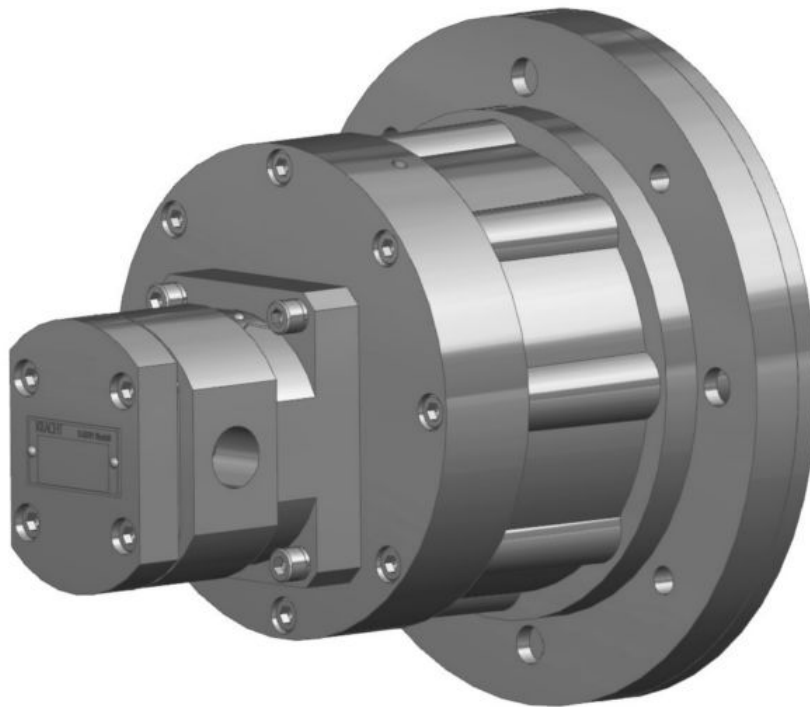


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Operating instructions (Translation)



Gear pump KF 0/. ... Stainless steel + Magnetic coupling MINEX® -S

88039290002-00

Englisch

2017-01-27

KRACHT

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1 General

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the following device:

Gear pump KF 0/. ... Stainless steel + Magnetic coupling MINEX® -S

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

These operating instructions are a component of the device and must be kept accessible for the personnel near the device at all times.

If you have any questions about these operating instructions, please contact the manufacturer.

1.2 Manufacturer's address

KRACHT GmbH
Gewerbestraße 20
DE 58791 Werdohl
phone: +49 2392 935-0
fax: +49 2392 935-209
email: info@kracht.eu
web: www.kracht.eu

1.3 Applicable documents

1. KRACHT GmbH, DE 58791 Werdohl
 - Assembly drawing with the assembly dimensions of the magnetic coupling
2. KTR Kupplungstechnik GmbH, DE 48407 Rheine
 - KTR-N 46510: Operating/installation instructions for magnetic coupling
 - KTR-N 41010: Bell housing assembly instruction

Excerpts from these documents are included in these operating instructions.

If required, the original documents can be requested from the respective manufacturer.

1.4 Symbolism



DANGER

Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.



WARNING

Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.



CAUTION

Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.



NOTICE

Flagging of notices to prevent property damage.



Identification of basic safety instructions. Non-compliance can lead to hazards for people and the device.



Flagging of special user tips and other especially useful or important information.

2 Safety

2.1 Intended use

1. The device has been designed for operation with fluid. Dry operation is not permitted.
2. The device may be operated in filled condition only.
The medium must be compatible with the materials used in the device. The chemical competence is necessary for this. Be careful with ethylene oxide or other cathalytic or exothermic or self-decomposing materials. Please consult the manufacturer in cases of doubt.
3. The device may be operated only in usual industrial atmospheres. If there are any aggressive substances in the air, always ask the manufacturer.
4. Operation of the device is only permissible when complying with the operating instructions and applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
5. In case of any use of the device not according to specification, any warranty is voided.

2.2 Personnel qualification and training

The staff designated to assemble, operate and service the device must be properly qualified. This can be through training or specific instruction. Personnel must be familiar with the contents of this operating instructions.



Read the operating instructions thoroughly before use.

2.3 Basic safety instructions



1. Comply with existing regulations on accident prevention and safety at work along with any possible internal operator regulations.
2. Pay attention to the greatest possible cleanliness.
3. Wear suitable personal protection equipment.
4. Do not remove, make illegible or obliterate type plates or other references on the device.
5. Do not make any technical changes on the device.
6. Maintain and clean the device regularly.
7. Use spare parts approved by the manufacturer only.

2.4 Basic hazards

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

WARNING

Rotating parts!

Danger of injury from flying parts.

1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Do not operate the device against closed shut-off devices.
2. Do not operate the device in the false direction of rotation.

2.5 Special hazards

DANGER

Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).

WARNING

Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.




NOTICE

Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

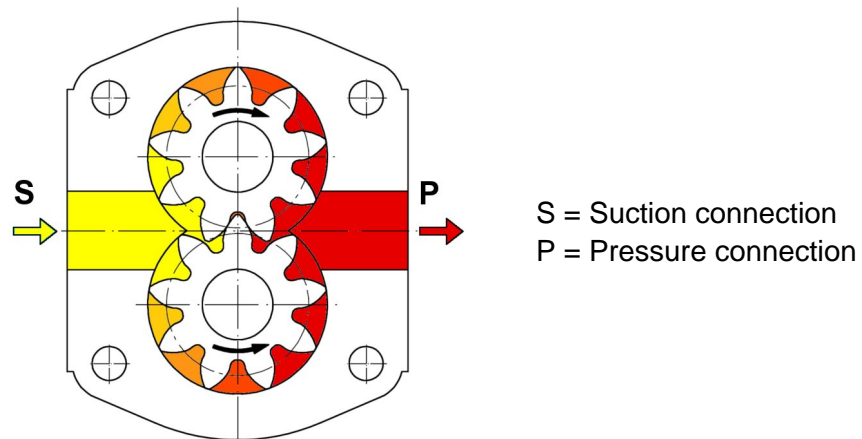
2.6 Labelling on equipment

	Magnetic field
	No entry for persons with cardiac pacemakers or implanted defibrillators
	Grounding

3 Device description

3.1 Functional principle

KF/KFF series pumps are external gear pump types that work according to the positive displacement principle.



When rotated, two gearwheels meshing together produce a volume enlargement as a result of the opening of the tooth spaces on the suction side (S), so that medium can flow in and so that a corresponding volume is displaced simultaneously by immersion of the teeth into the filled tooth spaces on the pressure side (P). Fluid transport takes place through entrainment in the tooth gaps along the wall of the wheel chamber. The so-called geometric flow rate V_g is being displaced per wheel rotation. A value that is stated in technical documents as rated volume V_{gn} to specify the pump size.

The actually delivered amount of liquid does not correspond with the theoretical value, it is being reduced through losses due to the necessary tolerances. The losses are less the lower the operating pressure and the higher the viscosity of the medium.

Gear pumps are self-priming within wide limits. The displacement cycle describe initially takes place without exhibiting appreciable pressure build-up. Only after setting external loads, for example, through delivery heights, flow resistances, line elements, etc. will the required working pressure arise to overcome these resistances.

As usual with non-axial play compensated pumps, the lateral clearance between gear and front face has been set in such a way that the maximum allowable operating pressure is managed in an adequate and secure way.

Bearing and shaft seal of the device are lubricated by the media. The device's operating life will be reduced if the medium contains abrasive ingredients.

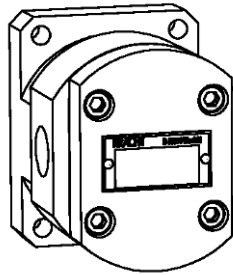
The shaft seal chamber is connected to the device's suction side. The pressure occurring at the shaft seal therefore corresponds to the pressure at the suction connection of the device.

Magnetic coupling

Versions with magnetic coupling are used when absolute leak-proofness is required on the shaft seal or when being operated with supply pressure on the suction side. The magnetic coupling is leak-proof within the permissible technical limits.

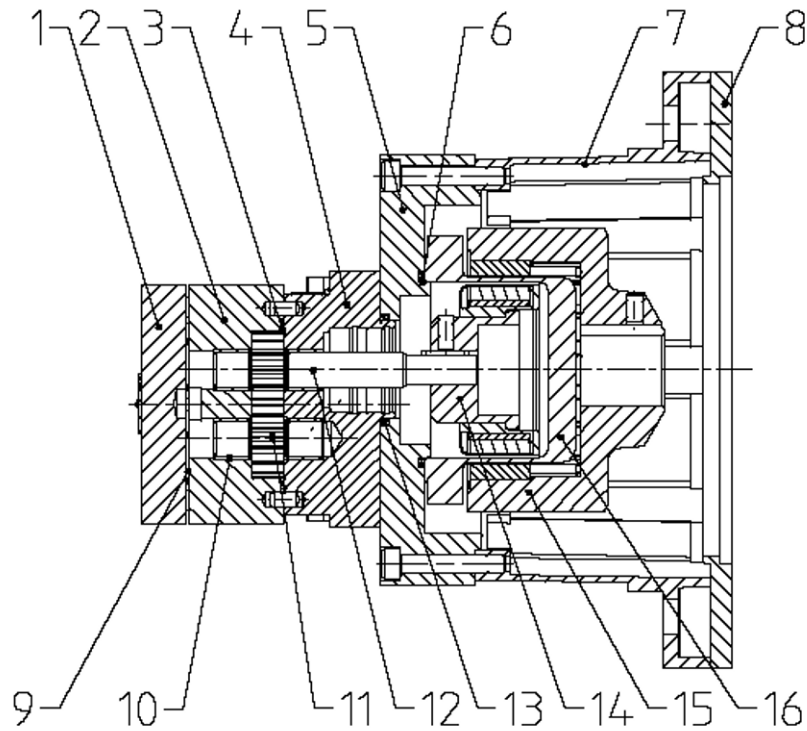
This magnetic coupling has the exterior rotor installed on the motor shaft and the interior rotor on the pump shaft. The torque is transmitted between the two rotors via magnetic force. A separating can installed in-between the two rotors provides hermetic sealing of the pump.

The device can be used in vacuum mode, e.g. for filling brake fluid, while doing so, the penetration of air into the system is reliably prevented. Leakage-free operation is ensured during operation in closed systems that have the system pressure applied on the suction side.

3.2 Possible versions**Gear pump with end cover**

Standard

3.3 Basic design



Explanation

- | | |
|-------------------|------------------------|
| 1. End cover | 9. Seal |
| 2. Housing | 10. Plain bearing bush |
| 3. O-Ring | 11. Driven shaft |
| 4. Flange cover | 12. Driving shaft |
| 5. Adapter flange | 13. O-Ring |
| 6. O-Ring | 14. Internal rotor |
| 7. Bell housing | 15. External rotor |
| 8. Flange | 16. Containment shroud |
- required for: MS.60

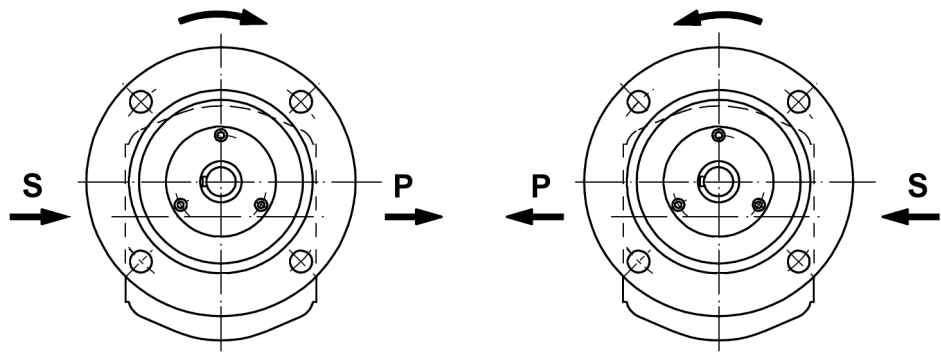
3.4 Rotation and delivery direction

The following definition applies with respect to the rotation and delivery direction of external gear pumps for pump connections positioned below the drive shaft:

Looking at the pump shaft end, the pumping flow is from left to right when the shaft is moving clockwise.

Looking at the pump shaft end, the pumping flow is from right to left when the shaft is moving counterclockwise.

Gear pump with end cover



S = Suction connection
P = Pressure connection

The direction of rotation is indicated by the bent arrow.
The flow direction is indicated by the straight arrows.

Hydraulic symbol	Flange mounting	
	Gear pump with end cover	
	KF 0/. .10K	KF 0/. .20K

3.5 Type key

Ordering example KF 0/. ... Stainless steel+ MINEX® -S														
Type key Gear pump														
KF	0/	2,5	S	1	0	K	P	0	A	0	Q	T	61	/470
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

Type key Magnetic coupling							
+	MSA60		-	A	4	-	...
	16.			17.	18.		19.

Explanation of type key KF 0/. ... Stainless steel + MINEX® -S	
1.	Product name
2.	Size 0
3.	Nominal size (Rated volume) V _{gn} KF 0: 0,5; 0,8; 1,0; 1,6; 2,5; 3,0; 4,0
4.	Flange mounting cover S KF 0
5.	Direction of rotation 1 Clockwise 2 Counterclockwise
6.	Outboard flange 0 Without mounting flange
7.	Construction of housing K Housing with threaded connection
8.	Shaft end P Cylindrical shaft end without outboard bearing
9.	2nd shaft end 0 Without 2nd shaft end
10.	End cover A For direction of rotation 1 or 2
11.	Design serial number (specified by manufacturer)
12.	Housing material and plain bearing Q Stainless steel (1.4308) Plastic plain bearings
13.	Gears version T Stainless steel (1.4057)

Explanation of type key KF 0/. ... Stainless steel + MINEX® -S			
14. Seal type			
60	Magnetic coupling without flushing O-Ring EPDM	65	Magnetic coupling with flushing O-Ring FKM
61	Magnetic coupling without flushing O-Ring FKM	68	Magnetic coupling with flushing O-Ring FEP
63	Magnetic coupling without flushing O-Ring FEP with FKM-core	90	Magnetic coupling with flushing O-Ring EPDM
15. Special number for special versions			
	See section 3.6 "Important special numbers"		
16. Magnetic coupling size KRACHT (KTR)			
	MSA46 (SA 46/6)	MSB60 (SB 60/8)	
	MSA60 (SA 60/8)		
17. Maximum operating temperature of magnetic coupling			
A	150 °C	B	300 °C
18. Magnetic coupling pressure range			
1	16 bar	3	40 bar
2	25 bar	4	60 bar
19. Additional information on magnetic coupling			

3.6 Important special numbers

Special number	Description
470	Wear protection coating on gear Gear pump made entirely of stainless steel <ul style="list-style-type: none"> Housing: 1.4404 (Hydrogen resistant) Gears: 1.4462 (Hydrogen resistant) On design with magnetic coupling Split case 65 bar

4 Technical data

4.1 General

General information KF 0/. ... Stainless steel + Magnetic coupling		
Design	Pump unit without motor	
Housing connection Gear pump ⁽¹⁾ ⁽²⁾	KF 0/0,5 - KF 0/1,0	Whitworth pipe thread G 3/8"
	KF 0/1,6 - KF 0/4,0	Whitworth pipe thread G 1/2"
Overview nominal size	Nominal size V_{gn}	Geom. displacement V_g [cm ³ /rev.]
	KF 0/0,5	0,5
	KF 0/0,8	0,8
	KF 0/1,0	1,0
	KF 0/1,6	1,61
	KF 0/2,0	2,01
	KF 0/2,5	2,51
	KF 0/3,0	3,01
	KF 0/4,0	4,0
Mounting position	Any	
Speed	$n_{min.}$	200 rpm
	n	See section 4.3 "Viscosity - Rotation speed assignment"
Operating pressure	p_e	See section 4.4 "Permissible pressure range"
	p_b	
Viscosity	v_{min}	10 mm ² /s
	v_{max}	20000 mm ² /s
Fluid temperature	ϑ_m	See section 4.5 "Permissible temperature range"
Ambient temperature	ϑ_u	
Material	See section 4.6 "Material data"	
Permissible media	Heat-transfer medium Lubricating fluids without abrasive components. (Petrols, solvents, etc. are not permissible.)	
⁽¹⁾ Pipe thread: ISO 228-1		
⁽²⁾ Other thread sizes/types see assembly drawing.		

4.2 Torques Magnetic coupling

Size	Torque [Nm] ⁽¹⁾			
	Pressure range 1	Pressure range 2	Pressure range 3	Pressure range 4
MSA46	3	-	-	-
MSA60	-	-	7	14
MSB60	-	-	14	14

⁽¹⁾ $\vartheta_u = 20\text{ °C}$

4.3 Viscosity - Rotation speed assignment

Kinematic viscosity ν [mm ² /s]										
≤ 100	200	300	500	1000	2000	3000	5000	10000	15000	20000
3600	2900	2300	1800	1500	950	750	650	500	400	≤ 350
Speed n_{\max} [rpm]										



Select the speed of rotation so that complete filling of the pump is ensured. This is given if the pressure on the suction side does not fall below the permissible pressure $p_{e \min}$.

4.4 Permissible pressure range

4.4.1 Operating pressure at suction side

Pressure range Magnetic coupling	Operating pressure ⁽¹⁾		
	Suction side		Pressure side
	$p_{e\ min}$ [bar abs.]	$p_{e\ max}$ [bar]	p_b [bar] (perm. continuous pressure)
1	0,6 ⁽²⁾ Vacuum equipment: 0,08 Standing still: 0	16	See section 4.4.2 "Operating pressure at pressure side"
2		25	
3		40	
4		60 ⁽³⁾	

⁽¹⁾ bar abs.: absolute pressure, bar: relative pressure
⁽²⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes)
⁽³⁾ Special number 470: 65 bar

4.4.2 Operating pressure at pressure side

Nominal size V_{gn}	Operating pressure Pressure side			
	$p_{b\ max}$ [bar] (Permissible operating pressure depends on the viscosity)			
	10 mm ² /s	30 mm ² /s	100 mm ² /s	≥ 500 mm ² /s
0/0,5	10	30	50	60
0/0,8	15	40	60	70
0/1,0				
0/1,6	20	60	80	80
0/2,0				
0/2,5	30	80	80	80
0/3,0				
0/4,0	40	80		

4.4.3 Differential pressure - viscosity assignment

Bearing	Δp_{max} [bar]		
	$v \geq 1,4\ mm^2/s$	$v \geq 6\ mm^2/s$	$v \geq 12\ mm^2/s$
Plastic plain bearings Iglidur® G; X	-	6	10

4.5 Permissible temperature range

Sealing material	Fluid temperature ϑ_m		
	$\vartheta_{m \text{ min}}$ [°C]	$\vartheta_{m \text{ max}}$ [°C]	
		Version Magnetic coupling	
		A	B
FKM	-15	150 ⁽¹⁾	150 ⁽¹⁾
EPDM	-20	130	130
FEP with FKM-core		150 ⁽¹⁾	200 ⁽¹⁾

⁽¹⁾ Plastic plain bearings Iglidur® G: 130 °C

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u \text{ min}}$ [°C]	$\vartheta_{u \text{ max}}$ [°C]
FKM	-15	60
EPDM	-20	
FEP with FKM-core		



NOTICE

Eddy current losses

Metal separating cans in a magnetic coupling will always induce eddy current losses within the rotating magnetic field that are converted into heat.

1. When using pump design variants without circulating fluid, be sure to account for increases in temperature caused by eddy current losses.

4.6 Material data

4.6.1 Gear pump

Seal type	O-Ring	Housing/Flange cover/Cover	Gears	Bearing
60	EPDM	Stainless steel (1.4308)	Stainless steel (1.4057)	Plastic plain bearings non-ferrous metal-free Iglidur® G; X
61	FKM			
63	FEP with FKM-core			
65	FKM			
68	FEP with FKM-core			
90	EPDM			

4.6.2 BG-Magnetic coupling

Version	Material				
	Internal rotor	External rotor	Containment shroud	Bell housing	Other materials
A (150 °C)	1.4571/ Sm2Co17	Steel/NdFeB - - -	1.4571 - - -	Al (mass fraction Mg ≤ 7.5 %)	Steel
B (300 °C)		Steel/Sm2Co17	1.4571/Hastelloy		

4.7 Weights

4.7.1 Gear pump

Nominal size V_{gn}	Gear pump with end cover [kg]
0/0,5	2,7
0/0,8	
0/1,0	
0/1,6	
0/2,0	
0/2,5	
0/3,0	
0/4,0	

4.7.2 BG-Magnetic coupling

Gear pump	BG-Magnetic coupling [kg]		
	MSA46	MSA60	MSB60
KF 0/.	3,1	5,6	7,5

4.8 Dimensions

Dimensions of the device can be found in the relevant technical data sheets.

5 Transport and storage

5.1 Special hazards



DANGER

Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).



WARNING

Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.



NOTICE

Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

5.2 General

- After receipt, check the device for transport damages.
- If transport damage is noticed, report this immediately to the manufacturer and the carrier. The device must then be replaced or repaired.
- Dispose of packing material and used parts in accordance with the local stipulations.

5.3 Transport



WARNING

Falling or overturning loads!

Danger of injury while transporting large and heavy loads.

1. Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
2. Attach lifting tackle only to suitable load points.
3. Attach the lifting tackle in such a manner that it cannot slip.
4. Pay attention to the load balance point.
5. Always avoid jerks, impacts and strong vibrations during transportation.
6. Never walk under suspended loads, never work under suspended loads.

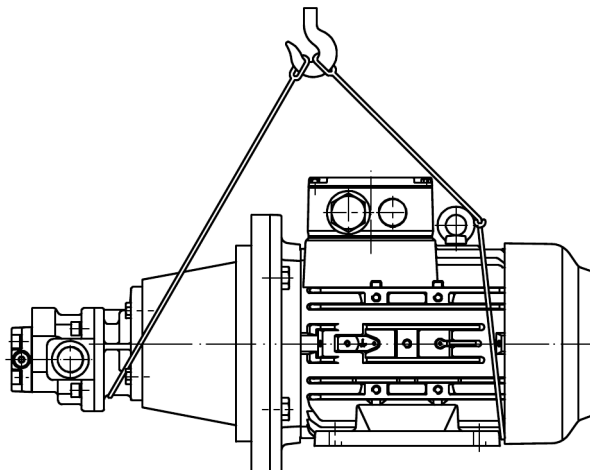


WARNING

Falling or overturning loads!

Danger of injury while transporting large and heavy loads.

1. Lifting eyes on motors are designed solely for the motor weight. Do not attach any additional loads.
2. Connect a unit comprising a pump and motor for lifting both the pump as well as the motor side.



5.4 Storage



Recommended storage conditions

1. Storage temperature: 5 °C - 25 °C
2. Relative air humidity: < 70 %
3. Store austenitic materials separated from ferritic materials.
4. Protect elastomer parts from light, especially direct sunlight.
5. Protect elastomer parts from oxygen and ozone.
6. Comply with maximum storage times of elastomeric parts:
 - 5 Years: AU (Polyurethane rubber)
 - 7 Years: NBR, HNBR, CR
 - 10 Years: EPM, EPDM, FEP/PTFE, FEPM, FKM, FFKM, VMQ, FVMQ

6 Installation

6.1 Safety instructions for installation

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Take measures against accidental touching of rotating parts.

WARNING

Rotating parts!

Danger of injury from flying parts.

1. Enclose rotating parts so as to avoid any danger from flying parts in the event of breakage or malfunction.

WARNING

Unshielded gearwheels!

Gearwheels can trap and crush fingers and hands.

1. Do not engage gearwheels.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

6.1.1 Special hazards



DANGER

Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).



WARNING

Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.



NOTICE

Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

6.2 Noise reduction



Measures for noise reduction

1. Use suction and pressure hoses.
2. Use bell housings with high damping properties (plastic or cast iron).
3. Use of damping rings and damping rods for separation of structure-borne noise.

6.3 Mechanical installation

6.3.1 Preparation

- Check the device for transport damage and dirt.
- Check the device for freedom of movement.
- Remove existing preservatives.
 - Use only those cleaning agents that are compatible with the materials used in the device.
 - Do not use cleaning wool.
- Compare the environmental and ambient conditions at the place of installation to the permissible conditions.
 - Ensure a sufficiently stable and level foundation.
 - Expose the device only to small vibrations, see IEC 60034-14.
 - Secure sufficient access for maintenance and repair.

6.3.2 Gear pump with magnetic coupling

The prerequisite for trouble-free operation is suitable load transmission between the pump and the drive. By default, a permanent magnetic coupling is used for this.

- Clean the coupling components.
- Remove magnetic dust.
- Follow the manufacturer's instructions when installing the coupling components.



The mounting dimensions of the coupling must be observed at all times to guarantee proper torque transmission. See the respective assembly drawing for the mounting dimensions/tightening torques.



For assembly, the coupling halves can be heated to approx. 80 °C and pushed onto the shaft ends while warm.



Hot surfaces!

Burn injury to skin if touched.

1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

- Slowly merge the pump unit and the drive to prevent the exterior rotor suddenly striking the split case.

 **WARNING**

Strong magnetic forces

Risk of crushing by suddenly engaging magnets.

1. Slowly merge the pump unit and the drive.
- Tighten all fastening screws with the specified torque.
 - Pay attention to sufficient screw-in depth of the fastening screws.
 - Rule out any distortion of the device.

Tightening torques [Nm]							
Thread size ⁽¹⁾	M6	M8	M10	M12	M16	M20	M24
Counter-thread Aluminium	4,6	11	22	39	95	184	315
Counter-thread Cast iron/Steel	8	18	37	65	161	315	544

⁽¹⁾ Bolts/nuts made of V2A

- Make sure no foreign bodies can get into the device.
- Take measures against accidental touching of rotating parts.
- Take measures against accidental touching of hot surfaces (> 60 °C).
- Mount the specified monitoring units as per the manufacturer's instructions.

6.4 Connection lines

6.4.1 General

 **WARNING**

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.



Additional connections

1. Provide measurement connections for pressure and temperature as close as possible to device.
2. If necessary, provide a facility to fill or empty the device and the line system.
3. If necessary, provide a facility to vent the device and the line system.

6.4.2 Suction line design

A less than optimally planned suction line can lead to increased noise emission, cavitation as well as reduction of the delivery rate (caused by not complete filling of the pump).

When designing the line, take the following points into consideration:

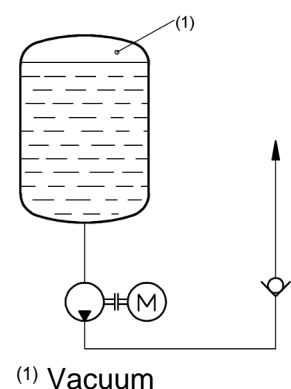
- The suction line must be piped as short as possible and in a straight line.
- Stipulate the nominal width of the suction line so that the permissible operating pressure $p_{e\ min}$ is not exceeded on the suction side.
- Avoid large suction heights.
- Avoid additional pressure loss through line resistances such as fittings, screwed connections, formed parts or suction filters/suction baskets. Ensure that all technically required suction filters/suction baskets are appropriately dimensioned.
- Make sure there is sufficient clearance of the suction port to the bottom and walls of the media container.
- Make sure that the suction opening lies underneath the lowest fluid level in all operating situations.
- When hose lines are used, ensure sufficient stability of the hoses so that they cannot become constricted through the sucking action.
- Comply with the recommended flow velocity in the suction line (max. 1.5 m/s).

Suction line at vacuum operation

If suction from a tank under vacuum is desired, the pump must be arranged approx. 1 m below the tank. The suction line must run in a straight line and without any resistances.

The tank may be subjected to vacuum only then when the pipework and the pump have been filled with liquid.

For this application, only pumps suitable for vacuum operation may be used.





NOTICE

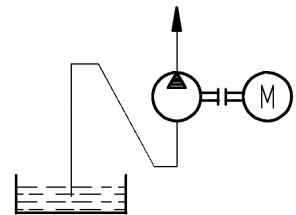
Cavitation damage

Undercutting the permissible suction port pressure results in cavitation.

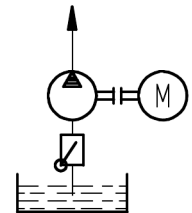
1. Design the suction line so that the pressure arising in operation on the suction side is always higher than the vapour pressure of the pumped medium. At the same time, comply with the installation altitude of the device above mean sea level.
2. For aqueous fluids, mount the device underneath the fluid level, set the operating temperature to 50 °C and limit the speed to 1500 rpm.

Prevention of suction problems

If there is a possibility that the suction line can run dry if the pump stops, piping the suction line as siphon is an option to avoid suction problems. This way, the pump will remain permanently filled after initial commissioning.



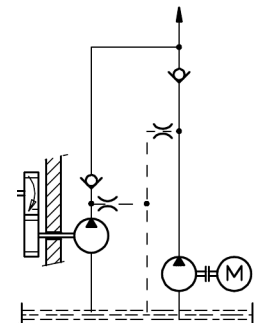
It is appropriate to employ a foot valve or a non-return valve in case of longer suction lines that can run dry while the pump is at rest. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



During operation of a pump that has to pump media via a non-return valve in a pressurized circuit (e.g. reserve pump in a lubricant circuit), suction problems can occur if the suction line is filled with air.

In this case the pressure pipe must be bled directly upstream of the non-return valve.

If no vent nozzle is used, the volume of the pressure pipe between the pump and the non-return valve must be at least 75 % of the suction line volume.



6.4.3 Pressure line design

When designing the line, take the following points into consideration:

- Select the nominal width of the pressure line so that the maximum permissible pressures are not exceeded.
- If necessary, provide a vent nozzle to prevent suction problems.

6.4.4 Mounting Connection lines



Position of the device connections: See [chapter 3 “Device description”](#)

- Clean all lines.
 - Do not use cleaning wool.
 - Pickle and flush welded pipes.
- Remove the protective plugs.
- Mount the lines.
 - Comply with the manufacturer's information.
 - Do not use any sealing materials such as hemp, Teflon tape or putty.

6.5 Change of the direction of rotation

When using pump type KF ./, rotation direction 1 or 2, reversing the direction is only possible by converting the pump.

The manufacturer normally carries out the conversion work and the customer should do this only in exceptional cases. Please consult the manufacturer about this.

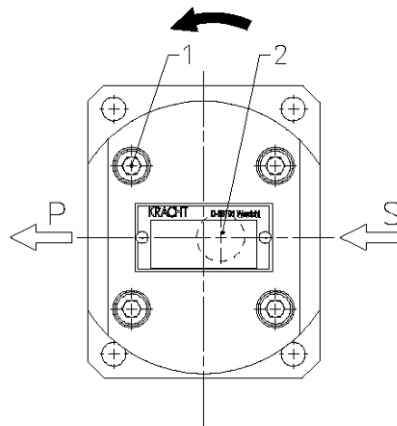


NOTICE

Leaks or increased wear

Damaged sealing surfaces or supports lead to lack of sealing and/or faults in later operation.

1. When assembling or disassembling housing components, be sure not to damage the bearings, e.g. by tilting.
2. When disassembling housing components, do not use screwdrivers or the like as a lever to separate the joints.
3. Do not remove, damage or jam seals.



S = Suction side
P = Pressure side

1. Fastening screws
2. Leak oil hole

When reversing the gear pump's direction of rotation turn the end cover 180°.

- Loose fastening screws.
- Remove the end cover from the pump housing and reassemble rotated by 180°.
- Tighten the fastening screws with the stated torque.
(Tightening torque $M_A = 8 \text{ Nm}$)



Inspection:

1. The leak oil hole in the end cover must be placed on the inlet port of the gear pump.

7 Operation start-up

7.1 Safety instructions for start-up

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Do not operate the device against closed shut-off devices.
2. Do not operate the device in the false direction of rotation.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

7.1.1 Special hazards

DANGER

Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).



WARNING

Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.



NOTICE

Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

7.2 Preparation

- Before starting the system make sure that a sufficient quantity of the operating fluid is extant to avoid dry running.
Take this into consideration especially with high output volumes.
- Check all fastening screws on the device.
- Fill pump and the suction line with medium.

7.3 Further operation start-up

- Open existing shut-off elements upstream and downstream of the device.
- Adjust pressure relief valves in the system installed for lowest opening pressure.
- Allow the device start without or with a low pressure load (jog mode).
 - Flow should have developed after 30 s at the latest.
- Run the device for a few minutes depressurised or with low pressure.
- Vent the system at the highest possible point.
- Gradually increase the pressure load up to the desired operating pressure.
- Operate the system for so long until the final operating state is achieved.
- Check the operating data such as:
 - Discharge flow
 - Operating pressure (as close as possible to device)
 - Fluid temperature (as close as possible to device)
 - Device temperature (in particular in the area of the bearing points)
 - ...

- Document the operating data of the initial start-up for later comparison.
- Check the level of the operating medium in the system.
- Check the filling level of the liquid seal (if existing).
- Check the device for leaks.
- Check all threaded connections for leaks and retighten if necessary.



In order to ensure a constant and reliable function of the device, an initial maintenance of the device is recommended after several hours warm-up time (max. 24 h). Faults can thus be identified at an early stage.

8 Removal

8.1 Safety instructions for removal

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

WARNING

Unshielded gearwheels!

Gearwheels can trap and crush fingers and hands.

1. Do not engage gearwheels.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

**NOTICE****Blocking of the device through hardening medium**

Hardening medium can mechanically jam the device and make it unusable.

1. Clean device immediately after operating with a hardening medium.

8.1.1 Special hazards**DANGER****Powerful magnetic field**

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).

**WARNING****Powerful magnetic field**

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.

**NOTICE****Powerful magnetic field**

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

8.2 Removal

- Depressurise and de-energize the system.
- Close existing shut-off elements upstream and downstream of the device.
- Open existing drain elements and loosen connection lines. Collect and dispose of discharging medium so that no hazard arises for persons or environment.
- Dismantle the device.
- Clean the device.
- Close the device connections and lines to prevent dirt penetration.

9 Maintenance

9.1 Safety instructions for maintenance

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

9.1.1 Special hazards

DANGER

Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).

WARNING

Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.

NOTICE

Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

9.2 Maintenance work



Checking and documentation of the operating data

Regular checking and documentation of all operating data such as pressure, temperature, current consumption, degree of filter soiling, etc. contributes to early problem detection.

- Perform maintenance according to specification.
- Replace defective and worn components.
- If required, request spare parts lists and assembly drawings from the manufacturer.
- Document the type and scope of the maintenance work along with the operating data.
- Compare the operating data with the values of the first commissioning. Determine the cause in case of major non-compliances (> 10 %).
- Dispose of packing material and used parts in accordance with the local stipulations.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

9.3 Maintenance instructions

The following information provides recommendations on maintenance work and maintenance intervals for the device being used.

Depending on the actually occurring loads in operation, the type, scope and interval of the maintenance work can deviate from the recommendations. The equipment builder/operator shall write an obligatory maintenance plan.



Within the framework of preventive maintenance, it is appropriate to replace wear parts before reaching the wear limit.

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator. Please consult the manufacturer about this.



Warranty

In case of improper implementation, any warranty is voided.

Maintenance recommendations Gear pump			
Interval	Maintenance work	Employees	Duration approx. [h]
Firstly: after max. 24 h	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
Daily	Audiometric monitoring: Unusual noise	1	0.1
	Cleaning: Remove dust deposits and dirt with a moist cloth		
	Visual inspection: Leakages		
	Visual inspection: Filling level of liquid seal (if existing)		
3000 Operating hours	Inspection: Discharge flow	1	1
	Inspection: Operating pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Add-on valve function (if existing)		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
6000 Operating hours	Visual inspection: Condition of gears	1	2
	Visual inspection: Condition of housing parts		
	Visual inspection: Condition of plain bearings		
	Visual inspection: Condition of shaft seal		
	Visual inspection: Condition of outboard bearings (if existing)		
As required	Replace: Plain bearings (only by manufacturer)	1	2
	Replace: Outboard bearing (if existing)		
	Replace: Shaft seal		
	Replace: Other seals		

Maintenance recommendations Magnetic coupling			
Interval	Maintenance work	Employees	Duration approx. [h]
6000 Operating hours	Visual inspection: Coupling status	1	1
	Visual inspection: Shaft bearing status		
	Visual inspection: Secondary seals status		
As required	Replace: Secondary seals	1	1

10 Repairs

10.1 Safety instructions for repair

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

DANGER

Rotating parts!

Danger of death due to body parts, hair or clothing getting trapped or entangled.

1. Before all work, ensure that existing drives are voltage-free and pressure-free.
2. Securely prevent restarting during all work.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

10.1.1 Special hazards


DANGER
Powerful magnetic field

Danger of death for people with heart pacemakers.

1. Maintain a safety clearance of at least 2 m to the unmounted components of the magnetic coupling.
2. Maintain a safety clearance of at least 0.5 m to assembled couplings with axially aligned magnetic rotors and surrounding coupling housing (bell housing).


WARNING
Powerful magnetic field

Danger of injury due to uncontrolled mutual attraction of magnetic parts or parts that can be magnetized.

1. When performing any work, bear in mind the magnetic forces which occur, especially within 0.5 m of the magnetic coupling.


NOTICE
Powerful magnetic field

Magnetic data carriers (discs, credit cards, etc.) can be damaged or erased by magnetic fields.

1. Maintain a minimum clearance of 1 m to the magnetic field.

10.2 General

The repairs covers:

1. Troubleshooting
Determination of damage, pinpointing and localisation of the damage cause.
2. Elimination of damage
Elimination of the primary causes and replacement or repair of defective components. The repair is generally made by the manufacturer.

Repairs by manufacturer

- Before returning the device, fill in the *return notification* form. The form can be filled in online and is available as a pdf file download.


Device contains hazardous material

If the device was operated with dangerous liquids, it must be cleaned before the return. If this should not be possible, the safety data sheet of the hazardous material is to be provided beforehand.

Repair by equipment builder/operator

If corresponding expertise and sufficient equipment is available, the equipment builder/operator can also make the repairs. Please consult the manufacturer about this.

- If required, request spare parts lists and assembly drawings from the manufacturer.
- Use spare parts approved by the manufacturer only.
- Dispose of packing material and used parts in accordance with the local stipulations.



Warranty

In case of improper implementation, any warranty is voided.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

10.3 Detecting and eliminating failures

Failure		Potential causes	Possible measures
1.1	Increased noise <i>- Pump cavitation</i>	Excessive negative pressure (not complete filling of the pump)	Check suction line design Use noise-optimised pump
		Suction line plugged	Clean the suction line
		Suction filter plugged or too small	Clean suction filter or use a larger filter Replace filter element
		Suction bascet plugged or too small	Clean intake strainer or dimension larger
		Fluid temperature too low	Adjust the temperature of medium

Failure		Potential causes	Possible measures
1.2	Increased noise - <i>Foaming or air in medium</i>	Pump sucks air	Check oil level in the tank
			Check suction line
			Check the shaft seal
		Shaft seal defective	Replace shaft seal
		Suction connection leaking	Retighten or replace threaded connections
			Replace seals
		System not vented	Vent system
		Return line ends above the fluid level	Extend return line
Heavy foaming in the system, e.g. in gears	Use noise-optimised pump		
1.3	Increased noise - <i>Mechanical vibrations</i>	Incorrectly aligned and/or loose coupling	Correct the alignment of the coupling and secure the coupling halves
		Incorrectly and/or insufficient line fastening	Fixate lines with suitable fastening material (e.g. pipe clamps)
		Wobbling pressure relief valve (if existing)	Increase valve opening pressure
		Not a noise-reducing setup	Use dampers
2	Pump does not suck	Dry run	Fill pump and the suction line with medium.
		Minimum filling level in the supply tank undercut	Top up medium
		False direction of rotation of the pump	Correct the direction of rotation
		Closed shut-off element in the suction line	Open the shut-off element
		Suction line plugged	Clean the suction line
		The air in the suction line cannot be compressed in the pressure line	Reduce the start-up pressure
			Vent the pressure line
			Increase volume of the pressure line
		Speed of the pump is too low	Check the pump design
			During frequency inverter operation: Check the operation/line frequency
Geodetic suction head too high	Check installation location		
	Provide pre-filling pump		

Failure		Potential causes	Possible measures
3	Insufficient pressure Insufficient pumping flow rate	Excessive negative pressure (not complete filling of the pump)	Check suction line design
		Viscosity too high	Provide pre-filling pump
		Speed of the pump is too low	Check the pump design
			During frequency inverter operation: Check the operation/line frequency
		Throttled shut-off element in the suction line	Open the shut-off element
		Suction line plugged	Clean the suction line
		Suction filter plugged or too small	Clean suction filter or use a larger filter
			Replace filter element
		Suction bascet plugged or too small	Clean intake strainer or dimension larger
		Constant triggering of pressure relief valve (if existing)	Increase valve opening pressure
Pump sucks air	Check oil level in the tank		
	Check suction line		
	Check the shaft seal		
Wear	Replace the device		
4	Excessive operating temperature	Cooling and heat dissipation insufficient	Increase the cooling capacity
		Not sufficient oil in the system	Check the container layout
		Excess fluid is being delivered into the supply tank via pressure relief valve under load	Check the pump design
5	Impermissible pump heating	Constant triggering of a directly attached pressure relief valve (if existing)	Increase valve opening pressure
		Pressure too high in association with a media viscosity that is too low	Check the system design
		Speed too fast in connection with media viscosity that is too high	Check the system design
		Suction pressure too high	Reduce the pressure
		Wear	Replace the device

Failure		Potential causes	Possible measures
6	Leakages <i>- Seal failure</i>	Poor maintenance	Comply with maintenance plan Replace seals
		Mechanical damage	Replace seals
		Thermal overload	Check the operating datas Replace seals
		Pressure too high	Check the operating datas Replace seals
		Gas content in medium too high	Check the operating datas Replace seals
		Corrosion/chemical impact	Check the material compatibility Replace seals
		Wrong direction of rotation	Correct the direction of rotation Replace seals
		Contaminated medium	Provide filtration Replace seals
		Loose threaded connections	Retighten or replace threaded connections
7.1	Magnetic coupling <i>- Change in operating noise and/or the occurrence of vibrations</i>	Alignment error	See Operating/installation instructions for magnetic coupling: Failures, causes and clearance
		Breakdown of the magnetic forces	
		Damaged exterior magnets due to assembly error (external rotor striking the containment shroud)	
7.2	Magnetic coupling <i>- Repeated breakdown of the magnetic forces</i>	Operating parameters do not match the coupling power	See Operating/installation instructions for magnetic coupling: Failures, causes and clearance
		Excessive operating temperature	
		Abrasive particles in the pumping medium that block the pump	
7.3	Magnetic coupling <i>- Pump does not suck</i> <i>- The torque is not transmitted</i>	The magnets of the interior and exterior rotors are not placed flush above one another	Check the assembly dimensions in accordance with the assembly drawing

Failure		Potential causes	Possible measures
8	Motor protection switch tripped	Driving power too low	Check the drive design
		Motor incorrectly connected	Check motor connection
		Phase failure	Check feed/supply
		Current consumption too high	Check the operating datas
			Check direction of rotation
Motor circuit breaker incorrectly designed	Check the operating datas		
Consult the manufacturer for all unidentifiable failures.			