

KRAL pump stations.

DKC/DLC Series.

OID 02en-GB
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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
- Corresponding operating instructions of the pump
- Technical documentation of the supplied components

Additional documents for ATEX version

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

1.3 Target groups

The instructions are intended for the following persons:

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

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

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

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

Tab. 1: Target groups

1.4 Symbols

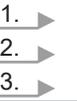
1.4.1 Danger levels

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

1.4.2 Danger signs

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

1.4.3 Symbols in this document

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

1.4.4 Symbols for personal protective equipment

Additional dangers arise for personnel without personal protective equipment. It is imperative that the personal protective equipment be worn.

Information on the personal protective equipment is provided separately at the beginning of the individual chapters in these instructions. The following table provides an overview.

	Meaning	Possible consequences of non-observance
	Protective helmet	Serious head injury through falling or toppling parts
	Protective goggles	Eye injury through hot, poisonous or corrosive liquids
	Hearing protection	Damage to hearing through loud noises
	Heat-resistant protective gloves with arm protection	Serious burns or cuts

2 Safety

1.5 Designations in this document

	Meaning	Possible consequences of non-observance
	Close fitting work clothing	Serious physical injury through clothes being drawn in
	Slip resistant safety boots	Serious foot injury through falling or toppling parts and serious physical injury through falling

1.5 Designations in this document

The following designations are used in these operating instructions:

Designation	Meaning
Small pump station	Station with pump sizes K 5–42/L 5–54
Large pump station	Station with pump sizes K 55-118/L 55–85

2 Safety

2.1 Proper use

- Use the pump station solely for transporting lubricating liquids that are chemically neutral and that do not contain gas or solid components.
- Use the pump station 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 station 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 station can also arise within the specified operating limits. This applies both to notably higher as well as to notably lower operating pressures. Under no circumstances may the minimum pressure lie below 2 bar. In case of any doubt, please contact the manufacturer.

2.2 Foreseeable misuse

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

2.3 Obligations of the operator-owner

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

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

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

2.4 Safety instructions

2.4.1 Fundamental safety instructions



The following safety instructions must be observed strictly:

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

3 Identification

3.1 Type code

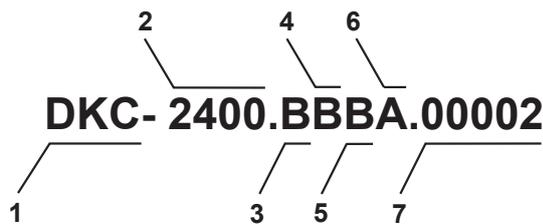


Fig. 1: Type code

- 1 Type
- 2 Size
- 3 Shaft seal
- 4 Pressure stage pressure maintaining valve
- 5 Suction-side two-way valve
- 6 Heating
- 7 Version index

Item	Classification	Description			
1	Type	DKC	<input type="checkbox"/> Station with pumps of the K series <input type="checkbox"/> Pressure build-up up to 16 bar		
		DLC	<input type="checkbox"/> Station with pumps of the L series <input type="checkbox"/> Pressure build-up up to 40 bar		
2	Size	Corresponds to delivery rate in [l/min] at rated speed			
3	Shaft seal	A	Standard mechanical seal		
		B	Mechanical seal of hard material		
		C	Standard radial shaft seal		
		D	Magnetic coupling		
		E	Mechanical seal with quench		
		F	High-temperature radial shaft seal		
		X	Special design		
4	Pressure stage pressure maintaining valve		Small pump station	Large pump station	
		A	Without pressure maintaining valve		
		B	Internal pressure maintaining valve	2 – 8 bar	3 – 7 bar
		C	Internal pressure maintaining valve	6 – 20 bar	7 – 16 bar
		D	Internal pressure maintaining valve	15 – 38 bar	16 – 34 bar
		E	External pressure maintaining valve	2 – 8 bar	3 – 7 bar
		F	External pressure maintaining valve	6 – 20 bar	7 – 16 bar
		G	External pressure maintaining valve	15 – 38 bar	16 – 34 bar
		X	Special design		

4 Technical data

3.2 Rating plate

Item	Classification	Description	
5	Suction-side two-way valve	A	Without suction-side two-way valve
		B	Suction-side two-way valve, manually operated
		C	Suction-side two-way valve, manually operated with limit switch
		D	Suction-side two-way valve, electrically operated with limit switch
		E	Suction-side two-way valve, pneumatically operated with limit switch
6	Heating	A	Without heating
		B	Electrical heating system in station block
		C	Fluid heating system in the station block
		D	Electrical heating system in the station block and at the pumps
		E	Fluid heating system in the station block and at the pumps
7	Version index	For internal administration	

Tab. 2: Type code

3.2 Rating plate

6	KRAL	CE	1	Construction year
5	Art.-Nr. Item no.		2	Max. allowable working pressure suction-side/Max. allowable working pressure pressure-side
4	Typ Type	Δp bar	3	Temperature range
3	SN Serial no.	Q l/min	4	Serial number
2	Tmin. / Tmax.	$^{\circ}\text{C}$ n min ⁻¹	5	Type
1	pS max. / pD max.	bar v mm ² /s	6	Article number
	Jahr Year	Gewicht Weight kg	7	Differential pressure
	KRAL GmbH, 6890 Lustenau, Austria	www.kral.at	8	Nominal delivery rate
			9	Rated speed
			10	Nominal viscosity
			11	Weight

Fig. 2: Rating plate

4 Technical data

4.1 Operating limits

In addition to the operating limits of the pump station, the operating limits of the attached pumps must also be observed.

Parameter	Unit	DKC	DLC
Max. allowable working pressure	[bar]	16	40
Max. inlet pressure	[bar]	6	6
Max. temperature of pumped liquid	[$^{\circ}\text{C}$]	180	180
Viscosity min. – max.	[mm ² /s]	2–10 000	2–10 000
Ambient temperature min. – max.	[$^{\circ}\text{C}$]	-20 ... 50	-20 ... 50

Tab. 3: Pump station operating limits

4.2 Filling volume

Parameter	Unit	Small pump station	Large pump station
Filling volume of station block	[l]	8	13

Tab. 4: Filling volume of station block

4.3 Required NPSH values

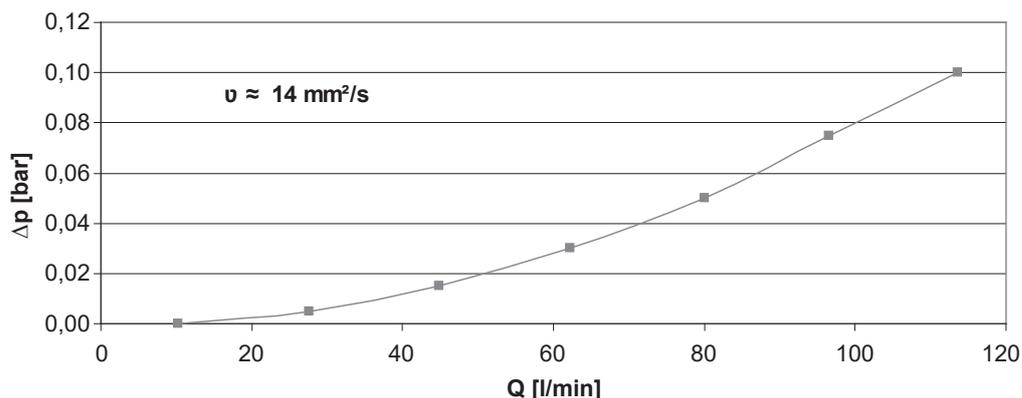
The required NPSH values of the pump depend on the size, the viscosity of the pumped liquid and the speed.

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

www.kral.at/en/screw-pumps

4.4 Internal pressure loss of the pump station

When determining the NPSH value of the pump station also take into account the internal pressure losses in the ducts of the station, in the reversing valve and particular in the strainer. The following diagram shows as an example the overall pressure loss from the connection of the station up to the suction flange of the pump under operation with a cleaner strainer.



Δp Pressure loss

Q Delivery rate

4.5 Sound pressure level

Size	Sound pressure level ± 3 [dB(A)]			
	Pump	Motor	1 pump + 1 motor	2 pumps + 2 motors
K 5–42	55.0	55.0	58.0	61.0
K 55–118	60.0	62.0	64.0	67.0
L 5–54	57.0	62.0	63.5	66.5
L 55–85	60.0	64.0	66.0	69.0

Tab. 5: Sound pressure level

4.6 Mesh width strainer/filter

Options	Usage	Viscosity [mm ² /s]	Mesh width [mm]
Strainer	Separation of coarse soiling during operation	< 20	0.25
		> 20	0.5
Commissioning strainer/ commissioning filter	Protection of the station during commissioning	–	0.02
Operating filter	Protection of the station during operation	–	Depending on pumped liquid

Tab. 6: Mesh width strainer/filter

4 Technical data

4.7 Weights

4.7 Weights

Part	Unit	Small pump station	Large pump station
Station block with strainer and reversing valve	[kg]	59	91
Internal pressure maintaining valve	[kg]	1.3	1.9
External pressure maintaining valve	[kg]	13.0	16.5
Two-way valve, manually operated	[kg]	8.1	14.0
Actuator, electrical	[kg]	7.3	7.3
Actuator, pneumatic	[kg]	5.8	5.8
Differential pressure indicator	[kg]	2.2	2.3
Base frame with oil pan	[kg]	21	26
Counter flanges, 2 pc.	[kg]	2.3	2.6
Pump with coupling and motor	[kg]	See corresponding operating instructions of the pump	

Tab. 7: Pump station weights

4.8 Heating system (optional)

4.8.1 Operating data

Operating data electrical heating system

Parameter	Unit	Small pump station	Large pump station
Voltage	[V]	230	
Wattage	[W]	220	2 x 220
Frequency	[Hz]	50/60	
Wire cross-section	[mm ²]	2 x 1	
Filling volume	[l]	0.40	2 x 0.12

Tab. 8: Operating data electrical heating system

Operating data fluid heating system

Parameter	Unit	Small pump station	Large pump station
Max. pressure	[bar]	16	
Max. liquid temperature	[°C]	180	
Connection outer diameter			
<input type="checkbox"/> Inserted screw connection	[mm]	28	22
<input type="checkbox"/> Swivel inserted screw connection	[mm]	–	22

Tab. 9: Operating data fluid heating system

4.8.2 Heating system special design

Please contact the manufacturer for special designs.

5 Function description

5.1 Structure

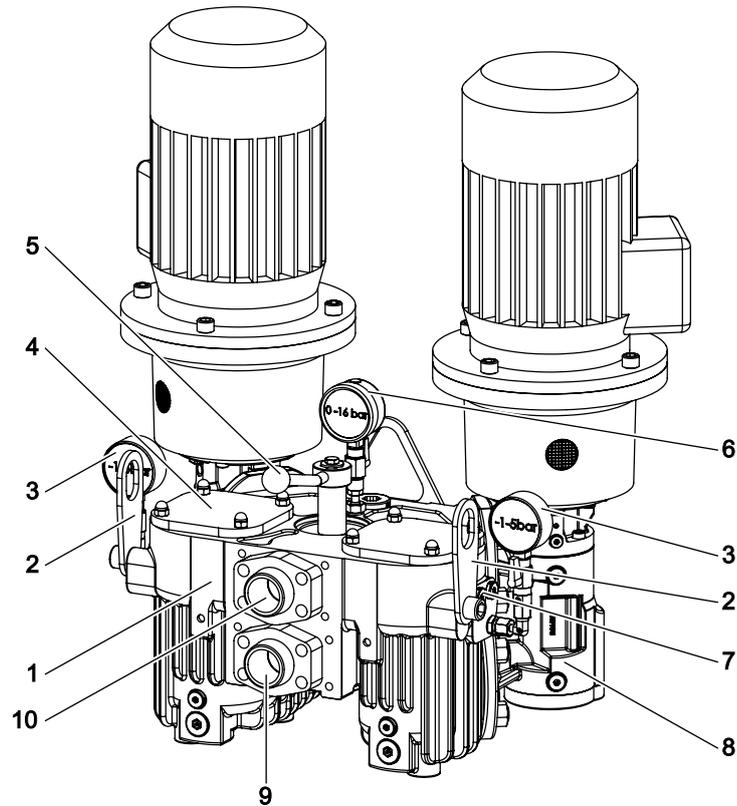


Fig. 3: Structure of pump station

1	Station block	5	Reversing valve lever	8	Pump
2	Lifting lug	6	Pressure-side pressure gauge	9	Pressure connection gauge
3	Suction-side pressure gauge	7	Loosen the screw plug of the vent hole	10	Suction connection
4	Strainer cover				

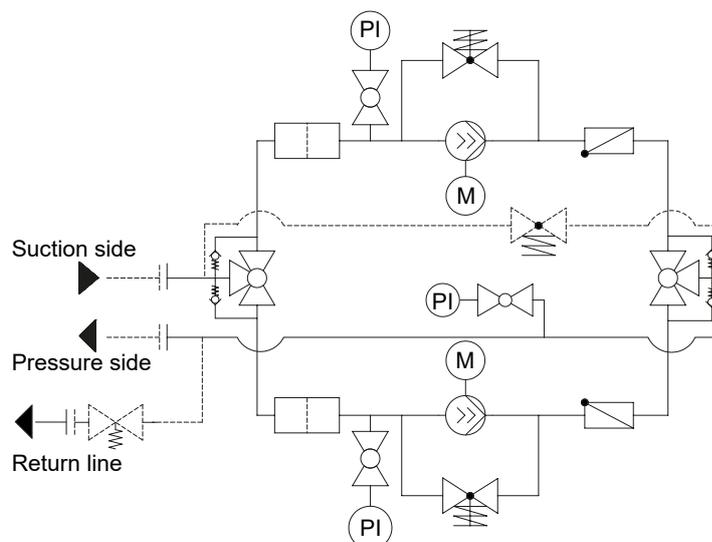


Fig. 4: Hydraulic scheme (--- = Option)

5 Function description

5.2 Functional principle

5.2 Functional principle

The pump stations of the DKC/DLC series are suitable for the parallel operation of two KRAL pumps of the K or L series. The functional description of the pumps is contained in the associated operating instructions of the pumps.

This is connected with the pipe system through the suction connection **10** at the front of the station. Depending on the position of the reversing valve **5**, the left-hand, the right-hand or both strainers are connected to the suction connection. The pumped liquid flows through the strainer from top to bottom and thus reaches the suction connection of the attached pumps. There the pressure of the pumped liquid is increased which finally returns to the station through the pressure connection of the pump. The pumped liquid flows through a non-return valve in an integral duct into the lower part of the station and via the reversing valve to the pressure connection **9** through which the fluid leaves the station again.

5.3 Reversing valve

If the lever of the reversing valve **5** is in one of the two side positions, the respectively other line of the station is separated from the fluid circuit so that the strainer of this line can be opened and cleaned. If the lever is in the centre position, both lines are connected to the fluid circuit. The delivery rate can thus be increased through parallel operation of the two pumps. If only one pump is being operated, the second pump can be cut in automatically if the delivery rate or the pressure drops at the active line. In order to ensure a uniform distribution of the operating hours, an interval-controlled automatic switch-over between the two pumps is also possible in this valve position. The non-return valves ensure that the respective pump that is stopped does not begin to rotate backwards.

5.4 Expansion valve

The fluid volume in the respectively blocked line of the station could result in an impermissibly high inner pressure due to heating up through thermal expansion. In order to prevent this, the cylinder of the reversing valve contains two small spring expansion valves that vent any overpressure in the respectively active line of the station.

5.5 Pressure measurement

A pressure gauge **6** is located in the centre of the station in order to monitor the supply pressure. The pressure gauge is always connected to the pressure side of the station and is thus independent of the position of the reversing valve **5**. In order to monitor the pressure on the suction sides of the two pumps, two further pressure gauges **3** are mounted. These pressure gauges show only the respective pressure at one of the two strainers and can be used to monitor the degree of soiling of the strainers. The pressure gauge in the blocked line shows only the inner pressure of the blocked strainer.

The stopcocks at the pressure gauges may only be opened to read the pressure values ↺ During operation, Page 32.

5.6 Strainer

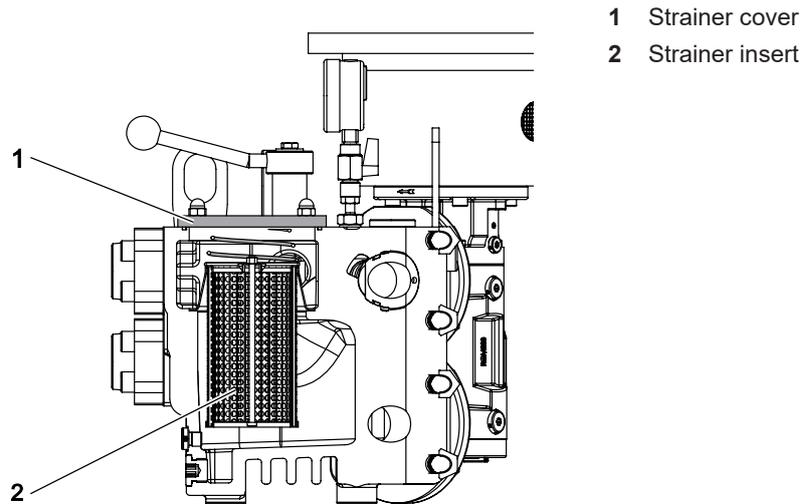


Fig. 5: Strainer

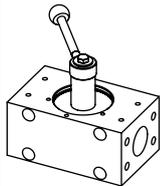
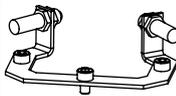
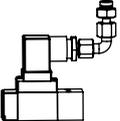
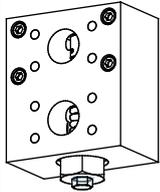
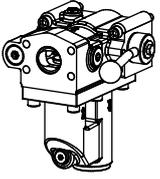
The pump station is equipped with two strainers as standard. These strainers serve to separate soiling that is normally not contained in the pumped liquid. Due to their small size the strainers cannot separate larger amounts of soiling occurring regularly, nor abrasive fine particles. In the case of such operating conditions the pump station has to be protected additionally by a correspondingly dimensioned operating filter. Very fine abrasive particles can, however, not be held back by the operating filter and cause increased wear to the pumps.

Alternatively the strainers can be replaced during commissioning by fine-meshed commissioning strainers ↪ Commissioning, Page 27. The commissioning strainer is available from the manufacturer. A further possibility is the use of an external commissioning filter.

The strainer inserts are made of metal and can be cleaned and reused ↪ Maintenance, Page 35.

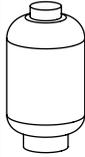
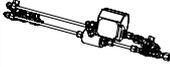
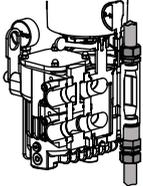
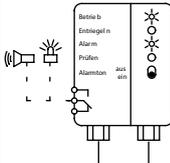
5.7 Options

Detailed information is provided in the respectively associated technical documentation.

Option/function		Option/function	
Two-way valve <input type="checkbox"/> Connection of the station to two pipe systems with different pumped liquids		Temperature monitoring <input type="checkbox"/> Monitoring of the temperature of the pumped liquid	
Limit switch <input type="checkbox"/> Remote control of the lever position at the two-way valve		Securing of the strainer cover <input type="checkbox"/> Controlled opening of the strainer chamber	
Pressure maintaining valve, internal <input type="checkbox"/> Ensuring of a constant supply pressure even when the liquid requirement varies		Pressure switch <input type="checkbox"/> Additional pressure monitoring	
Pressure maintaining valve, external <input type="checkbox"/> Ensuring of a constant supply pressure even when the liquid requirement varies <input type="checkbox"/> Recommended at high overflow amounts		Built-on volumeter OMA <input type="checkbox"/> Flow measurement <input type="checkbox"/> Mounting on the pump station	

5 Function description

5.8 Heating system (optional)

Option/function		Option/function	
Pulsation damper <input type="checkbox"/> Protection of the plant against pressure peaks <input type="checkbox"/> Not suitable for heavy fuel oil		Electrical heating system <input type="checkbox"/> At high-viscosity pumped liquids that do not flow sufficiently if not heated	
Differential pressure monitoring <input type="checkbox"/> Monitoring of the differential pressure at the strainer <input type="checkbox"/> Optical display or electrical contacts		Fluid heating system <input type="checkbox"/> At high-viscosity pumped liquids that do not flow sufficiently if not heated	
Leak oil monitoring <input type="checkbox"/> Monitoring of the leak oil quantity in the oil pan <input type="checkbox"/> To be used with an elevated oil pan			

Tab. 10: DKC/DLC options

5.8 Heating system (optional)

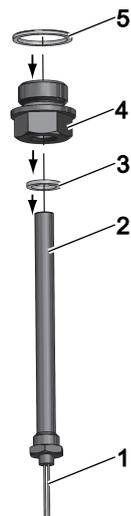
5.8.1 Possible types of heating

The pump station 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 power consumption or in problems arising through cavitation or sealing.

Possible types of heating:

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

5.8.2 Electrical heating system



- 1 Connecting cable
- 2 Heating element
- 3 Seal ring
- 4 Screw plug heating element
- 5 Seal ring

Fig. 6: Electrical heating system

At the small pump station the electrical heating system is installed in a heating duct within the station block. The electrical heating system for the large pump station consists of two heating elements that are integrated in two heating ducts of the station block. The output of the elements corresponds to the radiation losses and convection losses of the pump in the required temperature range so that overheating is not possible.

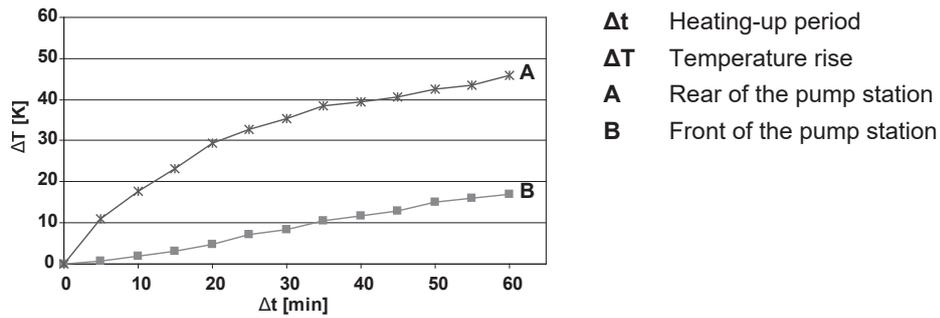


Fig. 7: Temperature rise after the heating system has been switched on

Heating of the station block of the small pump station after the steady-state condition has been reached:

- Rear of the pump station: approx. 60 K
- Front of the pump station: approx. 40 K

Small pump station	Large pump station
1 heating element	2 heating elements
1 screw plug	2 screw plugs
2 seal rings	4 seal rings
0.5 l thermal oil Caldo ISO 32	0.25 l thermal oil Caldo ISO 32

Tab. 11: Scope of delivery of electrical heating system

5.8.3 Fluid heating system

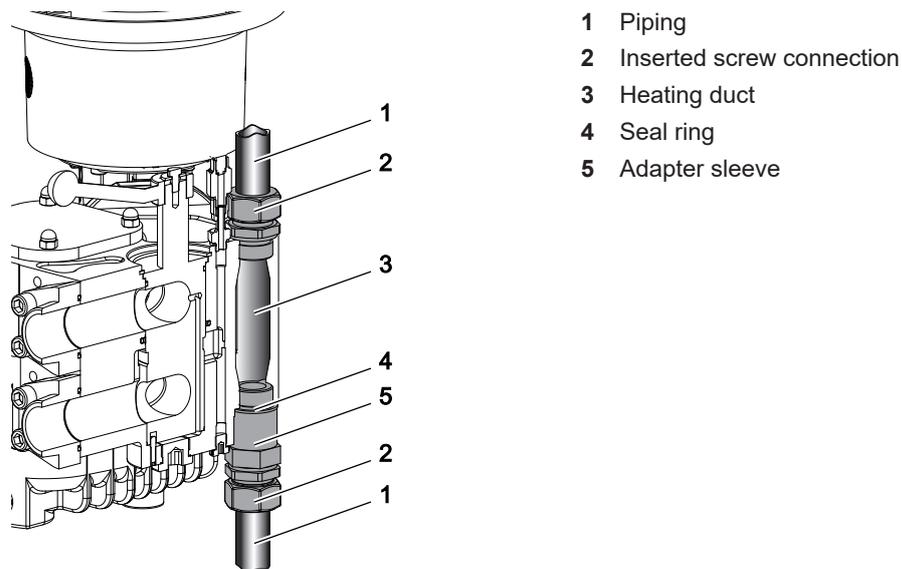


Fig. 8: Cross-section fluid heating system small pump station

In the case of the fluid heating system the heating fluid passes through one or two heating ducts in the station block. The screw connections required to this purpose are available from the manufacturer.

Small pump station	Large pump station
2 straight inserted screw connection	2 swivel inserted screw connections
1 seal ring	2 screw connections
1 adapter sleeve	–

Tab. 12: Scope of delivery of the fluid heating system

5.8.4 Heating system special design

Please contact the manufacturer for special designs.

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 qualified personnel.
- A crane operator and transport personnel are required for transportation (2 persons).
- 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.
- Cordon off the danger zone and ensure that unauthorized persons cannot enter the danger zone.

6.2 Dangers during storage



The following safety instructions must be observed:

- Observe the storage conditions.

6.3 Unpacking and checking the state of delivery

Personnel qualification: Trained personnel

1. ► Upon delivery unpack the pump station and check it 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 station

Personnel qualification: Transport personnel

Personal protective equipment: Work clothing
 Protective helmet
 Protective gloves
 Safety boots

Aids: Mobile crane, forklift, hoisting equipment
 Traverse



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.
- Do not stand under raised loads.

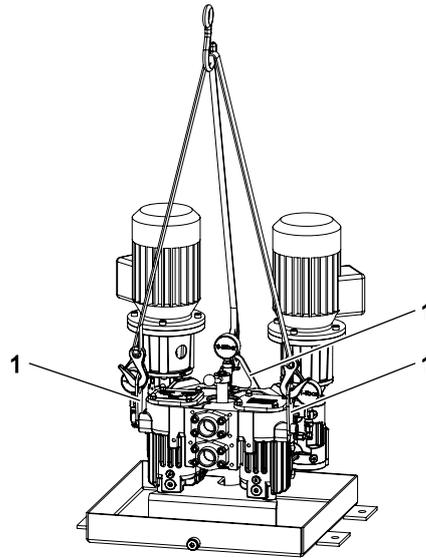


Fig. 9: Fastening of hoisting equipment - principle diagram

➔ Secure the hoisting equipment to the lifting lugs **1** of the pump station and lift the pump station using the crane.

6.5 Storing the pump station

During the test run, the internal components of the pump station are wetted with test oil, which has a preservative effect. The pipe connections are fitted with protective covers. Unless otherwise specified, the outer parts of the pump station are preserved with a single-coat PU-based two-component paint. The preservative applied at the factory will protect the pump station 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 station 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 station against damage, heat, sunlight, dust, moisture and magnetic fields.
- ▶ 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 18.

6.6 Heating system (optional)

6.6.1 Storing heating elements

1. ➔ Store the heating element in an absolutely dry room or in hermetically sealed plastic bags.
2. ➔ If the heating element has absorbed humidity, dry it for eight hours in a drying furnace at 180 °C.

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. 13: 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"/> Castrol Rustilo DWX 21 or other preservative offering comparable protection

1. ➤ Open the strainer cover.
2. ➤ Pour the preservative into the station block until it reaches approx. 2 cm under the rim, while slowly turning the fan impeller of the motor in the direction of rotation at the pumps.
3. ➤ Close the strainer cover.
4. ➤ After about six months storage check the filling level of the oil 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 21 or other preservative offering comparable protection

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

7.4 Removing the preservation

Personnel qualification:	<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"/> Solvent <input type="checkbox"/> Steam-jet cleaning device with wax-dissolving additives <input type="checkbox"/> Collection tank



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 station with solvents, if necessary using a steam-jet cleaning device.
2. ➤ Remove the strainer cover carefully in order to reduce any pressure that may exist in the pump station.
3. ➤ Drain the pump station, collecting the preservative in a collection tank.
4. ➤ To remove the residual preservative, flush the pump station 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 52.
- Ensure that all the components can be accessed and that maintenance work can be carried out easily.

8.2 Dangers during removal



The following safety instructions must be observed strictly:

- Have all work carried out only by authorized qualified personnel.
- Before beginning work, let the pump station 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 liquids is sufficiently large.

8.3 Mounting the pump station

Note Soiling in the pipe system impairs the service life of the pump station. If the pipe system is flushed using the pump station during the initial commissioning, an additional commissioning filter has to be installed temporarily before the pump station. Alternatively the strainers supplied as standard can be replaced during commissioning by fine-meshed commissioning strainers.

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"/> 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 station on a stable bearing underground.
- ▶ Ensure that fastening elements and pipings are fastened sufficiently.

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 station.
- ▶ Ensure that a commissioning filter is installed when the pipe system is flushed and cleaned using the pump.

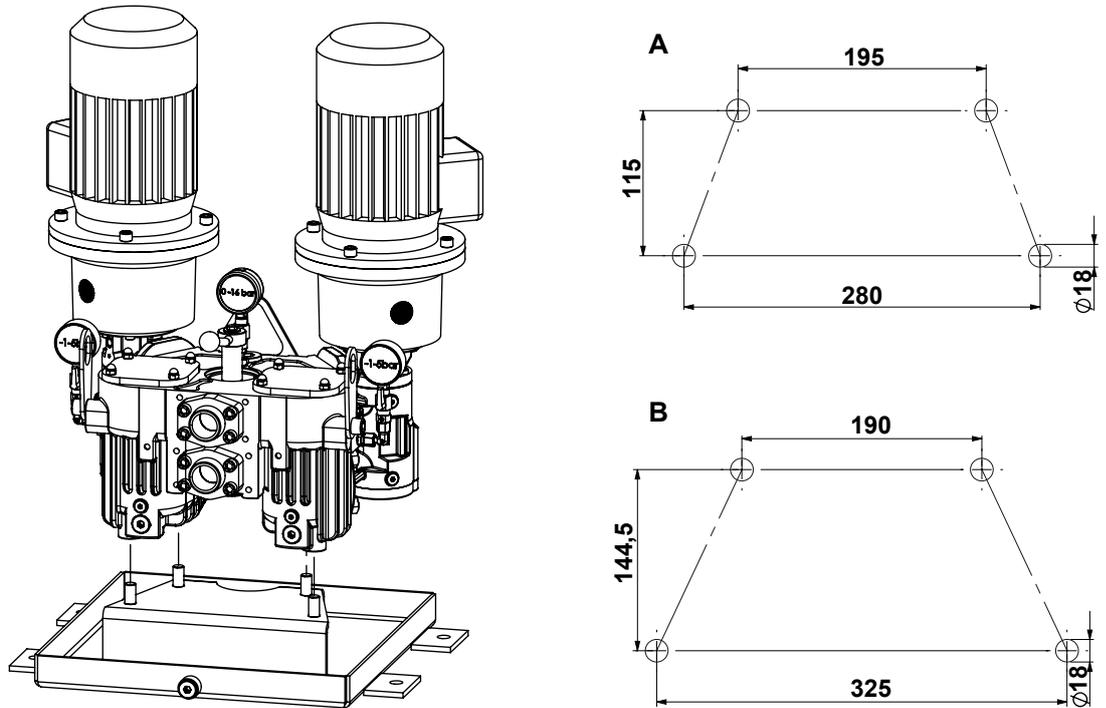


Fig. 10: Mounting on the base frame with oil pan

- A Large pump station
B Small pump station

Requirement:

- ✓ Pump station connections protected against soiling, for example by using the protective cover mounted in the factory
1. Bring the pump station into the installation position.
 2. Fasten the pump station with fastening elements securely on the ground. The pump station including oil pan must rest fully on a base frame or on the floor in order to avoid vibrations.

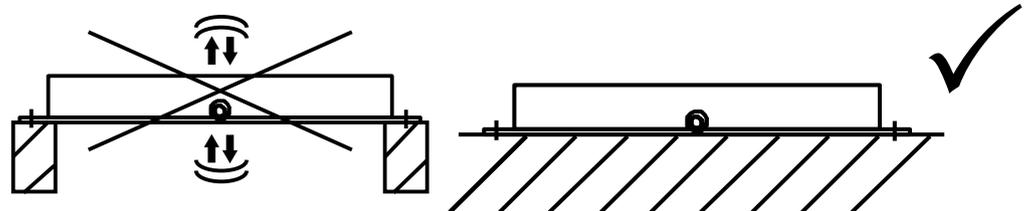


Fig. 11: Securing the oil pan

3. After the connecting work clean the pipe system thoroughly ↪ Commissioning, Page 27.

8.4 Protecting the pump station against pressure peaks

ATTENTION

Damage to the plant components through pressure peaks.

- ▶ Use pulsation damper.

Note The pulsation damper is available as an option from the manufacturer.
 —▶ Install the pulsation damper in the pipe system.
 -or-
 Mount the pulsation damper on the pump station.

8.5 Installing the heating system (optional)

8.5.1 Danger when installing the heating element



The following safety instructions must be observed strictly:

- Ensure that any vapours arising can escape freely.

8.5.2 Installing the electrical heating system

The electrical heating system is installed in one heating duct within the station block in the case of the small pump station and in two heating ducts within the station block in the case of the large pump station.

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

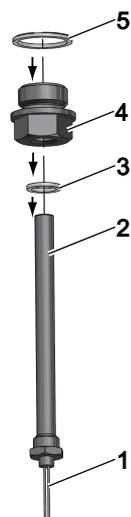


⚠ DANGER

Risk of injury through emitted thermal oil.

In the case of complete filling of the heating duct the station block may burst.

- ▶ Observe the upper filling limit of the heating duct.

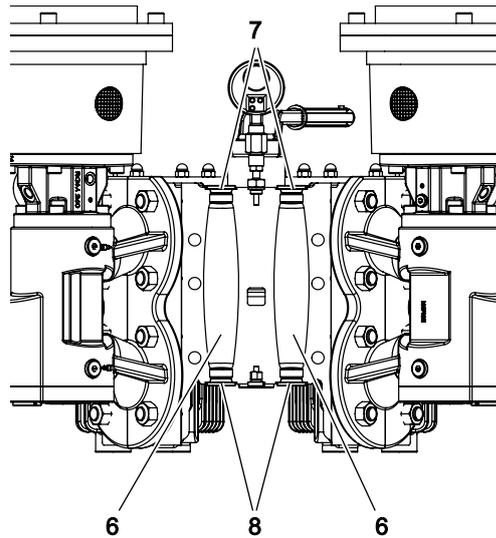


- | | |
|---|----------------------------|
| 1 | Connecting cable |
| 2 | Heating element |
| 3 | Seal ring |
| 4 | Screw plug heating element |
| 5 | Seal ring |

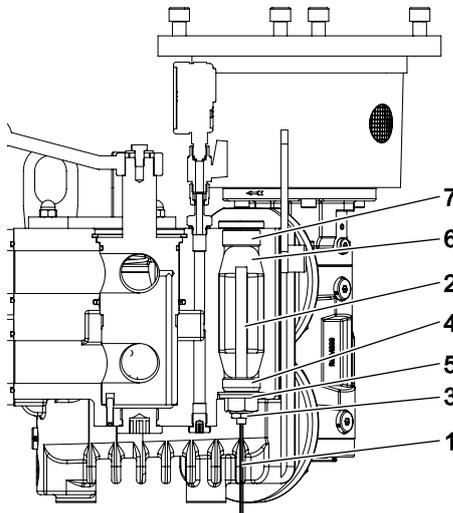
1. ▶ Slide the seal ring **3**, screw plug of the heating element **4** and seal ring **5** onto the heating element **2**.
2. ▶ Screw the screw plug of the heating element **4** tight.

8 Installation, removal

8.5 Installing the heating system (optional)



3. ➤ Remove the lower screw plug 8 of the heating duct 6 at the station block (figure shows the large pump station).

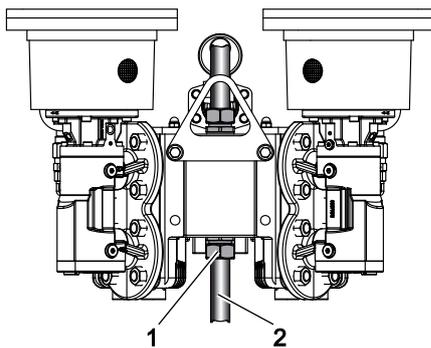


4. ➤ Insert the heating element from below into the heating duct 6 and tighten the screw plug of the heating element 4.
5. ➤ **Large pump station:** Prepare the second heating element in the same manner and insert it into the second heating duct.
6. ➤ Remove the upper screw plug 7 of the heating duct at the station block.
7. ➤ **Small pump station:** Fill the heating duct up to a maximum of 45 mm under the threaded end of the screw plug with thermal oil.
-or-
Large pump station: Fill both heating ducts up to a maximum of 70 mm under the threaded end of the screw plug with thermal oil.
8. ➤ Close the heating duct again with the upper screw plug 7.

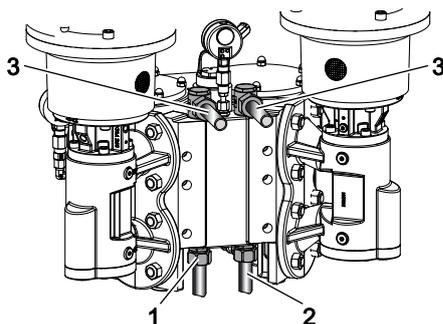
8.5.3 Installing the fluid heating system

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

1. ➤ Remove the upper and lower screw plug of the heating duct.



2. ► **Small pump station:** Mount the piping 2 with the inserted screw connection 1.



3. ► **Large pump station:** Mount the piping 2 with the inserted screw connection 1 and the swivel inserted screw connection 3.

8.5.4 Installing the heating system special design

► When installing special designs contact the manufacturer.

8.6 Removing the pump station

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"/> 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.

8 Installation, removal

8.6 Removing the pump station



! DANGER

Risk of death resulting from falling load.

- ▶ Use intact and correctly dimensioned hoisting equipment.
- ▶ Ensure that the crane and hoisting equipment are in a flawless state.
- ▶ Do not stand under raised loads.
- ▶ Take the centre of gravity into account and secure the load against tilting.
- ▶ A crane operator and transport personnel are required for transportation (2 persons).



! DANGER

Risk of death through emitted pumped liquid.

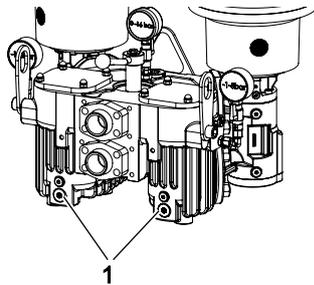
Pumped liquids can be hot, poisonous, combustible and caustic and can spray out under high pressure.

- ▶ Wear personal protective clothing during all the work. Ensure face protection.
- ▶ Before beginning work, let the pump station cool down to the ambient temperature.
- ▶ Ensure that the pump station 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 station and pumped liquid cooled down to the ambient temperature

1. ▶ Ensure that the pump station is deenergized and is secured against being switched back on.
2. ▶ Ensure that the pump station is depressurized.
3. ▶ Close the pressure-side and suction-side shut-off devices.
4. ▶ Loosen the connecting screws of the suction connection and the pressure connection. Collect any discharging pumped liquid.
5. ▶ After the pumped liquid has been drained completely, dismantle the pressure-side and suction-side connecting flange.



6. ▶ Open the screw plugs **1**, collect any discharging pumped liquid.
7. ▶ Remove the pump station.

9 Connection

9.1 Dangers during connection work



The following safety instructions must be observed strictly:

- Have all work on the pump station and pipe system only carried out by authorized qualified personnel.
- Ensure that impurities cannot get into the pump station and pipe system.
- Ensure that mechanical connections are mounted stress-free.
- Observe the tightening torques.
- Have all the work on the electrical equipment only carried out by electricians.
- Before commissioning ensure correct earthing, equipotential bonding and overcurrent protection.
- Before beginning work on the pump station 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 station to the pipe system

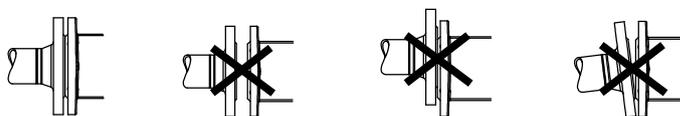


Fig. 12: Connecting the piping

Personnel qualification:	<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 <input type="checkbox"/> Torque wrench

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 station.
- ▶ 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 station is mounted free of mechanical stresses in the pipe system.
- ▶ Observe the tightening torques.

1. ▶ Check whether the reversing valve or the two-way valve moves easily.
If the levers of the valves cannot be turned by hand, remedy the fault before commissioning the pump station.
2. ▶ Attach protective covers in front of the connecting flanges before welding work.
3. ▶ Place the piping in position and support the weight of the piping. Do not use the pump station as a support for connected piping.
4. ▶ Install compensating elements if temperature-related material expansion is possible.
5. ▶ 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.
6. ▶ Tighten the connecting screws.

9.3 Connecting the pipe station electrically/pneumatically

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



! 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. Carefully earth the base frames with the screwing.
2. Connect the pump station electrically and pneumatically in accordance with the following circuit diagrams.

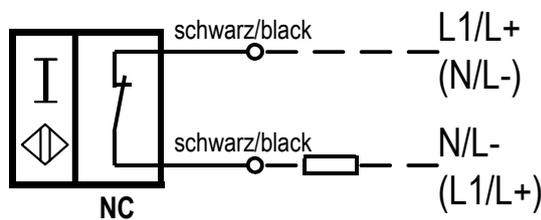


Fig. 13: Pin assignment of the limit switch for the suction-side two-way valve

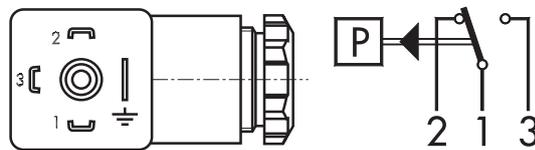


Fig. 14: Pin assignment of the pressure switch

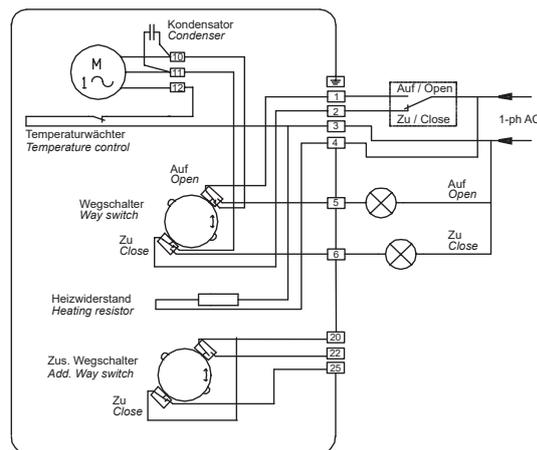


Fig. 15: Pin assignment of the electrical actuator

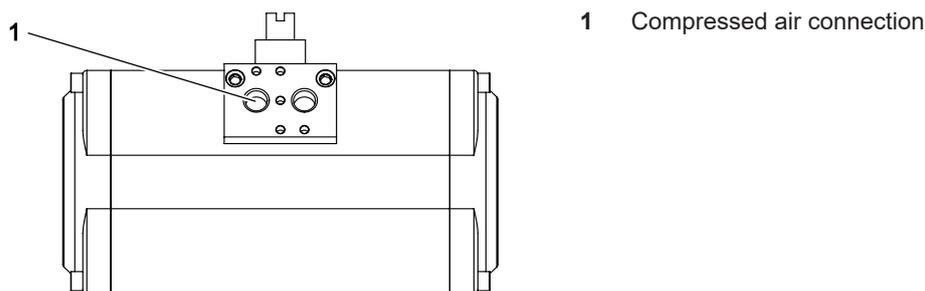


Fig. 16: Pin assignment of the pneumatic actuator

3. ► When connecting the pump station 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 pressure-side pipe system to protect the pump station.
- Before commissioning, make sure that the suction line and pump station are filled.
- Pumped liquids can be hot, poisonous, combustible and caustic. Use corresponding protective equipment.
- Observe the operating instructions of the pump and the further components.
- Ensure that the pump station is only operated within the operating limits.
- Ensure that during cooling down or heating up the pump station 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 impairs the service life of the pump station. If the pipe system is flushed using the pump station during the initial commissioning, an additional commissioning filter has to be installed temporarily before the pump station. Alternatively the strainers supplied as standard can be replaced during commissioning by fine-meshed commissioning strainers.

Personnel qualification:	<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

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 station.
- Ensure that a commissioning filter is installed when the pipe system is flushed and cleaned using the pump.

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/commissioning strainer installed (mesh width 0.02 mm)

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

10.2.2 Filling and venting the pump station

Possibilities

There are two possible ways to fill the pump station:

- Via the suction connection or pressure connection
- Via the strainers

Filling and venting the pump station 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 gloves <input type="checkbox"/> Protective helmet <input type="checkbox"/> Safety boots <input type="checkbox"/> Face protection
Aids:	<input type="checkbox"/> Collection tank

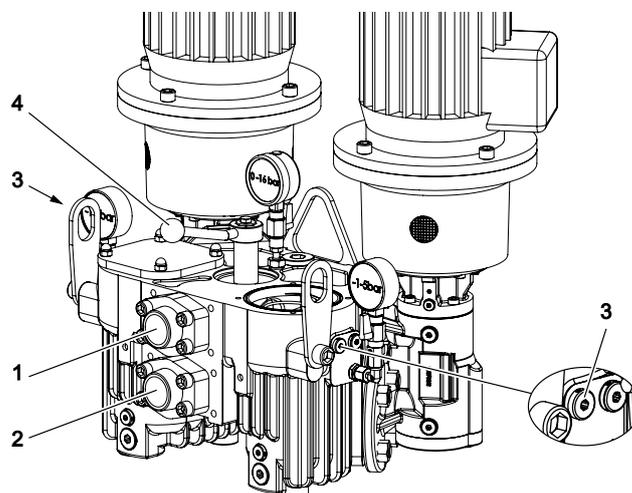


⚠ DANGER

Risk of death through emitted pumped liquid.

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

- ▶ Observe the operating instructions of the pump.
- ▶ 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. ➤ Ensure that the lever of the reversing valve **4** is in the middle position.
2. ➤ Open both screw plugs of the vent holes **3** by a max. of 2 rotations so that air can escape during the filling process.
3. ➤ Open the suction-side or pressure-side shut-off device and fill the pump station via the suction connection **1** or pressure connection **2**.
4. ➤ Vent the pumps. Take the corresponding operating instructions of the pumps into consideration in the process.
5. ➤ Tighten both screw plugs of the vent holes **3** again.

Filling and venting the pump station via the strainers

Personnel qualification:	<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 <input type="checkbox"/> Face protection
Aids:	<input type="checkbox"/> Collection tank

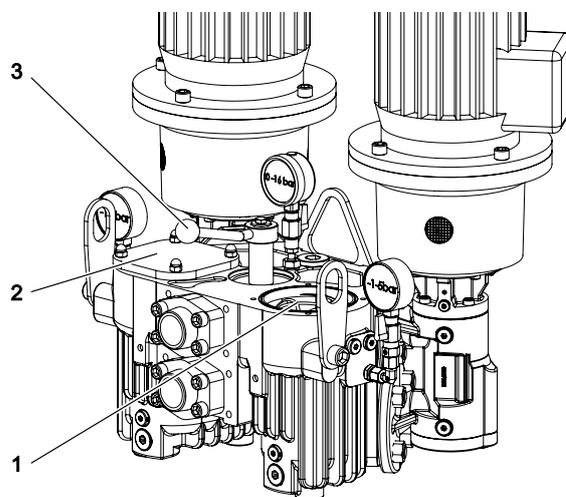


WARNING

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.



1. ➤ Ensure that the lever **3** of the reversing valve is in the middle position.
2. ➤ Dismantle the strainer cover **2**.
3. ➤ Fill the pumped liquid into the strainer chamber **1** until it is filled completely.
4. ➤ Vent the pumps. Take the corresponding operating instructions of the pumps into consideration in the process.
5. ➤ Fill the strainer chamber again with pumped liquid.
6. ➤ Mount the strainer cover **2**.

10.2.3 Checking the direction of rotation

The direction of rotation and the flow direction are indicated by arrows on the pump. The direction of rotation of the motor specifies the direction of rotation of the pump. That is to say, the fan impeller of the motor must rotate in the direction in which the arrow on the pump is pointing to indicate direction of rotation.

➤ For information on checking the direction of rotation please refer to the pump operating instructions.

10.2.4 Commissioning the pump station

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

Dry running can damage pump equipment.

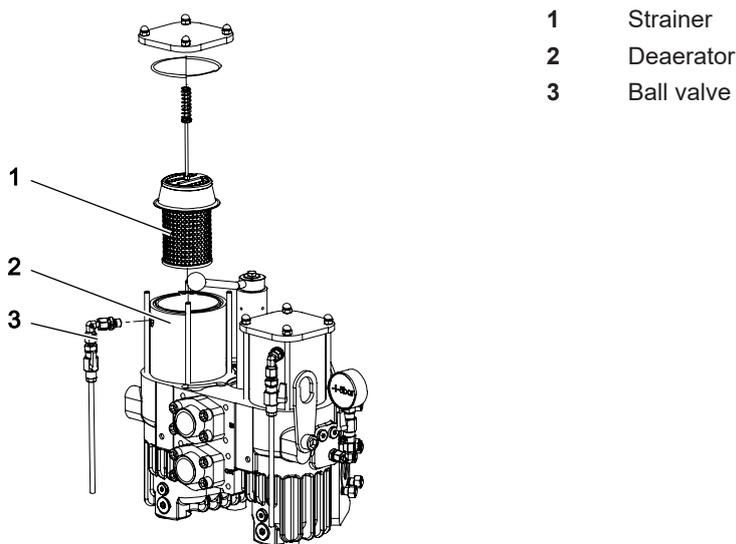
- ▶ Ensure that the pump and the connected pipe system are filled properly.
- ▶ If the pump does not deliver after 10 – 15 seconds, abort commissioning.

Requirement:

- ✓ Pump station set up and connected correctly
 - ✓ Motors connected correctly
 - ✓ Pipe system is free of impurities
 - ✓ Pump station filled
 - ✓ Shut-off devices in the suction line and pressure line opened
 - ✓ All connections are sealed
1. ▶ Switch on the pump station.
⇒ The pump station delivers when the pressure on the pressure side of the pump station rises.
 2. ▶ If the pump station does not deliver after 10–15 seconds of operation, abort commissioning, eliminate the cause of the fault and only then continue the commissioning procedure. Take the information from the fault table into account, ↪ Troubleshooting, Page 43.
 3. ▶ Run the pump station 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.
 4. ▶ Check the function of the overflow valve, see the pump operating instructions.

10.2.5 Venting the deaerator

The deaerator is a container above the strainer in which gas components from the medium collect. The gas can be discharged via the screwed-on ball valve, thus preventing cavitation



► During commissioning vent the deaerator twice an hour.

10.2.6 Taking the heating into operation (optional)

Connecting and commissioning the electric heating system

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



! 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 injury through emitted pumped liquid.

The station block may burst through heat expansion of the pumped liquid.

- Do not shut off the pump station from the pipe system during the heating process.

1. ► Connect the connecting cable of the heating element.
2. ► Switch on the electric heating system.

Commissioning the fluid heating system

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



! DANGER

Risk of injury through emitted pumped liquid.

The station block may burst through heat expansion of the pumped liquid.

- ▶ Do not shut off the pump station from the pipe system during the heating process.

—▶ Observe the permissible operational limits of the pump station and the pumps when setting the supplied mass flow and its temperature, ↗ Technical data, Page 8 and associated operating instructions of the pumps.

10.3 During operation

10.3.1 Checking the operating pressure

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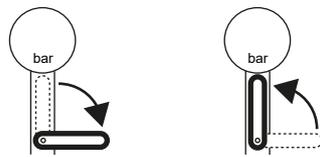


Fig. 17: Pressure gauge shut-off valves closed/open - principle diagram

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 Adjust overflow valve and test function

—▶ Check the setting of the overflow valve, see the pump operating instructions.

10.3.3 Setting the pressure maintaining valve (optional)

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

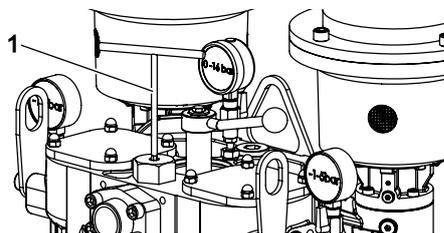


Fig. 18: Setting the internal pressure maintaining valve

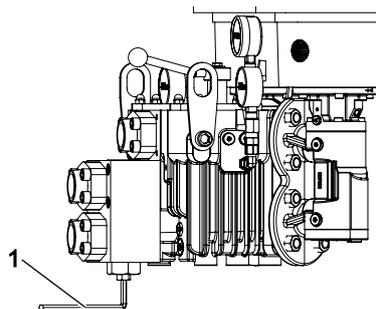


Fig. 19: Setting the external pressure maintaining valve

1. ➤ Remove the screw plug of the pressure maintaining valve.
2. ➤ Use the Allen key **1** to change the set pressure.
Turning clockwise: Increase the set pressure
Turning counter-clockwise: Decrease the set pressure
3. ➤ Tighten the screw plug of the pressure maintaining valve again.
4. ➤ Monitor the set pressure of the installed pressure gauge.

10.3.4 Activating the reversing valve

Personnel qualification: Trained personnel

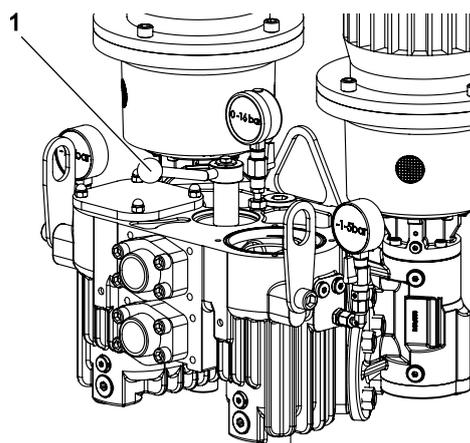


Fig. 20: Reversing valve lever

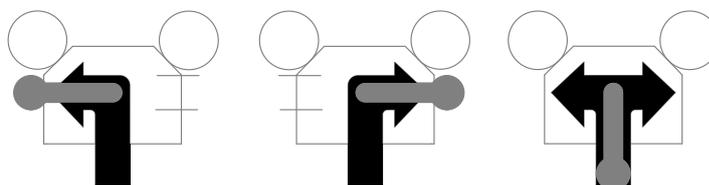


Fig. 21: Positions of the reversing valve

Note The reversing valve can be operated during operation.

1. ➤ Turn the lever **1** to the left.
⇒ The left-hand strainer and the left-hand pump are connected with the pipe system.
2. ➤ Turn the lever **1** to the right.
⇒ The right-hand strainer and the right-hand pump are connected with the pipe system.
3. ➤ Turn the lever **1** into the middle position.
⇒ Both strainers and both pumps are connected with the pipe system.

Note The reversing valve seals mechanically and therefore has a low amount of leakage.

10.3.5 Operating the two-way valve (optional)

The pump station can optionally be equipped with a two-way valve.

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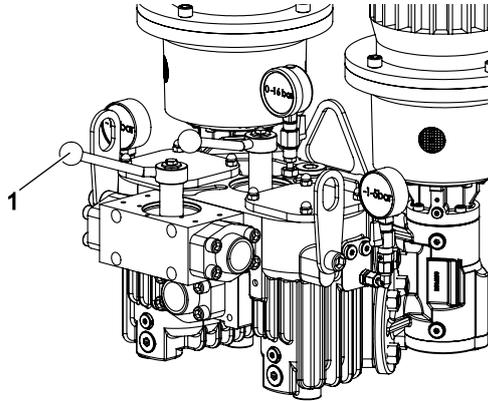


Fig. 22: Two-way valve

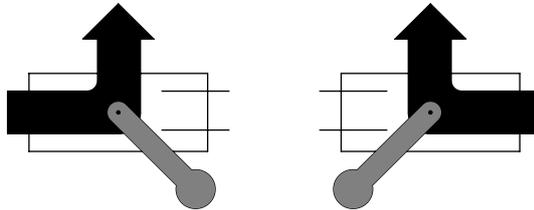


Fig. 23: Positions of the two-way valve

Note The two-way valve can be operated during operation.

1. ➤ Turn the lever 1 to the right.
⇒ The left-hand connection is connected to the pump station.
2. ➤ Turn the lever 1 to the left.
⇒ The right-hand connection is connected to the pump station.

10.3.6 Switching off the pump station

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

Seal damage through pressurizing during standstill.

- ▶ Ensure that the maximum permissible system pressure is not exceeded.

1. ➤ Switch off the motors.
2. ➤ Close the pressure- and suction-side shut-off devices.

10.4 Decommissioning

10.4.1 Taking the pump station out of operation

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 <input type="checkbox"/> Face protection
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.

➡ Carry out the following measures during operation interruptions.

Scope of the operation interruption	Measure
<input type="checkbox"/> Pump station shut down for longer period	➡ Depending on the pumped liquid
<input type="checkbox"/> Pump station drained	➡ Close the pressure- and suction-side shut-off devices.
<input type="checkbox"/> Pump station dismantled	➡ Disconnect the motors from the power supply and secure against being switched back on.
<input type="checkbox"/> Pump station stored	➡ Observe measures for storing and preservation ↪ Transportation, storage, Page 16.

Tab. 14: Measures during operation interruptions

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

Tab. 15: Measures depending on the behaviour of the pumped liquid

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

10.5 Recommissioning

10.5.1 Recommissioning the pump station

➡ Carry out all the steps as for the commissioning process, ↪ Commissioning, Page 27.

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 station 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 liquids 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 station and the requirements from the operating instructions of the components.

Component	Required maintenance	Cycle
Pump station	<input type="checkbox"/> Visual inspection <input type="checkbox"/> Acoustic inspection	4 weeks
Pump station (reversing valve)	<input type="checkbox"/> Change of the active pump line	4 weeks
Strainer	<input type="checkbox"/> Visual inspection <input type="checkbox"/> If required, clean	4 weeks
Degasser	<input type="checkbox"/> Venting	When necessary
Overflow valve	<input type="checkbox"/> Operation, Page 27 functional test	≤ 5 years

Tab. 16: Required maintenance

11.3 Maintaining the pump station

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. Change the active pump line every four weeks by means of the reversing valve in order to ensure a uniform distribution of the operating hours.
2. Check the pump station visually and acoustically every four weeks.
3. If there are signs of wear, eliminate the cause Servicing, Page 36.
4. Observe the additional operating instructions of the pumps and optional components.

11.4 Maintaining the strainers

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. Check the strainers visually and acoustically every four weeks.
2. In the case of a clear pressure drop clean the strainers Servicing, Page 36.

12 Servicing

12.1 Dangers during servicing



The following safety instructions must be observed strictly:

- Have all work carried out only by authorized qualified personnel.
- Before beginning work on the pump station ensure that the electrical power supply is deenergized and is secured against being switched back on.
- Before beginning work, let the pump station 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 station 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 liquids is sufficiently large.
- Observe the tightening torques Appendix, Page 52.
- Observe the operating instructions and data sheets of the components.

12.2 Signs of wear

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

Finding	Cause	Elimination
Increased running noises	Incipient damage to bearing	—▶ Replace the pump.
Increased leaking	Incipient damage to seal	—▶ Replace the shaft seal.
Deposits at the shaft seal	Low-volatile liquids	—▶ Clean the shaft 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.
Increased pressure drop at the strainer	Soiling of the strainers	—▶ Clean the strainer.

Tab. 17: Signs of wear

12.3 Servicing the pump station

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"/> Protective helmet
Aids:	<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.
- ▶ Before commissioning ensure correct grounding and equipotential bonding.
- ▶ Observe the operating instructions of the electrical components.



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.

—▶ Carry out all servicing work in accordance with the operating instructions of the pump and of the further components.

12.4 Replacing the pump

Personnel qualification:	<input type="checkbox"/> Fitter <input type="checkbox"/> Electrician
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Face protection <input type="checkbox"/> Protective gloves
Aids:	<input type="checkbox"/> Collection tank <input type="checkbox"/> Solvent



⚠ 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.



⚠ 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.
- ▶ If work on the blocked part of the pump station takes longer, monitor the filling level of the strainer housing and catch the leakage.



⚠ WARNING

Risk of injury through emitted pumped liquid when working on the pump station without previous pressure relief.

- ▶ Open the screw plug of the vent hole by a max. of 2 rotations in order to reduce the internal pressure in the housing.

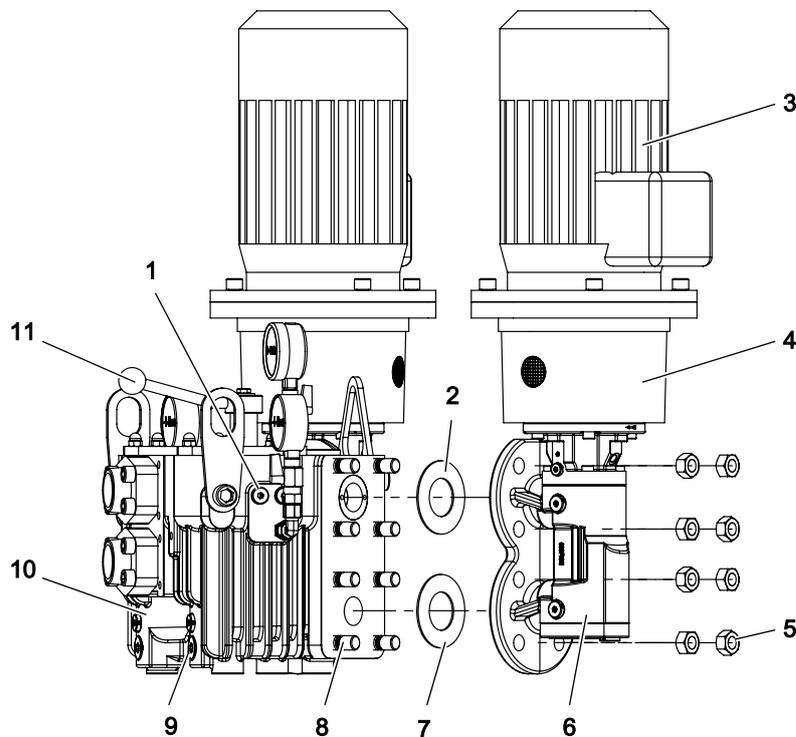


Fig. 24: Replacing the pump

1. ▶ Switch over the lever of the reversing valve **11** in order to shut off the respective side ↪ During operation, Page 32.
2. ▶ Open the screw plug of the vent hole **1** by a max. of two rotations in order to reduce the internal pressure in the housing.

3. ▶ Remove the screw plug **9** in order to drain the liquid in the strainer chamber.
4. ▶ Remove the hexagon nuts **5** at the pump flange.
5. ▶ Dismantle the pump **6**, remove the flat gaskets **2** and **7**.
6. ▶ Clean the sealing surfaces, place on new flat gaskets.
7. ▶ Place the new pump on the stud screws **8**, tighten the hexagon nuts **5**.
8. ▶ Tighten the screw plug **9** at the station block again.
9. ▶ Fill and vent the strainer chamber ↪ Commissioning, Page 27.

12.5 Cleaning the strainer

The frequency of cleaning the filter depends on the degree of soiling of the pumped liquid. In case of strongly soiled strainers cavitation and strong noise generation arise. The suction-side pressure gauge is used to indicate the degree of soiling.

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"/> Collection tank <input type="checkbox"/> Solvent



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.
- ▶ If work on the blocked part of the pump station takes longer, monitor the filling level of the strainer housing and catch the leakage.



WARNING

Risk of injury through emitted pumped liquid when working on the pump station without previous pressure relief.

- ▶ Open the screw plug of the vent hole by a max. of 2 rotations in order to reduce the internal pressure in the housing.

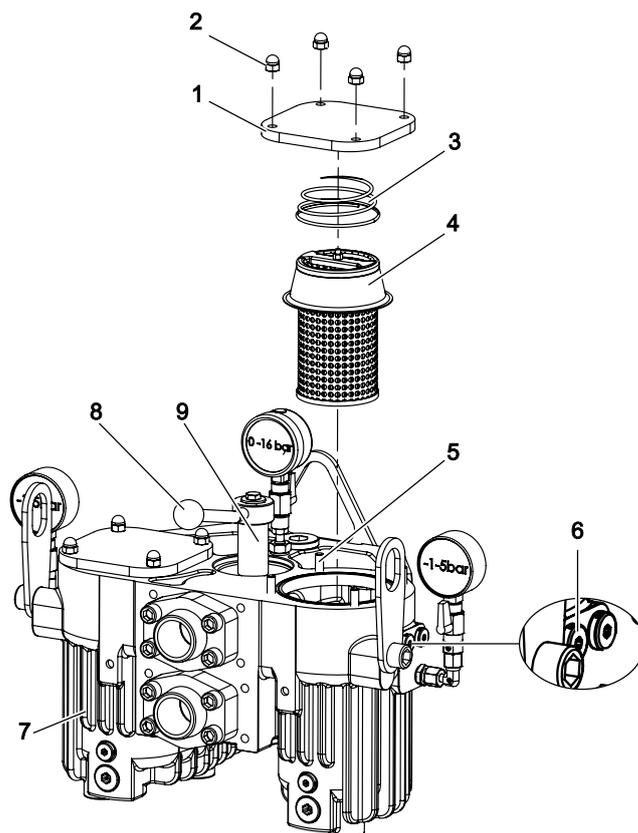


Fig. 25: Cleaning the strainer

1. ➤ Switch over the lever of the reversing valve **8** in order to shut off the respective side ↯ During operation, Page 32.
2. ➤ Open the screw plug of the vent hole **6** by a max. of 2 rotations in order to reduce the internal pressure in the housing.
3. ➤ Open the cap nuts **2** and remove the strainer cover **1**.
4. ➤ Remove the conical spring **3** and the strainer insert **4** from the strainer chamber.
5. ➤ Clean the strainer insert, for example by washing it in a solvent.
6. ➤ Reinsert the strainer insert and conical spring.
7. ➤ Place the strainer cover on the stud screws **5**, tighten the cap nuts **2**.
8. ➤ Retighten the screw plug of the vent hole **6**.
9. ➤ Bring the level of the reversing valve **8** to the desired position.

12.6 Replacing the seal ring of the control plug

Personnel qualification:	<input type="checkbox"/> Trained personnel
Personal protective equipment:	<input type="checkbox"/> Work clothing <input type="checkbox"/> Protective gloves <input type="checkbox"/> Protective helmet <input type="checkbox"/> Safety boots <input type="checkbox"/> Face protection
Aids:	<input type="checkbox"/> Collection tank <input type="checkbox"/> Plastic calibrating mandrel



⚠ 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.
- ▶ If work on the blocked part of the pump station takes longer, monitor the filling level of the strainer housing and catch the leakage.



⚠ WARNING

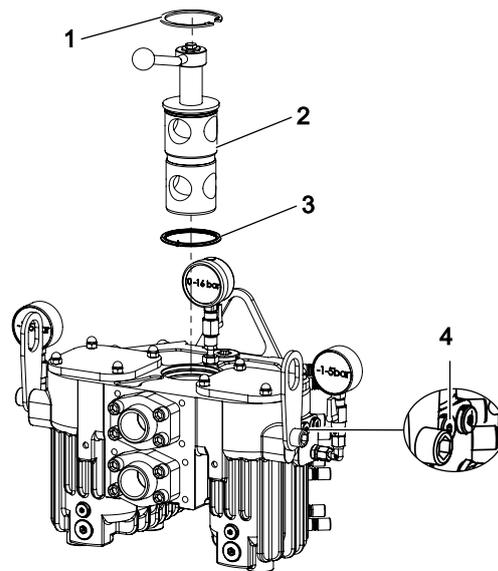
Risk of injury through emitted pumped liquid when working on the pump station without previous pressure relief.

- ▶ Open the screw plug of the vent hole by a max. of 2 rotations in order to reduce the internal pressure in the housing.

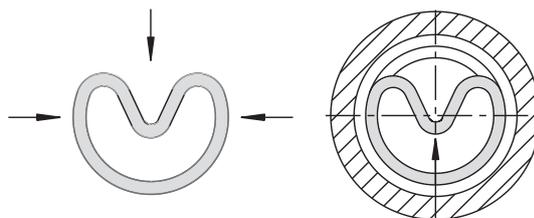
Requirement:

- ✓ Pump station switched off

1. ▶ Close the pressure-side and suction-side shut-off devices.



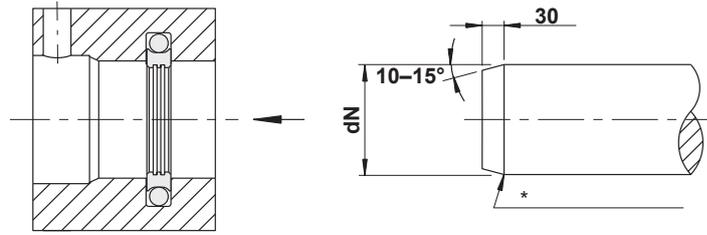
2. ▶ In order to reduce the inner pressure in the housings open the screw plug of the vent hole 4 by a max. of two rotations and subsequently drain the pump station.
3. ▶ Remove the circlip 1 and remove the control plug 2.
4. ▶ Remove the seal ring 3 with O-ring from the hole.



5. ▶ Insert the O-ring of the new seal ring into the groove. Press the seal ring into a kidney shape, place it in the groove in pressed form and press in the arrow direction against the O-ring.

13 Disposal

13.1 Dismantling and disposing of the pump station



6. ➤ Calibrate the seal with a suitable calibration mandrel (* rounded and polished).
7. ➤ Insert the control plug, mount the circlip 1.
8. ➤ Retighten the screw plug of the vent hole 4 and fill and vent the pump station ↪ Commissioning, Page 27.

13 Disposal

13.1 Dismantling and disposing of the pump station

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 station from the power supply and secure it against being switched back on
 - ✓ Pump station cooled down to the ambient temperature and disconnected from the pipe system
 - ✓ Pump station drained completely
 - ✓ Pump station at a location suitable for dismantling
1. ➤ Dismantle the pump station 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 station and dispose of them in separately.
 4. ➤ Recycle iron parts.

14 Troubleshooting

14.1 Possible faults

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

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

14.2 Troubleshooting

Fault identification							Cause	Remedy
1	-	-	-	-	-	-	Pump suction line closed	<ul style="list-style-type: none"> → Check the shut-off devices. If required, open.
1	2	3	-	5	-	-	Parts soiled (filter, suction line, suction valve, strainer)	<ul style="list-style-type: none"> → Clean parts.
1	2	3	-	5	-	-	Suction head too high	<ul style="list-style-type: none"> → 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.
1	-	3	-	-	-	-	Level in the intake container too low	<ul style="list-style-type: none"> → Fill the intake container.
1	-	-	-	-	-	-	Soiling of the filters/strainers	<ul style="list-style-type: none"> → Clean the filters/strainers ↪ Servicing, Page 36.
1	-	-	-	-	-	-	Too little pumped liquid in the pump	<ul style="list-style-type: none"> → Fill the pump with pumped liquid.
1	-	-	-	-	-	-	Incorrect pump direction of rotation	<ul style="list-style-type: none"> → Swap the two electrical connection phases ↪ Connection, Page 25.
1	-	3	4	5	-	-	Viscosity of the pumped liquid too high	<ul style="list-style-type: none"> → Increase the temperature of the pumped liquid. -or- Decrease the speed.
-	2	-	-	-	-	-	Viscosity of the pumped liquid too low	<ul style="list-style-type: none"> → Reduce the temperature of the pumped liquid. -or- Increase the speed.
-	2	3	-	5	-	-	Airlock/gas in the pumped liquid	<ol style="list-style-type: none"> 1. → Test the pipe system for air admission, replace leaking parts. 2. → Reduce the suction head. <ul style="list-style-type: none"> -or- Increase the inlet pressure.

14 Troubleshooting

14.2 Troubleshooting

Fault identification						Cause	Remedy
-	2	-	4	-	-	Speed/frequency/voltage of the motor false	<ol style="list-style-type: none"> 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.
-	2	-	-	-	-	Advanced wear of the housing/screw set	➤ Contact the manufacturer.
-	-	-	-	-	7	Advanced wear of sealing surfaces	➤ Replace the seal and check the pumped liquid for abrasive substances. If required, replace the filter/strainer. -or- Contact the manufacturer.
-	-	3	-	-	-	Coupling aligned incorrectly	➤ Assemble the coupling and motor correctly, see the associated operating instructions of the pumps.
-	-	3	-	-	-	Pump subject to mechanical stress	<ol style="list-style-type: none"> 1. ➤ Support the weight of the pipe system. 2. ➤ Connect the pump station correctly to the pipe system ↪ Connection, Page 25.
-	-	3	-	-	-	Vibrations/pulsations in the system	➤ Bear the pump station elastically. -or- Make the connections with hoses.
-	-	3	-	-	-	Flow speed in the pressure line or suction line too high	➤ Set the flow speed in the pressure line so that it does not exceed 3 m/s. -or- Set the flow speed in the suction line so that it does not exceed 1 m/s. -or- Contact the manufacturer.
-	-	3	4	-	7	Ball bearing damaged	➤ Replace the ball bearing, see corresponding operating instructions of the pump.
-	2	3	4	-	7	Superficial damage to pump parts coming into contact with the liquid	➤ Contact the manufacturer.
-	-	-	-	-	7	Shaft seal damaged through dry running	➤ Replace the shaft seal, see corresponding operating instructions of the pump.
-	-	-	-	-	7	Inlet pressure too high	<ol style="list-style-type: none"> 1. ➤ Reduce the inlet pressure at the system side. 2. ➤ Replace the shaft seal, see corresponding operating instructions of the pump.
-	-	-	-	-	7	Inlet pressure too low	➤ Install a non-return valve at the pressure side.
-	-	-	-	-	7	Shaft seal is overloaded through thermal/chemical influences	<ol style="list-style-type: none"> 1. ➤ Check the maximum operating temperature. 2. ➤ Check the suitability and resistance of the elastomers with regard to the pumped liquid. -or- Contact the manufacturer.
-	-	-	-	-	7	Overload of the shaft seal by pressure build-up during the heating process	➤ Open the pressure-side/suction-side shut-off device in order to avoid a pressure build-up through heat expansion of the pumped liquid.
1	2	3	4	5	-	Cold start when delivering high-viscosity liquids	➤ Install the heating system.
-	-	3	-	-	6	Differential pressure is too high and has overloaded the idle screws	➤ Contact the manufacturer.
-	-	3	-	-	6	Viscosity is too low and has overloaded the idle screws	➤ Contact the manufacturer.

Fault identification							Cause	Remedy
1	2	3	4	-	-	7	Pump damaged through dry running	→ Contact the manufacturer.
1	-	-	-	-	-	-	Pump does not vent	→ Vent the pressure line at the highest point.
1	2	3	-	-	-	-	Reversing valve lever in the incorrect position	→ Switch the lever of the reversing valve to the correct position ↵ During operation, Page 32.
-	2	-	-	5	-	-	Pressure maintaining valve set incorrectly	→ Set the pressure maintaining valve ↵ During operation, Page 32.

Tab. 18: Fault table

15 Spare parts

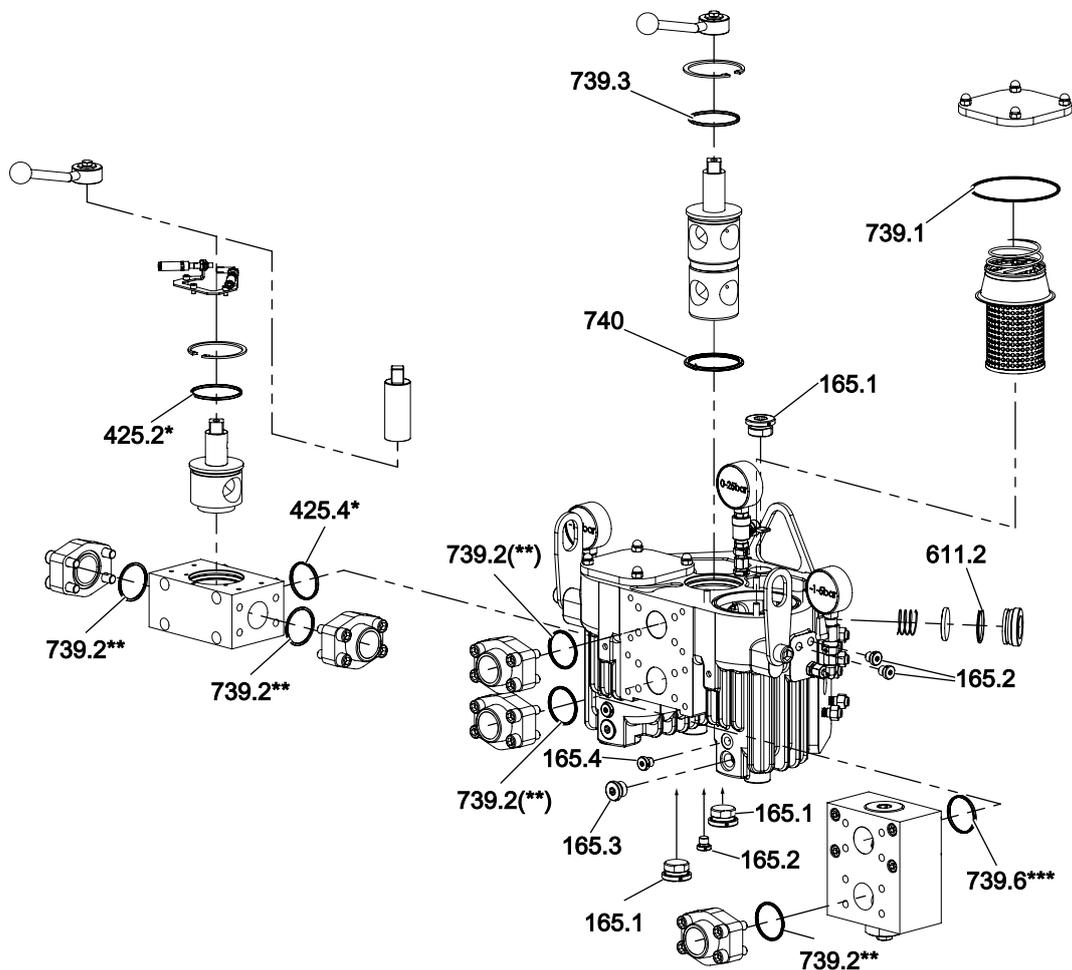
15.1 Maintenance kits

15 Spare parts

15.1 Maintenance kits

15.1.1 Small pump station maintenance kit DKC/DLC

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



Qty.	Item No.	Part
3	165.1	Screw plug
5	165.2	Screw plug
2	165.3	Screw plug
2	165.4	Screw plug
1	425.2*	O-ring
1	425.4*	O-ring
2	611.2	O-ring
2	739.1	O-ring
2 (3**, 4**)	739.2(**)	O-ring
1	739.3	O-ring
1	739.6***	O-ring
1	740	Seal ring
	*	For pump stations with two-way valve -or- For pump stations with two-way valve and external pressure retention valve

Qty.	Item No.	Part
	**	For pump stations with two-way valve or external pressure maintaining valve: 3 off -or- For pump stations with two-way valve and external pressure retention valve: 4 pc.
	***	For pump stations with external pressure retention valve -or- For pump stations with two-way valve and external pressure retention valve

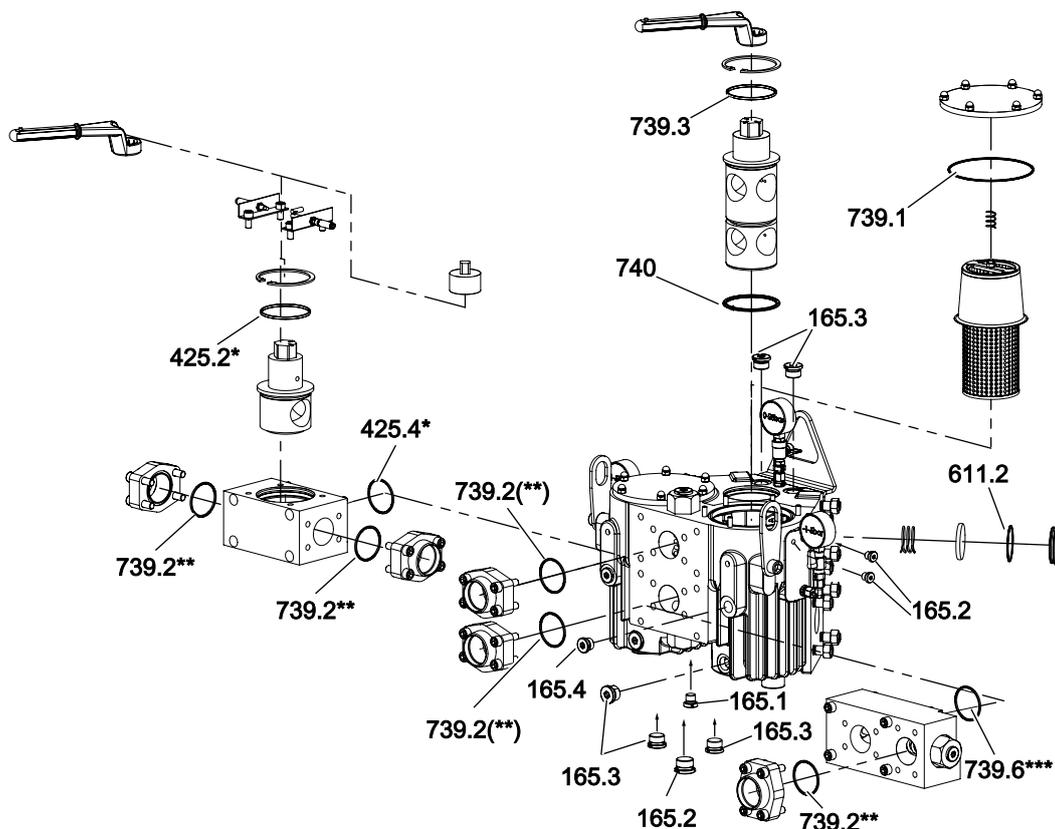
Tab. 19: Small pump station parts maintenance kit DKC/DLC

15 Spare parts

15.1 Maintenance kits

15.1.2 Large pump station maintenance kit DKC/DLC

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

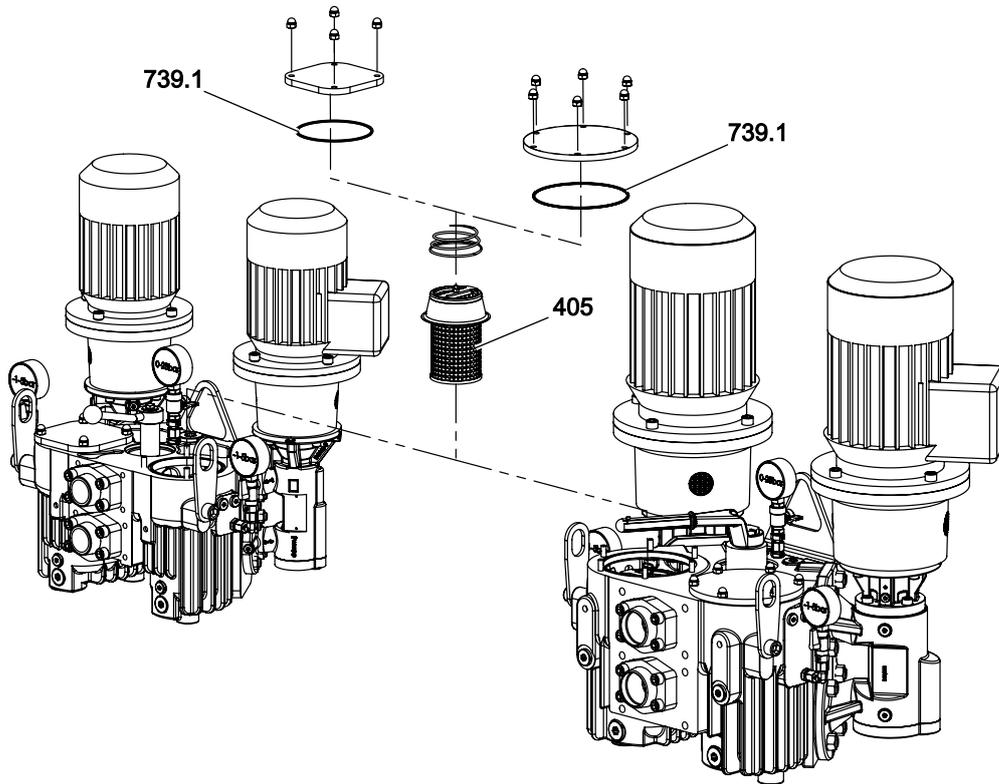


Qty.	Item No.	Part
1	165.1	Screw plug
5	165.2	Screw plug
6	165.3	Screw plug
2	165.4	Screw plug
1	425.2*	O-ring
1	425.4*	O-ring
2	611.2	O-ring
2	739.1	O-ring
2 (3**, 4**)	739.2(**)	O-ring
1	739.3	O-ring
1	739.6***	O-ring
1	740	Seal ring
	*	For pump stations with two-way valve -or- For pump stations with two-way valve and external pressure retention valve
	**	For pump stations with external pressure maintaining valve: 3 off -or- For pump stations with two-way valve and external pressure retention valve: 4 pc.
	***	For pump stations with external pressure retention valve -or- For pump stations with two-way valve and external pressure retention valve

Tab. 20: Large pump station maintenance kit DKC/DLC

15.1.3 Strainer maintenance kit DKC/DLC

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



Qty.	Item No.	Part
1	405	Strainer insert
1	739.1	O-ring

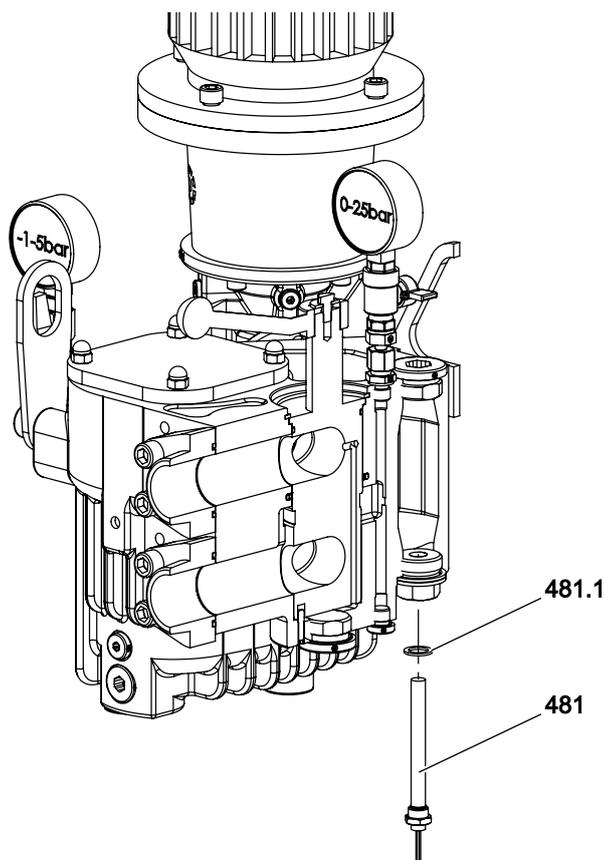
Tab. 21: Strainer maintenance kit DKC/DLC

15 Spare parts

15.1 Maintenance kits

15.1.4 Electric heater maintenance kit DKC/DLC

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



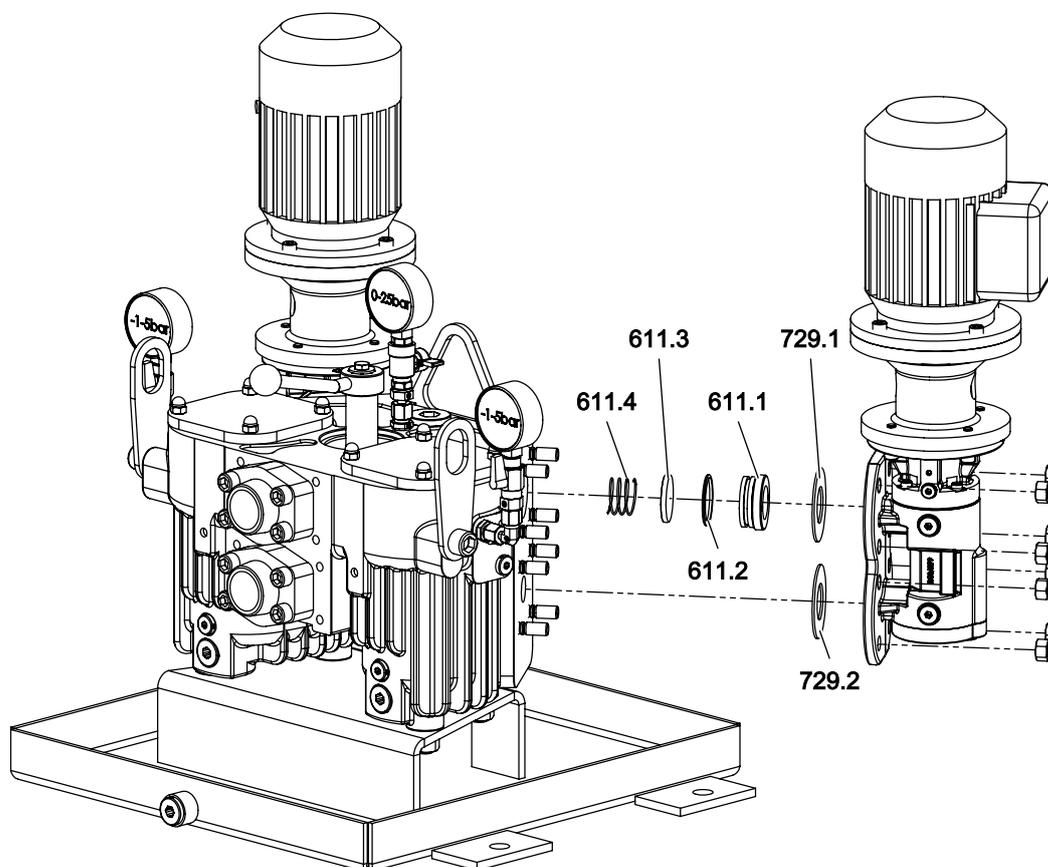
Qty.	Item No.	Part
1 (2*)	481	Heating element
1 (2*)	481.1	Seal ring
1**		Thermal oil
*		Only for large pump station
**		For small pump station: 0.5 l For large pump station: 0.25 l

Tab. 22: Electric heater maintenance kit DKC/DLC

15.2 Repair kits

15.2.1 Non-return valve repair kit DKC/DLC

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



Qty.	Item No.	Part
2	611.1	Supporting ring
2	611.2	O-ring
2	611.3	Sealing washer
2	611.4	Pressure spring
2	729.1	Flat gasket
2	729.2	Flat gasket

Tab. 23: Parts for non-return valve repair kit DKC/DLC

16 Appendix

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

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

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

Tightening torque [Nm]							
Screws with head contact surface							Countersunk screws
Thread	Stainless steel screws A2 and A4				Stainless steel screws A2 and A4		8.8
	5.6	8.8	10.9	8.8+ Alu*	Property class 70	Property class 80	
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. 24: Tightening torques metric screw thread

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

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

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

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

Tab. 25: Tightening torques with thread measured in inches

16.3 Contents of the Declaration of Conformity

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

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

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

Tab. 26: Directives observed



KRAL

