit	Value
Voltage	[V]	230
Frequency	[Hz]	50/60
Wire cross-section	[mm ²]	2 x 1

Tab. 14: Operating data electrical heating system

Heating-up period

Required heating-up period for temperature differences of 30 °C or 50 °C:

Size	Wattage [W]	Heating-up period [min] at a temperature difference of	
		30 °C	50 °C
5 – 54	1 x 100	20	35
55 – 85	1 x 220	20	35

Tab. 15: Heating-up period for electric heating system

Installing the electrical heating system

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

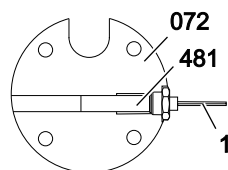
ATTENTION

Damage to the electrical heating system through leakage currents or flashovers at the emission point of the connecting cable.

- Protect the area of the connecting head against liquid and pasty liquids (lubricants, oil, plastics, etc.) as well as their vapours.

Requirement:

- ✓ Area of the connecting head protected against liquid and pasty liquids (lubricants, oil, plastics, etc.) as well as their vapours.
- ✓ Supply lines protected against mechanical vibrations in the area of the emission from the heating element. Any vapours arising have to escape freely.
- ✓ Heating element absolutely dry.



072	Heating cover
481	Heating element
1	Connecting cable

- Remove the socket screws and rating plate at the end cover of the pump.
- Mount the heating cover **072** to the end cover using the supplied socket screws.
- Screw the heating element **481** into the heating cover.
- Mount the rating plate on the heating cover.

Connecting the electrical heating system



! DANGER

Risk of death resulting from electric shock.

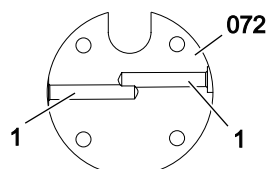
- Ensure that the electrical power supply is de-energized and is secured against being switched back on.
- Observe the operating instructions of the electrical components.

- Connect the connecting cable of the heating element.

Commissioning the electrical heating system

- Switch on the electric heating system.
- Take the required heating-up periods into account ↪ Accessories, Page 41.

15.1.3 Fluid heating system



072	Heating cover
1	Pipe connection

Fig. 14: Fluid heating system

The fluid heating system consists of a heating cover **072** attached additionally to the end cover through which a heating fluid (for example vapour, thermal oil) flows.

Scope of delivery:

Size 5 – 85

- 1 heating cover
- 4 socket screws

Tab. 16: Scope of delivery of the fluid heating system

Heating liquid operating data

Parameter	Unit	Value
Max. allowable working pressure	[bar]	16
Max. temperature	[°C]	200

Tab. 17: Heating liquid operating data

Heating-up period

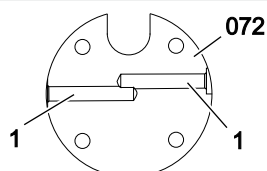
Required heating-up period for the temperature difference of 50 °C at a liquid temperature of 200 °C:

Size	Heating-up period [min] at a temperature difference of 50 °C
5 – 54	20
55 – 85	20

Tab. 18: Heating-up period for fluid heating system

Installing the fluid heating 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



072 Heating cover
1 Pipe connection

1. ➤ Remove the socket screws and rating plate at the end cover of the pump.
2. ➤ Mount the heating cover **072** to the end cover using the supplied socket screws.
3. ➤ Mount the piping at the pipe connections **1**.
4. ➤ Mount the rating plate on the heating cover.

Commissioning the fluid heating system

1. ➤ Take the required heating-up periods into account ➤ Accessories, Page 41.
2. ➤ When setting the pressure and temperature of the heating fluid take the permissible operating limits of the pump into account ➤ Technical data, Page 8.

15.1.4 Heating system special design

Please contact the manufacturer for special designs.

16 Spare parts

16.1 Overview

16 Spare parts

16.1 Overview

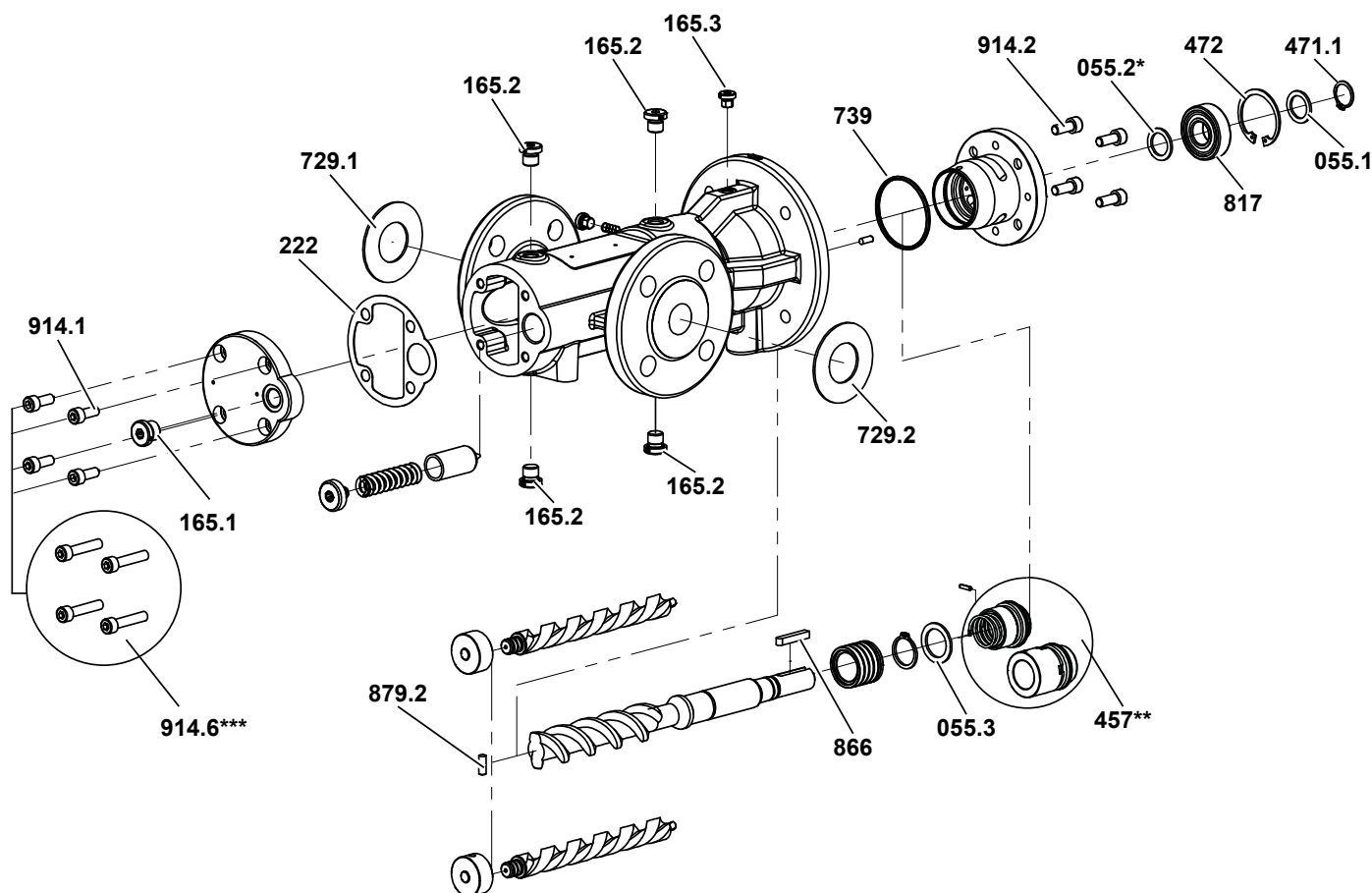
Model/Size	Type	Variant	Internal
LFI/LVI/LFT/LVT	Maintenance kit	Mechanical seal standard/hard material	OPW 34
LFW	Maintenance kit	Mechanical seal standard/hard material	OPW 21
LFM	Maintenance kit	Mechanical seal standard/hard material	OPW 22
LFI/LVI/LFT/LVT	Maintenance kit	Radial shaft seal standard/high-temperature	OPW 35
LFI/LVI/LFT/LVT/LFM	Repair kit	Screw set	OPR 07
LFI/LVI/LFT/LVT/LFM	Repair kit	Overflow valve	OPR 08
LFI/LVI/LFT/LVT/LFM	Tool set	Mechanical seal	OPR 05
LFI/LVI/LFT/LVT/LFM	Tool set	Radial shaft seal	OPR 06
LFI/LFT/LFM/LFW	Spare parts	Completion	ULF
LVI/LVT	Spare parts	Completion	ULF

Tab. 19: Overview of spare parts

16.2 Maintenance kits

16.2.1 Maintenance kit mechanical seal standard/hard material/balanced LFI/LVI/LFT/LVT

Note The maintenance kit contains only the numbered parts and is only supplied complete.



Qty.	Item No.	Part	Qty.	Item No.	Part
1	055.1	Supporting ring	1	729.1	Flat gasket, suction flange
1	055.2*	Supporting ring	1	729.2	Flat gasket, pressure flange
1	055.3	Supporting ring	1	739	O-ring
1	165.1	Screw plug	1	817	Ball bearing
4	165.2	Screw plug	1	866	Feather key
1	165.3	Screw plug	1	879.2	Straight pin
1	222	Flat gasket	4	914.1	Socket screw
1	457**	Mechanical seal	4	914.2	Socket screw
1	471.1	Circlip	4	914.6***	Socket screw
1	472	Circlip	1		Silicone grease 1 g
*		Only for Size 5 – 26 and 55 – 85			
**		Standard, hard material, balanced			
***		For LVI/LVT: replaces 914.1			

Tab. 20: Maintenance kit mechanical seal standard/hard material/balanced LFI/LVI/LFT/LVT

16 Spare parts

16.2 Maintenance kits

16.2.2 Maintenance kit mechanical seal standard/hard material LFW

Note The maintenance kit contains only the numbered parts and is only supplied complete.

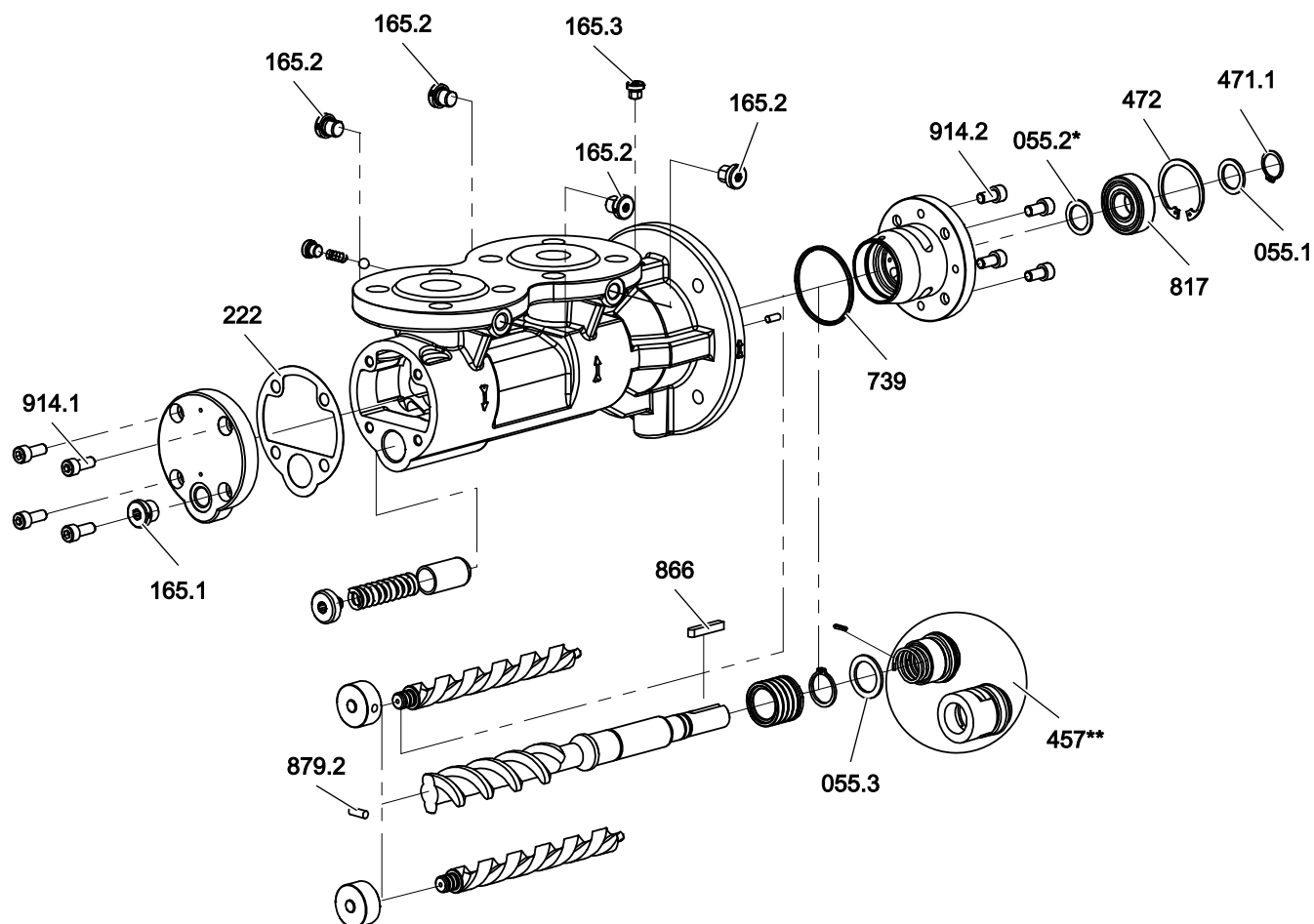


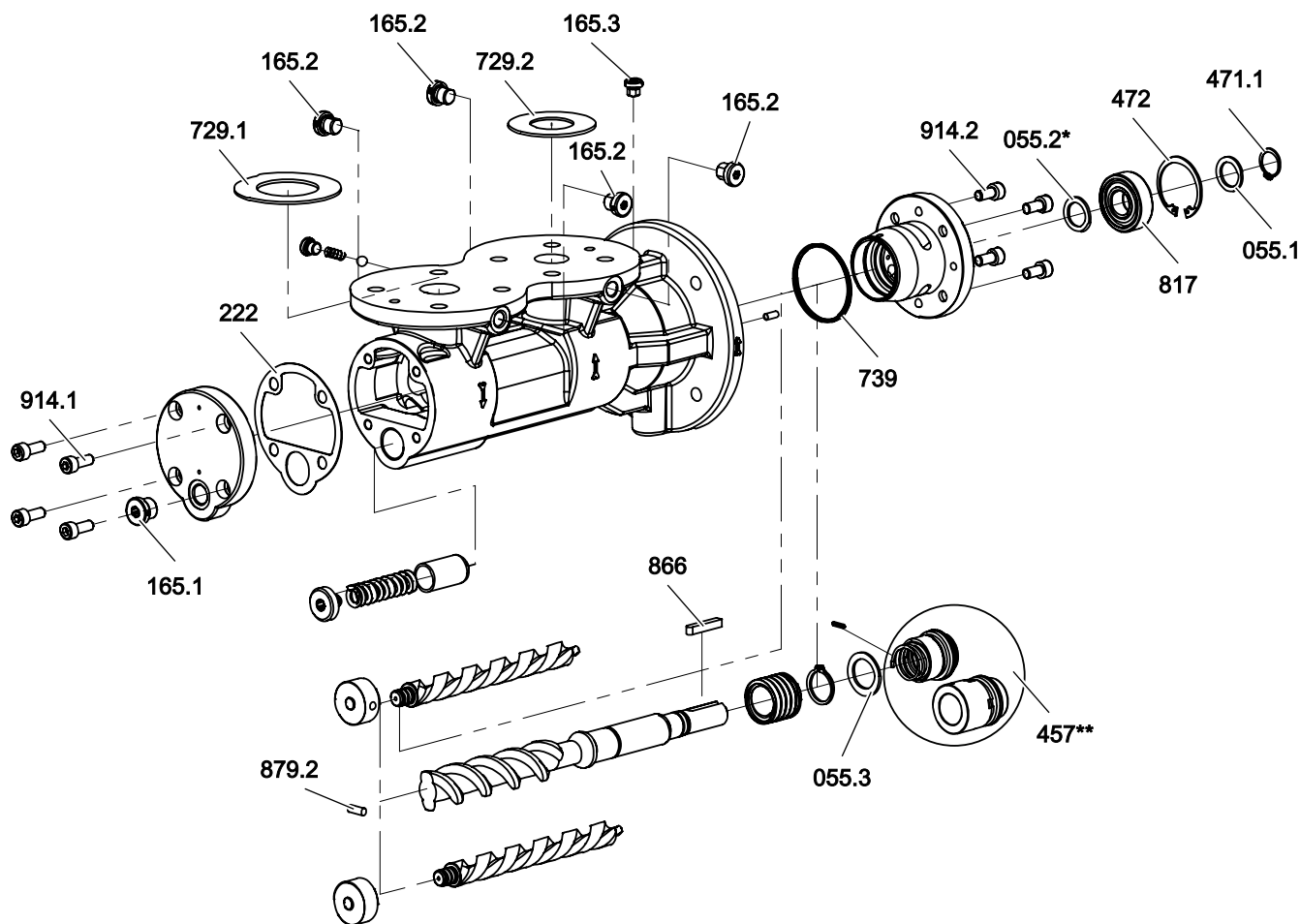
Fig. 15: OPW 21

Qty.	Item No.	Part	Qty.	Item No.	Part
1	055.1	Supporting ring	1	471.1	Circlip
1	055.2*	Supporting ring	1	472	Circlip
1	055.3	Supporting ring	1	739	O-ring
1	165.1	Screw plug	1	817	Ball bearing
4	165.2	Screw plug	1	866	Feather key
1	165.3	Screw plug	1	879.2	Straight pin
1	222	Flat gasket	4	914.1	Socket screw
1	457**	Mechanical seal	4	914.2	Socket screw
1		Silicone grease 1 g			
	*	Only for Size 5 – 26 and 55 – 85			
	**	Standard or hard material			

Tab. 21: Maintenance kit mechanical seal standard/hard material LFW

16.2.3 Maintenance kit mechanical seal standard/hard material/balanced LFM

Note The maintenance kit contains only the numbered parts and is only supplied complete.



Qty.	Item No.	Part	Qty.	Item No.	Part
1	055.1	Supporting ring	1	472	Circlip
1	055.2*	Supporting ring	1	729.1	Flat gasket, suction flange
1	055.3	Supporting ring	1	729.2	Flat gasket, pressure flange
1	165.1	Screw plug	1	739	O-ring
4	165.2	Screw plug	1	817	Ball bearing
1	165.3	Screw plug	1	866	Feather key
1	222	Flat gasket	1	879.2	Straight pin
1	457**	Mechanical seal	4	914.1	Socket screw
1	471.1	Circlip	4	914.2	Socket screw
1		Silicone grease 1 g			
	*	Only for Size 5 – 26 and 55 – 85			
	**	Standard, hard material, balanced			

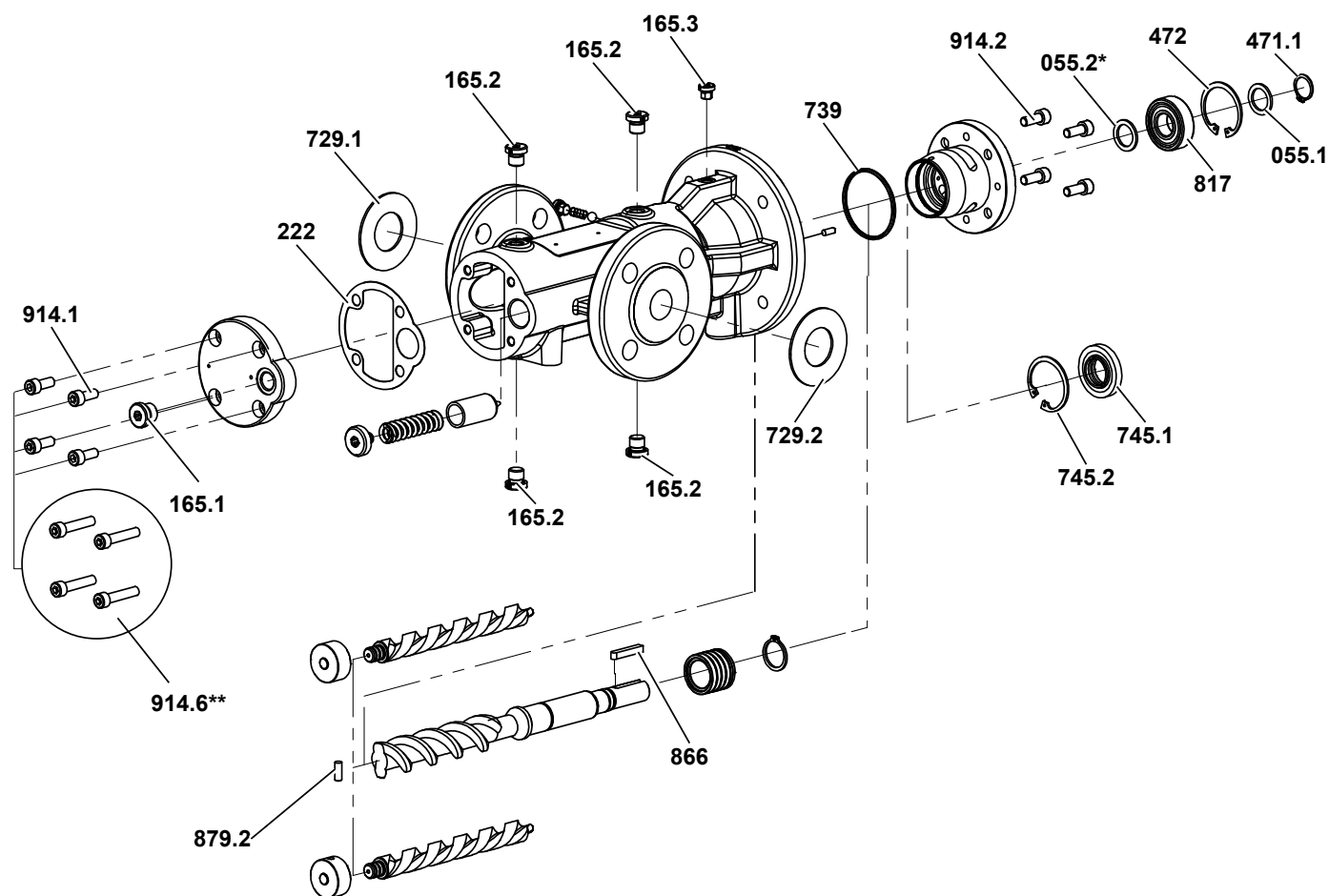
Tab. 22: Maintenance kit mechanical seal standard/hard material/balanced LFM

16 Spare parts

16.2 Maintenance kits

16.2.4 Maintenance kit radial shaft seal standard/high-temperature LFI/LVI/LFT/LVT

Note The maintenance kit contains only the numbered parts and is only supplied complete.



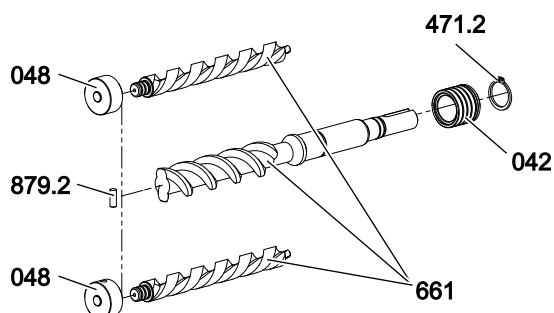
Qty.	Item No.	Part	Qty.	Item No.	Part
1	055.1	Supporting ring	1	745.1	Radial shaft seal ring
1	055.2*	Supporting ring	1	745.2	Supporting ring
1	165.1	Screw plug	1	817	Ball bearing
4	165.2	Screw plug	1	866	Feather key
1	165.3	Screw plug	1	879.2	Straight pin
1	471.1	Circlip	4	914.1	Socket screw
1	472	Circlip	4	914.2	Socket screw
1	729.1	Flat gasket, suction flange	4	914.6**	Socket screw
1	729.2	Flat gasket, pressure flange	1		MoS ₂ paste 15 g
1	739	O-ring			
	*	Only for Size 5 – 26 and 55 – 85			
	**	For LVI/LVT: replaces 914.1			

Tab. 23: Maintenance kit radial shaft seal standard/high-temperature LFI/LVI/LFT/LVT

16.3 Repair kits

16.3.1 Repair kit screw set LFI/LVI/LFT/LVT/LFM

Note The repair kit is only supplied in combination with a maintenance kit.

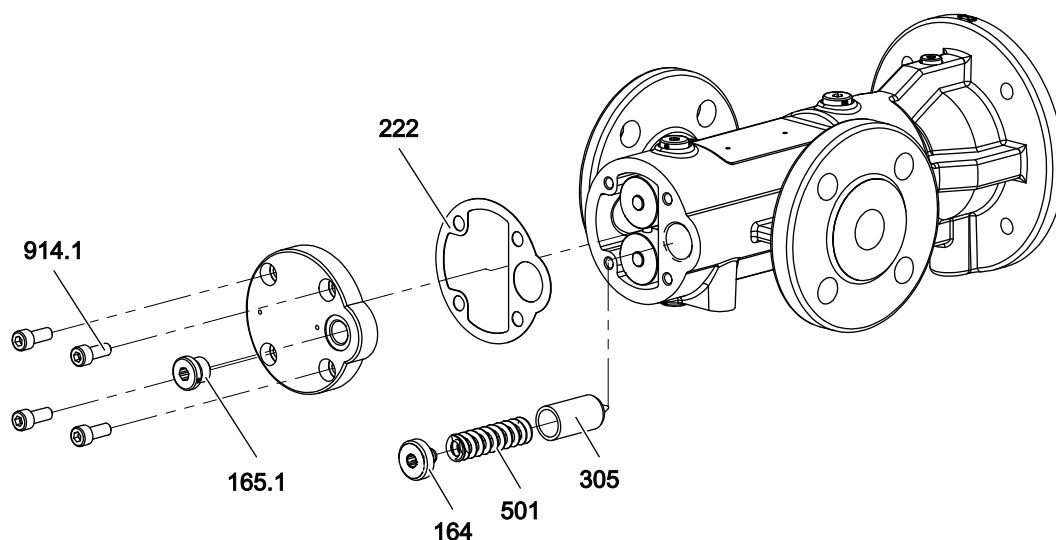


Qty.	Item No.	Part	Qty.	Item No.	Part
1	042	Balancing cylinder	1	661	Screw set
2	048	Balancing bush	1	879.2	Straight pin
1	471.2	Circlip			

Tab. 24: Repair kit screw set LFI/LVI/LFT/LVT/LFM

16.3.2 Repair kit overflow valve LFI/LVI/LFT/LVT/LFM

Note The repair kit contains only the numbered parts and is only supplied complete.



Qty.	Item No.	Part	Qty.	Item No.	Part
1	164	Adjusting screw	1	305	Valve body
1	165.1	Screw plug	1	501	Pressure spring
1	222	Flat gasket	4	914.1	Socket screw


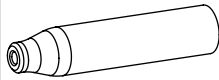

Tab. 25: Repair kit overflow valve LFI/LVI/LFT/LVT/LFM

16 Spare parts




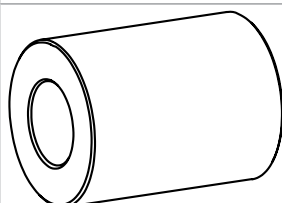
16.4 Tool sets

16.4 Tool sets

16.4.1 Mechanical seal tool kit L

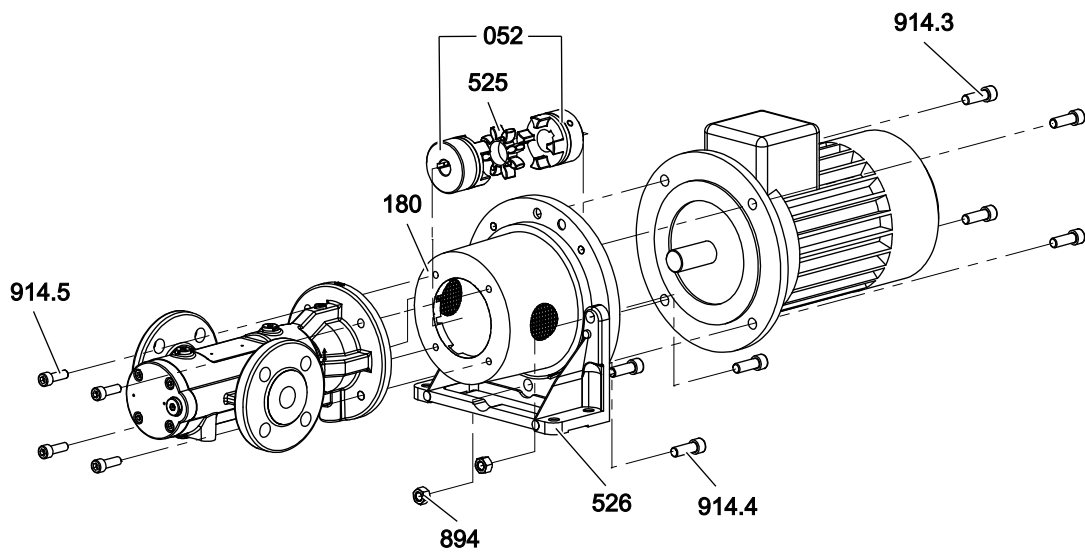
		Qty.	Part
C		1	Mounting arbour stationary seal ring
A		1	Main screw mounting sleeve
B		1	Mounting sleeve ball bearing

16.4.2 Tool set, radial shaft seal L

		Qty.	Part
D		1	Mounting arbour radial shaft seal ring
A		1	Main screw mounting sleeve
B		1	Mounting sleeve ball bearing
E		1	Positioning sleeve

16.5 Completions

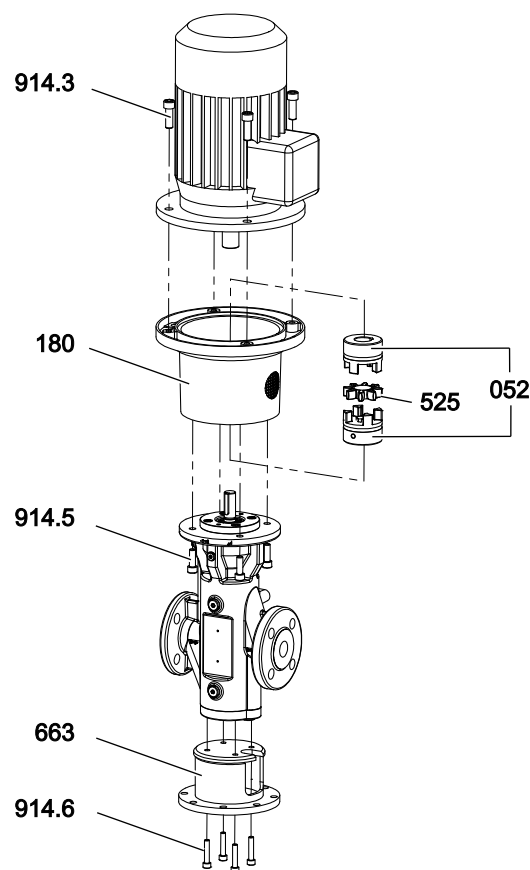
16.5.1 Completion type LFI/LFT/LFM/LFW



Qty.	Item No.	Part	Qty.	Item No.	Part
1	052	Coupling	3	894	Hexagon nut
1	180	Pump bracket	4	914.3	Socket screw
1	525	Coupling intermediate ring	3	914.4	Socket screw
1	526	Pump bracket foot	4	914.5	Socket screw

Tab. 26: Completion type LFI/LFT/LFM/LFW

16.5.2 Completion type LVI/LVT



Qty.	Item No.	Part	Qty.	Item No.	Part
1	052	Coupling	4	914.3	Socket screw
1	180	Pump bracket	4	914.5	Socket screw
1	525	Coupling intermediate ring	4	914.6	Socket screw
1	663	Pedestal			

Tab. 27: Completion type LVI/LVT

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

17 Appendix

17.1 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]							Countersunk screws
Screws with head contact surface							
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. 28: 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.

17.2 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. 29: Tightening torques with thread measured in inches

17.3 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. 30: Directives observed

