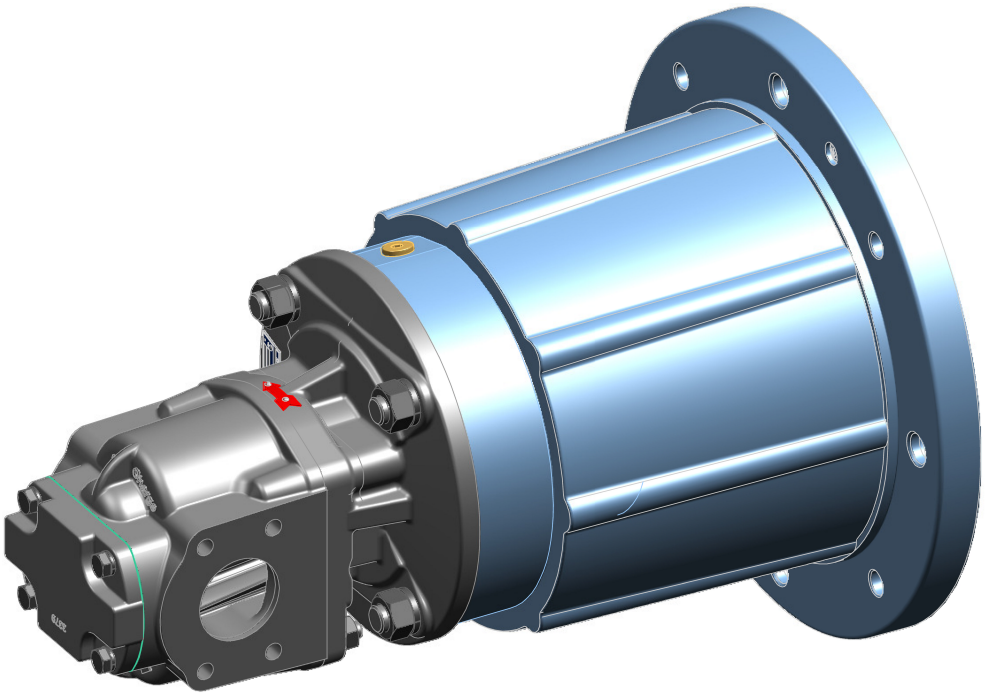
D.0034510002

Operating instructions (Translation)



Gear pump KF 3/. - KF 6/. + Magnetic coupling MINEX® -S

88034510002-08

Englisch

2020-03-09

KRACHT

Table of Content

1 General

1.1 About the documentation

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

Gear pump KF 3/. - KF 6/. + 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.

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

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.

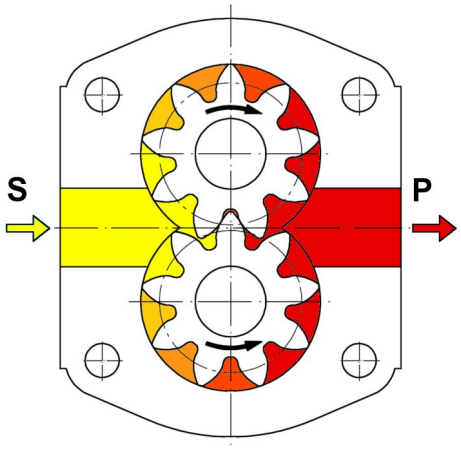
2.6 Labelling on equipment

	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.



S = Suction connection
P = Pressure connection

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

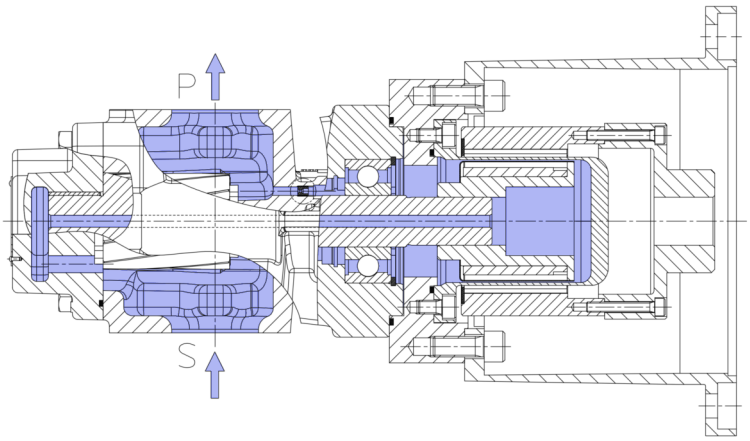
Versions with magnetic coupling are used when absolute leak-proofness is required on the shaft seal or when being operated with supply pressure on the suction side. The magnetic coupling is leak-proof within the permissible technical limits.

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.

On versions with rinsing, an internal forced rinsing of the interior rotor by the pumping medium is provided for continuous removal of the heat developing in the air gap. The magnetic coupling is cooled by a substream of the pumping medium.

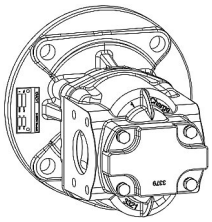
Cooling circuit



S = Suction connection
P = Pressure connection

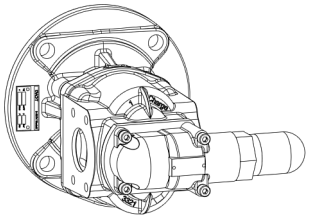
3.2 Possible versions

Gear pump with end cover



Standard

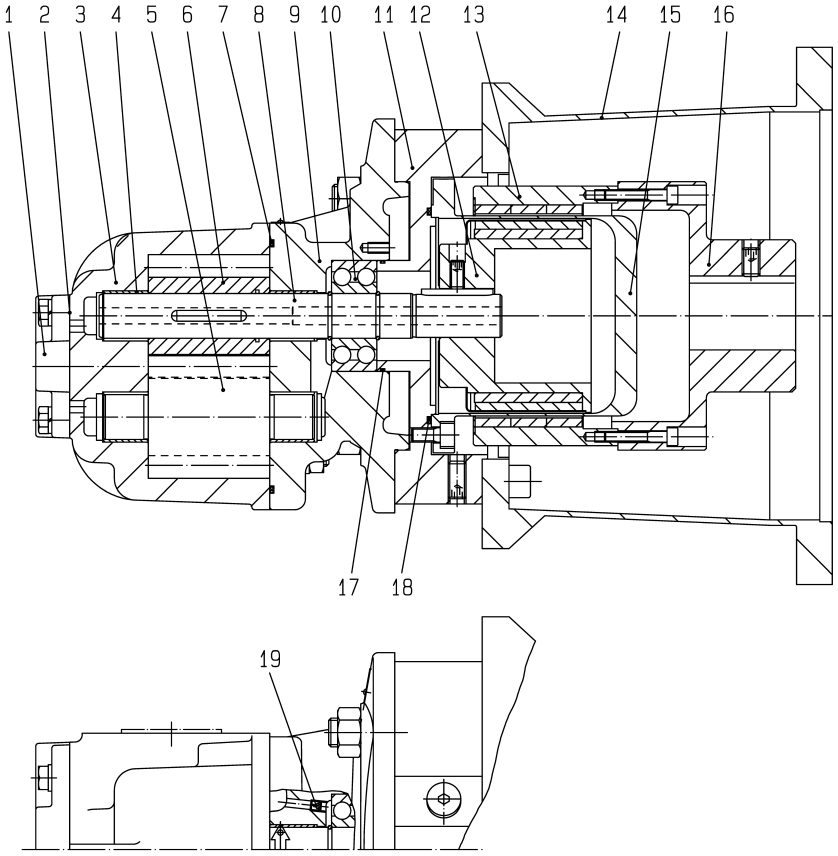
Gear pump with pressure relief valve



Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only. Constant triggering of the valve can destroy the gear pump due to overheating.

3.3 Basic design

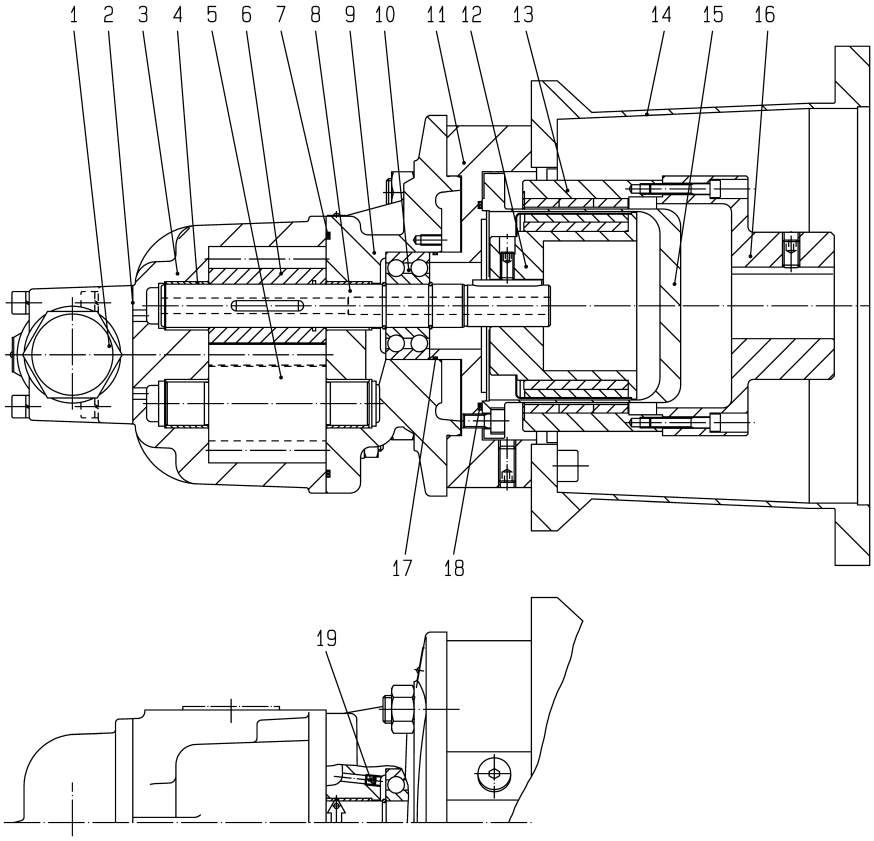
3.3.1 KF 3/. - KF 6/. (with end cover) + Magnetic coupling



Explanation

1. End cover
2. Seal
3. Housing
4. Plain bearing bush
5. Driven shaft
6. Gear
7. O-Ring
8. Shaft
9. Flange cover
10. Outbord bearing
11. Adapter flange
12. Internal rotor
13. External rotor
14. Bell housing
15. Containment shroud
16. Flange hub
17. O-Ring
18. O-Ring
19. Nozzle
    (Only design variants with rinsing.)

3.3.2 KF 3/. - KF 6/. ...DKF. (with pressure relief valve) + Magnetic coupling

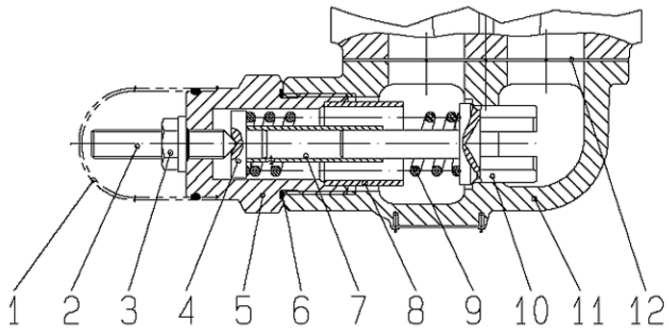


Explanation

1. Pressure relief valve
2. Seal
3. Housing
4. Plain bearing bush
5. Driven shaft
6. Gear
7. O-Ring
8. Shaft
9. Flange cover
10. Outbord bearing
11. Adapter flange
12. Internal rotor
13. External rotor
14. Bell housing
15. Containment shroud
16. Flange hub
17. O-Ring
18. O-Ring
19. Nozzle

    (Only design variants with rinsing.)

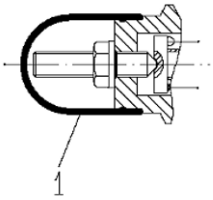
Basic set-up Pressure relief valve



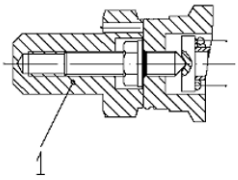
Explanation

1. cover
2. Adjustment screw
3. Seal nut
4. Spring guide
5. Cap screw
6. O-Ring
7. Guide sleeve
8. Distance tube
9. Compression spring
10. Valve cone
11. Housing
12. Seal

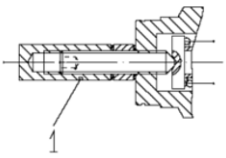
Variants cover



Thread protective cap



Cap nut



Cap nut KN17

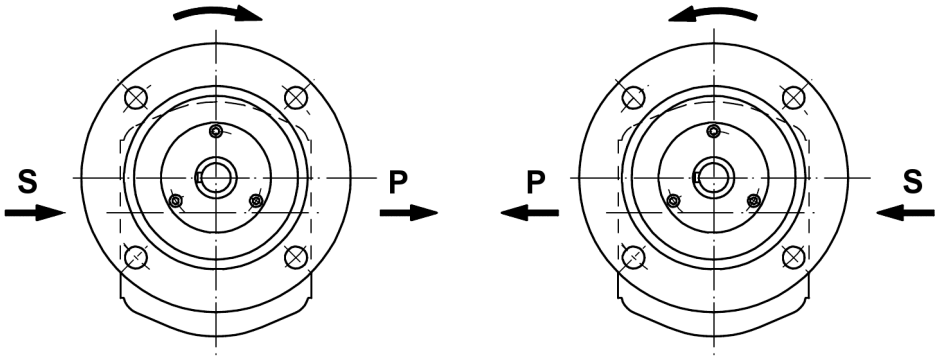
3.4 Rotation and delivery direction

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.

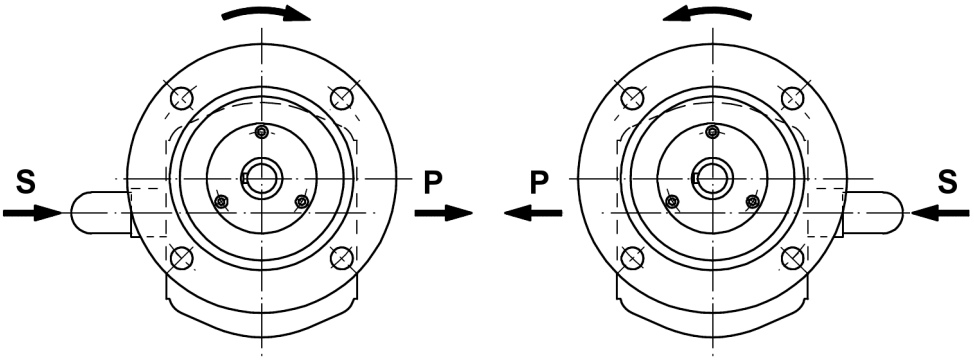
Gear pump with end cover



S = Suction connection

P = Pressure connection

Gear pump with pressure relief valve

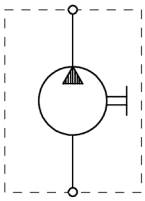
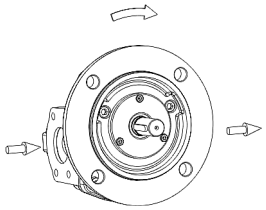
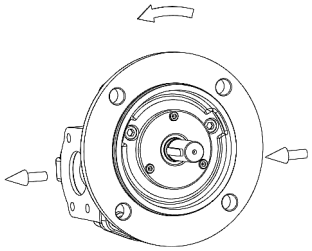
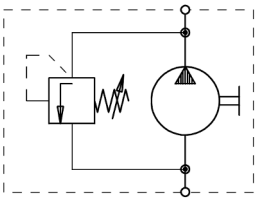
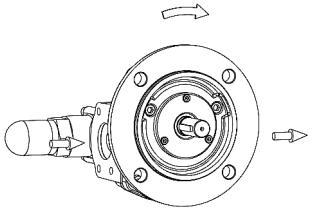
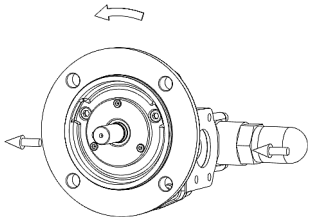


S = Suction connection

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 ./. .10B	KF ./. .20B
	**Gear pump with pressure relief valve**	
		
	KF ./. .10B .+DKF .	KF ./. .20B .+DKF .

3.5 Type key

Ordering example KF 3/. - KF 6/. + MINEX® -S																			
Type key Gear pump																			
KF		**3/**	**63**		**F**	**1**	**0**	**B**		**N**	**0**	**0**		**7**	**D**	**P**	**65**	**/197**	**+**	**DKF 3**	**D**	**04**
1.		2.	3.		4.	5.	6.	7.		8.	9.	10.		11.	12.	13.	14.	15.		16.	17.	18.

Type key Magnetic coupling						
+	**MSB75**	**-**	**A**	**4**	**-**	**...**
	19.		20.	21.		22.

Explanation of type key KF 3/. - KF 6/. + MINEX® -S				
1.	**Product name**			
2.	**Size**			
	3		**5**	
	4		**6**	
3.	**Nominal size (Rated volume)**			
	V_{gn}	**KF 3/:** 63; 80; 100; 112 **KF 4/:** 125; 150; 180 **KF 5/:** 200; 250; 315 **KF 6/:** 400; 500; 630; 730		
4.	**Flange mounting cover**			
	F	KF 3/.	**H**	KF 5/. KF 6/.
	G	KF 4/.		
5.	**Direction of rotation**			
	1	Clockwise	**2**	Counterclockwise
6.	**Outboard flange**			
	0	Without mounting flange		
7.	**Construction of housing**			
	B	Housing with flange connection		
8.	**Shaft end**			
	N	Cylindrical shaft end with outboard bearing		
9.	**2nd shaft end**			
	0	Without 2nd shaft end		
10.	**End cover**			
	A	For direction of rotation 1 or 2	**0**	Without end cover (for valve installation)
11.	**Design serial number** (specified by manufacturer)			

Explanation of type key KF 3/. - KF 6/. + MINEX® -S				
12.	**Housing material and plain bearing**			
	D	EN-GJL-250 (GG-25) Multi layer friction bearings contains lead	**V**	EN-GJS-400-15 (GGG-40) Multi layer friction bearings contains lead
13.	**Gears version**			
	P	Helical gear		
14.	**Seal type**			
	60	Magnetic coupling without flushing O-Ring EPDM	**68**	Magnetic coupling with flushing O-Ring FEP
	61	Magnetic coupling without flushing O-Ring FKM	**81**	Magnetic coupling with flushing O-Ring FEPM
	62	Magnetic coupling with flushing O-Ring CR (for compressor applications)	**83**	Magnetic coupling with flushing O-Ring FEP with silicone-core
	63	Magnetic coupling without flushing O-Ring FEP	**86**	Magnetic coupling without flushing O-Ring NBR
	65	Magnetic coupling with flushing O-Ring FKM (for compressor applications)	**90**	Magnetic coupling with flushing O-Ring EPDM
	66	Magnetic coupling without flushing O-Ring HNBR	**91**	Magnetic coupling with flushing O-Ring FFKM
	67	Magnetic coupling with flushing O-Ring HNBR (for compressor applications)	**95**	Magnetic coupling with flushing O-Ring FKM (Low temperature)
15.	**Special number**			
		See section 3.6 “Important special numbers”		
16.	**Pressure relief valve**			
	DKF 3	for KF 3/.	**DKF 5**	for KF 5/.
	DKF 4	for KF 4/.	**DKF 6**	for KF 6/.
17.	**Version DKF**			
	U	Housing material: EN-GJL-250	**V**	Housing material: EN-GJS-400-15
		O-Ring: Material will be defined by pump		O-Ring: Material will be defined by pump
		cover: Thread protective cap		cover: Cap nut
	W	Housing material: EN-GJL-250		
		O-Ring: Material will be defined by pump		
		cover: Cap nut		

Explanation of type key KF 3/. - KF 6/. + MINEX® -S				
18.	**Pressure setting ranges**			
	04	2 - 4 bar	**16**	8 - 16 bar
	08	4 - 8 bar	**25**	16 - 25 bar
19.	**Magnetic coupling size KRACHT**			
	MSB75		MSC135S	
	MSC75		MSD135	
	MSB110		MSD135S	
	MSC110		MSD165	
	MSC110S		MSE165	
	MSC135			
20.	**Maximum operating temperature of magnetic coupling**			
	A	150 °C	**B**	300 °C
21.	**Magnetic coupling pressure range**			
	1	16 bar	**3**	40 bar
	2	25 bar	**4**	60 bar
22.	**Additional information on magnetic coupling**			

3.6 Important special numbers

Special number	Description
197	Noise-optimized version for aerated oils (1)
273	Noise-optimized version for aerated oils (1) **(197)** White metal bearing, Δp_{max} = 10 bar
304 **332**	Plastic plain bearings Iglidur® X (non-ferrous metal-free), Δp_{max} = 10 bar
346	**KF 3/. for compressor applications** Plastic plain bearings Iglidur® G (non-ferrous metal-free), Δp_{max} = 10 bar
	KF 4/. - KF 5/. for compressor applications Plastic plain bearings Iglidur® X (non-ferrous metal-free), Δp_{max} = 10 bar **(304)**
	KF 6/. for compressor applications Plastic plain bearings Iglidur® H370 (non-ferrous metal-free), Δp_{max} = 10 bar
(1) *Measures for noise optimisation are only possible for one rotational direction and only effective for aerated oils or vacuum (only in connection with seal versions that are suitable for vacuum operation). Can lead to a reduction of delivery rate.*	

3.7 Sealing material depending on refrigerant and lubricant (screw compressor)

refrigerant		Oil							
		M	**M***	**M* - PAO**	**AB**	**E**	**PAO**	**AB - PAO**	**PAG**
R717 (NH_3)	Ammonia	CR/ HNBR	CR/ HNBR	CR/ HNBR	CR	-	HNBR CR (1)	CR	CR/ HNBR
R290 (C_3H_8)	Propane	-	-	-	-	-	HNBR	-	HNBR
R1270 (C_3H_6)	Propy-lene	-	-	-	-	-	HNBR	-	HNBR
R744 (CO_2)	Carbon dioxide	-	-	-	-	CR	HNBR	-	CR
R22	H-FCKW	CR	-	-	CR	CR	-	CR	-
R134a, R404a, R407C, R410A, R507, R23	H-FKW	-	-	-	-	HNBR	-	-	-
(1) *only for the oils: Fuchs Reniso Synth 68, Klüber Summit R100/R150/R200*									

Explanation:

M	Mineral oil
M*	Mineral oil with special treatment (hydrocracked oil)
AB	Alkylbenzene
E	Polyolester
PAO	Polyalphaolefin
PAG	Polyalkylglycol
CR	Chloroprene rubber
HNBR	Hydrogenated nitrile rubber

4 Technical data

4.1 General

General information KF 3/. - KF 6/. + Magnetic coupling			
Design		Pump unit without motor	
Housing connection Gear pump (1)		KF 3/.	Flange connection SAE 1 1/2" - M10
		KF 4/.	Flange connection SAE 2"
		KF 5/200	Flange connection SAE 2 1/2"
		KF 5/250; KF 5/315	Flange connection SAE 3" -M12
		KF 6/.	Flange connection SAE 4"
Mounting position		Any	
Viscosity	v_{min}	See section 4.5.2 “Differential pressure - viscosity assignment”	
	v_{max}	8000 mm^2/s	
Speed	**n**	See section 4.2 “Overview nominal sizes” + section 4.4 “Viscosity - Rotation speed assignment”	
Operating pressure	p_e p_b	See section 4.5 “Permissible pressure range”	
Ambient temperature	ϑ_u	See section 4.6 “Permissible temperature range”	
Fluid temperature	ϑ_m		
Material		See section 4.7 “Material data”	
Filtering		Filter porosity ≤ 60 µm	
Permissible media		Lubricating fluids without abrasive components. Fluids with constituents that can be magnetised are not permissible. (Petrols, solvents, etc. are not permissible.) Compressor applications: Refrigeration oil (max. 5% gas content), Hydraulic oil, Mineral oil	

(1) *Pipe thread: ISO 228-1; Flange connection: ISO 6162-1 (SAE J518)*

4.2 Overview nominal sizes

Nominal size V_{gn}	Geom. displacement V_g [cm³/rev.]	Speed (1)		Sound pressure level (2) L_{pA} [dBA]	Mass inertia x10 $^{-4}$ J [kg m²]
		n_{min} [rpm]	n_{max} [rpm] (3)		
3/63	63.8	200	2000	≤ 75	4.25
3/80	81.3			≤ 76	5
3/100	100.8			≤ 76	6.75
3/112	112.6			≤ 77	7.5
4/125	129			≤ 78	13.75
4/150	153			≤ 79	16
4/180	184			≤ 80	19.25
5/200	204			≤ 81	27.5
5/250	255			≤ 82	34.5
5/315	321			≤ 82	43
6/400	405			≤ 82	105
6/500	505			≤ 83	130
6/630	629			≤ 84	160
6/730	730		1500	≤ 85	195

(1) *Comply with media-specific properties.*
(2) *n = 1500 rpm ; v = 34 mm²/s ; p = 5 - 25 bar.*
(3) *Pay attention to the viscosity.*

4.3 Rated torque Magnetic coupling

Size	Rated torque [Nm] (1)			
	Pressure range 1	Pressure range 2	Pressure range 3	Pressure range 4
MSB75	-	24	-	24
MSC75	-	40	-	40
MSB110	-	60	60	54
MSC110	-	95	95	-
MSC110S	-	-	-	77
MSC135	-	145	-	-
MSC135S	-	-	-	125
MSD135	-	200	-	-
MSD135S	-	-	-	160
MSD165	-	280	-	-
MSE165	-	370	-	270

(1) $\vartheta_u = 20\ °C$

4.4 Viscosity - Rotation speed assignment

Kinematic viscosity v [mm²/s]						
≤ 400	500	1000	2000	5000	10000	15000
2000	1800	1200	800	500	350	250
Recommended rpm n [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 $p_{e\ min.}$

4.5 Permissible pressure range

4.5.1 Operating pressure of suction side and pressure side

Pressure range Magnetic coupling	Housing material	Operating pressure (1) (2)		
		Suction side		Pressure side
		$p_{e\ min}$ [bar abs.]	$p_{e\ max}$ [bar]	p_b [bar] (perm. continous pressure)
1	EN-GJL-250	0.6 (3) Vacuum equipment: 0.08 Standing still: 0	16	EN-GJL-250: 35 EN-GJS-400-15: 63
	EN-GJS-400-15			
2	EN-GJL-250		25	
	EN-GJS-400-15			
3	EN-GJL-250		25	
	EN-GJS-400-15		40	
4	EN-GJL-250		25	
	EN-GJS-400-15		60	

(1) *bar abs.: absolute pressure, bar: relative pressure*
(2) *Comply with permissible differential pressure (see section 4.5.2 "Differential pressure - viscosity assignment").*
(3) *Start-up condition: 0.4 bar absolute (max. 30 minutes)*

4.5.2 Differential pressure - viscosity assignment

Storage	Δp_{max} [bar]			
	v ≥ 1.4 mm²/s	v ≥ 6 mm²/s	v ≥ 12 mm²/s	
Multi layer friction bearings contains lead (Standard) DU, P10 - - - - Multi layer friction bearings lead free, DP4	3	12	KF 3/.	25
			KF 4/.	
			KF 5/200	
			KF 5/250	20
			KF 5/315	16
			KF 6/400	25
			KF 6/500	20
			KF 6/630	16
			KF 6/730	14
Plastic plain bearings Iglidur® G; X; H370 - - - - White-metalled bearing TEGO® V738	-	3	10 (1) KF 6/730: 6 (1)	

(1) *for compressor applications from v ≥ 7 mm²/s*

4.6 Permissible temperature range

Sealing material	Fluid temperature ϑ_m		
	$\vartheta_{m\ min}$ [°C]	$\vartheta_{m\ max}$ [°C]	
		Version Magnetic coupling	
		A	B
FKM	-20	150 (1)	150 (1)
CR		100	100
HNBR		150 (1)	150 (1)
EPDM		130 (1)	130 (1)
FEP with FKM-core		150 (1)	200 (1)
FFKM		150 (1)	200 (1)
NBR		90	90
FEPM	-10	150 (1)	200 (1)
FEP with silicone-core	-30	150 (1)	200 (1)
FKM (Low temperature)		150 (1)	150 (1)
(1) **Pump with bearing material Iglidur® G: max. 110 °C**			

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u\ min.}$ [°C]	$\vartheta_{u\ max.}$ [°C]
FKM	-20	60
CR		
HNBR		
EPDM		
FEP with FKM-core		
FFKM		
NBR		
FEPM	-10	
FEP with silicone-core	-30	
FKM (Low temperature)		

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.

4.7 Material data

4.7.1 Gear pump

Seal type	O-rings	enclosure/ flange cover/ Cover	Pressure relief valve	Gears	Bearing
60	EPDM	EN-GJL-250 (GG-25) - - - EN-GJS-400-15 (GGG-40)	See section 3.5 “Type key”	Case-hardened steel (1.7139)	Multi layer friction bearings contains lead (Standard) DU, P10 (Steel, CuSn, PTFE, Pb) - - - Plastic plain bearings non-ferrous metal-free Iglidur® - - - Multi layer friction bearings lead free DP4 (Steel, CuSn, PTFE) - - - White-metalled bearing TEGO® V738 (Steel, Cu, Sn, Sb, Cd, Ni, As)
61	FKM				
62	CR				
63	FEP with FKM-core				
65	FKM				
66	HNBR				
67	HNBR				
68	FEP with FKM-core				
81	FEPM				
83	FEP with silicone-core				
86	NBR				
90	EPDM				
91	FFKM				
95	FKM (Low temperature)				

4.7.2 BG-Magnetic coupling

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

4.8 Weights

4.8.1 Gear pump

Nominal size V_{gn}	Gear pump [kg]	
	with end cover	with DKF valve
3/63	12.0	13.5
3/80		
3/100	13.5	15.0
3/112		
4/125	18.5	20.0
4/150	20.0	21.5
4/180	21.0	22.5
5/200	28.0	30.0
5/250	33.0	35.0
5/315		
6/400	51.0	59.0
6/500	55.0	63.0
6/630	65.0	73.0
6/730		

4.8.2 BG-Magnetic coupling

Gear pump	BG-Magnetic coupling [kg]				
	MSB75	MSC75	MSB110	MSC110	MSC110S
KF 3/.	10.2	11.6	29.0	31.0	-
KF 4/.	-	17.0	21.4	25.4	-
KF 5/.	-	-	27.2	28.3	30.0
KF 6/.	-	-	-	31.1	-

Gear pump	BG-Magnetic coupling [kg]					
	MSC135	MSC135S	MSD135	MSD135S	MSD165	MSE165
KF 3/.	-	-	-	-	-	-
KF 4/.	35.8	-	34.3	-	-	-
KF 5/.	31.2	-	35.1	36.0	61.6	-
KF 6/.	-	33.2	35.0	36.0	57.7	61.5

4.9 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.

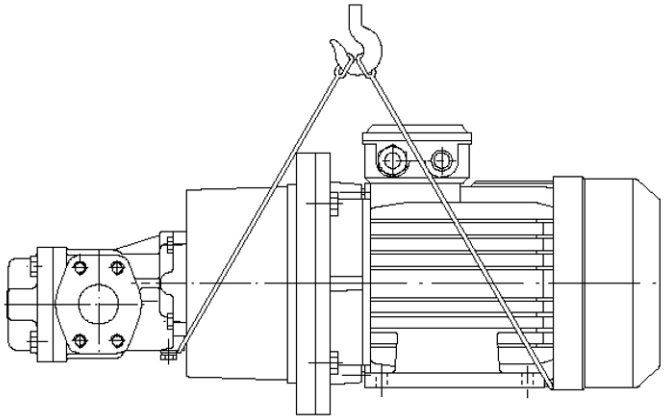
1. Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
2. Attach lifting tackle only to suitable load points.
3. Attach the lifting tackle in such a manner that it cannot slip.
4. Pay attention to the load balance point.
5. Always avoid jerks, impacts and strong 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

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil preserves the interior parts for up to 6 months.

Metallic exposed exterior parts are protected against corrosion by suitable conservation measures, also up to 6 months.

In case of storage, a dry, dust-free and low-vibration environment is to be ensured. The device is to be protected against influences from weather, moisture and strong fluctuations of temperature. The recommended storage conditions are to be adhered to.

Below the permissible ambient temperature ϑ_u elastomer seals lose their elasticity and mechanical loading capacity, since the glass transition temperature is fallen below. This procedure is reversible. A force action on the device is to be avoided in case of storage below the permissible ambient temperature ϑ_u.

Devices with EPDM seals are not mineral-oil resistant and are not tested for their function. There is no preservation of the interior parts. If the device is not taken into operation immediately, all corrosion-prone surfaces are to be protected by suitable conservation measures. The same applies for devices which are not tested for other reasons.

When storing for a long period of time (> 6 months), treat all surfaces at risk of corrosion again with suitable preserving agents.

If high air humidity or aggressive atmospheres are expected, take additional corrosion-preventing measures.

Storage in corrosion protection bags (VCI) maximum of 6 months.

NOTICE

Corrosion/chemical impact

Improper storage can render the device useless.

1. Protect endangered surfaces by means of suitable conservation measures.
2. Comply with recommended storage conditions.

Recommended storage conditions

1. Storage temperature: 5 °C - 25 °C
2. Relative air humidity: < 70 %
3. Protect elastomer parts from light, especially direct sunlight.
4. Protect elastomer parts from oxygen and ozone.
5. 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.

⚠ CAUTION

Hot surfaces!
Burn injury to skin if touched.
1. Wear protective gloves at temperatures ≥48°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	10	25	49	85	210	425	730
(1) *Screws/Nuts with min. strength class 8.8/8*							

- 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

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).

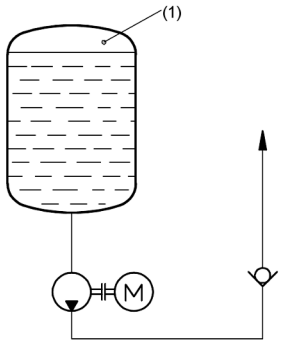
When designing the line, take the following points into consideration:

- 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.



(1) Vacuum

NOTICE

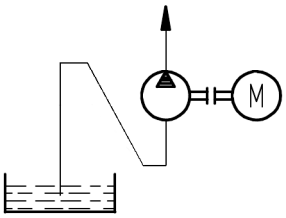
Cavitation damage

Undercutting the permissible suction port pressure results in cavitation.

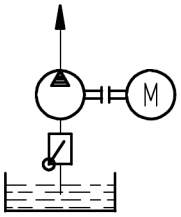
1. Design the suction line so that the pressure arising in operation on the suction side is always higher than the vapour pressure of the pumped medium. At the same time, comply with the installation altitude of the device above mean sea level.
2. For aqueous fluids, mount the device underneath the fluid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

Prevention of suction problems

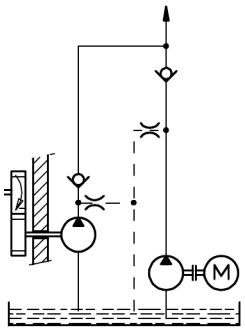
If there is a possibility that the suction line can run dry if the pump stops, piping the suction line as siphon is an option to avoid suction problems. This way, the pump will remain permanently filled after initial commissioning.



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

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

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.

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.

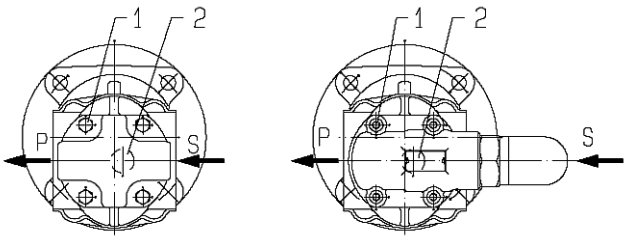
Design variants with internal rinsing do not allow for the rotation direction to be reversed. Unit must be replaced.

The gear pump type KF 6/370 does not allow for the rotation direction to be reversed. Unit must be replaced.

6.5.1 Standard version gear pumps

Depending on the design, a change in direction of rotation is possible.

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



S = Suction connection

P = Pressure connection

1. Fastening screws
2. Leak oil hole

To change the direction of rotation of the gear pump, turn the end cover or the pressure relief valve 180°.

- Loose fastening screws.
- Remove the end cover or the pressure relief valve respectively from the pump housing and put it back on rotated by 180°.
- Tighten the fastening screws with the stated torque.

Fastening screws KF 3/. - KF 6/.		
Nominal size	**KF 3/.; KF 4/.**	**KF 5/.; KF 6/.**
Tightening torques [Nm]	25	49

When checking, pay attention to the following points:

1. Gear pumps without pressure relief valve must have the leak oil hole in the end cover on the inlet side.
2. Gear pumps with pressure relief valve must have their pressure relief valve adjusting screw point toward the pump´s suction side.

6.5.2 Gear pumps in noise-optimized design variants

Please consult the manufacturer about this.

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 ≥48°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.

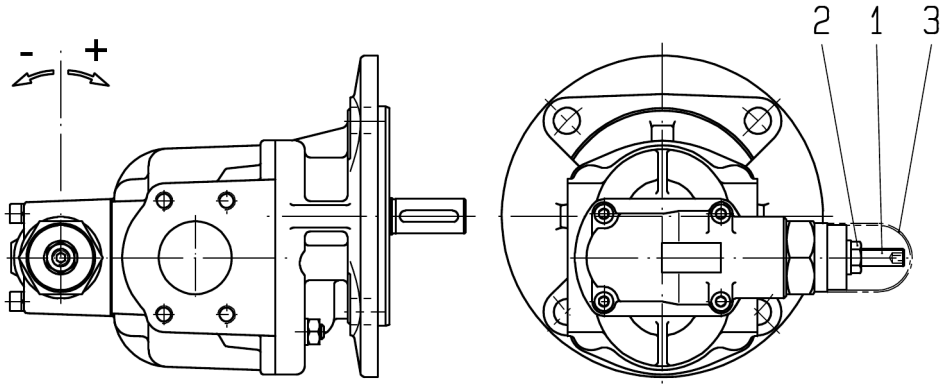
7.3 Pressure relief valve adjustment

Directly attached pressure relief valves of the series "D" are used exclusively for protection of the gear pumps and may respond on a short-term basis only.

The valves are factory set to the rated pressure of each pressure stage. Setting pressures that deviate from this are stated on the rating plate.

NOTICE

Failure of the pump
Long triggering of the valve can cause the pump to overheat.
1. Only allow intermittent triggering of the valve.



- Lower response pressure
+ Higher response pressure

1. Adjustment screw
2. Hexagonal nut
3. cover

Pressure setting:

- Remove cover
- Remove hexagon nut
- Set the response pressure using the adjusting screw
- Secure the adjusting screw with hexagon nut
- Mount cover

WARNING

Failure of load-carrying parts due to overload!
Danger of injury from flying parts.
Danger of injury from spurting fluids.
1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

7.4 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 ≥48°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 operting 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.
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1. Depressurise the device and all connection lines before doing any work.
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CAUTION

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NOTICE

Powerful magnetic field

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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**	**Employ-ees**	**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, clean 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 bear-ings (if existing)		
As required	Replace: Plain bearings (only by manufacturer)	1	2
	Replace: Outbord 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 ≥48°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** *- Pump cavitation*	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
1.2	**Increased noise** *- Foaming or air in medium*	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** *- Mechanical vibrations*	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

Failure		Potential causes	Possible measures
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** *- Seal failure*	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** *- Change in operating noise and/or the occurrence of vibrations*	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** *- Repeated breakdown of the magnetic forces*	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** *- Pump does not suck* *- The torque is not transmitted*	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.			