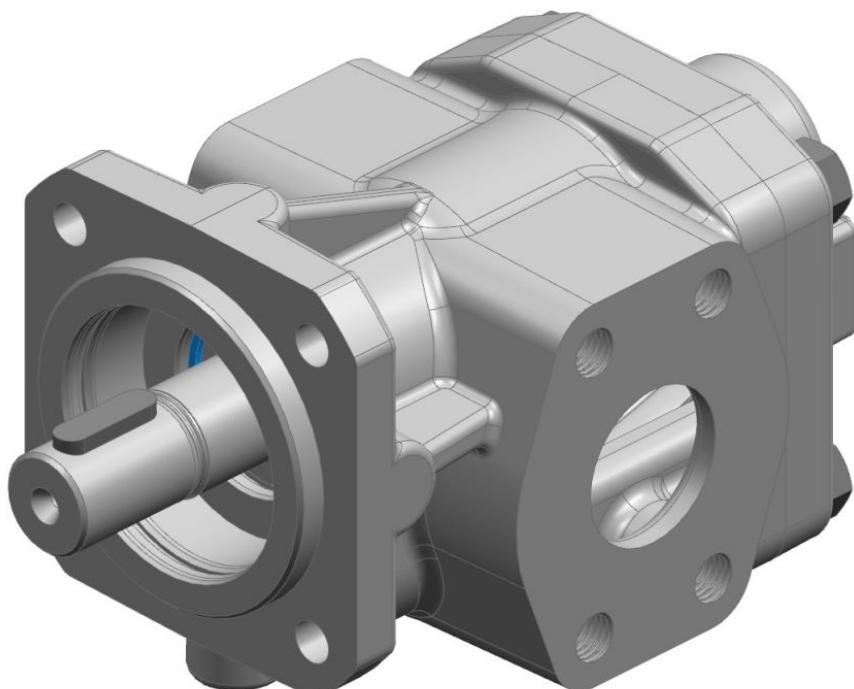


KRACHT

D.0027450002

Operating instructions (Translation)



Gear pump KFF 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 KFF 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.

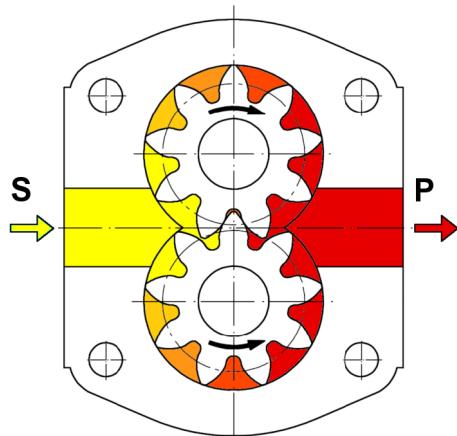
- a) Do not operate the product with shut-off devices closed.
- b) Do not operate the product in the wrong rotational direction.

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.

This series were developed specifically for use with fuels, especially for marine fuels. Especially diesel fuels (MGO/DMA) exhibit low lubricity, which cannot be determined through the viscosity. The HFRR test acc ISO 12156 is a recognised method for measuring the lubricity of diesel fuels.

The characteristic value determined in this manner is referred to as the Wear Scar Diameter (WSD) and increases with decreasing lubricity. This characteristic value is stated by fuel manufacturers and used when assessing the stability of components.

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).

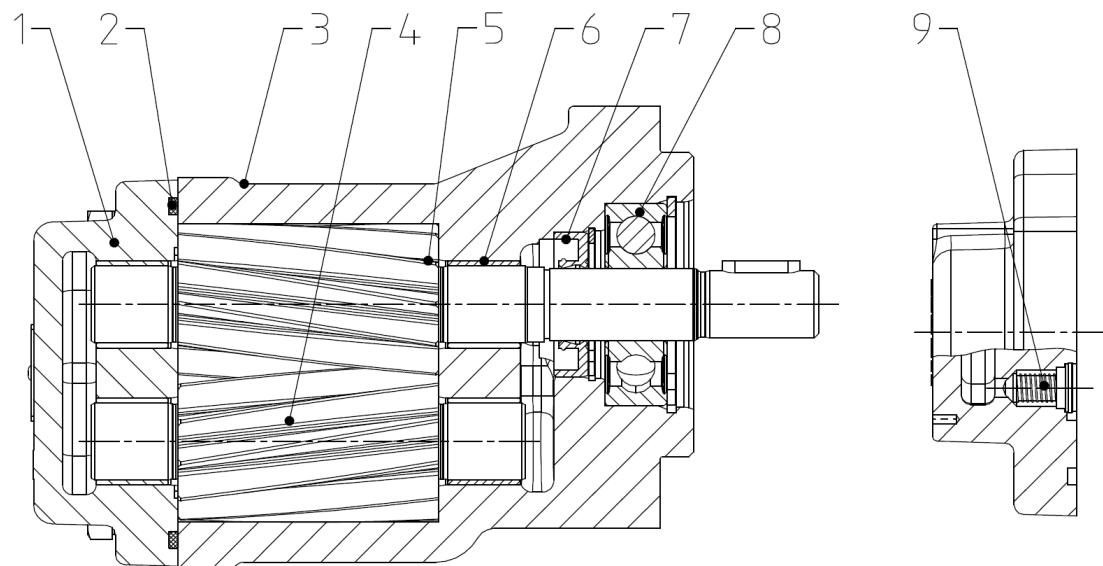


NOTICE

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

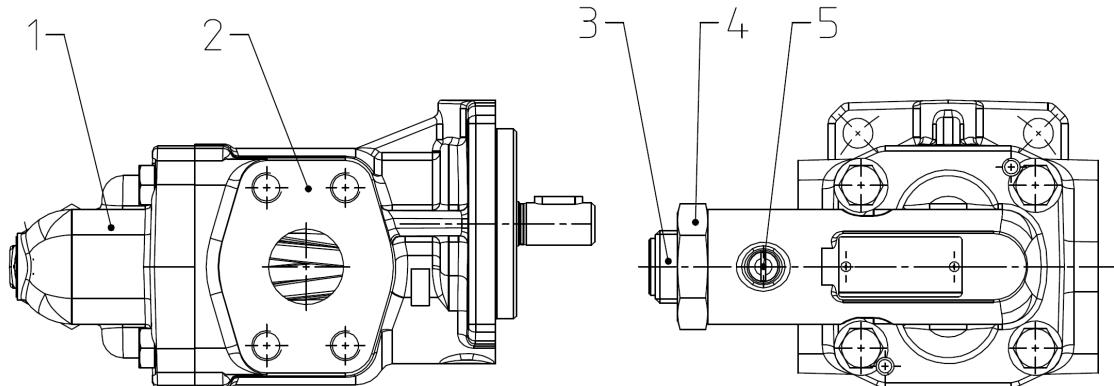


1	End cover	2	O-ring
3	Housing	4	Driven shaft
5	Driving shaft	6	Plain bearings
7	Shaft seal	8	Roller bearings

(**Types of seals** [▶ 19])

9 Valve

(only Direction of rotation: 3)

Gear pump with pressure relief valve (D- Valve)

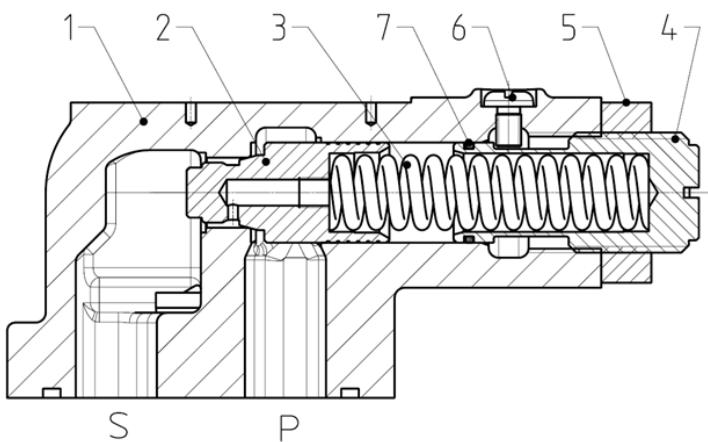
1 Pressure relief valve

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

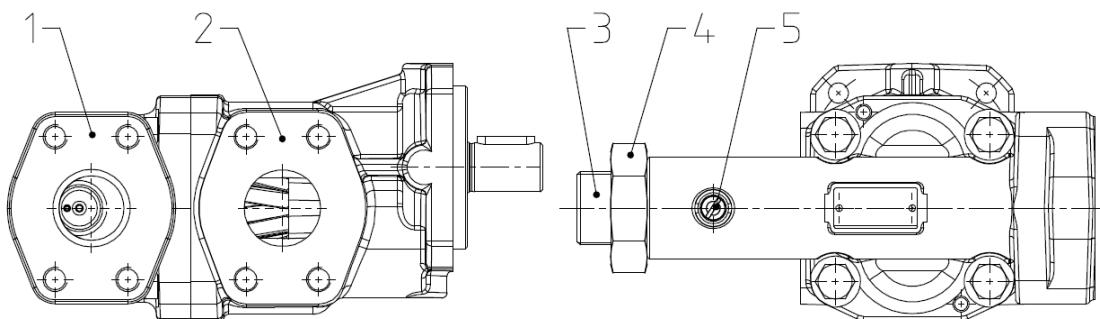
4 Adjustment screw

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	

3.3 Type key

Ordering example

KFF	40	2	F	1	0	A	0	Z	V	0	0	0	G	G	E	0	G	D	W	/...
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	2			D	15		/...
		22.	23.			24.	25.			26.	27.		28.

Explanation of type key

1. Product name

2. Nominal

V _{gn}	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25
	Size 2: 32; 40; 50; 63; 80
	Size 3: 100; 112; 125; 150; 180; 200
	Size 4: 250; 315; 400; 500; 630

3. Housing material

2	EN-GJS-400-15
---	---------------

4. Seal material

F	FKM
---	-----

5. Direction of rotation

1	Clockwise	3	Clockwise/counterclockwise with changing direction of delivery
2	Counterclockwise		

6. Outbord bearing

0	Without	V	Outbord bearing
---	---------	---	-----------------

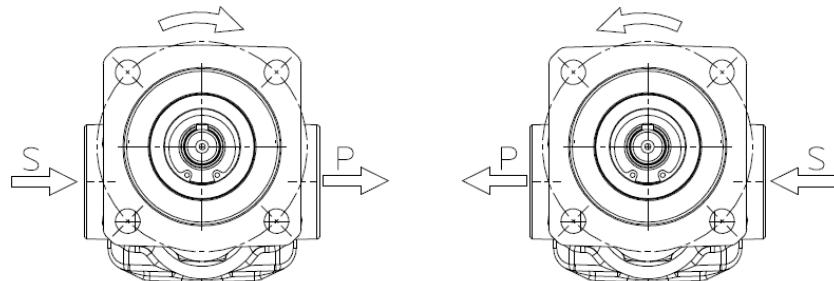
Explanation of type key				
7. Flange type				
A	4-hole flange DIN ISO 3019	L	SAE B Two-hole flange	
B	4-hole flange	N	SAE A 2-hole flange	
8. Flange cover material				
0	Without			
9. Shaft end				
Z	Cylindrical shaft end	S	Gear shaft profile SAE A	
10. Type of end cover				
D	End cover	V	Valve	
11. 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	Whitworth pipe thread	G 3/4	KF 2.5-12	
A		G 1	KF 16-25	
C	Flange connection	SAE 3/4"	M10 -15 deep	KF 2.5-12
D		SAE 1"	M10 -17 deep	KF 16-25
G		SAE 1 1/2"	M12 -20 deep	KF 32-80
I		SAE 2"	M12 -20 deep	KF 50-112
J		SAE 2 1/2"	M12 -20 deep	KF 100-150
L		SAE 3"	M16 -32 deep	KF 125-315
M		SAE 3 1/2"	M16 -32 deep	KF 180-315
N		SAE 4"	M16 -32 deep	KF 400-630
P		SAE 5"	M16 -32 deep	KF 400-630
15. Pressure side connection				
A	Whitworth pipe thread	G 3/4	KF 2.5-12	
A		G 1	KF 16-25	
C	Flange connection	SAE 3/4"	M10 -15 deep	KF 2.5-12
D		SAE 1"	M10 -17 deep	KF 16-25
G		SAE 1 1/2"	M12 -20 deep	KF 32-80
I		SAE 2"	M12 -20 deep	KF 50-112
J		SAE 2 1/2"	M12 -20 deep	KF 100-150
L		SAE 3"	M16 -32 deep	KF 125-315
M		SAE 3 1/2"	M16 -32 deep	KF 180-315
N		SAE 4"	M16 -32 deep	KF 400-630
P		SAE 5"	M16 -32 deep	KF 400-630
Pipe thread: DIN EN ISO 228-1; Flange connection: DIN ISO 6162-1 (SAE J518)				

Explanation of type key			
16. Gear material			
E	16MnCr5 - 1.7139		
17. Gear coating			
0	Without		
18. Type of bearing			
G	Plain bearings		
19. Material bearing			
D	Multi layer friction bearings (contains lead)		
20. Seal type			
W	Rotary shaft seal	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 [▶ 21]			
22. Valve			
D	Pressure relief valve		
T	Pressure relief valve with Tank connection	Flange connection	SAE 1 1/2" KF 32-80
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			
F	FKM		
25. Housing material			
2	EN-GJS-400-15		
26. Material bearing			
D	Multi layer friction bearings (contains lead)		
27. Pressure stage (Pressure setting ranges)			
15	1...15 bar	25	15...25 bar
30	15...30 bar		
28. Special number			
Special numbers [▶ 21]			

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.

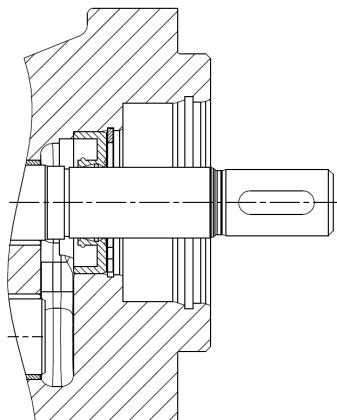
The flow direction is indicated by the straight arrow.



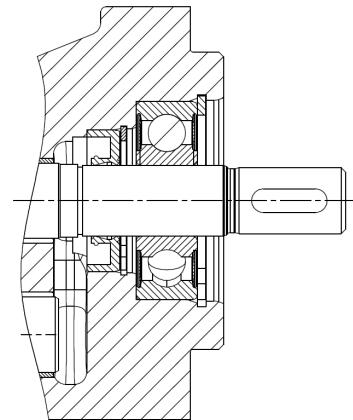
S = Suction connection

P = Pressure connection

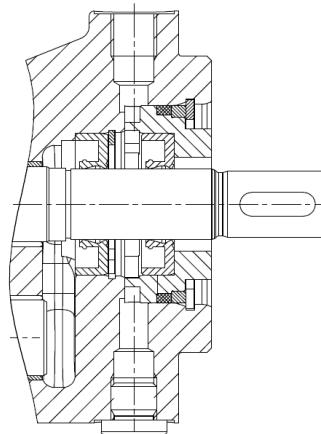
3.5 Types of seals



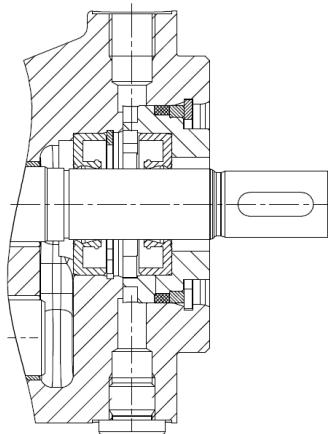
Rotary shaft seal



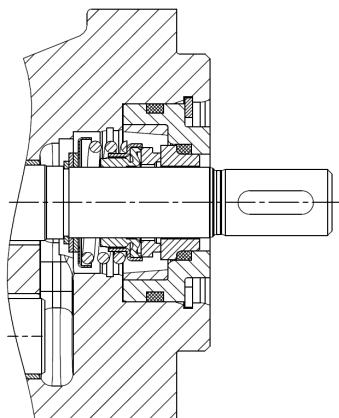
Rotary shaft seal with roller bearings



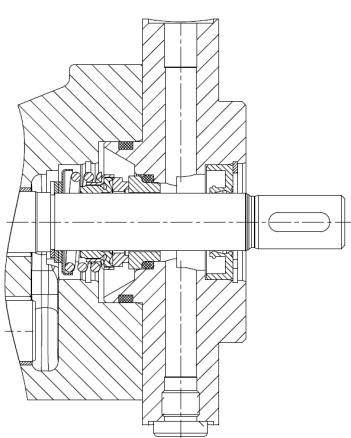
Double rotary shaft seal
Connection borehole G 1/8



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



Mechanical seal



Mechanical seal with fluid buffer
KF 32-80: Connection borehole G 1/4
(for fluid buffer)

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.

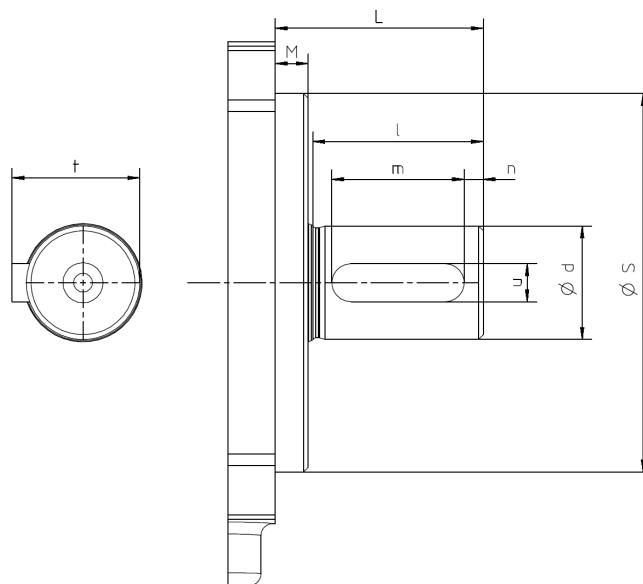
3.7 Special numbers

Special number	Description
74	For vacuum operation
198	Mechanical seal Sliding ring: SiC-Si Counter ring: SiC-Si
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

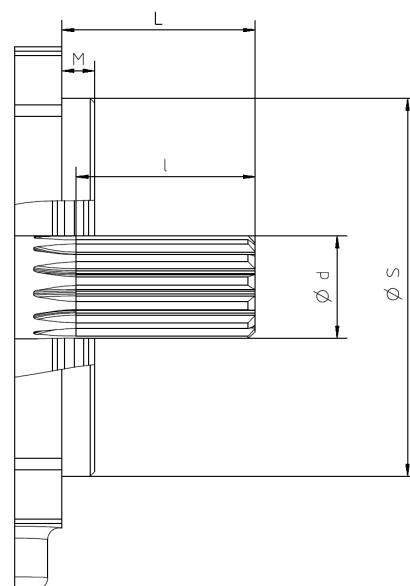
3.8 Special numbers

Special number	Description
002	Viscosity range 300...1000 mm ² /s
003	Viscosity range 1000...10.000 mm ² /s

3.9 Shaft ends



Nominal	L	S _{h8}	M	d _{j6}	I	m	n	t	u
KFF 2.5-25	33	63	7	14	25	16	4	16	5
KFF 32-80	44	80		24	36	28		27	8
KFF 100-200	60	110	8	28	50	40	5	31	8
KFF 250-630	90	160		38	80	63	8	41	10



Nominal	Special number	L	S _{h8}	M	Profile	Diametral pitch (DP)	Num- ber of teeth	d _{h11}	I
KFF 32-80	506	31.75	82.17	7	SAE A	16/32	9	15.26	16

4 Technical data

4.1 General

General information			
Mounting position	without fluid buffer	Any	
	with fluid buffer	Shaft end horizontal , fluid buffer connection 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	
Speed	n	Nominal sizes+ Assignment of viscosity - speed [▶ 25]	
Operating pressure	p_e	Allowable pressures [▶ 25]	
	p_b		
Viscosity	v_{min}	Assignment of differential pressure to viscosity [▶ 26]	
	v_{max}	20000 mm ² /s	
Fluid temperature	ϑ_m	Permissible temperature range [▶ 26]	
Ambient temperature	ϑ_u	Permissible temperature range [▶ 26]	
Filtering	β	$\leq 60 \mu\text{m}$	
Materials		Material data [▶ 27]	
Permissible media		Lubricating fluids without abrasive components (Petrols, solvents, etc. are not permissible) Fuels (WSD $\leq 520 \mu\text{m}$) ⁽¹⁾	

⁽¹⁾ Limit value applicable for marine fuels compliant with ISO 8217 (WSD = Wear Scar Diameter)



TIP

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

4.2 Nominal sizes

Nominal	Geom. displacement	Speed		Perm. radial force	Sound pressure level	Mass inertia
		n_{\min}	n_{\max} (2)			
		[cm ³ /U]	[1/min]			
V_{gn}	V_g	n_{min}	n_{max} (2)	F_{radial} [N]	L_{pA}⁽¹⁾	x10⁻⁶
	[cm ³ /U]	[1/min]	(n= 1500 1/min)			
2.5	2.55	3600	700	≤ 67	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	200	1500	≤ 68	217	
40	40.21				254	
50	50.2				299	
63	63.18				368	
80	80.5				443	
100	101.5			≤ 69	741	
112	113.5				806	
125	129.4	3000	2500	≤ 65	1418	
150	155.6				1637	
180	186.6				1911	
200	206.2				2072	
250	245.1			≤ 75	4133	
315	312.9				5011	
400	399.5	2000	2500	≤ 77	6618	
500	496.5				7830	
630	622.5			≤ 80	9591	

⁽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 [mm ² /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 [bar _{abs.}]	p_e max [bar _{rel.}]	p_b [bar _{rel.}]	(perm. continuous pressure)
FKM	Rotary shaft seal	-	0.6 ⁽¹⁾	Max. Operating pressure suction side [▶ 26]	25	40
	Double rotary shaft seal					
	Double rotary shaft seal	74	0.1	0.2		
	Mechanical seal	-	0.6 ⁽¹⁾	10		

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

⁽¹⁾ Start-up condition: 0.4 bar absolute (max. 30 minutes)

4.4.2 Max. Operating pressure suction side

Speed n [1/min]	$p_{e\ max}$ [bar]					
	KFF 2.5-63	KFF 80	KFF 100-180	KFF 200	KFF 250-315	KFF 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]		
	$v = 1.4 \text{ mm}^2/\text{s}$	$v = 6 \text{ mm}^2/\text{s}$	$v = 12 \text{ mm}^2/\text{s}$
Multi layer friction bearings (contains lead) (Standard)	3	12	25

Fuels (WSD $\leq 520 \mu\text{m}$) ⁽¹⁾		
Plain bearings	Δp_{max} [bar]	
	$v = 1.2 \text{ mm}^2/\text{s}$	$v = 1.2 \text{ mm}^2/\text{s}$
Multi layer friction bearings (contains lead) (Standard)	12	

⁽¹⁾ Limit value applicable for marine fuels compliant with ISO 8217 (WSD = Wear Scar Diameter)

4.6 Permissible temperature range

Sealing material	Fluid temperature ϑ_m	
	$\vartheta_{m\ min}$ [°C]	$\vartheta_{m\ max}$ [°C]
FKM	-20	150

Sealing material	Ambient temperature ϑ_u	
	$\vartheta_{u\ min}$ [°C]	$\vartheta_{u\ max}$ [°C]
FKM	-20	60



NOTICE

Note media-specific properties.

4.7 Material data

Seal type	Materials				
	Shaft seal	O-ring	Housing / End cover / Valve housing	Gears / Valve piston	Plain bearings
Rotary shaft seal - - -	FKM		EN-GJS-400-15	Casehardened steel	Multi layer friction bearings (contains lead) (Steel (St), CuSn, PTFE, Pb)
Double rotary shaft seal				16MnCr5 - 1.7139	
Mechanical seal	AQ2VF F	FKM			

4.8 Weight

Nominal V_{gn}	Gear pump with [kg]		Added weight
	End cover	Pressure relief valve	
2.5	2.9 ⁽¹⁾	3.7 ⁽¹⁾	1.3
4			
5			
6			
8			
10			
12			
16			
20			
25			
32	7.7	9.5	1.6
40			
50			
63			
80	9.4	11.2	3.3
100			
112			
125			
150	22.2	26.5	3.3
180			
200			
250	24.8	29.1	-
315			

Nominal V_{gn}	Gear pump with [kg]		Added weight
	End cover	Pressure relief valve	Mounting angle
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).

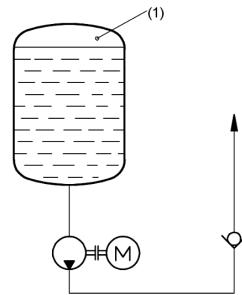
When designing the lines, bear in mind the following points:

- 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

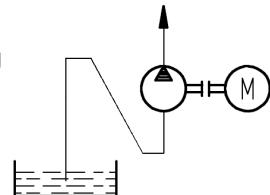
Cavitation damage

Pressure below the permissible suction side pressure causes cavitation

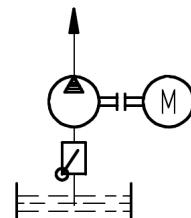
- Design the suction line so that the pressure that sets in during operation is always higher on the suction side than the vapour pressure of the pumped medium. At the same time, make sure that the device is installed above sea level.
- If fluids contain water, install the device below the fluid level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

Prevention of suction problems

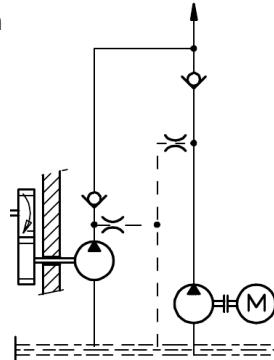
If there is a possibility of the suction line running dry while the pump is at a standstill, laying the suction line as a U-trap is a way of avoiding suction problems. This way, the pump will remain permanently filled after initial commissioning.



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** [▶ 19]

6.5 Change of the direction of rotation

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

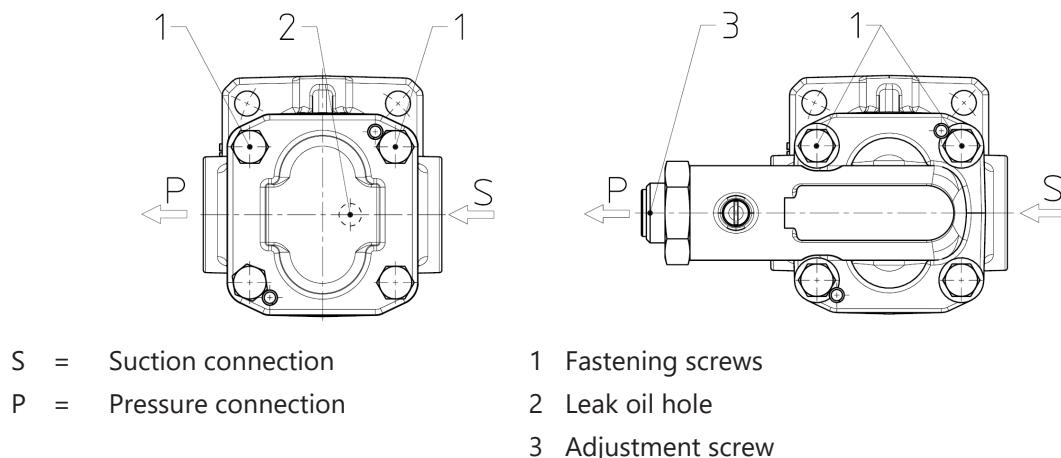
The modification required is normally carried out by the manufacturer and should only be carried out by the customer in exceptional cases. Please consult the manufacturer for this purpose.

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°.

- a) Undo the fastening screws.
- b) Remove the end cover or the pressure relief valve respectively from the pump housing and put it back on rotated by 180°.
- c) 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:

- a) Gear pumps without pressure relief valve must have the leak oil hole in the end cover on the inlet side.
- b) 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

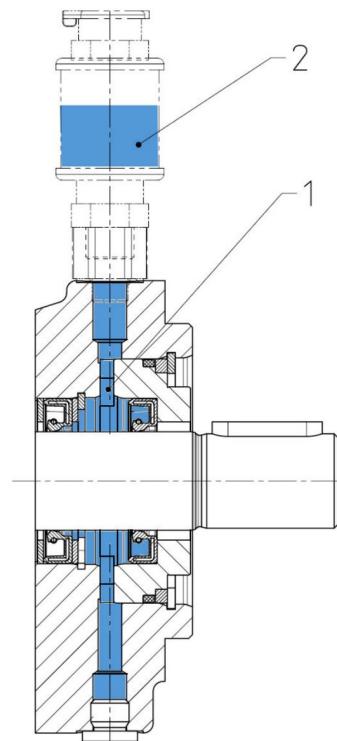
Burns of the skin on contact.

- 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.

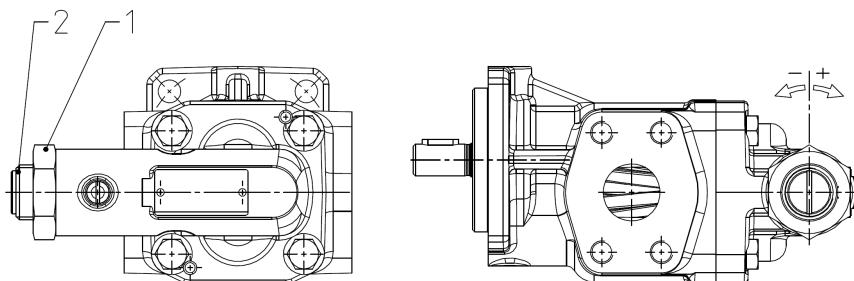


TIP

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 1 Hexagonal nut
- + response pressure higher 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 [▶ 47]**
- 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		