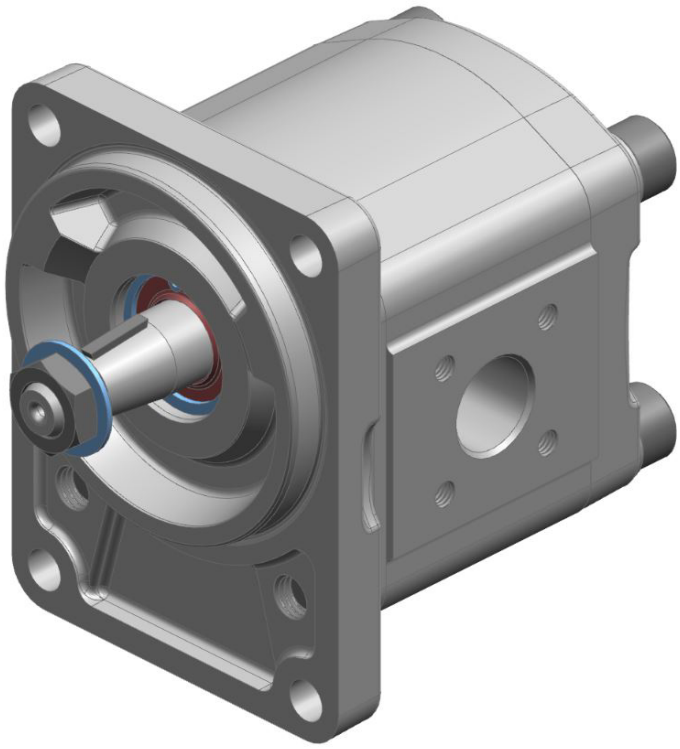
KRACHT

D.0030600002

Operating instructions (Translation)



High pressure gear motor KM 1

English

03 • 13/05/2025

Table of content

1 General

1.1 About the documentation

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

High pressure gear motor KM 1

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.

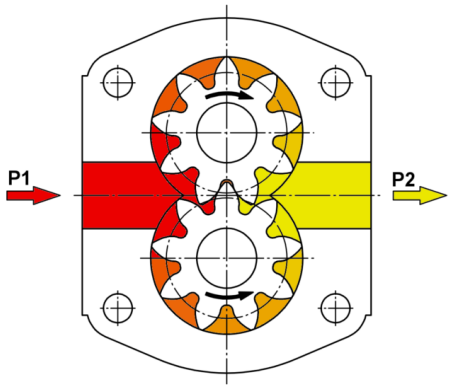
a) Do not operate the product with shut-off devices closed.

b) Do not operate the production in the wrong rotational direction.

3 Device description

3.1 Functional principle

This series pumps are external gear motors types that work according to the positive displacement principle.



P1 Feed side

P2 Drain side

High pressure gear motors are used to convert hydraulic energy into mechanical energy. The hydraulic energy is generally generated by an upstream pump. With the aid of a suitable hydraulic fluid, the energy is output through two externally-toothed gears as the torque through the driven shaft to the consumer.

The configuration of a gear motor is fundamentally similar to a gear pump. They are manufactured for one or two directions of rotation. The geometric displacement volume V_g is consumed. A value that is stated in technical documents as the motor size.

According to its configuration, the external gear motors are classified as so-called gland-type bearing pumps.

All the essential functional elements, gearing and gland bearings are located in an aluminium housing made of high-strength extrusion alloy closed on each side by the end cover or flange cover (cast iron). The gearing made of case-hardened steel with surface hardening consists of the driving shaft pinion and the driven shaft pinion.

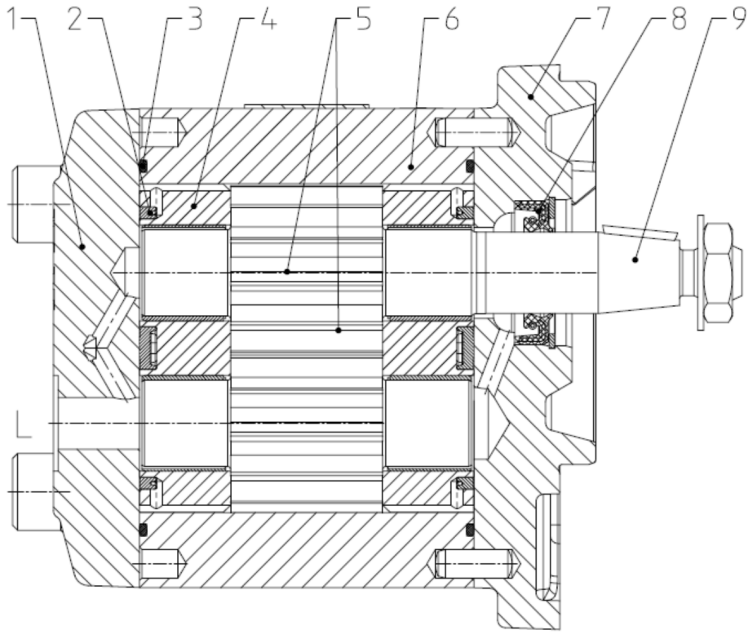
The gland bearings located on both sides of the gearing support the shaft journals and sealing elements in heavy-duty multi-component plain bearings which are used for pressure field sealing to compensate axial clearance.

The working pressure of the unit is reached only under load through the connected consumer. The speed of the unit here depends on the supplied pressure medium volume per time-unit.

Depending on the design and the application, the leakage oil is removed internally or externally.

3.2 Variants

Gear motor



1	End cover	2	Seal
3	O-ring	4	Bearing bush with multi layer friction bearings
5	Gears	6	Housing
7	Flange cover	8	Shaft seal
9	Output shaft end	L	Leak oil connection

3.3 Type key

Ordering example																								
KM		**1/8**		**3**	**N**	**3**	**0**		**G**	**2**	**K**	**A**	**2**		**0**	**1**	**A**	**A**	**E**	**0**		**B**	**D**	**W**	**/...**
1.		2.		3.	4.	5.	6.		7.	8.	9.	10.	11.		12.	13.	14.	15.	16.	17.		18.	19.	20.	21.

Explanation of type key			
1. Product name			
2. Nominal			
V_{gn}	Size 1: 5.5; 6.3; 8; 11; 12.5; 14; 16; 19; 22; 25		
3. Housing material			
3	Aluminium (Al)		
4. Seal material			
F	FKM	**N**	NBR
5. Direction of rotation			
1	Clockwise	**2**	Counterclockwise
3	Clockwise / Counterclockwise		
6. Outbord bearing			
0	Without	**S**	Heavy-duty version
L	light version		
7. Flange type			
A	SAE A 2-hole flange LA= 106.4 Z-Ø= 82.55	**L**	Square 2-hole flange with O-ring (Without shaft seal) LA= 60/60 Z-Ø= 52
F	Square 2-hole flange LA= 60/60 Z-Ø= 50	**M**	Square 2-hole flange LA= 60/60 Z-Ø= 50
G	Rectangular 4-hole flange LA= 72/100 Z-Ø= 80	**Q**	Square 2-hole flange with O-ring LA= 60/60 Z-Ø= 52
K	Rectangular 4-hole flange LA= 71.4/96.1 Z-Ø= 36.47		
LA= Hole distance; Z-Ø = Centering diameter			
8. Flange cover material			
2	EN-GJS-400-15	**3**	Aluminium (Al)
9. Shaft end			
A	Cone 1:5 Ø20 - F-shaft in conjunction with front bearing	**B**	Cone 1:5 Ø20 - X-shaft in conjunction with front bearing
C	Cone 1:5 Ø17 - F-shaft in conjunction with front bearing	**D**	Cone 1:5 Ø17 - X-shaft in conjunction with front bearing
F	Flat pin ($M_{max.}$= 40 Nm)	**K**	Cone 1:5 Ø17 ($M_{max.}$= 160 Nm)
S	Gear shaft profile SAE A ($M_{max.}$= 55 Nm)	**M**	Cone 1:8 Ø17 ($M_{max.}$= 160 Nm)
X	Gear shaft profile B17x14 DIN 5482 ($M_{max.}$= 70 Nm)	**Z**	Cylindrical shaft end

Explanation of type key			
10. Type of end cover			
A	End cover with leakage oil connection M12x1.5 to the rear	**B**	End cover with leakage oil connection M12x1.5 on the side
E	End cover with leakage oil connection G1/4 to the rear	**F**	End cover with leakage oil connection 7/16-20 UNF to the rear
G	End cover with leakage oil connection M14x1.5 to the rear	**H**	End cover with suction valve and leakage oil connection G1/4 to the rear
J	End cover with suction valve and leakage oil connection 7/16-20 UNF to the rear	**K**	End cover with suction valve and leakage oil connection M12x1.5 upwards or downwards (depending on direction of rotation)
M	End cover with G1/4 leakage oil connec-tion at the top or bottom	**Z**	Intermediate piece
0	Without		
11. Cover material			
2	EN-GJS-400-15	**3**	Aluminium (Al)
0	Without		
12. 2nd shaft end			
0	Without	**1**	Yes
13. Axial clearance compensation			
1	Yes		
14. Input			
A	Ø15/LK35	**B**	G 3/4
C	G 1/2	**D**	M22x1.5
E	SAE 1/2"	**F**	3/4-16 UNF
J	7/8-14 UNF	**L**	G 3/8 hinten
Q	Ø 13.5 with LK 30.2; 45° offset 4x M6	**N**	M18x1.5
0	Without		
15. Output			
A	Ø15/LK35	**B**	G 3/4
C	G 1/2	**D**	M22x1.5
J	7/8-14 UNF	**L**	G 3/8 back
Q	13.5 with LK 30.2; 45° offset 4x M6	**N**	M18x1.5
0	Without		
16. Gear material			
E	16MnCrS5 - 1.7139		
17. Gear coating			
0	Without		
18. Type of bearing			
B	Bearing bush	**M**	Bearing gland with minimised clearance
19. Material bearing			
D	Multi layer friction bearings (contains lead)		

Explanation of type key			
20. Seal type			
0	Without	**W**	Rotary shaft seal
H	Rotary shaft seal (PKF/PEEK)		
21. Special number			
Special numbers [▷ 15]			

⚠ ATTENTION

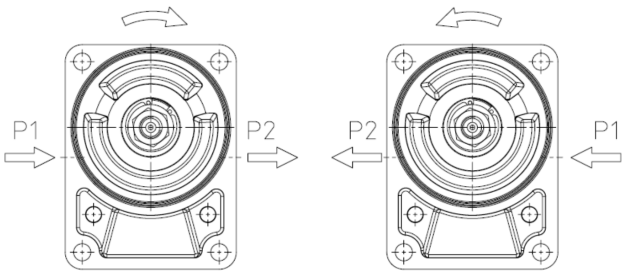
Wear

Dry running leads to premature wear of the shaft ends.

a) Sufficient lubrication must be ensured for drive via the shaft ends, flat journals and splined shaft profile.

3.4 Rotary and flow direction

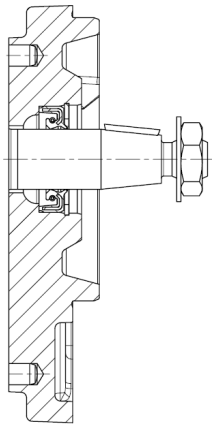
The direction of rotation is indicated by the bent arrow, looking at the driven shaft end. The flow direction is indicated by the straight arrow. The flow directions are below the output shaft.



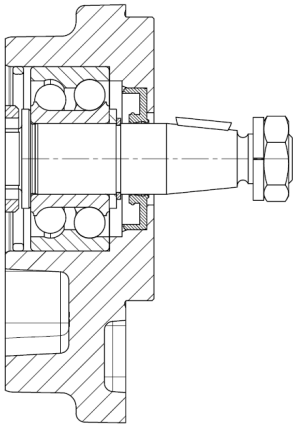
P1 = Feed side

P2 = Drain side

3.5 Types of seals

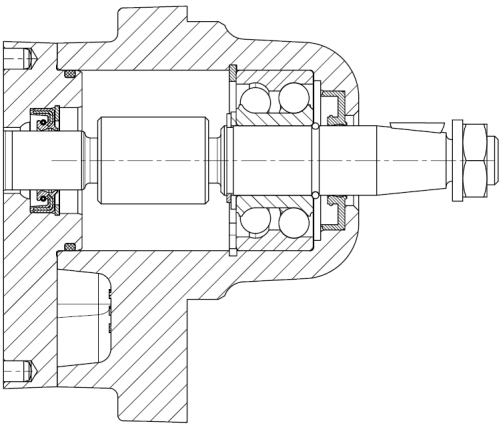


Rotary shaft seal



Rotary shaft seal with roller bearings

light version



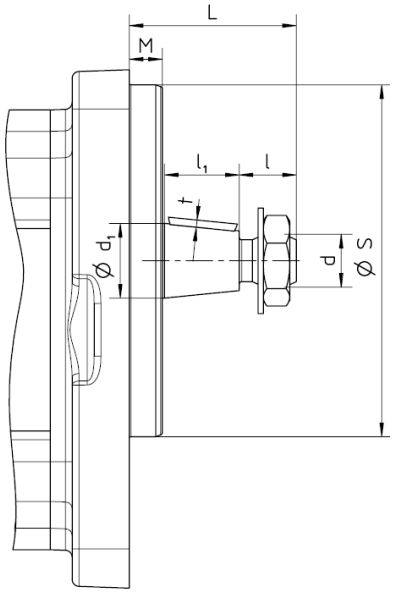
Rotary shaft seal with roller bearings

Heavy-duty version

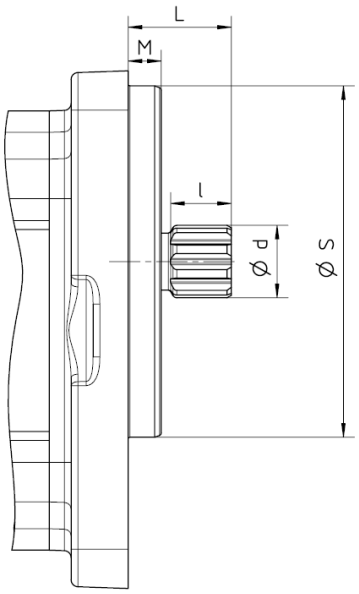
3.6 Special numbers

Special number	Description
336	Strengthened shaft end

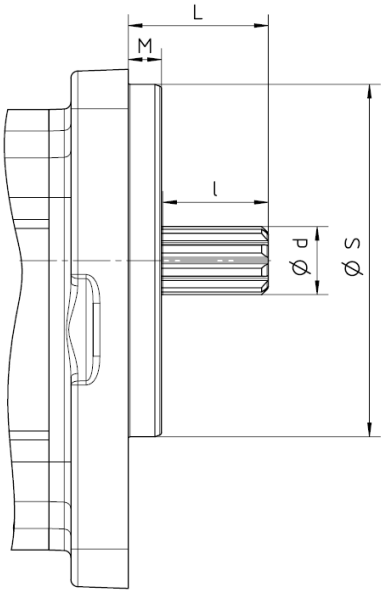
3.7 Shaft ends



Flange cover	Shaft end	L	S	M	Cone	d	d_1	l_1	l	t
G	**A; B**	47	80	8	1:5	M14x1.5	20	20	15.5	2
G	**C; D; K**	40.5	80	8	1:5	M12x1.5	17	17	13	1.5
G	**M**	39.5			1:8			18.2	12.1	
F	**C; D; K**	40.5	50	7.5	1:5	M12x1.5		17	13	
K	**M**	39.5	36.47	4.8	1:8	M12x1.5		18.2	12.1	
M	**A; B**	47	50	7.5	1:5	M14x1.5	20	20	15.5	2
M	**C; D; K**	40.5	50	7.5	1:5	M12x1.5	17	17	13	1.5



Flange cover	Shaft end	L	S	M	Profile	DIN	Diametral pitch (DP)	Number of teeth	d_{h11}	l
A	**S**	31.7	82.55	6.35	SAE A	-	16/32	9	15.46	16
G	**X**	23.5	80	7.5	B17x14	5482	-		16.5	14
A	**X**		82.55	6.35						
K	**X**	22	36.47	4.8						
F	**X**	26	50	7.2						
M	**X**									
Q	**X**		52							
L	**X**	-								



Flange cover	Shaft end	L	S	M	Profile	Diametral pitch (DP)	Number of teeth	d_{h11}	l
A	**S /336**	31.7	82.55	6.35	SAE A	16/32	9	15.46	23.9

4 Technical data

4.1 General

General information			
Mounting position			Any
External loads on shaft end		$\mathbf{F}_{axial}$	Axial forces are not permissible
		$\mathbf{F}_{radial}$	Axial and radial forces are only permissible in combination with an outboard bearing **Permissible radial force [▷ 19]**
Speed		**n**	**Nominal sizes [▷ 19]**
Operating pressure		$\mathbf{p}_e$	**Allowable pressures [▷ 21]**
		$\mathbf{p}_b$	
Viscosity	Permitted in continuous operation	$\boldsymbol{\nu}_{min}$	10 mm^2/s
		$\boldsymbol{\nu}_{max}$	600 mm^2/s
	Recommended for continuous operation	$\boldsymbol{\nu}_{min}$	30 mm^2/s
		$\boldsymbol{\nu}_{max}$	45 mm^2/s
Fluid temperature		$\boldsymbol{\vartheta}_m$	**Permissible temperature range [▷ 22]**
		$\boldsymbol{\vartheta}_u$	
Filtering		**β**	$\beta_{25} \geq 75$ für ... 300 bar
			$\beta_{40} \geq 75$ für ... 100 bar
Oil cleanliness			NAS 1638 Class 10 ISO 4406:1999 Code 21/19/16
Permissible media			Mineral oil according to DIN 51524/25 Motor oil according to DIN 51511 Bio-oils of the "HEES" group can be used up to 70 °C and at maximum pressure reduced by about 20 %

TIP

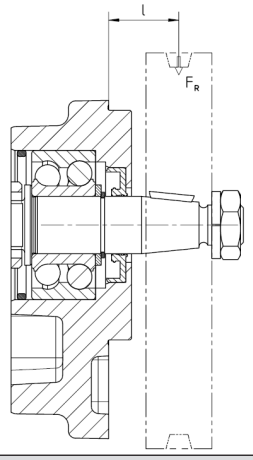
A reduced shaft seal life is possible in the vertical installation position (shaft end at the top).

4.2 Nominal sizes

Nominal	Geom. displacement		Speed		Mass inertia
V_{gn}	V_g [cm³/rev.]		n_{min}	n_{max}	x10⁻⁶
	Standard	game minimised	[rpm]		J [kg m²]
5.5	5.45	5.6	200	4000	35.7
6.3	6.28	6.45			39.9
8	7.9	8.16			51.1
9.6	9.59	9.86			56.5
11	10.9	11.2			62.9
14	13.85	14.25			77.7
16	15.9	16.32			87.7
19	18.8	19.37			102.5
22	22.3	22.9			119.6
25	25.21	25.97			135.3

4.3 Permissible radial force

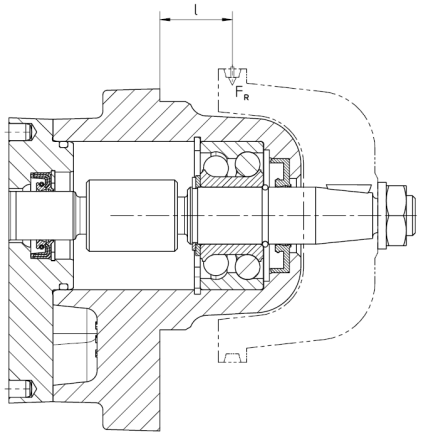
With attachment bearing , light version



Perm. radial force F_R [N] (1)				
Bracing distance l [mm]	Speed n [rpm]			
21.5 Centre shaft	1000	2000	3000	4000
0	1500	1300	1100	900
10	1200	900	700	650
20	850	700	650	600
30	700	600	500	450
40	600	500	450	400
50	550	450	400	350

(1) related to a bearing service life LH= 10.000 h

With attachment bearing , Heavy-duty version



Perm. radial force F_R [N] (1)				
Bracing distance l [mm]	**Speed n [rpm]**			
21.5 Centre shaft	**1000**	**2000**	**3000**	**4000**
0	2700	2200	1800	1700
10	1650	1400	1300	1200
20	1300	1050	900	750
30	1000	700	650	600
40	700	600	550	450
50	600	550	450	400
60	550	450	400	350

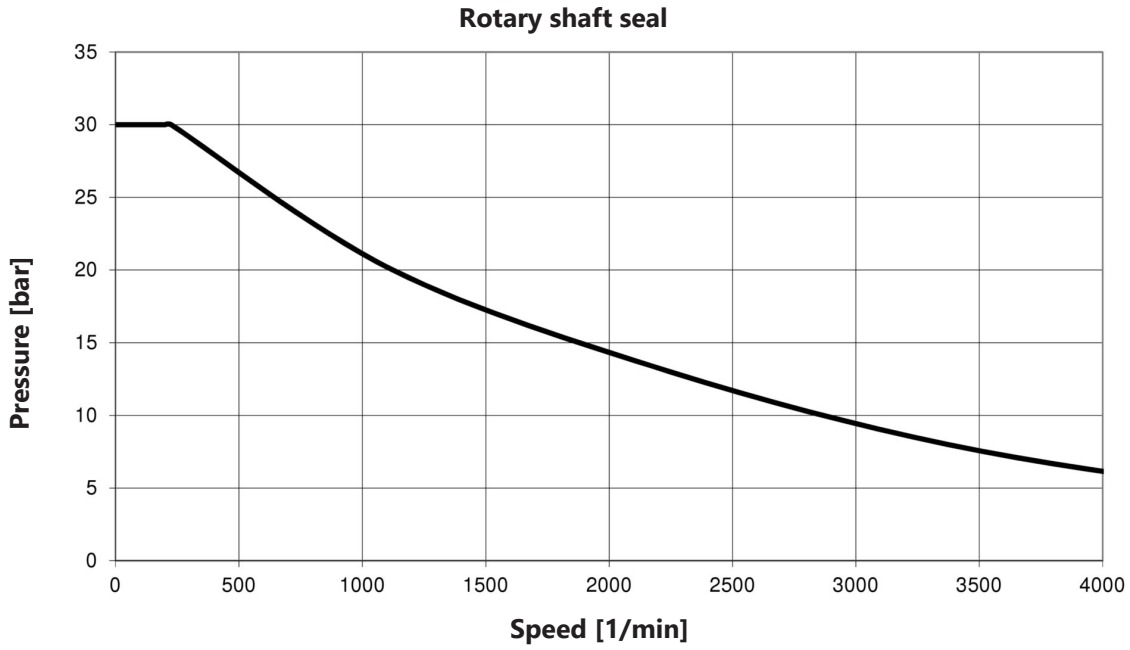
(1) related to a bearing service life LH= 10.000 h

4.4 Allowable pressures

4.4.1 Working pressure feed side and drain side

Nominal V_{gn}	Operating pressure				
	Drain side		Feed side		
	external leak oil discharge $p_{2\ max.}$	Internal leakage oil removal $p_{2\ max}$	$p_{max.}$ [bar]	p_N [bar]	p_D [bar]
	[bar]		(Maximum pressure)	(Nominal pressure)	(perm. continuous pressure)
5.5	120	Allocation speed - pressure [▷ 21]	300	280	250
6.3					
8					
9.6					
11					
14					
16			260	240	210
19			220	200	180
22			200	180	150
25					

4.5 Allocation speed - pressure



4.6 Permissible temperature range

Sealing material	Fluid temperature ϑ_m	
	$\vartheta_{m\ min}$ [°C]	$\vartheta_{m\ max}$ [°C]
FKM / P5000	-20	100
NBR / P5000		90
Sealing material	**Ambient temperature ϑ_u**	
	$\vartheta_{u\ min}$ [°C]	$\vartheta_{u\ max}$ [°C]
FKM	-15	60
NBR	-20	

NOTICE

Note media-specific properties.

4.7 Material data

Materials						
Shaft seal	**O-ring**	**Housing**	**End cover / Flange cover**	**Gears**	**Bearing**	**Seal, Pressure fields**
NBR		Aluminium (Al) (percent by weight Mg ≤ 7.5%) - - - EN-GJS-600	Aluminium (Al) (percent by weight Mg ≤ 7.5%) - - - EN-GJS-600	Case-hardened steel (16MnCrS5 - 1.7139)	Multi layer friction bearings (contains lead)	P5000 (TPU)
FKM						

4.8 Weight

Aluminium (Al) - Ductil cast iron						
Nominal V_{gn}	**Gear motor [kg]**					
	Flange type					
	A[2]	**G[1][2]**	**K**	**F[2]/ M / Q**	**L [2]**	**F with mounting bracket**
5.5	3.2	3.2	2.6	2.8	2.7	4.3
6.3	3.3	3.3	2.7	2.9	2.8	4.5
8						
9.6	3.4	3.4	2.8	3.0	2.9	4.6
11	3.5	3.5	2.9	3.1	3.0	4.7
14	3.6	3.6	3.0	3.2	3.1	4.8
16	3.8	3.8	3.2	3.4	3.2	5.0
19	3.9	3.9	3.3	3.5	3.4	5.1
22	4.1	4.1	3.5	3.7	3.6	5.3
25	4.3	4.3	3.7	3.9	3.8	5.5

[1] + 3.5 kg With attachment bearing

[2] + 1.1 kg With attachment bearing

Aluminium (Al)						
Nominal V_{gn}	**Gear motor [kg]**					
	Flange type					
	A[2]	**G[1][2]**	**K**	**F[2]/ M / Q**	**L [2]**	**F with mounting bracket**
5.5	2.1	2.2	1.9	1.8	1.8	3.3
6.3	2.2	2.3	2.0	1.9	1.9	3.5
8						
9.6	2.3	2.4	2.1	2.0	2.0	3.6
11	2.4	2.5	2.2	2.1	2.1	3.7
14	2.5	2.6	2.3	2.2	2.2	3.8
16	2.7	2.8	2.5	2.4	2.3	4.0
19	2.8	2.9	2.6	2.5	2.5	4.1
22	3.0	3.1	2.8	2.7	2.7	4.3
25	3.2	3.3	3.0	2.9	2.9	4.5

[1] + 3.5 kg With attachment bearing

[2] + 1.1 kg With attachment bearing

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 Motors with free shaft end

The prerequisite for trouble-free operation is suitable load transmission between the motor and the consumer.

By default a torsionally 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]		
Fastening screws	**Hexagonal nut**	
M10	**M12x1.5**	**M14x1.5**
50^{+10}	30	63
Screws/Nuts with min. strength class 10.9/12.9		

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 Feed line

A feed line that is not optimally planned can lead to increased noise emissions, cavitation and a reduction of the flow rate.

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

- The nominal width of the feed line must be selected so that the permissible operating pressure $p_{max.}$ is not exceeded on the feed side.
- Install a pressure relief valve with return to the reservoir as close as possible to the feed connection of the unit.
- Comply with the recommended flow velocity in the feed line (3 m/s - 5 m/s).

6.4.3 Drain line and leakage oil line

When designing the lines, comply with the following points:

- Install the lines as short as possible and in a straight line.
- The nominal width of the drain line must be selected such that the maximum permissible pressures are not exceeded.
- 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.
- Comply with the recommended flow velocity in the drain line (0.5 m/s - 1.5 m/s).

⚠ ATTENTION

Install a pressure relief valve with return to the reservoir between 2 series connected motors.

6.4.4 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

6.5 Change of the direction of rotation

A change in the direction of rotation is not possible.

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.

7.3 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 [▸ 38]**
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 product for leaks.
l) Check all fittings for leaks and retighten if necessary.

TIP

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

8 Removal

8.1 Safety instructions for disassembly

⚠ DANGER

Hazardous fluids

Danger to life when handling hazardous fluids

a) Comply with the safety data sheets and regulations on handling the hazardous fluids.

b) Collect and dispose of hazardous fluids so that no hazard is created for persons or the environment.

⚠ DANGER

Rotating parts

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

a) Before carrying out any work, disconnect any drives and actuators from the power supply or depressurise them.

b) Safely prevent restarting during the work.

⚠ WARNING

Exposed gears

Gearwheels can trap and crush fingers and hands.

a) Do not engage gearwheels.

⚠ WARNING

Failure of pressure bearing parts due to overload

Risk of injury from flying parts.

Risk of injury due to splashing fluids.

a) Before carrying out any work, depressurise the product and all connection pipes.

b) Securely prevent the pressure from being restored during work.

⚠ CAUTION

Hot surfaces

Burns of the skin on contact.

a) At temperatures ≥ 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

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

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

9.4.2 Check the operating pressure

The operating pressure is indicated by the pressure gauges.

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

9.4.3 Check the media temperature

The media temperature is measured through the temperature sensor.

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

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

9.4.4 Check the device temperature

Measure the surface temperature in the area of the bearing.

9.4.5 Check the equipotential bonding

Check the equipotential bonding for tight fit and proper functioning.

9.4.6 Check the condition of the operating fluid

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

- Replace operating fluid if necessary.

9.4.7 Noise test unusual noises

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

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

9.4.8 Cleaning

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

9.4.9 Visual inspection of leakage

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

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

9.4.10 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.

9.4.11 Visual check of the condition of housing parts

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

9.4.12 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.

9.4.13 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.

9.4.14 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.

9.4.15 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.

9.4.16 Replacing the plain bearings

These are replaced only by the manufacturer.

Contact the manufacturer.

9.4.17 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.

9.4.18 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		
Cavitation of the motor	Foreign bodies in the feed line/ drain line	Clean feed line/drain line
	Fluid temperature too low	Adjust the temperature of medium
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
Insufficient pressure **Insufficient flow rate**		
	Motor speed too Low	Check the unit design
		Check the design of the feed line/drain line
	Too low viscosity	Check the system design
	Closed/throttled blocking element	Open the shut-off element
	Foreign bodies in the feed line/ drain line	Clean feed line/drain line
	Wear/Tooth flank worn out	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 unit temperature		
	Pressure too high in association with a media viscosity that is too low	Check the system design
	Suction pressure too high	Reduce the pressure
	Excess fluid is being delivered into the supply tank via pressure relief valve under load	Check the unit design
	Wear	Replace the device

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

Unit does not start		
	Wrong direction of rotation	Correct the direction of rotation
	Minimum filling level in the reservoir tank undercut	Refill media
	Closed/throttled blocking element	Open the shut-off element
	Foreign bodies in the feed line/ drain line	Clean feed line/drain line
Consult the manufacturer in the event of unidentifiable faults		