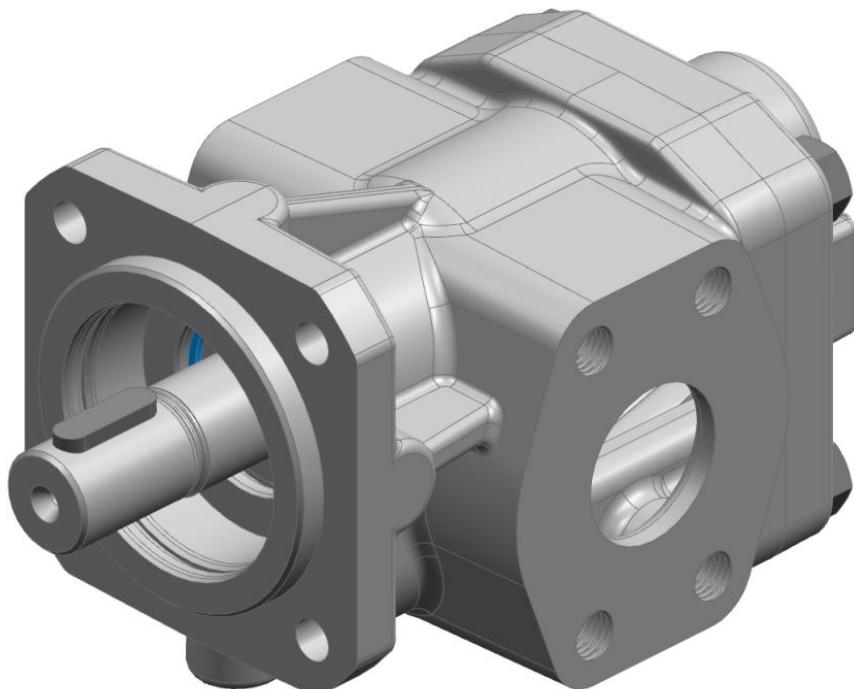


KRACHT

D.0024710002

Operating instructions (Translation)



Gear pump KF 2.5-630
English

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1 General

1.1 About the documentation

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

Gear pump KF 2.5-630

These operating instructions are an integral part of the product and must be kept in the immediate vicinity of the

product and accessible to the personnel at all time.

Different versions of the product are produced. Which version is concerned is stated on the device's type plate.

If you have any questions about this operating manual, please contact the manufacturer.

1.2 Manufacturer address

KRACHT GmbH
Gewerbestraße 20
D-58791 Werdohl
Tel: +49 2392 935-0
Fax: +49 2392 935-209
Email: info@kracht.eu
Web: www.kracht.eu

1.3 Other applicable documents

In addition to these instructions, also comply with the relevant instructions of plants or plant parts available or planned on site.

1.4 Symbols



⚠ DANGER

Identification of an immediate hazard, which can lead to death or severe bodily injury if not avoided.



⚠ WARNING

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



⚠ CAUTION

Identification of a possible low-risk hazard that can result in minor or moderate physical injury if not avoided.

⚠ ATTENTION

Identification of notes to prevent property damage.



NOTICE

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



TIP

Identification of special user tips and other particularly useful or important information

2 Safety

2.1 Intended use

1. The product has been designed for operation with fluids.
Dry operation is not permitted.
2. The product may only be operated when completely filled.
3. The fluid must be compatible with the materials used in the product. Chemical expertise is required for that. Be careful with ethylene oxide or other catalytically or exothermically reacting or self-decomposing substances. Please consult the manufacturer in cases of doubt.
4. The product may only be used in normal industrial atmospheres. If there are any aggressive substances in the air, always consult the manufacturer.
5. The product may only be operated in compliance with these operating instructions and the applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
6. Use of the product for purposes other than those for which it is intended invalidates any warranty.

2.2 Personal qualification

The personnel charged with the assembly, operation and maintenance of the product must have the necessary qualifications.

This can be achieved through training or appropriate instruction.

The personnel must be familiar with the contents of these operating instructions.



NOTICE

Read the operating instructions in full before using the product.

2.3 Pressure relief valve (D-valve)

2.3.1 Foreseeable misuse

Misuse	Risk	Consequences
Continuous operation in bypass mode	If the valve is used continuously as a control device (prolonged outflow), the medium pumped in the circuit heats up extremely quickly.	Destruction of seals, seizing of the pump due to breakdown of the lubricating film.
Adjustment without pressure gauge	Adjusting the pressure screw without simultaneous pressure monitoring.	Unnoticed overloading of system components or bursting of the pump casing.
Back pressure in suction line	Introduction of pressure into the suction connection of the pump (e.g. by external feed pumps).	The counterpressure is added to the spring pressure. The valve only opens at significantly higher, possibly impermissible pressure.
Operation with solids	Contaminated medium.	The valve piston can jam in the open position (no pressure build-up) or become stuck in the seat (no longer providing protection).

2.4 Basic safety instructions



NOTICE

Basic safety instructions

Non-compliance can lead to hazards for people and the unit.

- a) Follow existing regulations for accident prevention and safety at work as well as the internal regulations of the operating company.
- b) Ensure the greatest possible cleanliness.
- c) Wear suitable personal protective equipment.
- d) Do not remove type plates or other information or make them illegible or unrecognisable.
- e) Do not make any technical modifications.
- f) Comply with maintenance intervals.
- g) Only use spare parts approved by the manufacturer.

2.5 Fundamental hazards



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids.

- a) Defective components and connection lines must be replaced or fixed without delay.
- b) Use only components and connection lines approved for the expected pressure range.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.
- b) Safely prevent restarting during the work.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Take measures to prevent accidental touching of rotating parts.



WARNING

Rotating parts

Risk of injury caused by ejected parts

- a) Enclose rotating parts so that in the event of fracture or malfunction, there is no risk caused by ejected parts.



⚠️ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Before carrying out any work, depressurise the product and all connection pipes.
- b) Securely prevent the pressure from being restored during work.



⚠️ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Use only connections and lines approved for the expected pressure range.
- b) Securely prevent the permissible pressures from being exceeded, e.g. by using pressure relief valves or bursting discs.
- c) Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the product.



⚠️ WARNING

Failure of pressure bearing parts due to overload

Risk of injury caused by flying parts.

Risk of injury caused by splashing fluids.

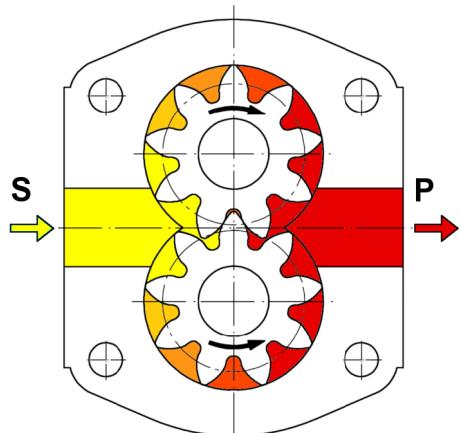
- a) Do not operate the product with shut-off devices closed.
- b) Do not operate the production in the wrong rotational direction.

3 Device description

3.1 Functional principle

3.1.1 Gear pump

The pumps of this series are external gear pumps, which operate according to the displacement principle.



S Suction connection

P Pressure connection

During rotation, two interlocking gears cause a volume increase by opening the tooth spaces on the suction side (S), so that the medium can flow in and at the same time, on the discharge side (pressure side, P), a corresponding volume is displaced by the meshing of the teeth in the filled tooth gaps. Fluid transport takes place through entrainment in the tooth spaces along the wall of the wheel chamber.

With each gear rotation, the so-called geometric displacement volume V_g is displaced. A value that is named the rated volume V_{gn} in technical documents to specify the pump size.

The displacement process described takes place initially without a noticeable pressure build-up. Only after external loads are applied, e.g. by head, flow resistances, pipe elements, etc., does the required working pressure set in to overcome these resistances.

The pressure applied to the shaft seal equals the pressure at the suction connection of the product. The permissible pressure is determined by the type of seal.

3.1.2 Pressure relief valve (D-valve)

The optional integrated pressure relief valve is a direct-acting piston valve. It protects the pump from impermissible pressure peaks, which can occur, for example, when a shut-off device in the pressure line is closed.

The valve piston (2) is pressed against the valve seat by the pressure spring (3). If the pressure in the system rises above the value preselected on the adjustment screw (4), the piston is moved against the spring force. The path for the medium opens up. The medium flows internally from the pressure side (P) directly back to the suction side (S) of the pump (bypass operation).

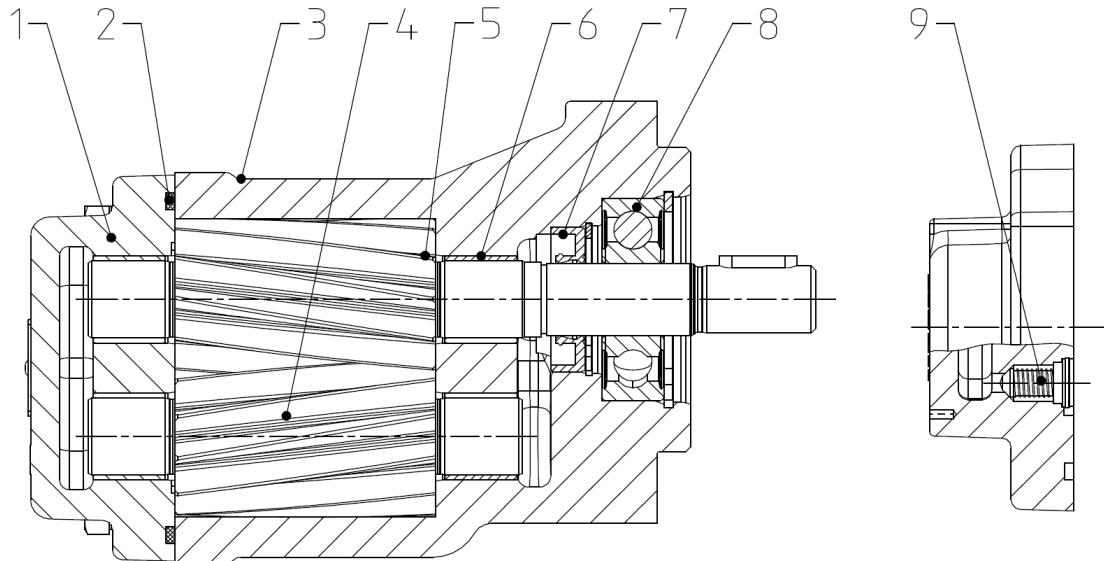


NOTICE

Due to its compact design, the valve has a steep opening characteristic. When the flow rate is completely bypassed (full bypass), the pressure in the system can significantly exceed the set opening pressure (response pressure). The valve is therefore designed purely as a pump protection valve and does not replace a safety valve for pressure vessels in accordance with the Pressure Equipment Directive.

3.2 Variants

Gear pump

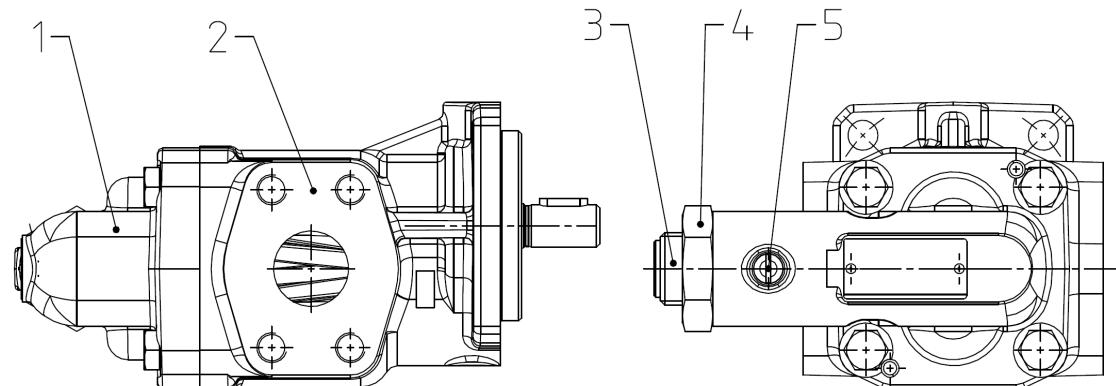


1 End cover	2 O-ring
3 Housing	4 Driven shaft
5 Driving shaft	6 Plain bearings
7 Shaft seal	8 Roller bearings

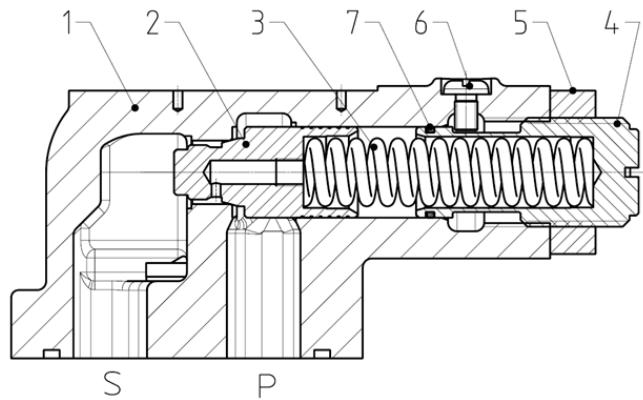
(**Types of seals [▶ 20]**)

9 Valve

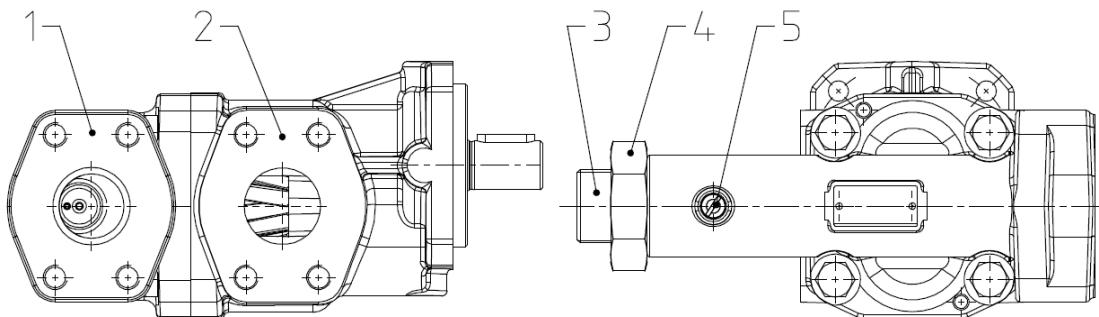
(only Direction of rotation: 3)

Gear pump with pressure relief valve (D- Valve)

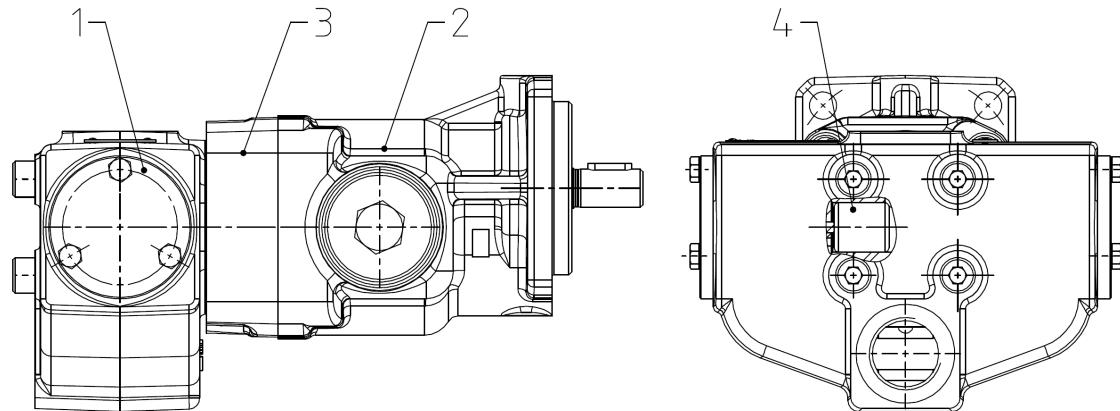
1 Pressure relief valve	2 Gear pump
3 Adjustment screw	4 Hexagonal nut
5 Stroke limitation for adjusting screw	

Pressure relief valve (D- Valve)

S Suction side	P Pressure side
1 Housing	2 Valve piston
3 Compression spring	4 Adjustment screw
5 Hexagonal nut	6 Stroke limitation for adjusting screw
7 O-ring	

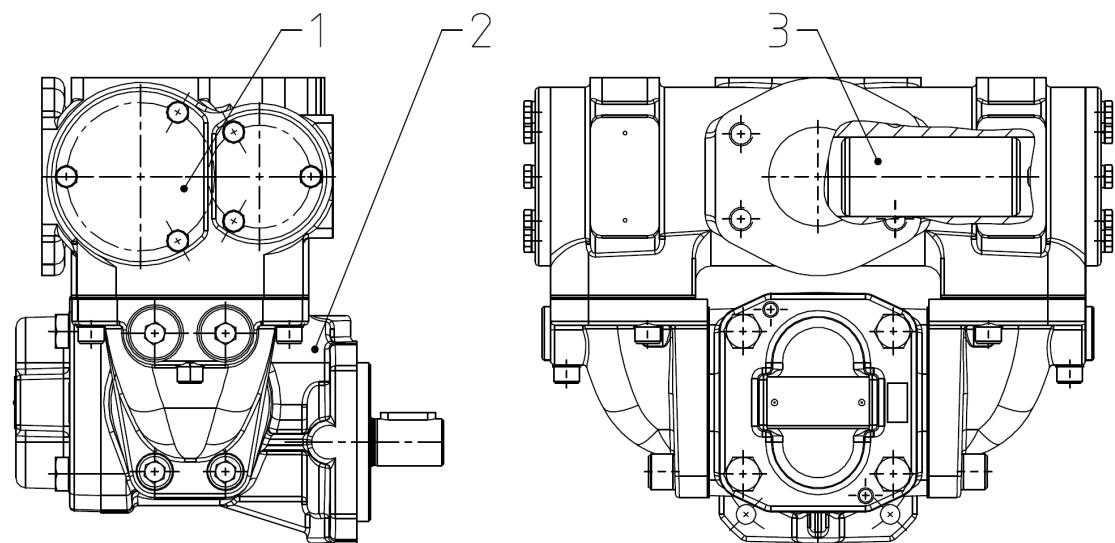
Gear pump with pressure relief valve (T- Valve)

1 Pressure relief valve with Tank connection	2 Gear pump
3 Adjustment screw	4 Hexagonal nut
5 Stroke limitation for adjusting screw	

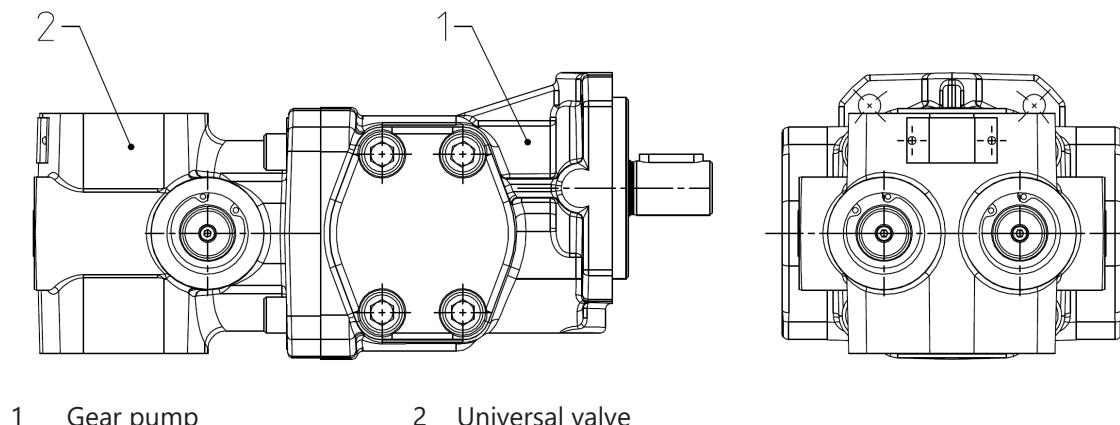
Gear pump KF 2.5-25 with Universal valve (C1)

1 Universal valve
3 Pipe adaptor

2 Gear pump
4 Piston

Gear pump KF 32-80 with Universal valve (C4)

1 Universal valve
2 Gear pump
3 Piston

Gear pump KF 32-112 with Universal valve (U)

1 Gear pump
2 Universal valve

3.3 Type key

Ordering example																				
KF	40	6	F	1	0	A	0	Z	V	0	0	0	G	G	E	0	G	D	W	/197
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

Ordering example										
+		D	2		F	6		D	15	/...
		22.	23.		24.	25.		26.	27.	28.

Explanation of type key																								
1. Product name																								
2. Nominal																								
<table border="1"> <tr> <td>V</td> <td>Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25</td> </tr> <tr> <td>gn</td> <td>Size 2: 32; 40; 50; 63; 80</td> </tr> <tr> <td>gn</td> <td>Size 3: 100; 112; 125; 150; 180; 200</td> </tr> <tr> <td>gn</td> <td>Size 4: 250; 315; 400; 500; 630</td> </tr> </table>																	V	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25	gn	Size 2: 32; 40; 50; 63; 80	gn	Size 3: 100; 112; 125; 150; 180; 200	gn	Size 4: 250; 315; 400; 500; 630
V	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25																							
gn	Size 2: 32; 40; 50; 63; 80																							
gn	Size 3: 100; 112; 125; 150; 180; 200																							
gn	Size 4: 250; 315; 400; 500; 630																							
3. Housing material																								
2	EN-GJS-400-15	6	EN-GJL-250																					
4. Seal material																								
C	CR	L	FKM - Low temperature																					
E	EPDM	N	NBR																					
F	FKM	P	FEP with FKM-core																					
G	FFKM	Q	PTFE																					
H	HNBR																							
5. Direction of rotation																								
1	Clockwise	3	Clockwise/counterclockwise with changing direction of delivery																					
2	Counterclockwise	4	Clockwise/counterclockwise with consistent direction of delivery																					
6. Outbord bearing																								
0	Without	V	Outbord bearing																					
7. Flange type																								
A	4-hole flange DIN ISO 3019	L	SAE B Two-hole flange																					
B	4-hole flange	N	SAE A 2-hole flange																					
I	Customer specific	T	SAE-C-2-hole flange																					
J	SAE D two-hole flange																							
8. Flange cover material																								
0	Without																							
9. Shaft end																								
Z	Cylindrical shaft end	F	Flat pin																					
B	Gear shaft profile SAE B	G	Gear shaft profile SAE B-B																					

Explanation of type key				
C	Gear shaft profile SAE C-C	Q	Gear shaft profile SAE C	
D	Cylindrical shaft end with nozzle in the shaft end	S	Gear shaft profile SAE A	
E	Cylindrical shaft end with centring hole DIN 332-2			
10. Type of end cover				
D	End cover	V	Valve	
11. Cover material				
2	EN-GJS-400-15	6	EN-GJL-250	
12. 2nd shaft end				
0	Without			
13. Axial clearance compensation				
0	Without			
14. Suction side connection				
A	Pipe thread	G 3/4	KF 2.5-12	
A		G1	KF 16-25	
C	Flange connection	SAE 3/4"	M10 -15 deep	
D		SAE 1"	M10 -17 deep	
G		SAE 1 1/2"	M12 -20 deep	
I		SAE 2"	M12 -20 deep	
J		SAE 2 1/2"	M12 -20 deep	
L		SAE 3"	M16 -32 deep	
M		SAE 3 1/2"	M16 -32 deep	
N		SAE 4"	M16 -32 deep	
P		SAE 5"	M16 -32 deep	
15. Pressure side connection				
A	Pipe thread	G 3/4	KF 2.5-12	
A		G 1	KF 16-25	
C	Flange connection	SAE 3/4"	M10 -15 deep	
D		SAE 1"	M10 -17 deep	
G		SAE 1 1/2"	M12 -20 deep	
I		SAE 2"	M12 -20 deep	
J		SAE 2 1/2"	M12 -20 deep	
L		SAE 3"	M16 -32 deep	
M		SAE 3 1/2"	M16 -32 deep	
N		SAE 4"	M16 -32 deep	
P		SAE 5"	M16 -32 deep	
Pipe thread: DIN EN ISO 228-1; Flange connection : DIN ISO 6162-1 (SAE J518)				
16. Gear material				
E	16MnCr5 - 1.7139			
17. Gear coating				

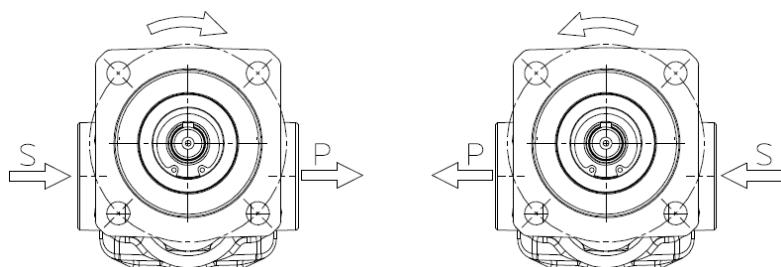
Explanation of type key						
0	Without					
18. Type of bearing						
G Plain bearings						
19. Material bearing						
D	Multi layer friction bearings (contains lead)	W	White metal bearing			
E	Multi layer friction bearings (non-ferrous metal-free)	X	Plastic plain bearings			
20. Seal type						
0	Without shaft seal	F	Triple rotary shaft seal Without connection for liquid supply			
W	Rotary shaft seal	G	Triple rotary shaft seal With connection for liquid supply			
D	Double rotary shaft seal Without connection for liquid supply	H	Mechanical seal			
E	Double rotary shaft seal With connection for liquid supply	J	Mechanical seal with radial shaft seal ring in front With connection for liquid supply			
21. Special number						
Special numbers [▶ 23]						
22. Valve						
D	Pressure relief valve		Nominal KF 2.5-630			
T	Pressure relief valve with Tank connection		SAE 1 1/2" KF 32-80			
U	Universal valve	Flange connection	SAE 1 1/2" KF 32-80			
U			SAE 2" KF 100-112			
C			SAE 2" KF 32-80			
C		Pipe thread	Suction connection G 3/4 KF 2.5-25			
			Pressure connection G 1/2			
23. Size KF						
1	KF 2.5-25	4	KF 125-200			
2	KF 32-80	5	KF 250-315			
3	KF 100-112	6	KF 400-630			
24. Seal material						
C	CR	L	FKM - Low temperature			
E	EPDM	N	NBR			
F	FKM	P	FEP with FKM-core			
G	FFKM	Q	PTFE			
H	HNBR					
25. Housing material						

Explanation of type key			
2	EN-GJS-400-15	6	EN-GJL-250
26. Material bearing			
D	Multi layer friction bearings (contains lead)	W	White metal bearing
E	Multi layer friction bearings (non-ferrous metal-free)	X	Plastic plain bearings
27. Pressure stage (Pressure setting ranges)			
15	1...15 bar	25	15...25 bar
30	15...30 bar		
28. Special number			
Special numbers [▶ 27]			

3.4 Direction of rotation and discharge

The direction of rotation is indicated by the curved arrow, when looking towards the end of the drive shaft. The pump connections are below the drive shaft.

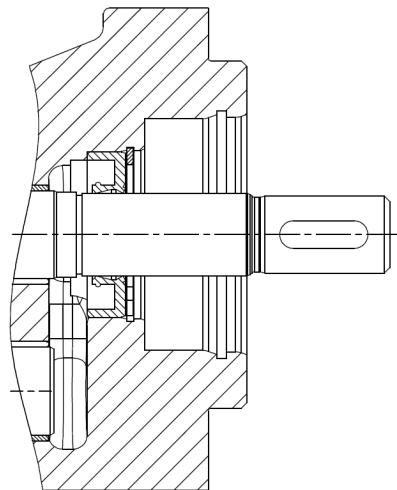
The flow direction is indicated by the straight arrow.



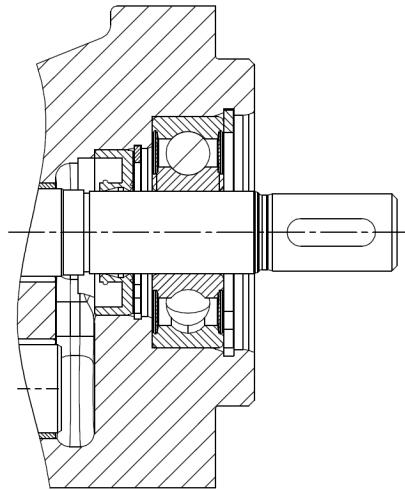
S = Suction connection

P = Pressure connection

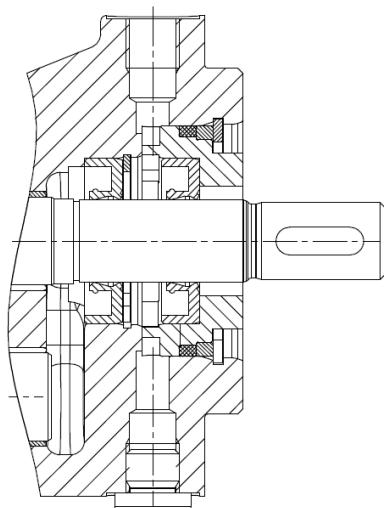
3.5 Types of seals



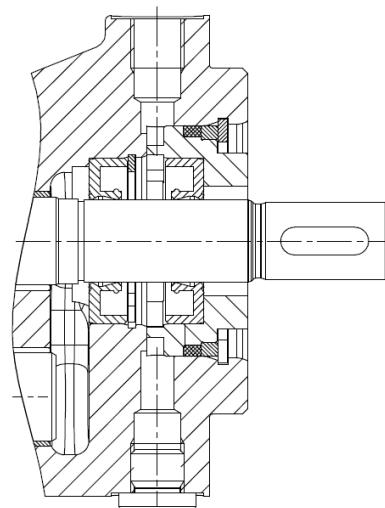
Rotary shaft seal



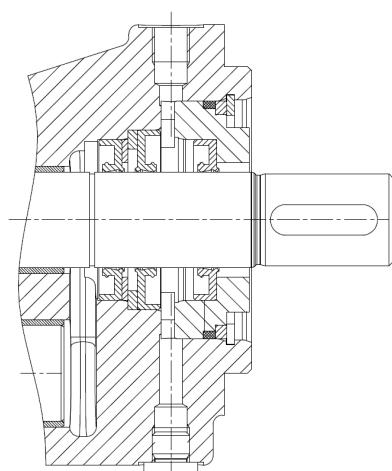
Rotary shaft seal with roller bearings



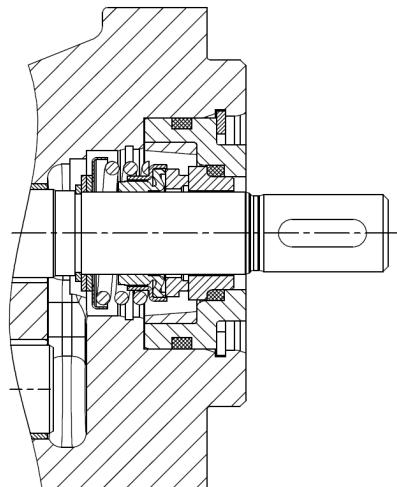
Double rotary shaft seal
Connection borehole G 1/8
(for fluid buffer)



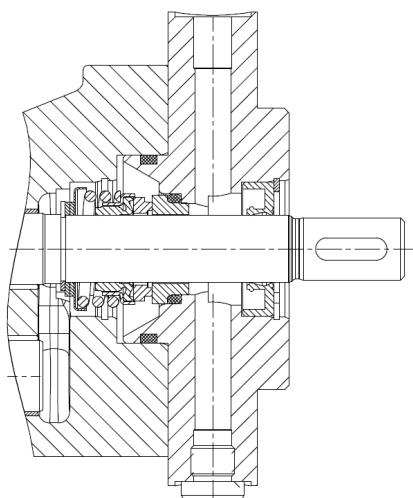
Double rotary shaft seal
(for vacuum operation)
Connection borehole G 1/8
(for fluid buffer)
Special number: 74



Triple rotary shaft seal
(for vacuum operation + for normal operation)
Connection borehole G 1/8
(for fluid buffer)



Mechanical seal



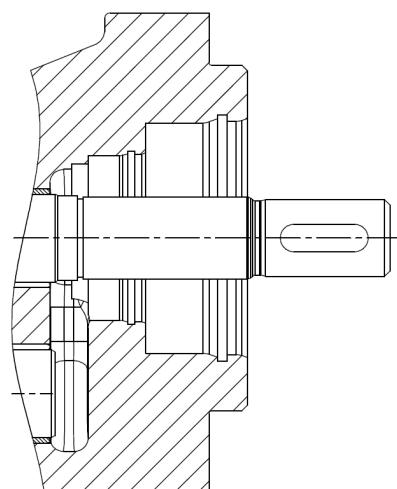
Mechanical seal with fluid buffer

KF 2.5-25: Connection borehole G 1/8

(for fluid buffer)

KF 32-80: Connection borehole G 1/4

(for fluid buffer)



Without shaft seal

(Leak oil drain through shaft sealing chamber)

3.6 Fluid seal

Versions with a fluid seal are used if absolute leak tightness is required at the shaft seal, e.g. when pumping media

- which harden on contact with air.
- which crystallise on contact with the moisture in air.
- which must not be allowed to leak into the environment.
- which are under vacuum and whose seal should be gas tight.

Select the installation so that the connection for the fluid seal is at the top.

3.7 Special numbers

Special number	Description
74	For vacuum operation
156	<p>For compressor applications</p> <p>KF 32-80</p> <p>Housing hardened GJL</p> <p>Mechanical seal</p> <p>Sliding ring: SiC-Si</p> <p>Counter ring: impregnated with synthetic resin</p> <p>KF 2.5-25</p> <p>Mechanical seal</p> <p>Sliding ring: SiC</p> <p>Counter ring: SiC</p> <p>Plastic plain bearings</p>
166	Driving shaft + driven shaft polished (tip circle diameter) (Special size)
168	<p>Without shaft seal</p> <p>With outboard bearing and additional flange adapter</p> <p>Flat journal version with coupling</p> <p>Shaft end with fine thread M12x1,25</p>
173	<p>Housing connection</p> <p>KF 2.5-12: Flange connection 3/4-14 NPT</p> <p>KF 16-25: Flange connection 1-11-1/2 NPT</p>
175	Valve is flowed through in the opposite direction
197	Noise-optimized version for oils containing air
198	<p>Mechanical seal</p> <p>Sliding ring: SiC-Si</p> <p>Counter ring: SiC-Si</p>
252	<p>Special number 166</p> <p>Housing hardened GJL</p>

Special number	Description
255	<p>All fastening screws made of stainless steel + Special number 197 Inner rotary shaft seal with sealing lip mounted on the pump side! Outer rotary shaft seal with sealing lip fitted to the shaft end!</p>
289	<p>Rotary shaft seal BAUM X</p>
297	<p>Inner rotary shaft seal Turcon Roto Variseal (pmax=10 bar at 700 rpm) Outer rotary shaft seal BABSL</p>
307	<p>Without shaft seal Cover with suction hole</p>
309	<p>For vacuum operation + Special number 197</p>
313	<p>Housing hardened GJL Shaft end with flat pin (special)</p>
326	<p>Shaft end with centring hole similar to DIN 332-2 type D KF 150+200: M8 -19 deep + Special number 197</p>
331	<p>Housing Suction hole to the suction side Mechanical seal Sliding ring: SiC-Si Counter ring: SiC-Si</p>
343	<p>With universal valve Gear pump attached in the "0 degrees" position between the mounting flanges of the universal unit. In the version with universal valve U2, the pump is attached rotated by 180°. (Gear pump horizontal, shaft end below the connections!)</p>
375	<p>For compressor applications Mechanical seal Sliding ring: SiC-C-Si Counter ring: Carbon antimony-impregnated Special shaft end Special flange Plastic plain bearings</p>
376	<p>For compressor applications End cover as suction connection with adapter plate + Special number 375</p>
380	<p>All fastening screws made of stainless steel</p>
387	<p>With universal valve Suction connection at bottom of valve body</p>

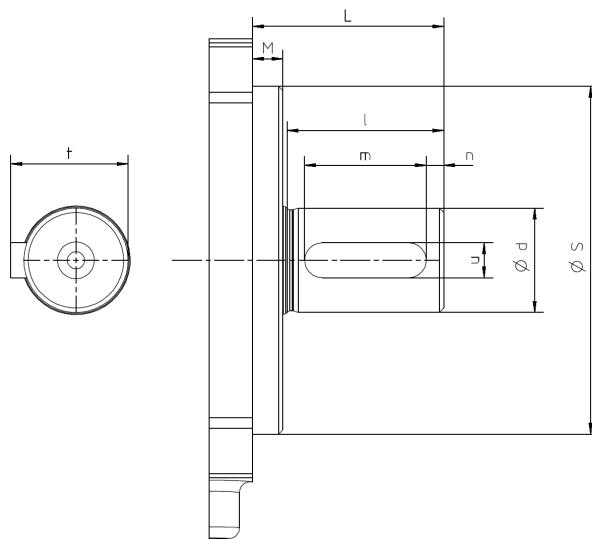
Special number	Description
398	Combination of Special number 197 + 380
408	Special grooves in the housing (KF 2.5)
409	Flange type (Customer specific) 4-hole flange Outer diameter 240; Centering diameter 160; Bolt circle 210
424	Driving shaft with polished bearings
429	Snap ring on the shaft end
430	Shaft end with splined shaft profile SAE B Profile length= 16 mm
433	Shaft end with journal M25x1.5 + Special number 197
442	Shaft end with splined shaft profile SAE B Profile length= 45 mm
444	Shaft end with splined shaft profile SAE B Profile length= 33.3 mm + Special number 197
450	Shaft end with hole for dowel pin
452	Housing with additional threaded holes + Special number 197
458	Standard KF 12 With special dimensions and special shaft end
466	Mould parting line on the housing is deburred
471	Cover for both directions of rotation + Special number 197 Specification of the preferred direction of rotation
481	Housing with screwable relubrication opening and lubricating oil hole
485	Special number 444 Inner rotary shaft seal with sealing lip mounted on the pump side! Outer rotary shaft seal with sealing lip fitted to the shaft end!
492	SAE B 2-hole flange mounted rotated by 90 Shaft end with splined shaft profile SAE B Profile length= 45 mm
503	With forced-feed lubrication + Special number 197
505	Shaft end with splined shaft profile SAE B Profile length= 33.3
506	Flange design 4-hole Flange to SAE A 2-hole (dimension K) Shaft end with splined shaft profile SAE A Profile length= 16 mm

Special number	Description
523	Combination of Special number 197 + 503 + 380
526	Housing drilled through on pressure side. Insert with lubricating oil hole Ø1mm
529	Double rotary shaft seal Outer rotary shaft seal with sealing lip fitted to the shaft end! Leakage oil hole open at the bottom + Special number 197
540	Shaft end with splined shaft profile SAE B Profile length= 24.4 mm + Special number 197
546	Lubrication of the inner rotary shaft seal by flushing
547	Shaft end with splined shaft profile SAE B Profile length= 33.3 mm
548	Spherical roller bearing
550	Two-hole flange mounted rotated 90
551	Shaft end with splined shaft profile SAE B Profile length = 24.5 mm Fit radial shaft seal with sealing lip to the shaft end! Housing with additional suction hole on the suction side
553	Shaft end with splined shaft profile SAE B Profile length = 25 mm
558	Shaft end with splined shaft profile SAE B Profile length = 42 mm + Special number 197
561	Rotary shaft seal MSS1 - FKM low temperature
562	Rotary shaft seal BABS1 - FKM low temperature
563	Rotary shaft seal BABS1 - FKM low temperature Threaded hole in the housing + Special number 197
564	Without housing centring
565	Operating temperature (air) -15 °C to +200 °C
566	Rotary shaft seal BABS1 - FKM low temperature + Special number 197
567	Rotary shaft seal MSS1 - FKM low temperature + Special number 197
569	Mould parting on the housing deburred Rotary shaft seal MSS1 - FKM low temperature

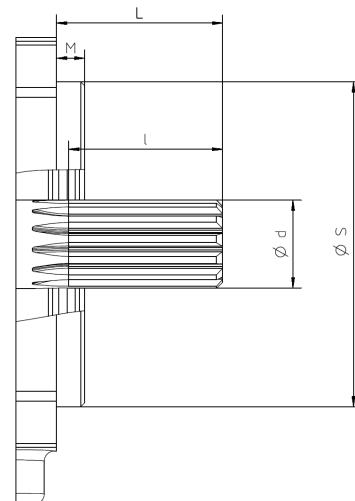
3.8 Special numbers

Special number	Description
001	180° rotated D-valve
002	Viscosity range 300...1000 mm ² /s
003	Viscosity range 1000...10.000 mm ² /s
004	Non-return valve in the piston
005	Ex grooves in the valve cover
006	O-ring FKM VI-580
007	for highly viscous media with bore in the piston
008	Valve cover GJL hardened
009	Underwater version
014	Fine control grooves and nozzle option
015	Special spring, pressure stage 1...6 bar
016	Special spring, pressure stage 1...28 bar
017	Valve cover with dowel pin instead of adapter sleeve

3.9 Shaft ends



Nominal	Special number	L	S _{h8}	M	d _{j6}	l	m	n	t	u	
KF 2.5-25	-	33	63	7	14	25	16	4	16	5	
	-				24	36	28	4	27	8	
KF 32-80	-	44	80	8	20	30	20	5	22.5	6	
	-				28	50	40	5	31	8	
	375	40			24	50	40	5	27	8	
KF 100-200	-	60	110	8	24	36	28	4	27	8	
KF 125-200	375				38	80	63	8	41	10	
KF 100-112	375	46			32				35		
KF 100-150	562; 563; 566										
KF 250-630	-	90	160								
KF 400-630	375										
KF 250-315	375										



Nominal	Flange type	Shaft end	Special number	L	S _{h8}	M	Profile	Dia-metral pitch (DP)	Number of teeth	d _{h11}	I
KF 32-80	N	L	S	-	31.75	82.17	SAE A	7	9	15.26	16
			-			41.2				38	
			551			101.6				24.5	
			553							25	
			444/505/485	41.2						33.3	
	A	B	442/492	46				16/32	13	45	
			-		41	80				38	
			540							25.4	
			-	41						38	
			547							33.3	
KF 100-200	B	I	430	73		110	SAE B	8	21.81	16	
			-	41						38	
			558	95						42	
			444/496		41.2	101.6				33.3	
	L	B	442							15	
			-	41			SAE B-B	12/24	15	24.98	20
			550	46	127					37.58	
			-	55	160					38	
KF 250-630	A	C	-				SAE C-C	12/24	17	31.23	47.5
	J	Q	-	55.4	152.4						

4 Technical data

4.1 General

General information					
Mounting position	KF without fluid buffer	Any			
	KF with Universal valve U2 + U3				
	KF with fluid buffer	Shaft end horizontal , fluid buffer connection top			
	KF with Universal valve C1 + C4	Piston horizontal , Pressure connection on top			
External loads on shaft end	F_{axial}	Axial forces are not permissible			
	F_{radial}	Radial forces are only permissible in combination with an roller bearings			
	Nominal sizes [▶ 31]				
Speed	n	Nominal sizes [▶ 31] + Assignment of viscosity - speed [▶ 32]			
Operating pressure	p_e	Allowable pressures [▶ 33]			
	p_b				
Viscosity	ν_{min}	Assignment of differential pressure to viscosity [▶ 34]			
	ν_{max}	20000 mm ² /s			
		Pressure relief valve with Tank connection	5000 mm ² /s		
Fluid temperature	ϑ_m	Permissible temperature range [▶ 34]			
Ambient temperature	ϑ_u	Permissible temperature range [▶ 34]			
Filtering	β	$\leq 60 \mu\text{m}$			
Materials	Material data [▶ 36]				
Permissible media	Lubricating fluids without abrasive components (Petrols, solvents, etc. are not permissible) For compressor applications : Refrigeration oil (max. 5% gas content); Hydraulic oil; Mineral oil				

TIP



A reduced shaft seal life is possible in the vertical installation position (shaft end at the top).

4.2 Nominal sizes

Nominal	Geom. dis- placement	Speed		Perm. radial force	Sound pres- sure level	Mass inertia
V _{gn}	V _g	n _{min}	n _{max} (2)	F _{radial} [N]	L _{pA} ⁽¹⁾	x10 ⁻⁶
	[cm ³ /U]	[rpm]		(n= 1500 rpm)	[dBA]	J [kg m ²]
2.5	2.55					14.0
4	4.03					15.9
5	5.05					17.8
6	6.38					20.5
8	8.05					24.0
10	10.11					28.4
12	12.58					33.7
16	16.09					42.3
20	20.1					50.8
25	25.1					61.7
32	32.12					217
40	40.21					254
50	50.2					299
63	63.18					368
80	80.5					443
100	101.5					741
112	113.5					806
125	129.4					1418
150	155.6					1637
180	186.6					1911
200	206.2					2072
250	245.1					4133
315	312.9					5011
400	399.5					6618
500	496.5					7830
630	622.5					9591
32	32.12					217
40	40.21					254
50	50.2					299
63	63.18					368
80	80.5					443
100	101.5					741
112	113.5					806

⁽¹⁾ n= 1500 1/min; v= 34 mm²/s; p= 5-25 bar

⁽²⁾ Pay attention to the viscosity

4.3 Assignment of viscosity - speed

Kinematic viscosity ν [mm2/s]	Recommended rpm n [1/min]
100	3600
200	2900
300	2300
500	1800
1000	1200
2000	800
3000	650
6000	450
10000	300
20000	200



TIP

Select the speed of rotation so that complete filling of the pump is ensured. This is the case if the pressure on the suction side does not fall below the permissible pressure p_e min.

4.4 Allowable pressures

4.4.1 Operating pressure, suction and pressure side

Seal material	Seal type	Special number	Operating pressure						
			Suction side		Pressure side				
			$p_{e \min}^{(1)}$ [bar _{abs.}]	$p_{e \max}$ [bar _{rel.}]	p_b [bar _{rel.}]	(perm. continuous pressure)			
NBR	Rotary shaft seal	0.6 ⁽²⁾	Max. Operating pressure suction side [▶ 34]	25	40				

FKM									
EPDM				0.5					
FKM (Low temperature)				25 ⁽³⁾					
NBR									
FKM							25		
FKM									
CR									
HNBR	Mechanical seal	375	25	35 ⁽⁴⁾	-				
FKM									
FEP with FKM-core									
CR				10					
HNBR									
FKM									
NBR	Double rotary shaft seal	156	25	25	40				
FKM									
PTFE									
EPDM									

bar_{abs.} = Absolute pressure ; **bar_{rel.}** = Relative pressure

⁽¹⁾ with Universal valve $p_{e \min} = 0.65$ bar abs.

⁽²⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes)

⁽³⁾ $\vartheta_M < -20$ °C; Housing material GJL: 16 bar

⁽⁴⁾ Permissible differential pressure $\Delta p = 10$ bar

4.4.2 Max. Operating pressure suction side

Speed n [1/min]	p _{e max} [bar]					
	KF 2.5-63	KF 80	KF 100-180	KF 200	KF 250-315	KF 400-630
≤ 750	6	6	6	6	5.5	5
≤ 1000	5	5	5	5	4.5	4
≤ 1500	4	4	3.5	3.5	3	2.5
≤ 2000	3	3	2.5	2.5	2	1.5
≤ 2500	2.5	2.5	2	2	-	-
≤ 3000	2	2	1.5	-	-	-
≤ 3600	1.5	-	-	-	-	-

4.5 Assignment of differential pressure to viscosity

Plain bearings	Δp _{max} [bar]		
	v = 1,4 mm ² /s	v = 6 mm ² /s	v = 12 mm ² /s
Multi layer friction bearings (contains lead) (Standard)	3	12	25
Multi layer friction bearings (non-ferrous metal-free)	-	6	10 ⁽¹⁾
Plastic plain bearings	-	-	-
White metal bearing	-	-	-

⁽¹⁾ For compressor applications v ≥ 7 mm²/s

4.6 Permissible temperature range

Sealing material	Fluid temperature θ _m	
	θ _{m min}	θ _{m max} [°C]
CR		100
EPDM		120
FEP with FKM-core		200
FFKM / FEP with FKM-core		200
FKM	-20	150
HNBR		90
NBR		200
PTFE / FEP with FKM-core		150
FKM (Low temperature)	-30	

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u \min} [^\circ\text{C}]$	$\vartheta_{u \max} [^\circ\text{C}]$
CR		
EPDM		
FEP with FKM-core		
FFKM / FEP with FKM-core	-20	
FKM		60
HNBR		
NBR		
PTFE / FEP with FKM-core		
FKM (Low temperature)	-30	



NOTICE

Note media-specific properties.

4.7 Material data

Seal type	Spe-cial num-ber	Materials				
		Shaft seal	O-ring	Housing / End cover / Valve housing	Gears / Valve pis-ton	Plain bear-ings
Rotary shaft seal	-	NBR ; FKM; EPDM; FKM (Low temperature)				Multi layer friction bearings (contains lead) (Steel (St), CuSn, PTFE, Pb)
	-	PTFE	FEP with FKM-core			- - -
Double rotary shaft seal	-	FKM; NBR; EPDM				Multi layer friction bearings (non-ferrous metal-free) (Steel (St), CuSn, PTFE)
	-	PTFE	FEP with FKM-core			- - -
Without shaft seal	-	-	FKM; NBR; CR; HNBR			White metal bearing (Steel (St), SnS-b12Cu5Cd or SnSb12Cu6)
Mech-anical seal	-	AQ2VFF	FKM		Case-hardened steel 16MnCr5 - 1.7139	- - -
	- - -	Q2Q2K1G3 FFKM (KF 2.5-25)		EN-GJL-250		Plastic plain bearings non-ferrous metal-free Iglidur®
		Q2B2K1G3 FFKM (KF 32-200)	FEP with FKM-core	EN-GJS-400-15		- - -
	156	Q2Q2K1G3 FFKM (KF 2.5-25)	CR HNBR			- - -
		Q2B2K1G3 FFKM (KF 32-200)	FKM			Plastic plain bearings non-ferrous metal-free Iglidur®
						- - -
	375	Q3AN1FE	CR			
		Q3AP1FE	HNBR			
		Q3AVFE	FKM			

4.7.1 Compressor application

Refrigerant		Oil							
		M	M*	M*-PAO	AB	E	PAO	AB-PAO	PAG
R717 (NH3)	Ammonia	CR / HNBR	CR / HNBR	CR / HNBR	CR	-	CR ⁽¹⁾ / HNBR	CR	CR / HNBR
R290 (C3H8)	Propane	-	-	-	-	-	HNBR	-	HNBR
R1270 (C3H6)	Propylene	-	-	-	-	-	HNBR	-	HNBR
R744 (CO2)	Carbon dioxide	-	-	-	-	CR	HNBR	-	HNBR
R22	H-CFC	CR	-	-	CR	CR	-	CR	-
R134a, R404a, R407C, R410A, R507, R23	H-FC	-	-	-	-	HNBR	-	-	-

⁽¹⁾ only for oils: Fuchs Reniso Synth 68, Klüber Summit R100/R150/R200

M= Mineral oil

M*= Mineral oil with special treatment (hydrocracked oil)

AB= Alkylbenzene

E= Polyester

PAO= Polyalphaolefin

PAG= Polyalkylglykol

4.8 Weight

Nominal V_{gn}	Gear pump with [kg]					Added weight
	End cover	Pressure re- lief valve	Pressure re- lief valve with Tank connection	with Uni- versal valve C	with Uni- versal valve U	
2.5	2.9 ⁽¹⁾	3.7 ⁽¹⁾	-	6.9	-	1.3
4						
5						
6						
8						
10						
12						
16	3.5 ⁽¹⁾	4.3 ⁽¹⁾	-	7.5	-	1.6
20						
25						
32						
40	7.7	9.5	12.4	27.5	15.5	3.3
50						
63	9.4	11.2	14.3	29.5	17.5	-
80						
100	16.0	18.7	-	-	21.6	-
112						
125	22.2	26.5	-	-	-	-
150						
180	24.8	29.1	-	-	-	-
200						
250	44.2	47.2	-	-	-	-
315						
400	54.7	57.9	-	-	-	-
500						
630	60.8	64.0	-	-	-	-

⁽¹⁾ Housing with flange connection + 1.3 kg

4.9 Dimensions

The dimensions of the product are given in the technical data sheets.

5 Transport and storage

5.1 General

- a) After receiving the delivery, check the product for transport damage.
- b) If transport damage is found, the manufacturer and the transport company must be notified immediately. The product must then be replaced or repaired.
- c) Dispose of packaging materials and used parts according to local regulations.

5.2 Transport



⚠ WARNING

Falling or toppling loads

Risk of injury during transport of large and heavy loads.

- a) Use only suitable means of transport and lifting gear with sufficient load-bearing capacity.
- b) Attach lifting gear only to suitable places on the load.
- c) Attach the lifting gear so that it cannot slip.
- d) Note the centre of gravity of the load.
- e) Avoid sudden, jerky movements, impacts and strong vibrations during transport.
- f) Do not step under overhead loads, do not work under overhead loads.



NOTICE

Eyebolts can be screwed into the thread of the flanged connections to transport the product.

5.3 Storage

The product's function is tested in the factory with mineral hydraulic oil. The connections are then closed. The remaining residual oil preserves the internal parts for up to 6 months.

Bright metallic external parts are also protected against corrosion by suitable preservation measures for up to 6 months.

During storage, ensure a dry, dust-free and low-vibration environment. The product must be protected from weather, moisture and large temperature fluctuations. Comply with the recommended storage conditions.

Below the permissible ambient temperature ϑ_u , elastomer seals lose their elasticity and mechanical loading capacity, as the temperature is below the glass transition temperature. This process is reversible. Avoid the application of force on the product during storage below the permissible ambient temperature ϑ_u .

Products with EPDM seals are not mineral oil resistant and their function is not tested. The internal parts are not preserved. If the product is not put into operation immediately, all surfaces exposed to corrosion must be protected by suitable preservation measures. The same applies to products that are not tested for other reasons.

In case of storage for a longer period (> 6 months), all surfaces exposed to corrosion must be retreated with suitable preservatives.

If high humidity or an aggressive atmosphere is to be expected, additional suitable corrosion prevention measures must be taken.



NOTICE

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

⚠ ATTENTION

Corrosion/chemical attack

Improper storage can make the product unusable.

- Use suitable preservation measures to protect exposed surfaces.
- Comply with the recommended storage conditions.

5.4 Storage conditions



TIP

Recommended storage conditions

- Storage temperature: 5 °C – 25 °C
- Relative humidity: < 70 %
- Protect elastomer parts from light, particularly direct sunlight.
- Protect elastomer parts from oxygen and ozone.
- Note the maximum storage period of elastomer parts:
 - ⇒ 5 years: AU (polyurethane rubber)
 - ⇒ 7 years: NBR, HNBR, CR
 - ⇒ 10 years: EPM, EPDM, FEP/PFTE, FEPM, FKM, FFKM, VMQ, FVMQ

6 Installation

6.1 Safety instructions for installation



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.
- b) Safely prevent restarting during the work.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Take measures to prevent accidental touching of rotating parts.



WARNING

Rotating parts

Risk of injury caused by ejected parts

- a) Enclose rotating parts so that in the event of fracture or malfunction, there is no risk caused by ejected parts.



WARNING

Exposed gears

Gearwheels can trap and crush fingers and hands.

- a) Do not engage gearwheels.



⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Before carrying out any work, depressurise the product and all connection pipes.
- b) Securely prevent the pressure from being restored during work.



⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Use only connections and lines approved for the expected pressure range.
- b) Securely prevent the permissible pressures from being exceeded, e.g. by using pressure relief valves or bursting discs.
- c) Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the product.



⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

- a) Take measures to prevent accidental touching of hot surfaces (< 60 °C).



TIP

Measures to reduce noise

- a) Use of suction and pressure hoses.
- b) Use of pump supports with high damping properties (plastic or grey cast iron)
- c) Use of damping rings and damping rails to isolate structure-borne sound.

6.3 Mechanical installation

6.3.1 Preparation

- a) Check the product for transport damage and contamination.
- b) Check the product for smooth and easy movement.
- c) Remove any preservative present.
- d) Clean all lines.
 - ⇒ Only use cleaning agents that are compatible with the materials used.
 - ⇒ Do not use cleaning wool.
- e) Compare the environmental and ambient conditions at the place of use with the permissible conditions.
 - ⇒ Make sure that the foundation is sufficiently stable and level.
 - ⇒ Expose the product only to low vibrations, see IEC 60034-14.
 - ⇒ Ensure sufficient accessibility for maintenance and repair.
- f) Position the product and secure it against slipping.
 - ⇒ Comply with the manufacturer's instructions.
 - ⇒ Do not use any sealing materials such as hemp, Teflon tape or putty.
- g) Remove existing protective plugs.

6.3.2 Gear pump with free shaft end

Suitable power transmission between the gear pump and drive is required for fault-free operation.

In a standard product, a flexible claw coupling is used for this.

- a) Preassemble the coupling parts as described by the manufacturer.
- b) Position the pump and drive relative to each other.
 - ⇒ Note the allowable installed position.
 - ⇒ Note the allowable direction of rotation.
- c) Tighten the fastening screws to the specified torque.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Take measures to prevent accidental touching of rotating parts.



⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

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

Tightening torques [Nm]

Thread size	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

Screws/Nuts with min. strength class 8.8/8



NOTICE

- Comply with the allowable displacement values of the coupling.
- Prevent stressing of the product.
- Make sure the fastening screws have sufficient depth of engagement.



NOTICE

- In case of products without a shaft seal, make sure that the leaked oil from the shaft seal space is removed in a controlled way and does not get into the environment.
- Make sure that foreign objects cannot get into the product.
- If products have a fluid seal, install a tank for holding the seal fluid.
 - Install the tank above the product.
 - The connection on the device must face upwards.
 - It must be possible to check the fluid level at any time.

6.4 Connection lines

6.4.1 General



⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Use only connections and lines approved for the expected pressure range.
- b) Securely prevent the permissible pressures from being exceeded, e.g. by using pressure relief valves or bursting discs.
- c) Pipelines must be designed in such a way that no tension e.g. caused by changes in length due to fluctuations in temperature can be transferred to the product.



NOTICE

Additional connections

- a) Provide measurement connections for pressure and temperature as near as possible on the device.
- b) If necessary, provide an option for filling and draining the device and line system.
- c) If necessary, provide an option for venting the device and line system.

6.4.2 Suction line

A suction line that is not optimally designed can lead to increased noise emissions, cavitation and even a reduction in the capacity (due to less filling of the pump).

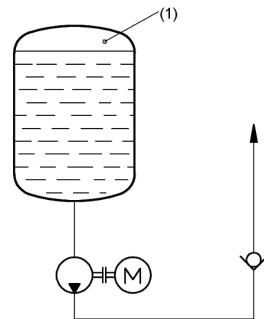
When designing the lines, bear in mind the following points:

- Lay the suction line as short and straight as possible.
- Specify the nominal size of the suction line so that the operating pressure on the suction side is not less than the permissible operating pressure p_e min.
- 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.
- Pay attention to sufficient distance of the suction opening from the floor and walls of the media tank.
- Make sure that the suction opening is below the lowest fluid level in any operating situation.
- When using hoses, make sure that they have sufficient stability so that they do not become constricted by the suction effect.
- Note the recommended flow velocity in the suction line (max. 1.5 m/s).

Suction line at vacuum operation

If medium is to be drawn from a tank under vacuum, the pump must be positioned approx. 1 m below the tank. The suction line must be laid straight and without any resistances.

The tank may be subjected to vacuum only then when the pipework and the pump have been filled with liquid. Only pumps suitable for vacuum operation may be used for this purpose.



NOTICE

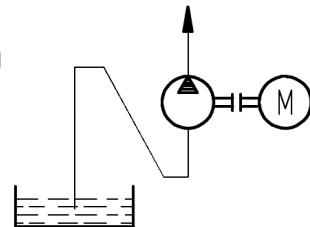
Cavitation damage

Pressure below the permissible suction side pressure causes cavitation

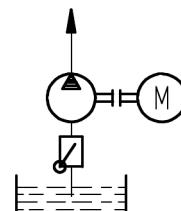
- Design the suction line so that the pressure that sets in during operation is always higher on the suction side than the vapour pressure of the pumped medium. At the same time, make sure that the device is installed above sea level.
- If fluids contain water, install the device below the fluid level and limit the operating temperature to 50 °C and the speed to 1500 1/min.

Prevention of suction problems

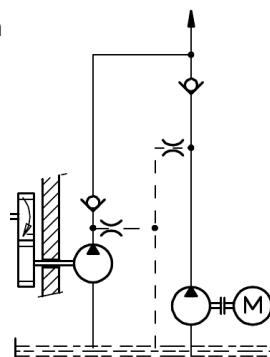
If there is a possibility of the suction line running dry while the pump is at a standstill, laying the suction line as a U-trap is a way of avoiding suction problems. This way, the pump will remain permanently filled after initial commissioning.



In case of longer suction lines that can run empty during the standstill, it is useful to insert a foot valve or a non-return valve. These must have been designed for use in suction lines and should offer as low a flow resistance as possible.



When operating a pump that has to pump via a non-return valve into a pressurized circuit (e.g. reserve pump in a lubricant circuit), intake difficulties can occur if the suction line is filled with air. In this case the pressure line must be vented directly upstream of the non-return valve. If a venting nozzle is not inserted, the volume of the pressure line between the pump and non-return valve must be at least 75% of the suction line volume.



6.4.3 Pressure pipe

When designing the lines, bear in mind the following points:

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

6.4.4 Tank line with T-valve

Specify the nominal width of the tank line so that the delivery volume can be discharged at low or no pressure. The tank line must be passed directly into the supply tank.

6.4.5 Connection line installation

a) Clean all lines.

- ⇒ Do not use cleaning wool.
- ⇒ Pickle and rinse welded pipes.

b) Remove existing protective plugs.

c) Install the lines.

- ⇒ Comply with the manufacturer's instructions.
- ⇒ Do not use any sealing materials such as hemp, Teflon tape or putty.

TIP



Location of the device connections: **Direction of rotation and discharge** [▶ 20]

6.5 Change of the direction of rotation

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

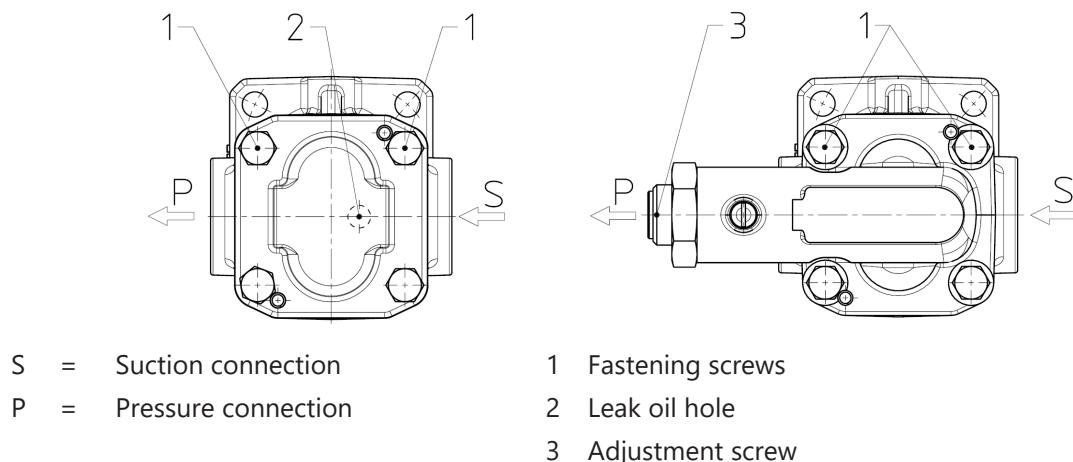
The modification required is normally carried out by the manufacturer and should only be carried out by the customer in exceptional cases. Please consult the manufacturer for this purpose.

NOTICE



Gear pumps in noise-optimised design and/or with pressure lubrication cannot be converted.

6.5.1 Gear pump without noise optimisation



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

- Undo the 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.

Gear pump	Tightening torques [Nm] fastening screws end cover
KF 2.5-25	25
KF 32-80	49
KF 100-200	85
KF 250-630	215



NOTICE

When checking, pay attention to the following points:

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

7 Commissioning

7.1 Safety instructions for start-up



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury caused by flying parts.

Risk of injury caused by splashing fluids.

- a) Do not operate the product with shut-off devices closed.
- b) Do not operate the production in the wrong rotational direction.



CAUTION

Hot surfaces

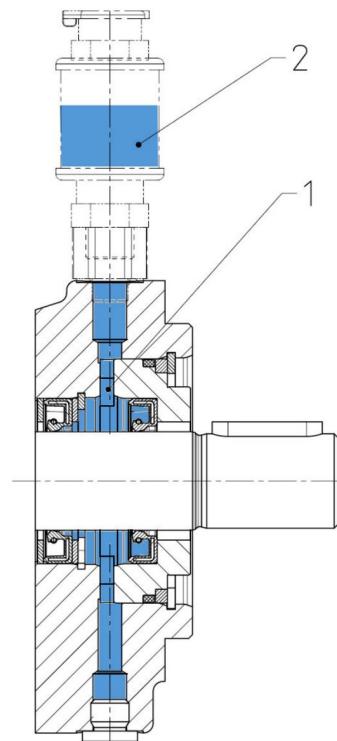
Burns of the skin on contact.

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

7.2 Preparation

- a) Before starting the system make sure that a sufficient quantity of the service fluid is extant to avoid dry running. This must be taken into account especially with large line volumes.
- b) Check all fastening screws on the product.
- c) Fill the pump and the suction line with medium.

7.3 Filling the quench chamber



1 Quench chamber
2 Container for quench-liquid

- a) For versions with fluid seal, fill the quench chamber with a suitable seal fluid.
 - ⇒ Fill from the tank provided.
 - ⇒ Fill fluid until the quench chamber is completely full and the tank is half full.
- b) Do not apply pressure or vacuum to the quench chamber.



NOTICE

Seal failure due to running dry

Lack of seal fluid can cause the seal to fail.

- a) Do not start up the pump without seal fluid.

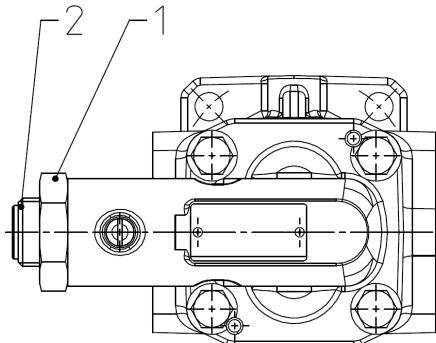


TIP

A second connection on the product enables the quench chamber to be purged/flushed and the seal fluid to be drained.

7.4 Pressure valve setting

The valves are set to the rated pressure of the respective pressure stage in the factory. Set pressures deviating from this are given on the type plate.



- response pressure lower + response pressure higher	1 Hexagonal nut 2 Adjustment screw
---	---------------------------------------

- a) Loosen the hexagon nut.
- b) Use the adjusting screw to set the set pressure.
- c) Secure the adjusting screw with a hexagon nut.



⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury caused by splashing fluids.

- a) Note the permissible pressure setting range of the valve.
- b) Check the pressure setting (the valve must not block).

7.4.1 Pressure relief valve

Directly attached series D pressure relief valves are used only to protect the gear pump and may only operate for a short time.



NOTICE

Failure of the gear pump

Longer operation of the valve can cause the gear pump to overheat.

- a) Operate the valve for a short time only.

Directly attached series T pressure relief valves are used to protect the gear pump. The valve can be used to control the pressure of the gear pump, which enables constant setting of the system pressure.



NOTICE

Overheating of the gear pump

Direct return into the suction line can cause excessive temperatures in the gear pump.

- a) For heat dissipation, the pumping medium passing through the T-valve must be discharged directly into the storage tank.

7.5 Additional commissioning

- a) Open existing shut-off elements in front of and behind the product.
- b) Set pressure relief valves installed in the system to the lowest opening pressure.
- c) Start the product without pressure load or with low pressure (jog mode).
⇒ A flow should have developed after 30 s at the latest.
- d) Run the product pressureless or at low pressure for a few minutes.
- e) Vent the system at the highest possible point.
- f) Gradually increase the pressure up to the required operating pressure.
- g) Operate the system until the final operating condition is reached.
- h) Check the operating data.
⇒ **Maintenance table [▶ 57]**
- i) Document the operating data of the initial commissioning for later comparison.
- j) Check the level of the operating medium in the system.
- k) Check the level of the seal fluid (if present).
- l) Check the product for leaks.
- m) Check all fittings for leaks and retighten if necessary.



TIP

In order to ensure a constant and reliable function of the product, an initial maintenance of the product is recommended after several hours warm-up time (max. 24 h). This allows faults to be detected at an early stage.

8 Removal

8.1 Safety instructions for disassembly



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.
- b) Safely prevent restarting during the work.



WARNING

Exposed gears

Gearwheels can trap and crush fingers and hands.

- a) Do not engage gearwheels.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Before carrying out any work, depressurise the product and all connection pipes.
- b) Securely prevent the pressure from being restored during work.



CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures $\geq 48^{\circ}\text{C}$ allow the product to cool first.

⚠ ATTENTION**Blocking of the product due to curing media**

Curing media can mechanically block the product and make it unusable.

- a) Clean the product immediately after operation with curing media.

8.2 Dismantling

- a) Depressurise and de-energise the system.
- b) Close existing shut-off elements in front of and behind the product.
- c) Open existing drain elements and undo connection lines. Collect and dispose of leaking media so that no hazard is created for persons or the environment.
- d) Dismantle the product.
- e) Clean the product.
- f) Seal the process connections and lines to prevent the ingress of dirt.

**NOTICE**

The concrete procedure for cleaning depends on the media being used.

- a) See the safety data sheet of the media in use.

9 Maintenance

9.1 Safety instructions for maintenance



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.
- b) Safely prevent restarting during the work.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Before carrying out any work, depressurise the product and all connection pipes.
- b) Securely prevent the pressure from being restored during work.



CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures ≥ 48 °C allow the product to cool first.

9.2 Maintenance work



TIP

Checking and documentation of the operating data

Regular checking and documentation of all operating data helps to detect faults at an early stage.

- Perform the maintenance work according to specifications.
- Replace defective or worn components.
- If necessary, 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 initial commissioning.
In case of large deviations (> 10 %) determine the cause.
- Dispose of packaging materials and used parts according to local regulations.



NOTICE

Protective devices and notes

After maintenance and/or repair, reattach all protective devices and notices removed in the process to their original position.

9.3 Maintenance instructions

The following information provides recommendations for maintenance work and maintenance intervals for the product in use.

Depending on the actual loads occurring during operation, the type, scope and interval of the maintenance work may deviate from the recommendations. A mandatory maintenance plan must be drawn up by the installer/operating company.



TIP

In the course of preventive maintenance, it is advisable to replace wearing parts before the wear limit is reached.

With the appropriate know-how and sufficient equipment, the repair can also be carried out by the installer/operating company.

If necessary, request spare parts lists and assembly drawings from the manufacturer.
Please consult the manufacturer for this purpose.



NOTICE

Warranty

Any warranty will be void if not executed properly.

9.4 Maintenance table

9.4.1 Maintenance table

		First time after max. 24h	Daily	3000 operating hours	6000 operating hours	If necessary	Additional information
9.4.2	Check the operating pressure	2					
9.4.3	Check the media temperature	2					
9.4.4	Check the device temperature	2					
9.4.5	Check the function of the add-on valve	2					
9.4.6	Check the equipotential bonding	2					
9.4.7	Check the condition of the operating fluid	2					
9.4.8	Noise test unusual noises		1				
9.4.9	Cleaning		1				
9.4.10	Visual inspection of leakage		1				
9.4.11	Visual check of seal fluid level		2				
9.4.2	Check the operating pressure			2			
9.4.3	Check the media temperature			2			
9.4.4	Check the device temperature			2			
9.4.5	Check the function of the add-on valve			2			
9.4.6	Check the equipotential bonding			2			
9.4.7	Check the condition of the operating fluid			2			
9.4.12	Visual check of the gearbox condition				3		
9.4.13	Visual check of the condition of housing parts				3		
9.4.14	Visual check of the condition of the plain bearings				3		
9.4.15	Visual check of the condition shaft seal				3		
9.4.16	Visual check of the condition of the outboard bearing				3		
9.4.17	Replacing the outboard bearing					3	
9.4.18	Replacing the plain bearings					3	
9.4.19	Replacing the shaft seal					3	
9.4.20	Replacing other seals					3	

1 - 0,1 h; 2 - 0,2 h; 3 - 0,75 h

9.4.2 Check the operating pressure

The operating pressure is indicated by the pressure gauges.

- If there is no operating pressure, check the individual components of the product.
- Comply with the product-specific data sheets/operating instructions.

9.4.3 Check the media temperature

The media temperature is measured through the temperature sensor.

The values are displayed by the built-in controller in the electrical control system.

- If the media temperature is too high or too low, check the product components.
- Comply with the product-specific data sheets/operating instructions.

9.4.4 Check the device temperature

Measure the surface temperature in the area of the bearing.

9.4.5 Check the function of the add-on valve

Add-on valves must be operated at regular intervals. This is necessary to ensure their faultless function.

9.4.6 Check the equipotential bonding

Check the equipotential bonding for tight fit and proper functioning.

9.4.7 Check the condition of the operating fluid

Pay attention to colour (dark colouring), odour and milky turbidity.

- Replace operating fluid if necessary.

9.4.8 Noise test unusual noises

In this case, attention must be paid to increased noise or uneven operation (pump unit).

- In case of unusual noises, examine the individual components of the product and line fixings and check the operating medium for foaming.
- Comply with the product-specific data sheets/operating instructions.

9.4.9 Cleaning

Remove dust deposits and dirt with a damp, clean cloth.

9.4.10 Visual inspection of leakage

Care must be taken here to ensure that there is no leakage from the connections.

- In the event of leaks in the connections, the glands must be tightened and, if necessary, the seals replaced.

9.4.11 Visual check of seal fluid level

Pay attention to the level of the seal fluid. If necessary, top up the seal fluid.

If there is no automatic monitoring, the filling level must be checked at least before each shift begins.

If the level drops unusually quickly within a short time, it is possible that the outer or inner shaft seal is leaking.

If the level increases, it is likely that the inner shaft seal is leaking and barrier medium is mixed with the pumped medium.

- Stop plant operation immediately in both cases.

9.4.12 Visual check of the gearbox condition

The driving shaft pinion and driven shaft pinion are wearing parts. In case of excessive wear, the parts or the pump must be replaced.

Important places to check are the surfaces opposite the shaft seal and bearing bushes, end faces of the driving shaft pinion and driven shaft pinion as well as the tooth flanks.

9.4.13 Visual check of the condition of housing parts

Important places to check are the end faces of the impeller chamber.

9.4.14 Visual check of the condition of the plain bearings

The plain bearings are wearing parts. In case of excessive wear, the parts or the pump must be replaced.

In case of multilayer plain bearings, the wear limit is reached if the bronze layer of the bearing is 50-70 % exposed.

When loaded on the suction side, the driving shaft pinion and driven shaft pinion are supported in the bearings so that wear is identified there first.

9.4.15 Visual check of the condition shaft seal

Pay attention to leak quantities and impermissible temperature increases.

- Small leaked quantities are indispensable for the function of the seal.
- In case of excessive leaked quantities or impermissible temperature increase, the pump must be shut down immediately. Replace the seal.

9.4.16 Visual check of the condition of the outboard bearing

The outboard bearing is a wearing part.

The life of the bearing primarily depends on the operating conditions.

The bearing should therefore be checked for damage after 4000 h at the latest. In the event of unacceptable wear, the bearing must be replaced.

Onsetting wear or pending failure can become noticeable due to increased heating of the bearing, increased power consumption, irregular running or even noise emissions.

9.4.17 Replacing the outboard bearing

With the appropriate know-how and adequate equipment, the repair can also be carried out by the installer/operating company.

To this end, if necessary, request spare parts and assembly drawings from the manufacturer.

Only use spare parts approved by the manufacturer.

9.4.18 Replacing the plain bearings

These are replaced only by the manufacturer.

Contact the manufacturer.

9.4.19 Replacing the shaft seal

With the appropriate know-how and adequate equipment, the repair can also be carried out by the installer/operating company.

To this end, if necessary, request spare parts and assembly drawings from the manufacturer.

Only use spare parts approved by the manufacturer.

9.4.20 Replacing other seals

With the appropriate know-how and adequate equipment, the repair can also be carried out by the installer/operating company.

To this end, if necessary, request spare parts and assembly drawings from the manufacturer.

Only use spare parts approved by the manufacturer.

10 Repair

10.1 Safety instructions for repairs



DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

- a) Comply with the safety data sheets and regulations on handling the hazardous fluids.
- b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.



DANGER

Rotating parts

Risk to life due to entanglement or winding of parts of the body, hair or clothing items.

- a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.
- b) Safely prevent restarting during the work.



WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

- a) Before carrying out any work, depressurise the product and all connection pipes.
- b) Securely prevent the pressure from being restored during work.



CAUTION

Hot surfaces

Burns of the skin on contact.

- a) At temperatures ≥ 48 °C allow the product to cool first.

10.2 General

Corrective maintenance includes:

1. Troubleshooting

Finding damage, determining and localising the cause of the damage.

2. Damage repair

Removing the primary causes and replacing or repairing defective components. Repairs are generally carried out by the manufacturer.

Repair by the manufacturer

Before returning the product, fill out the return form. The form can be filled out online and is available to download as a pdf file or can be requested from the manufacturer.



NOTICE

Device contains hazardous substances

If the device has been operated with hazardous fluids it must be cleaned before it is returned. If this is not possible, the safety data sheet of the hazardous material must be provided in advance.

Repair by the installer/operating company

With the appropriate know-how and sufficient equipment, the repair can also be carried out by the installer/operating company. Please consult the manufacturer for this purpose.

- a) If necessary, request spare parts lists and assembly drawings from the manufacturer.
- b) Only use spare parts approved by the manufacturer.
- c) Dispose of packaging materials and used parts according to local regulations.



NOTICE

Warranty

Any warranty will be void if not executed properly.



NOTICE

Protective devices and notes

After maintenance and/or repair, reattach all protective devices and notices removed in the process to their original position.

10.3 Fault table

Fault	Potential causes	Possible measures
Increased noise		
Pump cavitation	Excessive negative pressure (not complete filling of the pump)	Check suction line design Use noise-optimised pump
	Suction line clogged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter Replace filter element
	Suction basket plugged or too small	Clean intake strainer or dimension larger
	Fluid temperature too low	Adjust the temperature of medium
Foaming or air in media	Pump does not suck	Check the oil level in the tank
		Check suction line
		Check the shaft seal
	Shaft seal defective	Replace seals
	Suction connection leaking	Tighten or replace the screw connections
		Replace seals
	System not vented	Vent the system
Mechanical vibrations	Return line ends above the fluid level	Extend return line
	Heavy foaming in the system, e.g. in gears	Use noise-optimised pump
	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)
Pump does not suck	Wobbling pressure relief valve	Increase valve opening pressure
	Not a noise-reducing setup	Use dampers
	Dry run	Fill pump and the suction line with medium
	Minimum filling level in the reservoir tank undercut	Refill media
	Wrong direction of rotation	Correct the direction of rotation
	Throttled/closed shut-off element in the suction line	Open the shut-off element
	Suction line clogged	Clean the suction line

Pump does not suck		
	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
Insufficient pressure		
Insufficient pumping flow rate		
	Excessive negative pressure (not complete filling of the pump)	Check suction line design
	Too high media viscosity	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/closed shut-off element in the suction line	Open the shut-off element
	Suction line clogged	Clean the suction line
	Suction filter plugged or too small	Clean suction filter or use a larger filter Replace filter element
	Suction basket plugged or too small	Clean intake strainer or dimension larger
	Constant triggering of pressure relief valve (if existing)	Increase valve opening pressure
	Pump does not suck	Check the oil level in the tank Check suction line Check the shaft seal
	Wear	Replace the device
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

Impermissible pump heating		
	Constant triggering of 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
	Gland lid overtightened (for gland seal)	Unscrew gland lid and readjust leakage
	Suction pressure too high	Reduce the pressure
	Wear	Replace the device
Leckage		
Seal failure	Lack of maintenance	Comply with maintenance intervals Replace seals
	Mechanical damage	Replace seals
	Thermal overload	Check operating data Replace seals
	Pressure too high	Check operating data Replace seals
	Gas content in media too high	Check operating data Replace seals
	Corrosion/chemical degradation	Check material compatibility Replace seals
	Wrong direction of rotation	Correct the direction of rotation Replace seals
	Contaminated medium	Provide filtration Replace seals
	Gland lid not sufficiently tightened (for gland seal)	Retighten gland lid
	Loose screw connection	Tighten or replace the screw connections
Coupling		
Coupling wear	Alignment error	Correct the alignment of the coupling and secure the coupling halves
	Spider overloaded	Check operating data Use harder spider
Cam break	Spider wear Torque transmission due to metal contact	Adapt maintenance intervals Replace coupling

Premature spider wear	Alignment error	Correct the alignment of the coupling and secure the coupling halves
	Replace spider	
	Spider failure due to chemical corrosion	Check material compatibility Replace spider
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 operating data
		Check direction of rotation
	Motor circuit breaker incorrectly designed	Check operating data
Consult the manufacturer in the event of unidentifiable faults		