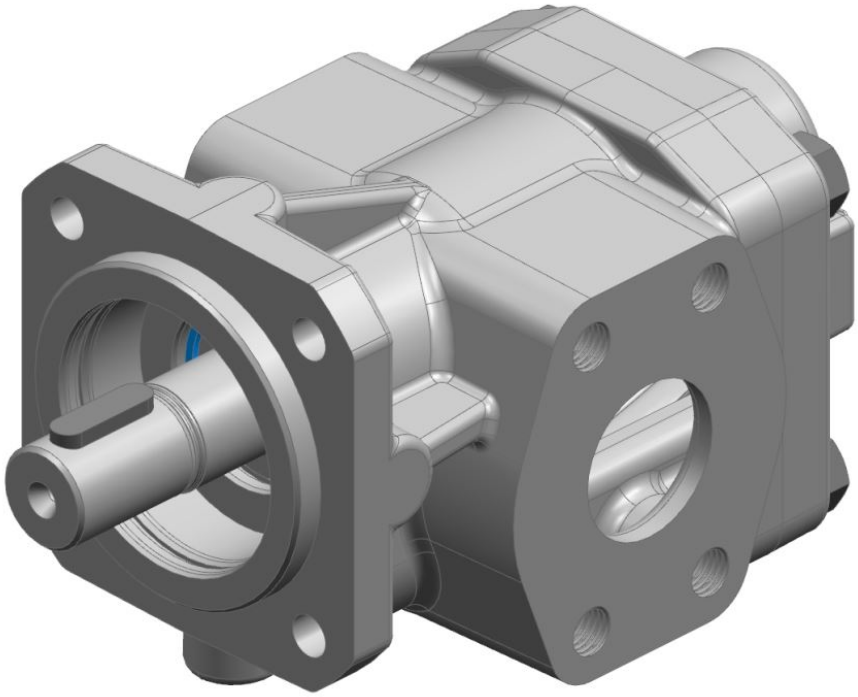
KRACHT

D.0024710002

Operating instructions (Translation)



Gear pump KF 2.5-630

English

31 • 11/10/2023

Table of content

1 General

1.1 About the documentation

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

Gear pump KF 2.5-630

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

product and accessible to the personnel at all time.

Different versions of the product are produced. Which version is concerned

is stated on the device's type plate.

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

1.2 Manufacturer address

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

1.3 Other applicable documents

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

1.4 Symbols

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

⚠ ATTENTION

Identification of notes to prevent property damage.

NOTICE

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

TIP

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

2 Safety

2.1 Intended use

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

2.2 Personal qualification

The personnel charged with the assembly, operation and maintenance of the product must have the necessary qualifications.
This can be achieved through training or appropriate instruction.
The personnel must be familiar with the contents of these operating instructions.

NOTICE

Read the operating instructions in full before using the product.

2.3 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.

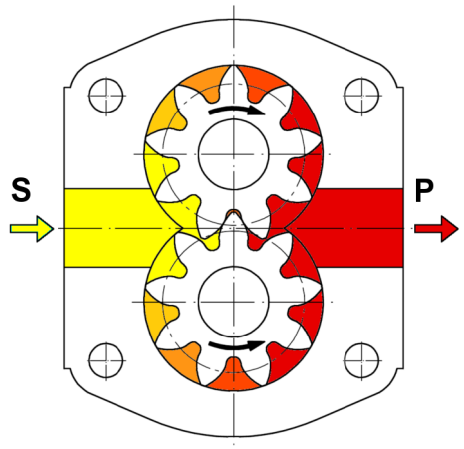
a) Do not operate the product with shut-off devices closed.

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

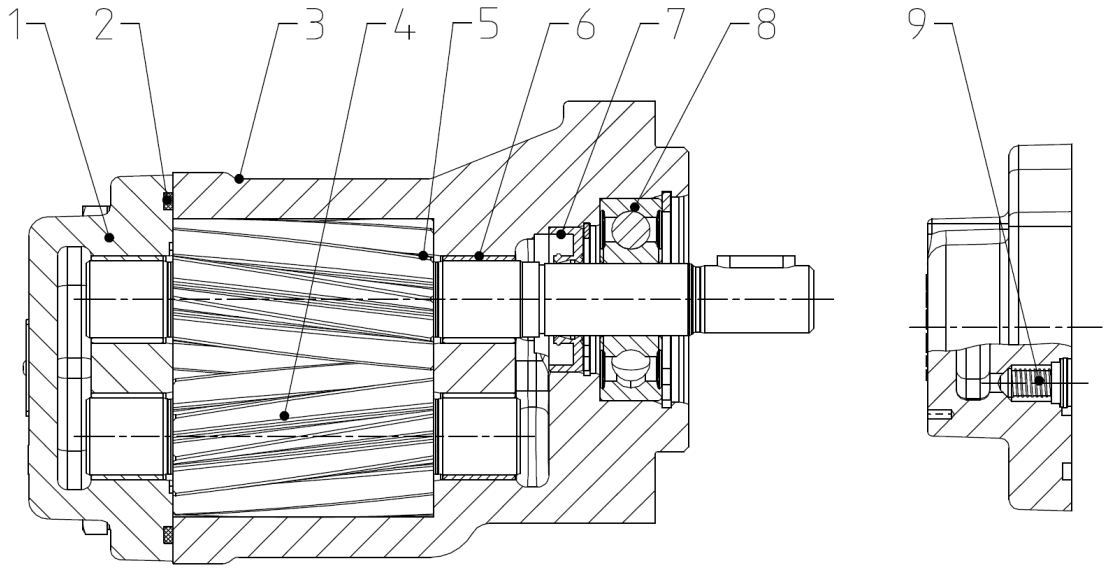
During rotation, two interlocking gears cause a volume increase by opening the tooth spaces on the suction side (S), so that the medium can flow in and at the same time, on the discharge side (pressure side, P), a corresponding volume is displaced by the meshing of the teeth in the filled tooth gaps.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

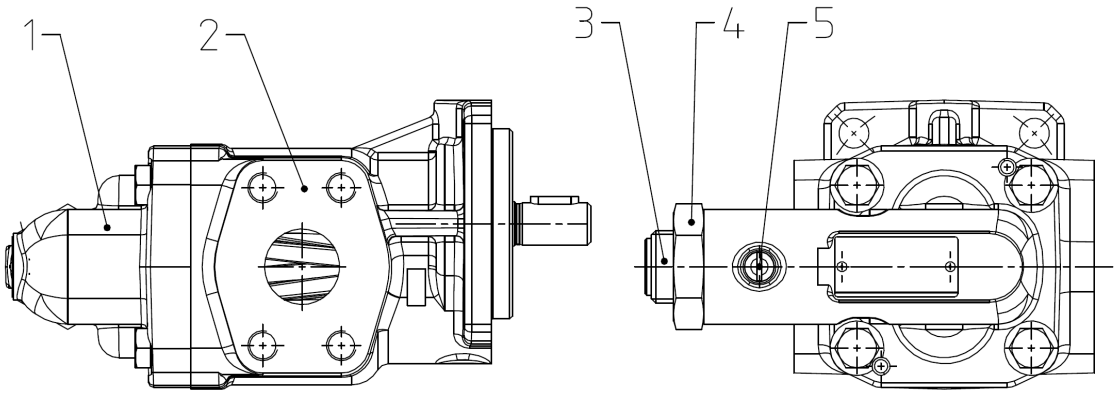
3.2 Variants

Gear pump



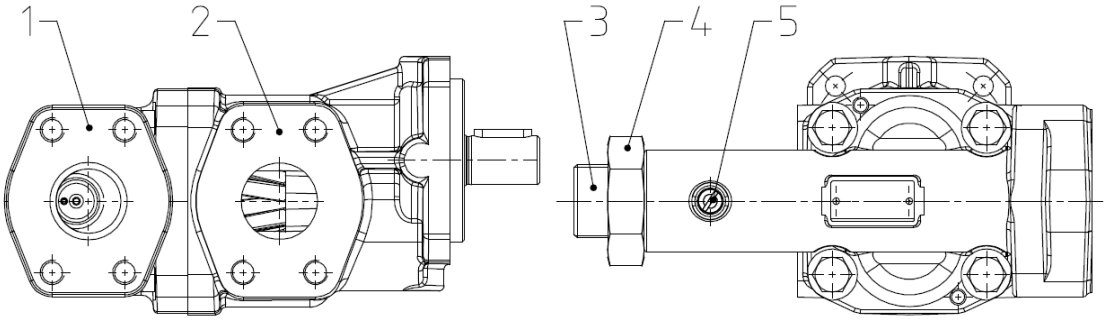
1 End cover
2 O-ring
3 Housing
4 Driven shaft
5 Driving shaft
6 Plain bearings
7 Shaft seal
(**Types of seals [▸ 16]**)
8 Roller bearings
(Fixing type: G; X)
9 Valve
(only Direction of rotation: B)

Gear pump with pressure relief valve



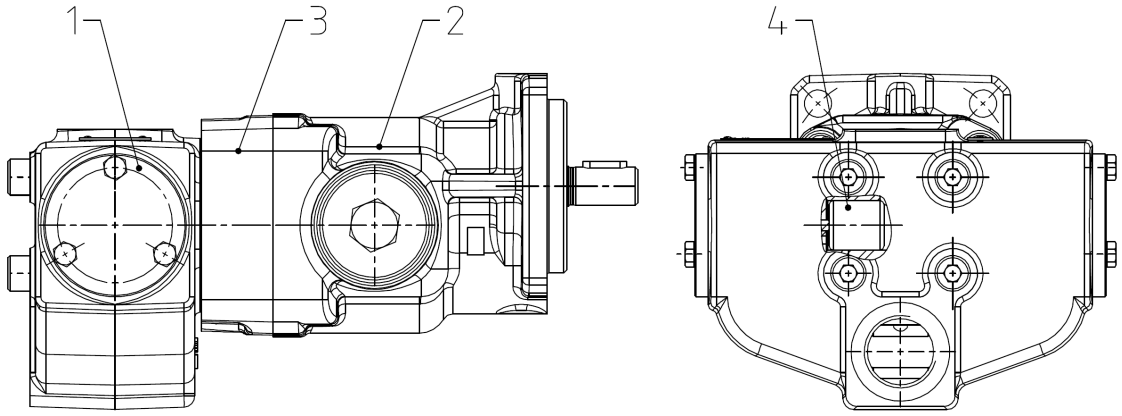
1 Pressure relief valve
2 Gear pump
3 Adjustment screw
4 Hexagonal nut
5 Retaining screw

Gear pump with pressure relief valve (T-valve)



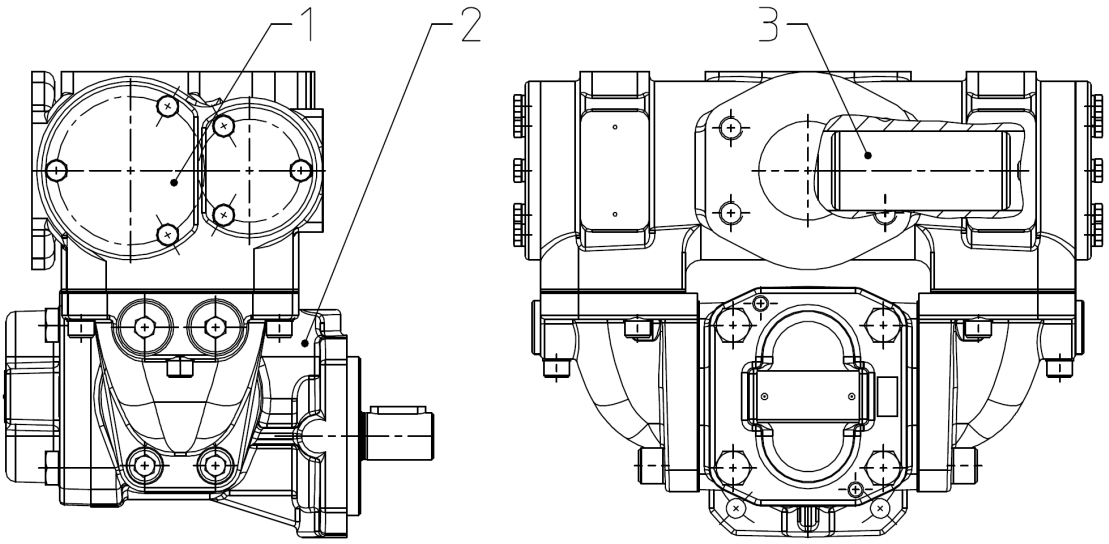
1 Pressure relief valve with Tank connection
2 Gear pump
3 Adjustment screw
4 Hexagonal nut
5 Retaining screw

Gear pump KF 2.5-25 with Universal valve



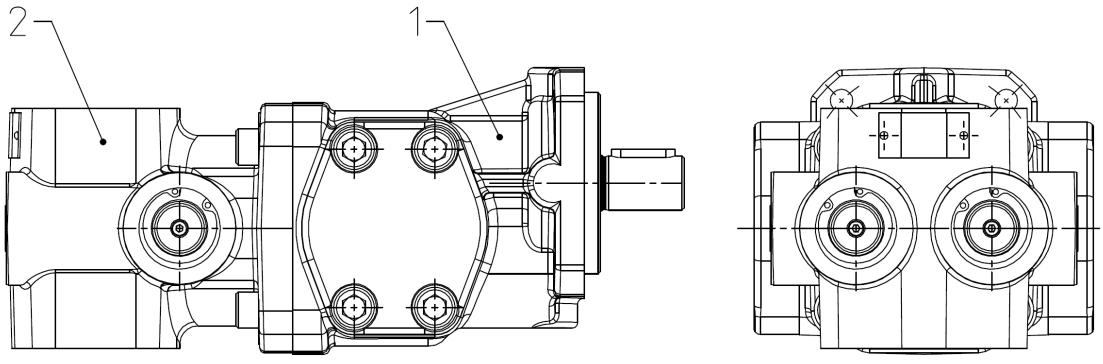
1 Universal valve
2 Gear pump
3 Pipe adaptor
4 Piston

Gear pump KF 32-80 with Universal valve



1 Universal valve
2 Gear pump
3 Piston

Gear pump KF 32-112 with Universal valve version 2



1 Gear pump
2 Universal valve

3.3 Type key

Ordering example												
KF		**40**		**R**	**F**		**2**	**/197**	**-**	**D15**	**-**	**GJS**
1.		2.		3.	4.		5.	6.		7.		8.

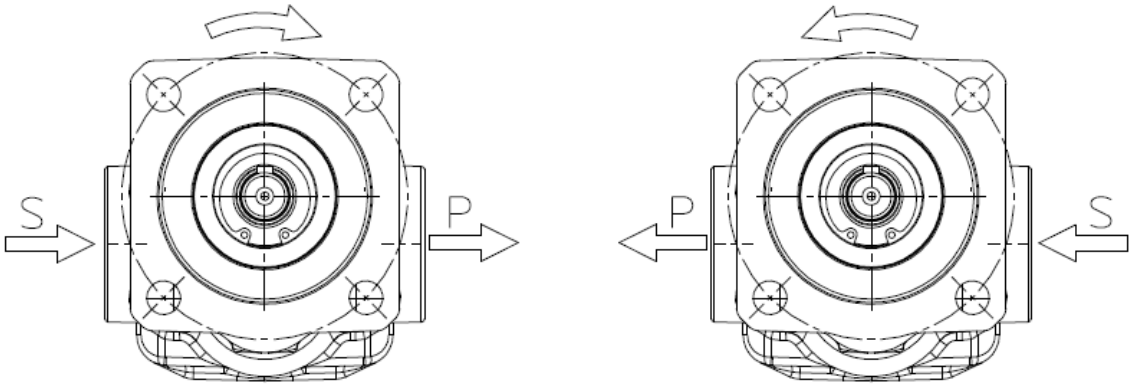
Explanation of type key			
1. Product name			
2. Nominal			
V_{gn}	Size 1: 2.5; 4; 5; 6; 8; 10; 12; 16; 20; 25		
	Size 2: 32; 40; 50; 63; 80		
	Size 3: 100; 112; 125; 150; 180; 200		
	Size 4: 250; 315; 400; 500; 630		
3. Direction of rotation			
R	Clockwise	**B**	Clockwise/counterclockwise with changing direction of delivery
L	Counterclockwise	**U**	Clockwise/counterclockwise with consistent direction of delivery
4. Fixing type			
F	DIN flange without roller bearings	**W**	Mounting angle without roller bearings
G	DIN flange with roller bearings	**X**	Mounting angle with roller bearings
5. Seal type			
1	Rotary shaft seal NBR (BABSL)	**23**	Rotary shaft seal FKM (MSS1) (Low temperature)
2	Rotary shaft seal FKM (BABSL)	**30**	Without shaft seal O-ring FKM
3	Rotary shaft seal PTFE (HN2390)	**31**	Rotary shaft seal FKM (BABSL) (Low temperature) (KF 32-200)
4	Double rotary shaft seal PTFE (HN2390)	**32**	Double rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)
5	Mechanical seal with FKM secondary seals (AX30) C2S2V1G3G1 (KF 2.5-200) B10SV1G3G1 (KF 250-630)	**33**	Mechanical seal with CR secondary seals Q3ANFE (KF 32-80) (For compressor applications)
6	with FFKM secondary seals (AX30) Q2Q2K1G3 (KF 2.5-80) Q2B2K1G3 (KF 32-200)	**34**	Mechanical seal with HNBR secondary seals Q3AP1FE (KF 32-630) (For compressor applications)

Explanation of type key			
7	Double rotary shaft seal FKM (BABSL)	**35**	Mechanical seal with FKM secondary seals Q3AVFE (KF 32-630) (For compressor applications)
9	Rotary shaft seal EPDM (R02-R) (not resistant to mineral oil)	**36**	Without shaft seal O-ring NBR
18	Rotary shaft seal FKM (BAUMX7)	**37**	Rotary shaft seal FKM (BABSL) O-ring FKM (Low temperature) (KF 100-112)
19	Double rotary shaft seal NBR (BABSL)	**40**	Mechanical seal with FKM secondary seals (L4) AQ2VFF
6. Special number			
Special numbers [▷ 19]			
7. Valve option			
Pressure relief valve			
D15	Pressure setting ranges 0-15 bar	**D25**	Pressure setting ranges 15-25 bar
D30	Pressure setting ranges 15-30 bar		
Universal valve			
U2	Version 2		
Pressure relief valve with Tank connection			
T15	Pressure setting ranges 0-15 bar	**T25**	Pressure setting ranges 15-25 bar
Viscosity range Pressure relief valve with Tank connection [mm²/s]			
No specification	12-300	**B**	1000-5000
A	300-1000		
8. Housing and cover material			
No specification	EN-GJL-250	**GJS**	EN-GJS-400-15

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.

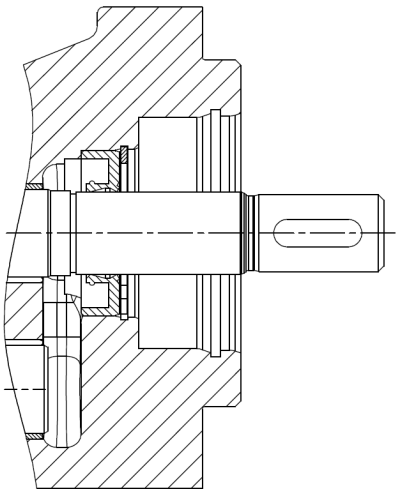
The flow direction is indicated by the straight arrow.



S = Suction connection

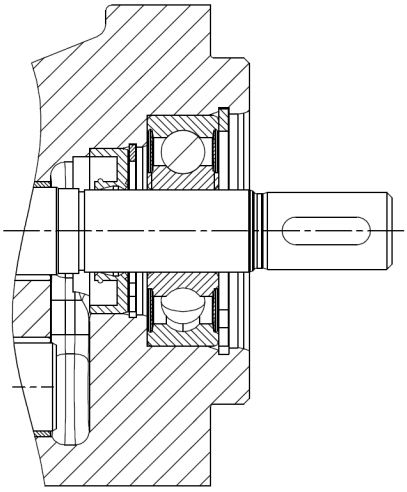
P = Pressure connection

3.5 Types of seals



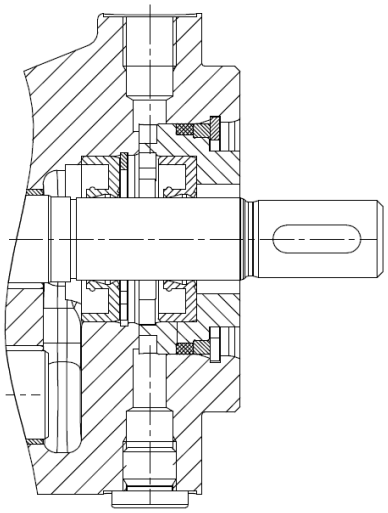
Rotary shaft seal

Seal type: 1; 2; 3; 9; 18; 23; 31

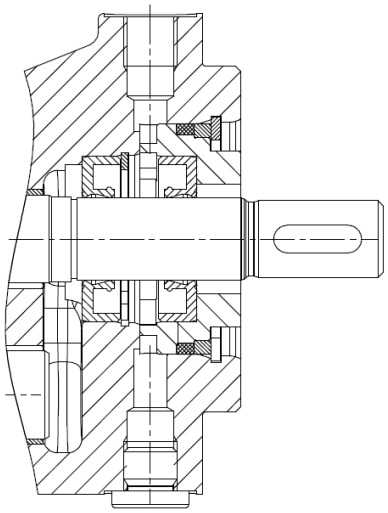


Rotary shaft seal with roller bearings

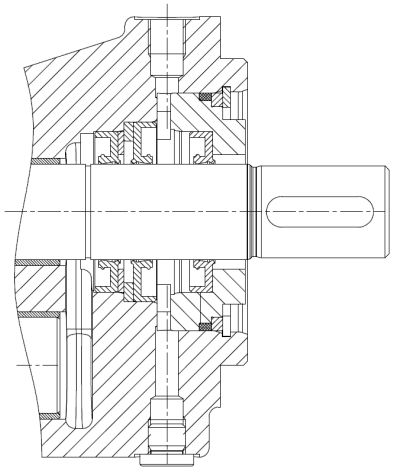
Seal type: 1; 2; 3; 9; 18; 31; 37



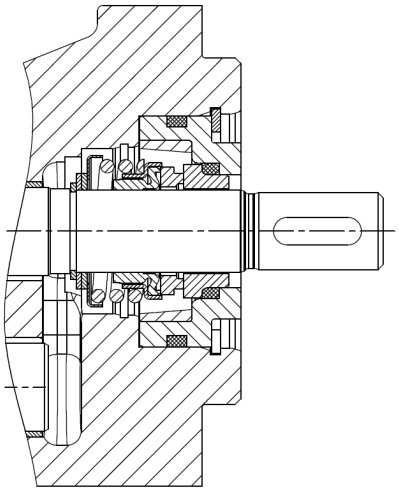
Double rotary shaft seal
Connection borehole G 1/8
(for fluid buffer)
Seal type: 4; 7; 19; 32



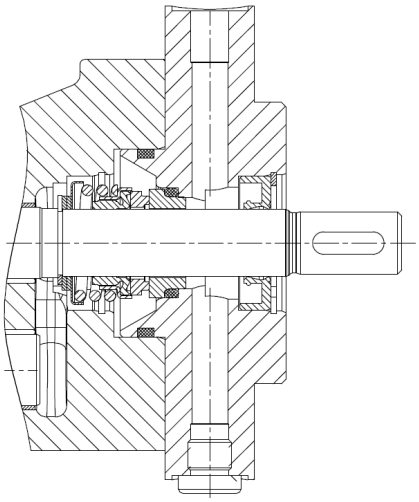
Double rotary shaft seal
(for vacuum operation)
Connection borehole G 1/8
(for fluid buffer)
Seal type: 4; 7; 19; 32
Special number: 74



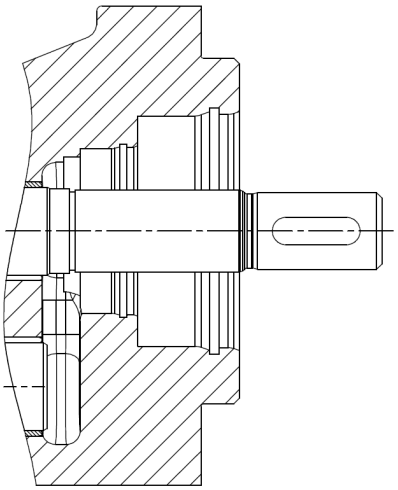
Triple rotary shaft seal
(for vacuum operation + for normal operation)
Connection borehole G 1/8
(for fluid buffer)
Seal type: 7
Special number: 322 (KF 100-112)



Mechanical seal
Seal type: 5; 6; 33; 34; 35; 40



Mechanical seal with fluid buffer
KF 2.5-25: Connection borehole G 1/8
(for fluid buffer)
KF 32-80: Connection borehole G ¼
(for fluid buffer)
Seal type: 5
Special number: 198



Without shaft seal
(Leak oil drain through shaft sealing chamber)
Seal type: 30; 36

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
45	Cylindrical shaft end - with centring hole DIN 332-2 Type D
51	Cylindrical shaft end - with centring hole DIN 332-2 Type D
74	Double rotary shaft seal for vacuum operation
156	**For compressor applications** O-ring: CR Plastic plain bearings (non-ferrous metal-free)
158	Housing connection KF 2.5-12: Flange connection SAE 3/4" KF 16-25: Flange connection SAE 1“
166	Without shaft seal O-ring: CR Plastic plain bearings (non-ferrous metal-free)
168	Without shaft seal With outboard bearing and additional flange adapter Flat journal version with coupling Shaft end with fine thread M12x1,25
173	Housing connection KF 2.5-12: Flange connection 3/4-14 NPT KF 16-25: Flange connection 1-11-1/2 NPT
175	Valve is flowed through in the opposite direction
182	Mechanical seal and front-mounted rotary shaft seal
191	Rotary shaft seal for vacuum operation **+ Special number 197**
197	Noise-optimized version for oils containing air

Special number	Description
198	**Special number 182** 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)
206	**For compressor applications** **Special number 156** O-ring**:** HNBR
232	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“
236	**Special number 168** Without flange adapter Flat journal version
245	Double rotary shaft seal BAUMX7 with grease fill
251	**Special number 166** O-ring FKM
252	**Special number 166** Housing/bearing cap nitrocarburised
255	Use under water Double rotary shaft seal BABSL + grease fill Fastening screws: stainless steel (A4) **+ Special number 197**
271	**Special number 74** O-ring CR Plastic plain bearings (non-ferrous metal-free)
289	Rotary shaft seal BAUM X
291	Stainless steel type plate and rivets
297	Inner rotary shaft seal, Turcon Roto Variseal (pmax=10 bar at 700 1/min) Outer rotary shaft seal, BABSL Plastic plain bearings (non-ferrous metal-free) Hennecke type plate
304	Plastic plain bearings (non-ferrous metal-free)
306	Plastic plain bearings (non-ferrous metal-free) Hennecke type plate **+** Special number **197**

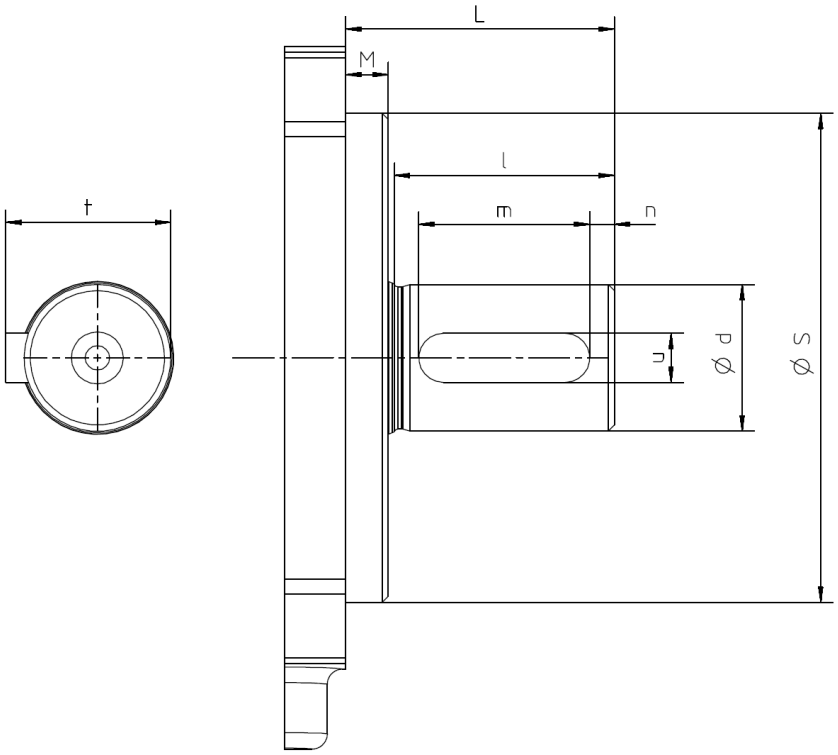
Special number	Description
307	Without shaft seal without flushing/purging Cover with extraction hole
309	Combination of **Special number 74+197**
313	Without shaft seal O-ring CR Plastic plain bearings (non-ferrous metal-free) Housing/bearing cap nitrocarburised Shaft end with flat journal
316	Combination of **Special number 197 + 232** Shaft end with splined shaft profile
317	Combination of **Special number 197 + 304**
318	Shaft end with splined shaft profile **+** Special number **197**
322	Triple rotary shaft seal Plastic plain bearings (non-ferrous metal-free) **+ Special number 232**
326	Combination of **Special number 45 + 197** KF 150 + KF 200: shaft end hole M8 / 19 mm deep
331	**Special number 198** Housing with extraction hole on suction side
332	**Special number 304**
343	With universal valve Gear pump attached in the “0 degrees” position between the mounting flanges of the universal unit. In the version with universal valve U2, the pump is attached rotated by 180°. (Gear pump horizontal, shaft end below the connections!)
344	Gear pump horizontal, shaft end below the connections **+ Special number 197**
345	Without shaft seal O-ring CR Plastic plain bearings (non-ferrous metal-free)
353	Multi layer friction bearings (non-ferrous metal-free) **+ Special number 197**
358	**Special number 297** Without customer-specific type plate
359	Combination of **Special number 158 + 197**
363	Plastic plain bearings (non-ferrous metal-free) **+ Special number 158**

Special number	Description
375	**For compressor applications** Plastic plain bearings (non-ferrous metal-free) Special shaft end Special flange
376	**Combination of** **Special number 375** End cover as suction connection with adapter plate
380	Fastening screws: stainless steel
387	With universal valve Suction connection at bottom of valve body
391	Combination of **Special number 197 + 232**
397	Use under water With universal valve Fastening screws: stainless steel
398	Use under water Fastening screws: stainless steel **+ Special number 197**
401	With SAE B 2-hole flange Shaft end with splined shaft profile Plastic plain bearings (non-ferrous metal-free) **+ Special number 197**
402	Combination of **Special number 74 + 158** or **232**
408	Special grooves in the housing (KF 2.5)
409	Additional adapter flange Cylindrical shaft end - with centring hole DIN 332-2 Type D
414	Without shaft seal **+ Special number 197** With specified preferred direction of rotation
424	Gear pump with polished bearing positions Housing material: EN-GJS-400-15
429	Snap ring on the shaft end
430	Shaft end with splined shaft profile
433	Shaft end with journal M25x1.5 **+ Special number 197**
437	**For compressor applications** O-ring FKM Plastic plain bearings (non-ferrous metal-free)
441	**Special number 424** Plastic plain bearings **(**non-ferrous metal-free)

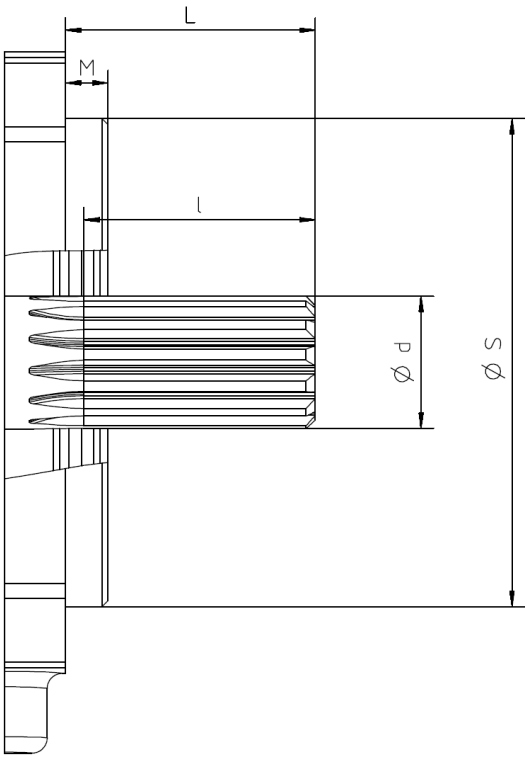
Special number	Description
442	With SAE B 2-hole flange Shaft end with splined shaft profile
443	Combination of **Special number 156 + 158**
444	With SAE B 2-hole flange Shaft end with splined shaft profile **+ Special number 197**
450	Shaft end with hole for dowel pin
452	Threaded hole 4x M8 / 16 deep in the housing KF 125-150: Suction connection 3“; Pressure connection 2 1/2" KF 180-200: Suction connection 3 1/2"; Pressure connection 3“ **+** Special number **197**
453	Plastic plain bearings (non-ferrous metal-free) **+ Special number 158**
458	Standard KF 12 With special dimensions and special shaft end
459	Combination of **Special number 74 + 197 + 158** or **232**
460	Combination of **Special number 206 + 158**
464	Combination of **Special number 401 + 232**
466	Mould parting line on the housing is deburred
468	Without shaft seal Shaft end with nozzle **+ Special number 197**
471	Cover for both directions of rotation **+ Special number 197** Specification of the preferred direction of rotation
473	Special painting
475	Combination of **Special number 401 + 232**
477	Shaft end with splined shaft profile
478	With SAE D 2-hole flange Shaft end with splined shaft profile **+ Special number 197**
481	Housing with screwable relubrication opening and lubricating oil hole
482	**Special number 481 + 158**
483	**Special number 481** KF 32-80: standard lubricating oil hole
485	**Special number 444** Outer shaft seal with sealing lip mounted facing the shaft end + circlip
488	With SAE C 2-hole flange Shaft end with splined shaft profile

Special number	Description
492	With SAE B 2-hole flange mounted rotated by 90° Shaft end with splined shaft profile
496	Combination of **Special number 444 + 232**
497	Combination of **Special number 477 + 197**
503	With forced-feed lubrication **+ Special number 197**
505	**Special number 444** Without **Special number 197**
506	With SAE A 4-hole flange Shaft end with splined shaft profile
510	O-ring CR White metal bearing **+ Special number 158**
511	Universal valve **+ Special number 197** Preferred direction of rotation, right (clockwise)
512	**Special number 511** Preferred direction of rotation, left (counter-clockwise)
513	**Special number 511** Shaft end with bonded nozzle
514	**Special number 391** Threaded holes M6 / 15 mm deep in the housing (for heater)
515	With SAE B 2-hole flange Shaft end with splined shaft profile
517	Combination of **Special number 255 + 391**
518	Joint d'arbre radial pour fonctionnement sous vide **+ Special number 158**
521	Combination of **Special number 391 + 503**
523	**Special number 468** Fastening screws: stainless steel
526	With SAE B 2-hole flange Shaft end with splined shaft profile
529	Double rotary shaft seal Outer rotary shaft seal with sealing lip mounted facing the shaft end! Leak oil hole at the bottom is open With SAE C 2-hole flange Shaft end with splined shaft profile **+ Special number 197**

3.8 Shaft ends



Nominal	Special number	L	S_{h8}	M	d_{j6}	l	m	n	t	u
KF 2.5-25	-	33	63	7	14	25	16	4	16	5
	156/206/437									
KF 32-80	-	44	80		24	36	28	4	27	8
	156/206									
	375	40			20	30	20	5	22,5	6
KF 100-200	-	60	110	8	28	50	40	5	31	8
KF 125-200	375									
KF 100-112	375				24	50	40	5	27	8
KF 100-150 Seal type: 31	-	46			24	36	28	4	27	8
KF 250-630	-	90	160		38	80	63	8	41	10
KF 400-630	375									
KF 250-315	375				32				35	



Nominal	Special number	L	S_{h8}	M	Profile	Diametral pitch (DP)	Number of teeth	d_{h11}	l
KF 32	506	31.75	82.157	7	SAE A	16/32	9	15.26	16
KF 32-80	401/464/475/526/515	421.2	101.6		SAE B		13	21.81	38
KF 32-50	442/492	46							45
KF 63-80	316/318/477	41	80						38
KF 63-150	444/505/485/496	41.15	101.6						33.3
KF 100-112	344	41	110	8					38
KF 112	430	73	110						16
KF 200	442	41.15	101.6						15
KF 200	477/497	41	110						38
KF 100; KF 200	488	46	127		SAE B-B		15	24.98	20
KF 250-630	477/497	55	160		SAE C-C	12/24	17	37.58	38
KF 250	478/529	55.4	152.4		SAE C	12/24	14	31.23	47.5

4 Technical data

4.1 General

General information				
Housing connection (1)	KF 2.5-12		Whitworth pipe thread	G 3/4
	KF 2.5-12 .../158		Flange connection	SAE 3/4"
	KF 16-25		Whitworth pipe thread	G 1
	KF 16-25 .../158		Flange connection	SAE 1"
	KF 32-80			SAE 1 1/2"
	KF 32-80		Tank connection	SAE 1 1/2"
	KF 50-80 .../232		Flange connection	SAE 2"
	KF 100-112			
	KF 50-80 .../232		Tank connection	SAE 1 1/2"
	KF 100-112 .../232		Flange connection	SAE 2 1/2"
	KF 125-150			
	KF 125-150 .../232			SAE 3"
	KF 180-200			
	KF 180-200 .../232			SAE 3 1/2"
	KF 250-315			SAE 3"
	KF 400-630			SAE 4"
	KF 2.5-25 with Universal valve	Suction connection	Whitworth pipe thread	G 3/4
		Pressure connection		G 1/2
	KF 32-80 with Universal valve		Flange connection	SAE 2"
	KF 32-80 with Universal valve version 2			SAE 1 1/2"
	KF 100-112 with Universal valve version 2			SAE 2"
Mounting position	KF without fluid buffer		Any	
	KF with Universal valve version 2			
	KF with fluid buffer		Shaft end horizontal , fluid buffer connection top	
	KF with Universal valve		Piston horizontal , Pressure connection on top	
External loads on shaft end	F_{axial}	Axial forces are not permissible		
	F_{radial}	Radial forces are only permissible in combination with an roller bearings **Nominal sizes [▷ 28]**		
Speed	**n**	**Nominal sizes [▷ 28]** + **Assignment of viscosity - speed [▷ 30]**		

General information			
Operating pressure	p_e p_b	**Allowable pressures [▷ 30]**	
Viscosity	ν_{min}	**Assignment of differential pressure to viscosity [▷ 32]**	
	ν_{max}	20000 mm²/s	
		Pressure relief valve with Tank connection	5000 mm²/s
Fluid temperature	ϑ_m	**Permissible temperature range [▷ 33]**	
Ambient temperature	ϑ_u	**Permissible temperature range [▷ 33]**	
Filtering	**β**	≤ 60 µm	
Materials		**Material data [▷ 34]**	
Permissible media		Lubricating fluids without abrasive components (Petrols, solvents, etc. are not permissible) For compressor applications : Refrigeration oil (max. 5% gas content); Hydraulic oil; Mineral oil	
(1)Pipe thread : EN ISO 228-1; Flange connection : ISO 6162-1 (SAE J518)			

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
V_{gn}	V_g	n_{min}	n_{max} (2)	F_{radial} [N]	L_{pA} (1)	x10^{-6}
	[cm³/U]	[1/min]		(n= 1500 1/min)	[dBA]	J [kg m²]
2.5	2.55	200	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

Nominal		Geom. displacement	Speed		Perm. radial force	Sound pressure level	Mass inertia
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)	[dBA]	J [kg m^2]
32		32.12			1500	≤ 68	217
40		40.21					254
50		50.2					299
63		63.18					368
80		80.5		3000			443
100		101.5				≤ 69	741
112		113.5					806
125		129.4				≤ 65	1418
150		155.6					1637
180		186.6					1911
200		206.2		2500			2072
250		245.1		2000	2500	≤ 75	4133
315		312.9					5011
400		399.5				≤ 77	6618
500		496.5					7830
630		622.5				≤ 80	9591
32	with Universal valve version 2	32.12		3000	1500	≤ 68	217
40		40.21					254
50		50.2					299
63		63.18		2200			368
80		80.5					443
100		101.5				≤ 69	741
112		113.5					806

(1) **n**= 1500 1/min; **ν**= 34 mm^2/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 pe min.

4.4 Allowable pressures

4.4.1 Operating pressure, suction and pressure side

Seal type	Special number	Operating pressure			
		Suction side		Pressure side	
		$p_{e\ min}$ (1) [$bar_{abs.}$]	$p_{e\ max}$ [$bar_{rel.}$]	p_b [$bar_{rel.}$]	
				(perm. continuous pressure)	(Pressure peaks)
1	-	0.6 (2)	**Max. operating pressure, suction side for seal type 1,2,7 and 19 [▷ 31]**	25	40
2	-				
3	-		2		
4	-				
	74	0.1	0.2		
5	-	0.6 (2)	10		
6	-		25	35	-
7	-		**Max. operating pressure, suction side for seal type 1,2,7 and 19 [▷ 31]**	25	40
	74	0.1	0.2		
9	-	0.6 (2)	0.5		

Seal type	Special number	Operating pressure			
		Suction side		Pressure side	
		$p_{e\ min}$ [1] [$bar_{abs.}$]	$p_{e\ max}$ [$bar_{rel.}$]	p_b [$bar_{rel.}$]	
				(perm. continuous pressure)	(Pressure peaks)
18	-				
19	-		**Max. operating pressure, suction side for seal type 1,2,7 and 19 [▶ 31]**		
	74	0.1	0.2		
23	-		0.5	25 [3]	-
30	-		25	25	40
31	-		0.5	25 [3]	-
32	-			25	40
	74	0.6 [2]	0.2		
36	-		25		
37	-		0.5	16 [4]	
40	-		10	25	

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

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

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

[3] ϑ_M < -20 °C; Housing material GJL: 16 bar

[4] Housing material GJS: 25 bar

4.4.2 Max. operating pressure, suction side for seal type 1,2,7 and 19

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

4.4.3 Compressor application

Seal type	Special number	Operating pressure			
		Suction side		Pressure side	
		$p_{e\ min}$ [$bar_{abs.}$]	$p_{e\ max}$ [$bar_{rel.}$]	p_b [$bar_{rel.}$]	p_b [$bar_{rel.}$]
				(perm. continous pressure)	(Pressure peaks)
6	156	0.6 (1)	10	25	40
	206				
	437				
33	375		25	35	-
34					
35					
$bar_{abs.}$ = Absolute pressure ; **$bar_{rel.}$** = Relative pressure					
(1) Start-up condition: 0.4 bar absolute (max. 30 minutes)					

4.5 Assignment of differential pressure to viscosity

Plain bearings	Δp_{max} [bar]		
	ν= 1,4 mm^2/s	ν= 6 mm^2/s	ν= 12 mm^2/s
Multi layer friction bearings (contains lead) (Standard)	3	12	25
Multi layer friction bearings (non-ferrous metal-free)			
Plastic plain bearings	-	6	10 (1)
White metal bearing			
(1) For compressor applications **ν** ≥ 7 mm^2/s			

4.6 Permissible temperature range

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

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

NOTICE

Note media-specific properties.

4.7 Material data

<table>
<tr><th rowspan="2">Seal type</th><th colspan="5">Materials</th></tr>
<tr><th>Shaft seal</th><th>O-ring</th><th>Housing / End cover / Valve housing</th><th>Gears</th><th>Plain bearings</th></tr>
<tr><td>1</td><td colspan="2">NBR</td><td rowspan="17">EN-GJL-250
- - -
EN-GJS-400-15</td><td rowspan="17">Case-hardened steel
16MnCrS5 - 1.7139</td><td rowspan="17">Multi layer friction bearings (contains lead)
(Steel (St), CuSn, PTFE, Pb)
- - -
Plastic plain bearings non-ferrous metal-free
Iglidur®
- - -
Multi layer friction bearings (non-ferrous metal-free)
(Steel (St), CuSn, PTFE)
- - -
White metal bearing
(Steel (St), SnSb12Cu5Cd or SnSb12Cu6)</td></tr>
<tr><td>2</td><td colspan="2">FKM</td></tr>
<tr><td>3</td><td>PTFE</td><td>FEP with FKM-core</td></tr>
<tr><td>4</td><td>PTFE</td><td>FEP with FKM-core</td></tr>
<tr><td rowspan="2">5</td><td>C2S2V1G3G1 (KF 2.5-200)</td><td rowspan="2">FKM</td></tr>
<tr><td>B10S-V1G3G1 (KF 250-630)</td></tr>
<tr><td rowspan="2">6</td><td>Q2Q2K1G3 (KF 2.5-25)</td><td rowspan="2">FEP with FKM-core</td></tr>
<tr><td>Q2B2K1G3 (KF 32-200)</td></tr>
<tr><td>7</td><td colspan="2">FKM</td></tr>
<tr><td>9</td><td colspan="2">EPDM</td></tr>
<tr><td>18</td><td colspan="2">FKM</td></tr>
<tr><td>19</td><td colspan="2">NBR</td></tr>
<tr><td>23</td><td colspan="2">FKM (Low temperature)</td></tr>
<tr><td>30</td><td>-</td><td>FKM</td></tr>
<tr><td>31</td><td colspan="2">FKM (Low temperature)</td></tr>
<tr><td>32</td><td colspan="2">EPDM</td></tr>
<tr><td>36</td><td>-</td><td>NBR</td></tr>
<tr><td>40</td><td>AQ2VFF</td><td>FKM</td></tr>
</table>

4.7.1 Compressor application

Seal type	Special number	Materials				
		Shaft seal	O-ring	Housing / End cover / Valve housing	Gears	Plain bearings
6	156	Q2Q2K1G3	CR	EN-GJL-250 - - - EN-GJS-400-15	Case-hardened steel 16MnCrS5 - 1.7139	Plastic plain bearings non-ferrous metal-free Iglidur® X
	206		HNBR			
	437		FKM			
33	375	Q3ANFE	CR			
34	375	Q3AP1FE	HNBR			
35	375	Q3AVFE	FKM			

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

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

M= Mineral oil

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

E= Polyester

PAO= Polyalphaolefin

PAG= Polyalkylglykol

4.8 Weight

Nominal V_{gn}	Gear pump with [kg]					Added weight
	End cover	Pressure relief valve	Pressure relief valve with Tank connection	with Universal valve	with Universal valve version 2	Mounting angle
2.5	2.9 (1)	3.7 (1)	-	6.9	-	1.3
4						
5						
6						
8						
10						
12						
16	3.5 (1)	4.3 (1)	-	7.5	-	
20						
25						
32	7.7	9.5	12.4	27.5	15.5	1.6
40						
50						
63	9.4	11.2	14.3	29.5	17.5	
80						
100	16.0	18.7	-	-	21.6	3.3
112						
125	22.2	26.5			-	
150						
180	24.8	29.1				
200						
250	44.2	47.2				-
315						
400	54.7	57.9				
500						
630	60.8	64.0				

(1) 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 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.

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 ≥48°C.

Tightening torques [Nm]							
Thread size	**M6**	**M8**	**M10**	**M12**	**M16**	**M20**	**M24**
Counter-thread Alu-minium	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).

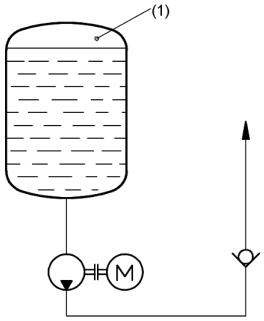
When designing the lines, bear in mind the following points:

- 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 pe 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

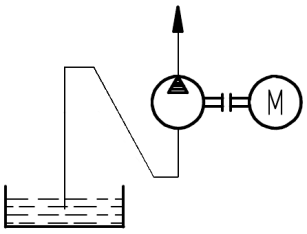
Pressure below the permissible suction side pressure causes cavitation

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.

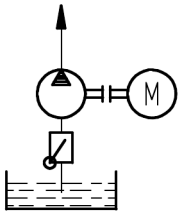
b) If fluids contain water, install the device below the fluid level and limit the operating temperature to 50 °C and the speed to 1500 1/min.

Prevention of suction problems

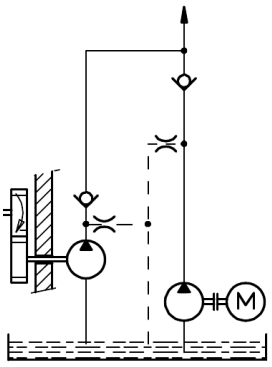
If there is a possibility of the suction line running dry while the pump is at a standstill, laying the suction line as a U-trap is a way of avoiding suction problems. This way, the pump will remain permanently filled after initial commissioning.



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 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 [▷ 16]**

6.5 Change of the direction of rotation

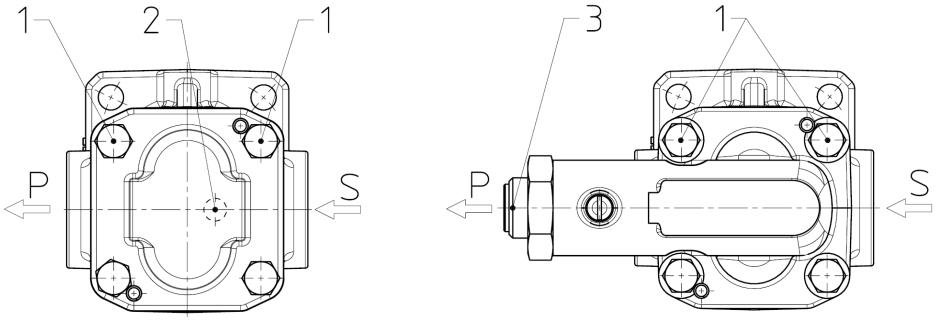
Depending on the design, a change in direction of rotation is possible.

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



S = Suction connection
P = Pressure connection

1 Fastening screws
2 Leak oil hole
3 Adjustment screw

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 suction 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 ≥48°C.

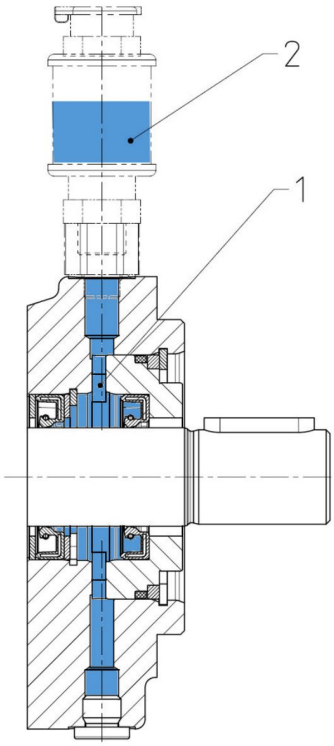
7.2 Preparation

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.

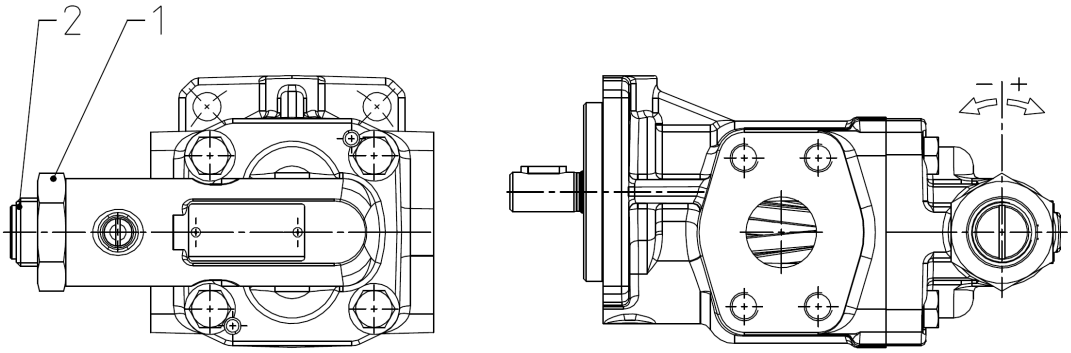
a) Do not start up the pump without seal fluid.

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 [▷ 55]**

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 ≥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 ≥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 ≥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 bascet 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
Pump does not suck		
	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 oper-ation: 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 oper-ation: 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 bascet 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 inter-vals
		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		