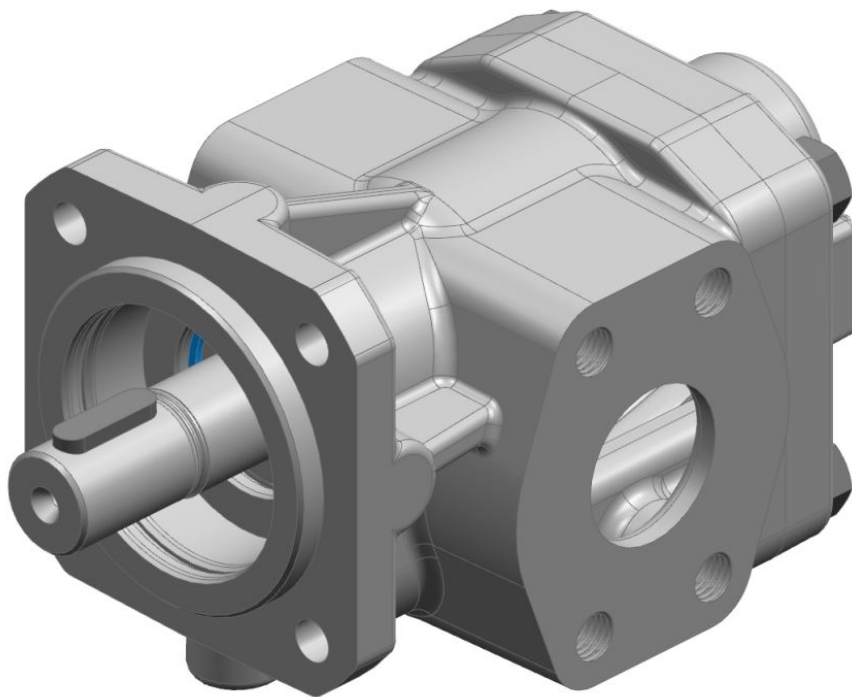


# KRACHT

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](mailto:info@kracht.eu)  
Web: [www.kracht.eu](http://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 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.



## 2.4 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.

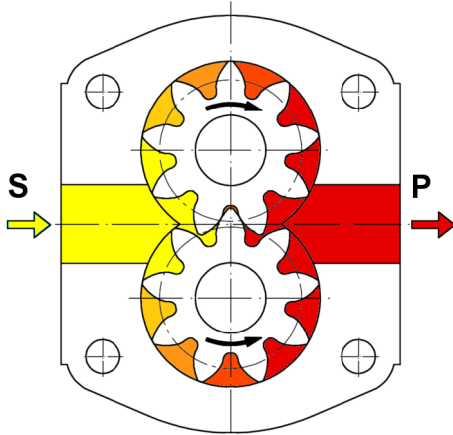
Risk of injury caused by splashing fluids.

- 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

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.

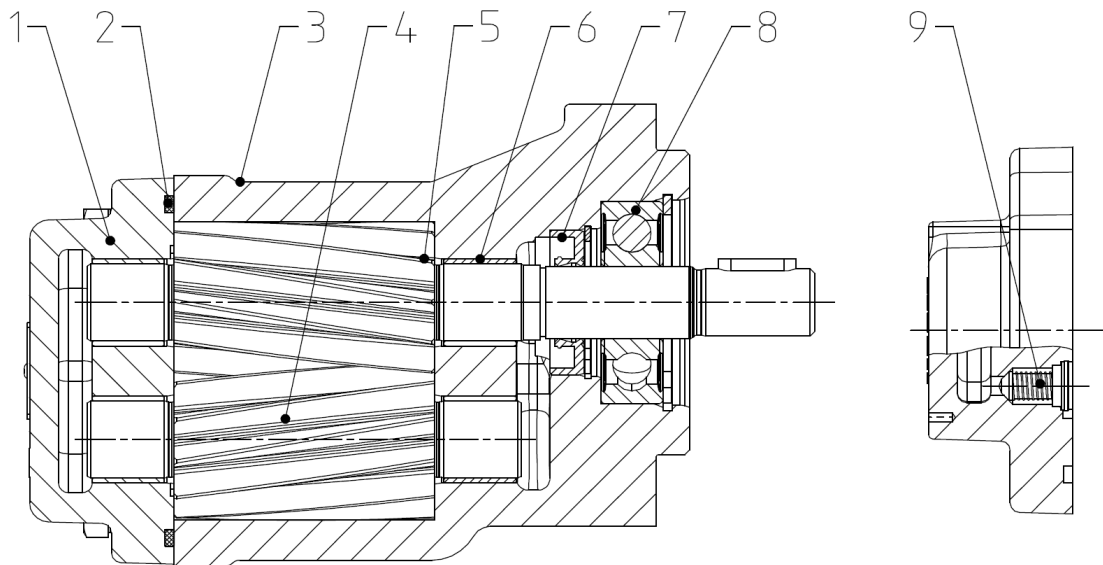
The displacement process described takes place initially without a noticeable pressure build-up. Only after external loads are applied, e.g. by head, flow resistances, pipe elements, etc., does the required working pressure set in to overcome these resistances.

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.

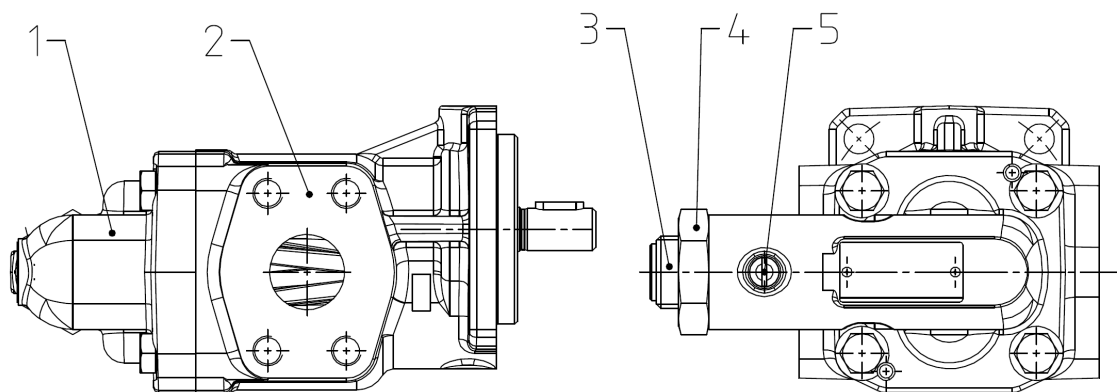
## 3.2 Variants

### Gear pump



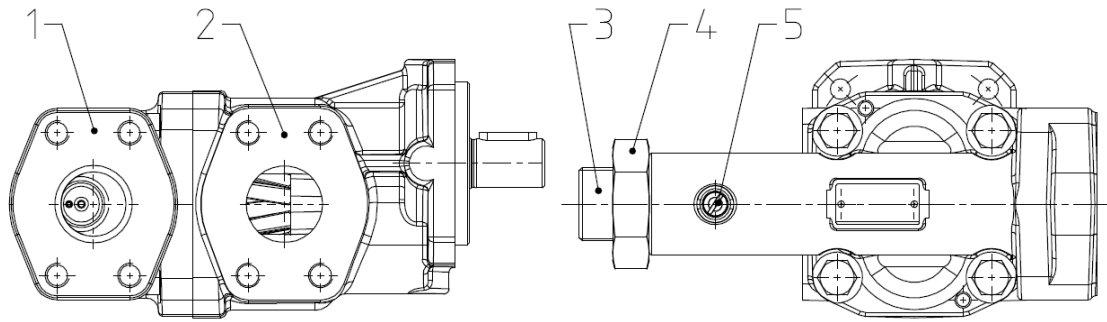
- |   |                                 |   |                            |
|---|---------------------------------|---|----------------------------|
| 1 | End cover                       | 2 | O-ring                     |
| 3 | Housing                         | 4 | Driven shaft               |
| 5 | Driving shaft                   | 6 | Plain bearings             |
| 7 | Shaft seal                      | 8 | Roller bearings            |
|   | <b>(Types of seals ▶ 15)</b>    |   | <b>(Fixing type: G; X)</b> |
| 9 | Valve                           |   |                            |
|   | (only Direction of rotation: B) |   |                            |

### Gear pump with pressure relief valve



- |   |                       |   |               |
|---|-----------------------|---|---------------|
| 1 | Pressure relief valve | 2 | Gear pump     |
| 3 | Adjustment screw      | 4 | Hexagonal nut |
| 5 | Retaining screw       |   |               |

**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 Retaining screw

### 3.3 Type key

Ordering example										
<b>KFF</b>		<b>40</b>		<b>R</b>	<b>F</b>		<b>2</b>	<b>/158</b>	<b>-</b>	<b>D15</b>
1.		2.		3.	4.		5.	6.		7.

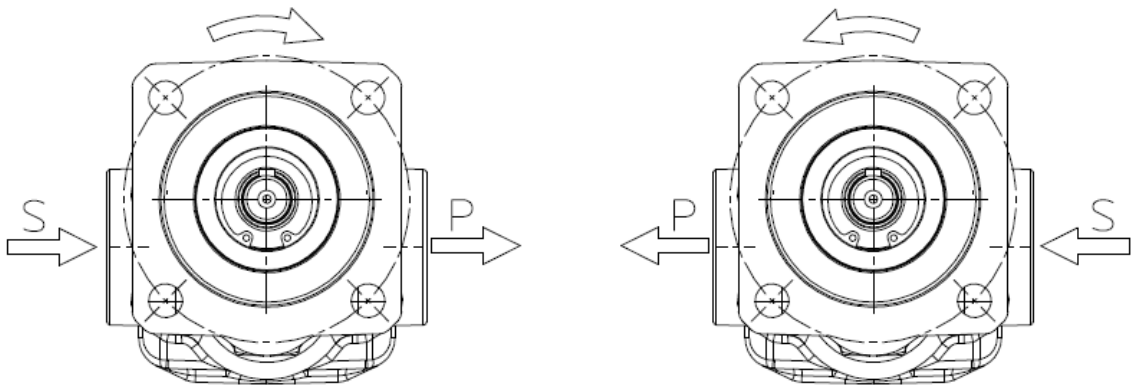
Explanation of type key			
<b>1. Product name</b>			
<b>2. Nominal</b>			
<b>V<sub>gn</sub></b>	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25		
	Size 2: 32; 40; 50; 63; 80		
	Size 3: 100; 112; 125; 150; 180; 200		
	Size 4: 250; 315; 400; 500; 630		
<b>3. Direction of rotation</b>			
<b>R</b>	Clockwise	<b>B</b>	Clockwise/counterclockwise with changing direction of delivery
<b>L</b>	Counterclockwise		
<b>4. Fixing type</b>			
<b>F</b>	DIN flange without roller bearings	<b>W</b>	Mounting angle without roller bearings
<b>G</b>	DIN flange with roller bearings	<b>X</b>	Mounting angle with roller bearings

<b>Explanation of type key</b>			
<b>5. Seal type</b>			
<b>2</b>	Rotary shaft seal FKM (BABSL)	<b>7</b>	Double rotary shaft seal FKM (BABSL)
<b>5</b>	Mechanical seal with FKM secondary seals (AX30) C2S2V1G3G1 (KF 2.5-200) B10SV1G3G1 (KF 250-630)	<b>40</b>	Mechanical seal with FKM secondary seals (L4) AQ2VFF
<b>6. Special number</b>			
<b>Special numbers [▶ 17]</b>			
<b>7. Valve option</b>			
<b>Pressure relief valve</b>			
<b>D15</b>	Pressure setting ranges 0-15 bar	<b>D25</b>	Pressure setting ranges 15-25 bar
<b>D30</b>	Pressure setting ranges 15-30 bar		
<b>Pressure relief valve with Tank connection</b>			
<b>T15</b>	Pressure setting ranges 0-15 bar	<b>T25</b>	Pressure setting ranges 15-25 bar
<b>Viscosity range Pressure relief valve with Tank connection</b>			
<b>No specification</b>	12-300	<b>B</b>	1000-5000
<b>A</b>	300-1000		

### 3.4 Direction of rotation and discharge

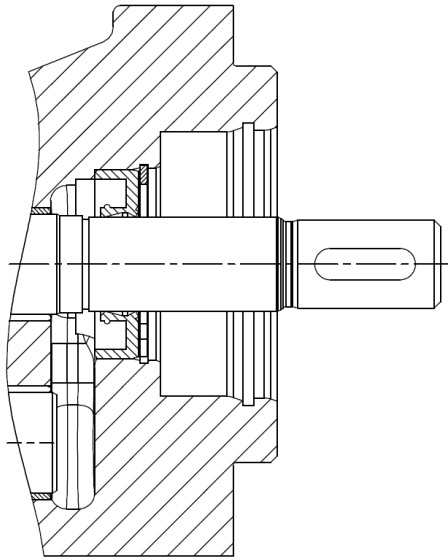
The direction of rotation is indicated by the curved arrow, when looking towards the end of the drive shaft. The pump connections are below the drive shaft.

The flow direction is indicated by the straight arrow.

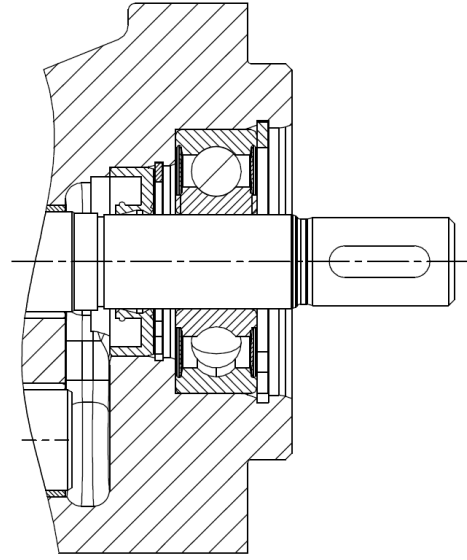


S = Suction connection  
P = Pressure connection

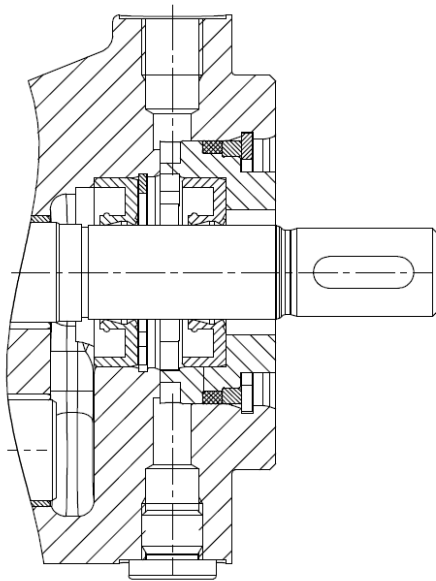
### 3.5 Types of seals



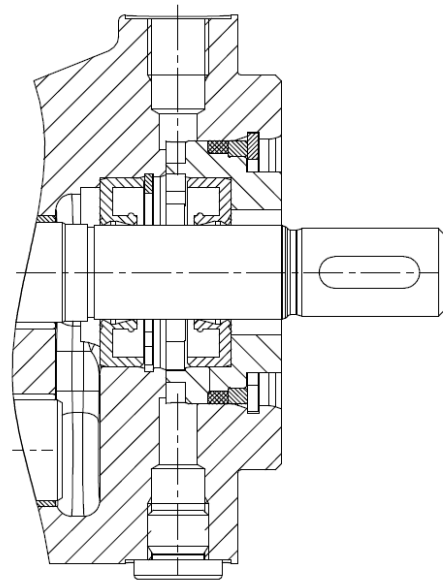
Rotary shaft seal  
Seal type: 2



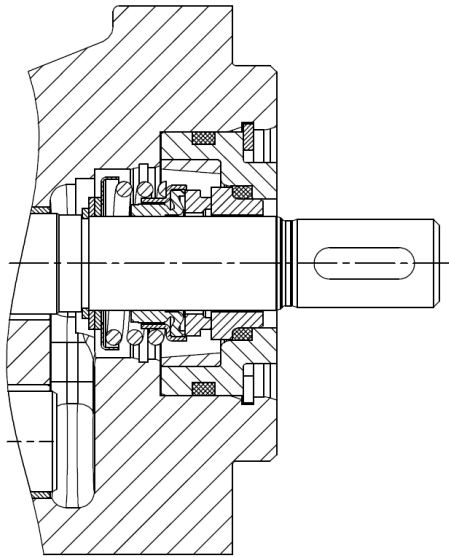
Rotary shaft seal with roller bearings  
Seal type: 2



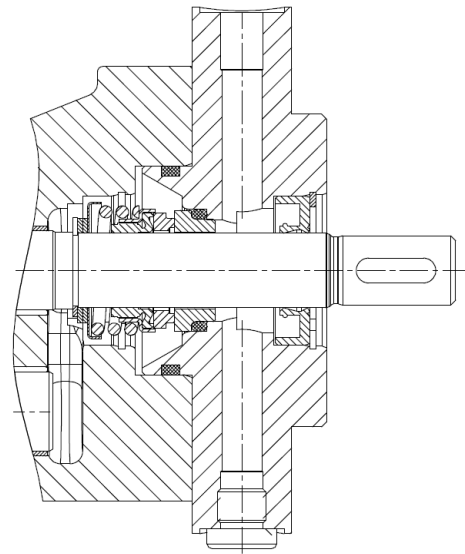
Double rotary shaft seal  
Connection borehole G 1/8  
(for fluid buffer)  
Seal type: 7



Double rotary shaft seal  
(for vacuum operation)  
Connection borehole G 1/8  
(for fluid buffer)  
Seal type: 7  
Special number: 74



Mechanical seal  
Seal type: 5; 40



Mechanical seal with fluid buffer  
KF 32-80: Connection borehole G 1/4  
(for fluid buffer)  
Seal type: 5; 40  
Special number: 182; 198

### 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.

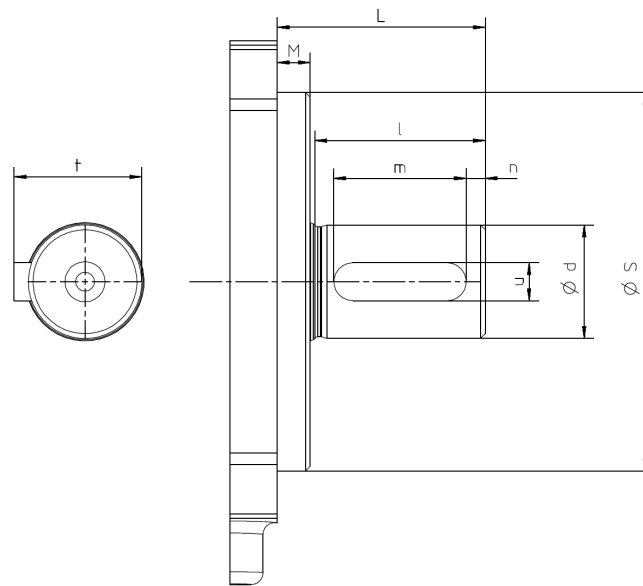
Select the installation so that the connection for the fluid seal is at the top.



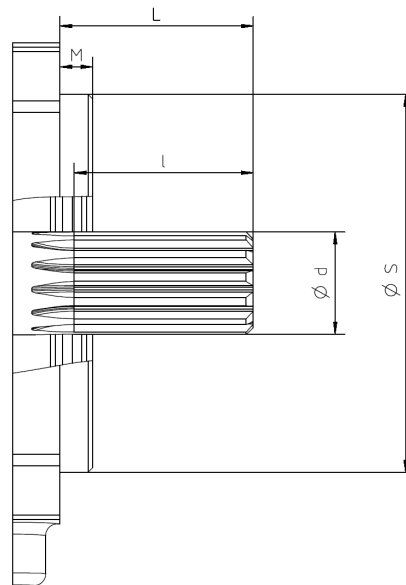
## 3.7 Special numbers

Special number	Description
<b>74</b>	Double rotary shaft seal for vacuum operation
<b>158</b>	Housing connection KF 2.5-12: Flange connection SAE 3/4" KF 16-25: Flange connection SAE 1"
<b>182</b>	Mechanical seal and front-mounted rotary shaft seal
<b>198</b>	<b>Special number 182</b> KF 100-150 mechanical seal : AX 15 S-015 Q2Q2V1G3G1 (5) KF 100-150 mechanical seal : L4BD015DINA10Q20VFF-B4CC (40) KF 100-112 mechanical seal : AX 15 SL025 Q2Q2V1G3G1 (5)
<b>232</b>	Housing connection KF 50-80 Flange connection SAE 2" KF 100-112 Flange connection SAE 2 1/2" KF 125-150 Flange connection SAE 3" KF 180-200 Flange connection SAE 3 1/2" KF 250-315 Flange connection SAE 3 1/2" KF 400-630 Flange connection SAE 5"
<b>402</b>	Combination of <b>Special number 74 + 158</b> or <b>232</b>
<b>506</b>	With SAE A 4-hole flange Shaft end with splined shaft profile

## 3.8 Shaft ends



Nominal	L	S <sub>h8</sub>	M	d <sub>j6</sub>	l	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 <sub>h8</sub>	M	Profile	Diametral pitch (DP)	Number of teeth	d <sub>h11</sub>	l
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				
<b>Housing connection</b> <sup>(1)</sup>		KFF 2.5-12	Whitworth pipe thread	G 3/4
		KFF 2.5-12 .../158	Flange connection	SAE 3/4"
		KFF 16-25	Whitworth pipe thread	G 1
		KFF 16-25 .../158	Flange connection	SAE 1"
		KFF 32-80		SAE 1 1/2"
		KFF 50-80.../232	Flange connection	SAE 2"
		KFF 100-112		
		KFF 100-112 .../232	Flange connection	SAE 2 1/2"
		KFF 125-150		
		KFF 125-150 .../232		
		KFF 180-200		SAE 3"
		KFF 180-200 .../232		
		KFF 250-315		SAE 3 1/2"
		KFF 400-630		SAE 3"
				SAE 4"
<b>Mounting position</b>		KFF without fluid buffer	Any	
		KFF with fluid buffer	Shaft end horizontal , fluid buffer connection top	
<b>External loads on shaft end</b>	$F_{axial}$	Axial forces are not permissible		
	$F_{radial}$	Radial forces are only permissible in combination with an roller bearings Nominal sizes		
<b>Speed</b>	$n$	Nominal sizes+ <b>Assignment of viscosity - speed [▶ 21]</b>		
<b>Operating pressure</b>	$p_e$	<b>Allowable pressures [▶ 22]</b>		
	$p_b$			
<b>Viscosity</b>	$v_{min}$	<b>Assignment of differential pressure to viscosity [▶ 23]</b>		
	$v_{max}$	20000 mm <sup>2</sup> /s		
<b>Fluid temperature</b>	$\vartheta_m$	<b>Permissible temperature range [▶ 23]</b>		
<b>Ambient temperature</b>	$\vartheta_u$	<b>Permissible temperature range [▶ 23]</b>		
<b>Filtering</b>	$\beta$	≤ 60 μm		
<b>Materials</b>	<b>Material data [▶ 23]</b>			
<b>Permissible media</b>	Lubricating fluids without abrasive components (Petrols, solvents, etc. are not permissible) Fuels (WSD ≤ 520 μm) <sup>(2)</sup>			
<sup>(1)</sup> Pipe thread : DIN EN ISO 228-1; Flange connection : DIN ISO 6162-1 (SAE J518)				
<sup>(2)</sup> 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 $V_{gn}$	Geom. displacement $V_g$ [cm <sup>3</sup> /U]	Speed		Perm. radial force $F_{radial}$ [N] (n= 1500 1/min)	Sound pressure level $L_{pA}$ <sup>(1)</sup> [dBA]	Mass inertia $J$ [kg m <sup>2</sup> ] $\times 10^{-6}$	
		$n_{min}$	$n_{max}$ <sup>(2)</sup> [1/min]				
2.5	2.55	200	3600	700	$\leq 67$	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		3000	1500	$\leq 68$	217	
40	40.21					254	
50	50.2					299	
63	63.18					368	
80	80.5					443	
100	101.5				$\leq 69$	741	
112	113.5					806	
125	129.4					$\leq 65$	1418
150	155.6						1637
180	186.6						1911
200	206.2	2500	2072				
250	245.1	2000	2500	$\leq 75$	4133		
315	312.9				5011		
400	399.5			$\leq 77$	6618		
500	496.5				7830		
630	622.5				$\leq 80$	9591	

<sup>(1)</sup> n= 1500 1/min; v= 34 mm<sup>2</sup>/s; p= 5-25 bar

<sup>(2)</sup> Pay attention to the viscosity

### 4.3 Assignment of viscosity - speed

Kinematic viscosity $\nu$ [mm <sup>2</sup> /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  $p_{e \text{ min}}$ .

## 4.4 Allowable pressures

### 4.4.1 Operating pressure, suction and pressure side

Seal type	Special number	Operating pressure			
		Suction side		Pressure side	
		$p_{e \min}$ [bar <sub>abs.</sub> ]	$p_{e \max}$ [bar <sub>rel.</sub> ]	$p_b$ [bar <sub>rel.</sub> ]	
				(perm. continuous pressure)	(Pressure peaks)
2	-	0,6 <sup>(1)</sup>	Max. Betriebsdruck Saugseite für Dichtungsart 2 und 7 ▶ 22]	25	40
5	-		10		
7	-		Max. Betriebsdruck Saugseite für Dichtungsart 2 und 7 ▶ 22]		
	74	0,1	0,2		
40	-	0,6 <sup>(1)</sup>	10		

**bar<sub>abs.</sub>** = Absolute pressure ; **bar<sub>rel.</sub>** = Relative pressure

<sup>(1)</sup> Start-up condition: 0.4 bar absolute (max. 30 minutes)

### 4.4.2 Max. Betriebsdruck Saugseite für Dichtungsart 2 und 7

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	$\Delta p_{max}$ [bar]		
	$v = 1.4 \text{ mm}^2/\text{s}$	$v = 6 \text{ mm}^2/\text{s}$	$v = 12 \text{ mm}^2/\text{s}$
<b>Multi layer friction bearings (contains lead)</b> (Standard)	3	12	25
<b>Fuels (WSD <math>\leq 520 \mu\text{m}</math>)<sup>(1)</sup></b>			
Plain bearings	$\Delta p_{max}$ [bar]		
	$v = 1.2 \text{ mm}^2/\text{s}$		
<b>Multi layer friction bearings (contains lead)</b> (Standard)	12		

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

## 4.6 Permissible temperature range

Sealing material	Fluid temperature $\vartheta_m$	
	$\vartheta_{m \text{ min}}$ [°C]	$\vartheta_{m \text{ max}}$ [°C]
<b>FKM</b>	-20	150

Sealing material	Ambient temperature $\vartheta_u$	
	$\vartheta_{u \text{ min}}$ [°C]	$\vartheta_{u \text{ max}}$ [°C]
<b>FKM</b>	-20	60



### NOTICE

Note media-specific properties.

## 4.7 Material data

Seal type	Materials				
	Shaft seal	O-ring	Housing / End cover / Valve housing	Gears	Plain bearings
<b>2</b>	FKM		EN-GJS-400-15	Case-hardened steel 16MnCrS5 - 1.7139	Multi layer friction bearings (contains lead) (Steel (St), CuSn, PTFE, Pb)
<b>5</b>	C2S2V1G3G1 (KFF 2.5-200)	FKM			
	B10SV1G3G1 (KFF 250-630)				
<b>7</b>	FKM				
<b>40</b>	AQ2VFF	FKM			

## 4.8 Weight

Nominal $V_{gn}$	Gear pump with [kg]		Added weight
	End cover	Pressure relief valve	Mounting angle
2.5	2.9 <sup>(1)</sup>	3.7 <sup>(1)</sup>	1.3
4			
5			
6			
8			
10			
12	3.5 <sup>(1)</sup>	4.3 <sup>(1)</sup>	1.6
16			
20			
25	7.7	9.5	1.6
32			
40			
50			
63	9.4	11.2	3.3
80			
100	16.0	18.7	-
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	-

<sup>(1)</sup>Special number 158: +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  $\vartheta_U$ , 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  $\vartheta_U$ .

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.

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

## 5.4 Storage conditions



## TIP

### Recommended storage conditions

- a) Storage temperature: 5 °C – 25 °C
- b) Relative humidity: < 70 %
- c) Protect elastomer parts from light, particularly direct sunlight.
- d) Protect elastomer parts from oxygen and ozone.
- e) 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.

## 6.2 Noise reduction

**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.

- a) 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

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



## NOTICE

- a) 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.
- b) Make sure that foreign objects cannot get into the product.
- c) 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).

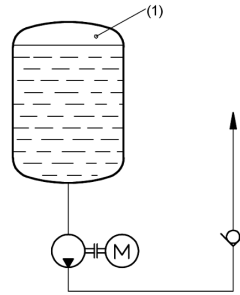
When designing the lines, bear in mind the following points:

- 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  $p_{e \text{ min}}$ .
- 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**

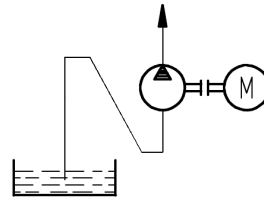
**Cavitation damage**

Pressure below the permissible suction side pressure causes cavitation

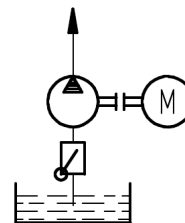
- a) Design the suction line so that the pressure that sets in during operation is always higher on the suction side than the vapour pressure of the pumped medium. At the same time, make sure that the device is installed above sea level.
- b) If fluids contain water, install the device below the fluid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

**Prevention of suction problems**

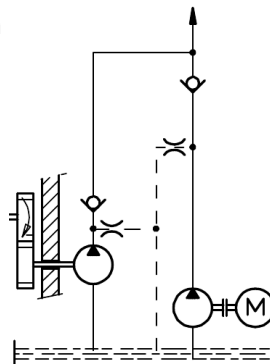
If there is a possibility of the suction line running dry while the pump is at a standstill, laying the suction line as a U-trap is a way of avoiding suction problems. This way, the pump will remain permanently filled after initial commissioning.



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 Connection line installation

---

- Clean all lines.
    - ⇒ Do not use cleaning wool.
    - ⇒ Pickle and rinse welded pipes.
  - Remove existing protective plugs.
  - 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** [► 14]

---

## 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.



#### TIP

Gear pump versions that are noise-optimised cannot be modified.

---

# 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**

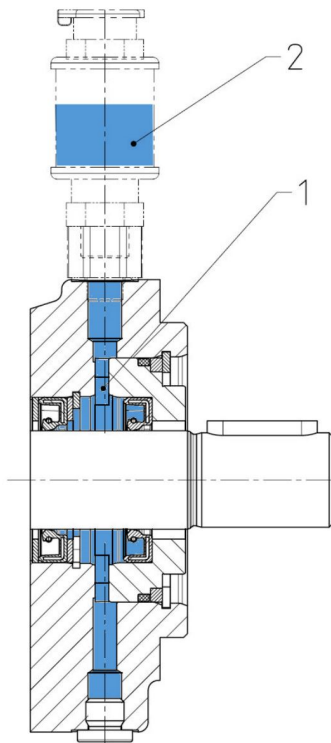
Burns of the skin on contact.

- 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.

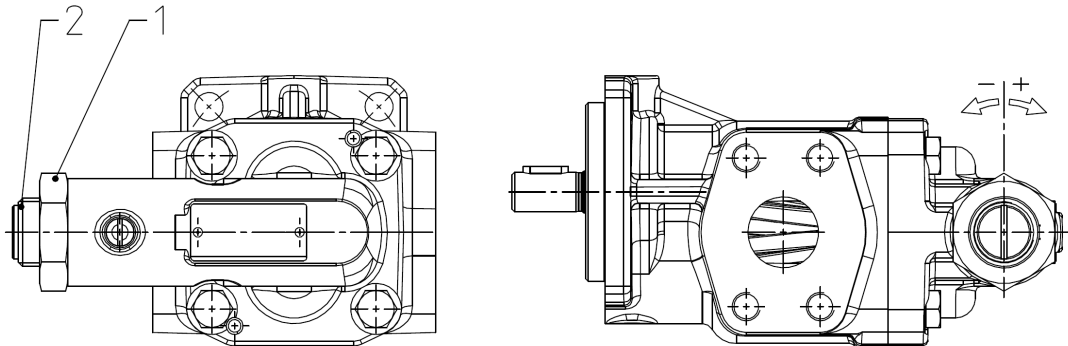


### TIP

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 [▶ 42]**
- 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.

## 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  $\geq 48$  °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  $\geq 48$  °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

		Firstly:after max. 24 h	Daily	3000 Operating hours	6000 Operating hours	As required	Additional in-formation
9.4.2	Check the rate of flow	2					
9.4.3	Check the operating pressure	2					
9.4.4	Check the media temperature	2					
9.4.5	Check the device temperature	2					
9.4.6	Check the function of the add-on valve	2					
9.4.7	Check the equipotential bonding	2					
9.4.8	Check the condition of the operating fluid	2					
9.4.9	Auditory check Unusual noises		1				
9.4.10	Cleaning		1				
9.4.11	Visual inspection for leakage		1				
9.4.12	Visual check of seal fluid level		2				
9.4.2	Check the rate of flow			2			
9.4.3	Check the operating pressure			2			
9.4.4	Check the media temperature			2			
9.4.5	Check the device temperature			2			
9.4.6	Check the function of the add-on valve			2			
9.4.7	Check the equipotential bonding			2			
9.4.8	Check the condition of the operating fluid			2			
9.4.13	Visual check of the gearbox condition				3		
9.4.14	Visual check of the condition of housing parts				3		
9.4.15	Visual check of the condition of the plain bearings				3		
9.4.16	Visual check of the condition shaft seal				3		
9.4.17	Visual check of the condition of the out-board bearing				3		
9.4.18	Replacing the outboard bearing					3	
9.4.19	Replacing the plain bearings					3	
9.4.20	Replacing the shaft seal					3	
9.4.21	Replacing other seals					3	

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

## 9.4.2 Check the rate of flow

The rate of flow is measured via the volumetric flow meter.

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

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

## 9.4.3 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.

## 9.4.4 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.

## 9.4.5 Check the device temperature

Measure the surface temperature in the area of the bearing.

## 9.4.6 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.

## 9.4.7 Check the equipotential bonding

Check the equipotential bonding for tight fit and proper functioning.

## 9.4.8 Check the condition of the operating fluid

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

- Replace operating fluid if necessary.

## 9.4.9 Auditory check 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.

## 9.4.10 Cleaning

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

### 9.4.11 Visual inspection for 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.

### 9.4.12 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.

### 9.4.13 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.

### 9.4.14 Visual check of the condition of housing parts

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

### 9.4.15 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.

### 9.4.16 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.

### 9.4.17 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.

### 9.4.18 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.

### 9.4.19 Replacing the plain bearings

These are replaced only by the manufacturer.

Contact the manufacturer.

### 9.4.20 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.

### 9.4.21 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  $\geq 48$  °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
<b>Increased noise</b>		
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
Return line ends above the fluid level	Extend return line	
Heavy foaming in the system, e.g. in gears	Use noise-optimised pump	
Mechanical vibrations	Incorrectly aligned and/or loose coupling	Correct the alignment of the coupling and secure the coupling halves
	Incorrectly and/or insufficient line fastening	Fixate lines with suitable fastening material (e.g. pipe clamps)
	Wobbling pressure relief valve	Increase valve opening pressure
	Not a noise-reducing setup	Use dampers
<b>Pump does not suck</b>		
	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



<b>Pump does not suck</b>		
	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		
<b>Insufficient pressure</b>		
<b>Insufficient pumping flow rate</b>		
	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 bascket 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	
<b>Excessive operating temperature</b>		
	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

<b>Impermissible pump heating</b>		
	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
<b>Leakage</b>		
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	
<b>Coupling</b>		
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
<b>Motor protection switch tripped</b>		
	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		