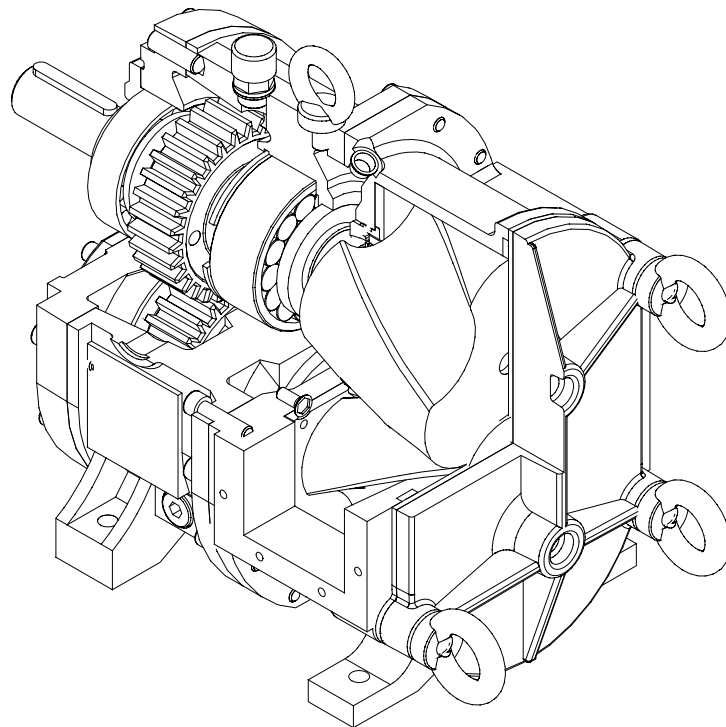


Operating and Maintenance Manual



Rotary Lobe Pump PL Series

Operating and Maintenance Manual Table of Contents

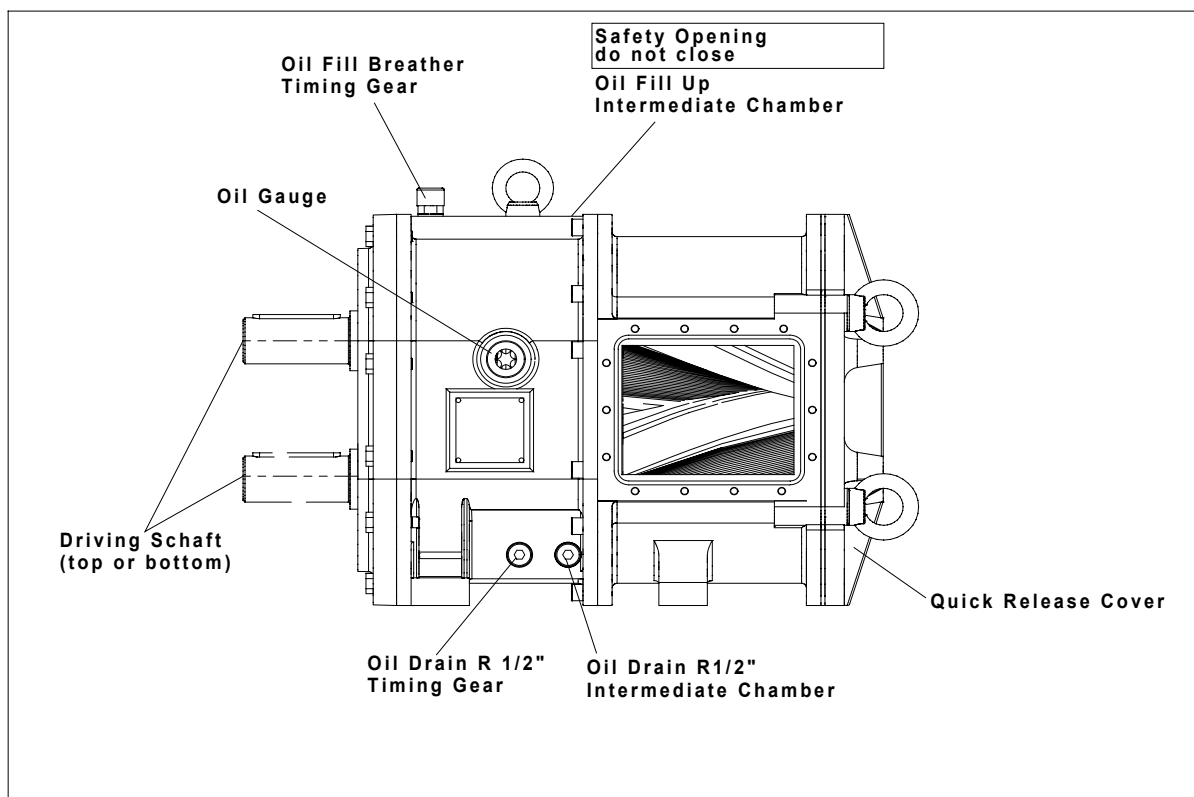
Rotary Lobe Pumps Models PL 100, PL 200, PL 300, PL 400

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1. Rotary Lobe Pump (Bare Shaft Pump)

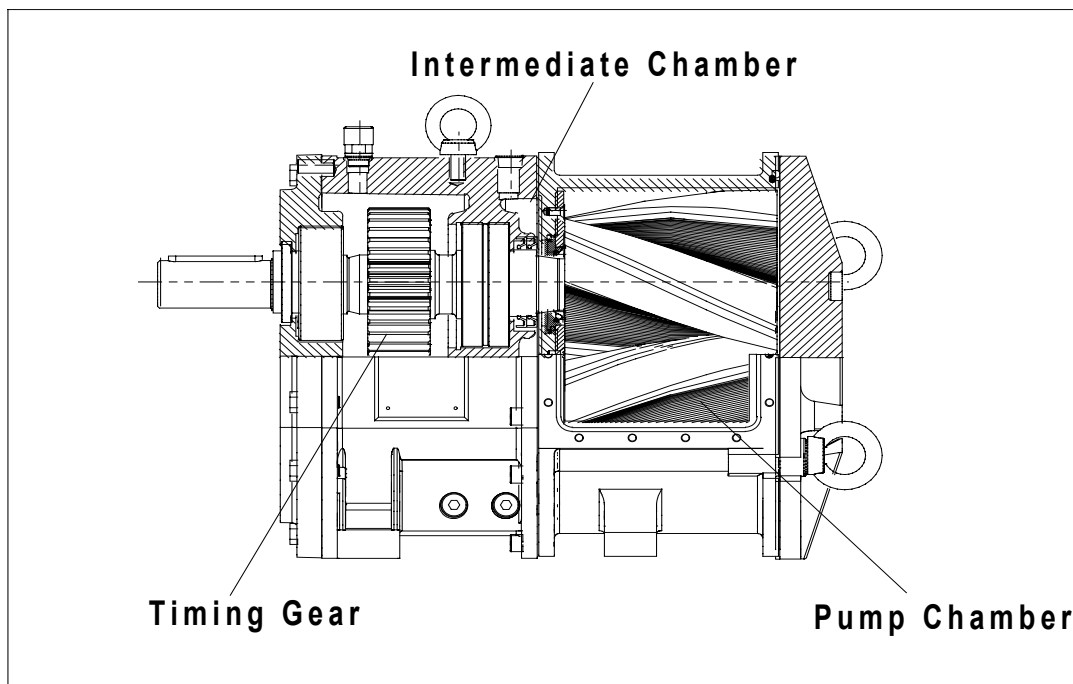
1.1 Construction of the Rotary Lobe Pump

Rotary Lobe Pumps of the PL Series are designed on a modular basis. Gear unit, axial wear plates, cover and mechanical seals remain the same throughout the series. The material of the fluid wetted parts of the pump unit should be adapted to the chemical and physical conditions of the fluid. The Code Number represents the parts used in the pump unit.



1.2 Flanges

The flange material is usually galvanized steel or stainless steel. Gaskets (see 7.2 Spare Parts List Pos. 25) have to be installed between the pump casing and the flanges. The material of the Gaskets should be adapted to the chemical and physical conditions of the fluid.



1.3 Drive Specification

The Rotary Lobe Pump needs a drive unit with suitable rotation speed and torque. The design of the drive unit (rotation speed and power) depends on the hydraulic conditions (i.e. capacity, pressure, viscosity) of the application.

1.4 Assembly of Aggregate

The Rotary Lobe Pump and the drive unit must be assembled free of distortion. The pump shaft and drive shaft have to be connected with a suitable coupling including guard for protection. After assembly of the pump aggregate on the foundation and in the pipe system the alignment of the coupling has to be controlled as part of the warranty. Follow also Operation and Maintenance Manual of Drive Unit!

Shaft Diameter of PL-Series:

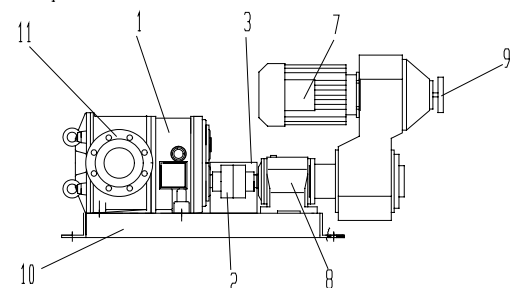
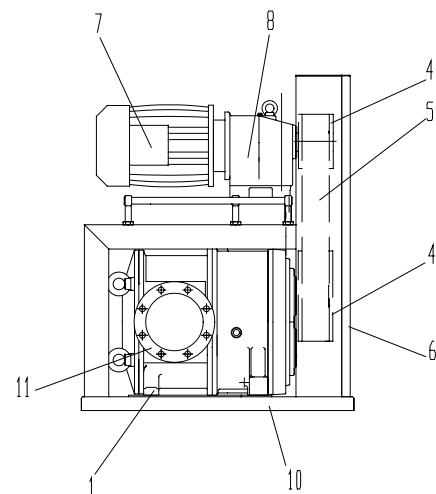
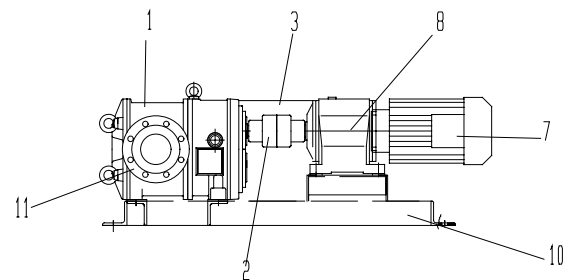
Shaft-Design	Diameter
Standard, DIN 748	35 mm (1,38 ")
PTO – Profile	1 3/8"

2. Complete - Aggregate

2.1 Standard Design

Rotary Lobe Pump and drive (standard: helical geared motor) fitted on common base (twist-free), made from galvanized steel, incl. elastic coupling and coupling guard. Also possible is an over-head mounted drive and a mechanically adjustable variable speed drive (VSD) for operation in a wide range of flow. The base of the aggregate has to be fastened on an even foundation.

- 1.) Rotary Lobe Pump
- 2.) Elastic coupling
- 3.) Coupling Guard
- 4.) V-Belt Disc
- 5.) V-Belt
- 6.) V-Belt Guard
- 7.) Motor
- 8.) Gear Reduction Unit
- 9.) Variable Speed Drive
- 10.) Base
- 11.) Flanges



2.2 Lubricant Level and Change

Before start up of the pump unit check oil level of timing gear at the oil gauge. The oil level must be at the middle of the oil gauge. The oil of the timing gear and the fluid of the of intermediate chamber has to be exchanged every two years or after 10.000 hours of operation.

The fluid level in the intermediate chamber must be at the level of the top shaft. The top opening of the intermediate chamber must remain open to the environment and must be protected against dirt with our plastic stopper. Submersible units must be equipped with a sensor for monitoring of the mechanical seal.

The functions of the intermediate chamber are

1. Lubrication and cooling of the mechanical seals and rotor/shaft connection
2. Detection of seal failures
3. Buffer zone to the sealed timing gear

Check fluid of intermediate chamber with every rotor change. When changing mechanical seals the intermediate chamber has to be flushed and cleaned with water before fill up of new fluid. Change the hydraulic oil at least every two years or after 10,000 operation hours.

Consider that atmospheric conditions (temperature, humidity, aggressiveness etc.) can change the interval of oil-changes.

Attention: Please check if the factory site filled lubricant types and/or listed oil types of the pump unit are allowable with the environmental regulations at the application site. If need please consult factory.

Oil quantity depending on model!

Rotary Lobe Pump	Timing Gear	Intermediate Chamber
Model	Oil quantity	Lubricant quantity
PL 100	App. 1,5 liter	App. 0,8 liter
PL 200	App. 1,5 liter	App. 0,8 liter
PL 300	App. 1,5 liter	App. 0,8 liter
PL 400	App. 1,5 liter	App. 0,8 liter

Factory site used oil types:

Timing Gear: Mobilgear 630
Intermediate Chamber: MOBIL AMBREX 68

Attached is a list of factory approved lubricant types for Rotary Lobe Pumps:

Oil Types Timing Gear

Type of lubricant	Ambient-Temperature	Viscosity	ARAL	BP	CASTROL	DEA	ESSO	KLüber	MOBIL	SHELL	TRIPOL
Minera Oil	-5...40 (normal)	ISO VG 220	Degol BG 220	Energol GR-XP220	Alpha SP 220 Alpha MW 220	Deagear DX SAE 85 W 90 Falcon CLP 150	Spartan EP 220	Klüberoil GEM 1-220	Mobilgear 630	Shell Omala Oel 220	Tribol 1100/220
Minera Oil	-15 25	ISO VG 100	Degol BG 100	Energol GR-XP 100	Alpha SP 100 Alpha MW 100	Deagear DX SAE 80W Falcon CLP 150	Spartan EP 100	Klüberoil GEM 1-100	Mobilgear 629	Shell Omala Oel 100	Tribol 1100/100
Minera Oil	-50...-15	ISO VG 15	Vitamol 1010	Bartran HV15	Hyspin AWS 15 Hyspin SP 15	Airkraft Hydraulic Oil 15	Univis J13	Isoflex MT 30 rot	Mobil DTE 11M	Shell Tellus Oel T15	Tripol 770

Lubricant Type Intermediate Chamber

Type of lubricant	Ambient-Temperature	Viscosity	ARAL	BP	CASTROL	DEA	ESSO	KLüber	MOBIL	SHELL	TRIPOL
Mineral Oil	-15...+40	ISO VG 68	Motanol HE 68	Energol CS 68	Magna 68	Renolin DTA 68	NURAY 68	Klüberoil GIM 1-68	AMBREX 68	SHELL Vitrea 68	Tripol 943 AW-68

Or alternative a mixture of Glysantine and water.

Attention: Oil level must be at the middle of the oil gauge



Oil level and oil change for drive follow instruction of Operation and Maintenance Manual of the drive unit.

3. Installation in the Process System

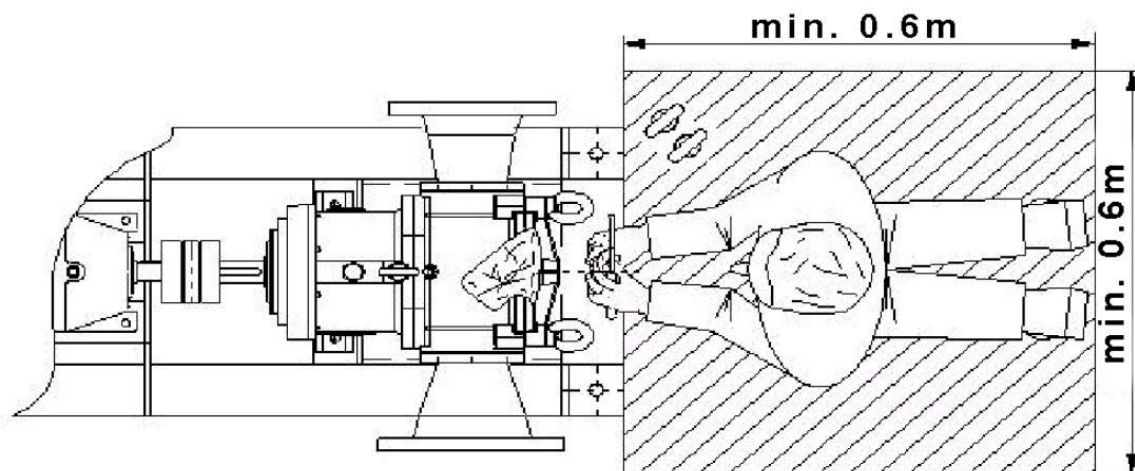
The Rotary Lobe Pumps are self-priming under certain conditions. To prevent cavitation install the pump with flooded suction or only with a small suction lift. With larger suction lifts and/or long suction pipes, control that the NPSH available of the system is higher in comparison to the required NPSH of the pump. The required NPSH value must be at least a 0,5 m under the NPSH available to prevent cavitation. With suction lifts over 2 m it is required to install a check valve at a suitable position in the pipe system.

Especially in pump installations with gaseous fluids it is important to prevent air bubbles on the suction side of the pump. If this is not practicable, install an air release valve close to the pump at a suitable position in the pipe system. This ensures a trouble free start up of the pump aggregate.

Install compensators (follow the mounting instruction of the compensator manufacturer) between pump flanges and system especially with thin-walled pipes. Also consider loads caused by changing physical conditions (i.e. temperature).

Connection flanges or valves are not allowed to load the pump unit.

Before start up check and if needed correct the alignment of the coupling. Uneven foundation surfaces have to be corrected.



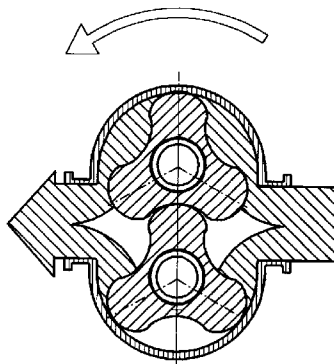
Recommended Maintenance Space

4. Start Up

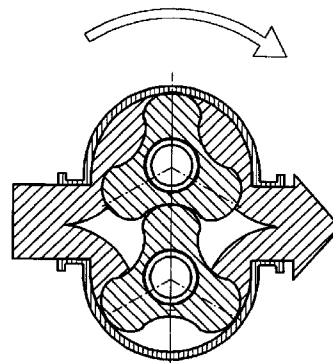
- Check the lubricant Levels (see 2.2)
- Check that the flange and pipe connections are sealed and not leaking.
- At pumps with infinite variable rotating flanges (i.e. mobile pumps) check the tightness of the clamps. Also check the quick connection flanges.
- Check all installed appurtenances in addition to the pump aggregate (i.e. VFDs, dry running protection, pressure gauges etc.).
- Check the rotation direction of the drive.

- **Prevent longer dry running in the start up phase. Fluid is needed for cooling of the pump.**
- **Do not operate pump in hose systems without supervision!**

- The Rotary Lobe Pump can operate in either direction. Check if rotation direction fits your needs.



Top shaft rotates counterclockwise.
Fluid flows in direction of arrow.



Top shaft rotates clockwise.
Fluid flows in direction of arrow.

Change rotation direction of the drive or change to the other driving shaft of the pump (if suitable) to reverse flow.

- Opening of valves.
- After a short time the Rotary Lobe Pump is displacing the nominal capacity. The pressure is not allowed to rise over the permissible pressure of the pipe system and of the Rotary Lobe Pump and shall not overload the drive unit.

The top opening of the **intermediate chamber** must remain open to the environment and must be closed for dirt protection with our **plastic stopper**. The closing off the top opening cause damages on the gear wheels and the bearings

5. Maintenance and Control

Before every start up check lubricant levels. In addition to, the Lubricant has to be changed in the named periods. (see 2.2).

5.1 Disassembly of Quick Release Cover and Flanges

Following are precautions before disassembly of quick release cover and flanges:

- Disconnect motor from power or remove drive from pump unit.
- Close suction and discharge valves.
- Loosen ring nuts of the quick release cover equally app. 5 mm and move the cover slowly of the pump casing. Pressure may still exist inside the pump.

Caution: Remaining pressure in the pump can splash fluid out of the gap between pump casing and cover. Cover gap with suitable rag.

5.2 Cleaning of the Rotary Lobe Pump

Remove quick release cover of the pump (see 5.1). Clean pump and flanges with suitable cleaning agent. Let the pump casing dry and use metal surface protection (i.e. grease) suitable for the rubber material of the rotors. Do not use grease with EPDM or SBR rotors.

5.3 Danger of Frost

The pump and pipe system must be secured against frost. As a supplement we can deliver a heated quick release cover.



Attention: Frozen fluid pieces from the pipe system can cause wear inside the pump, especially at the rubber - coating of the rotors.

6. Troubleshooting

6.1 Problem / Help

Pump does not start after shut down

Possible problem	Help
<ul style="list-style-type: none"> Solids have settled inside the pump after shut down. 	<ul style="list-style-type: none"> Cleaning of pump (see 5.2)
<ul style="list-style-type: none"> Rotors are swollen and are tight to the pump casing. 	<ul style="list-style-type: none"> Check temperature and chemical compounds of fluid. Change rotor to a suitable material.
<ul style="list-style-type: none"> Long fibers, foil or plastics are blocking the pump. 	<ul style="list-style-type: none"> Cleaning of pump and suction flange (see 5.1), plan the installation of a Multi-Chopper
<ul style="list-style-type: none"> Axial rotor tolerance misaligned 	<ul style="list-style-type: none"> Adjust axial rotor tolerance (see 6.6)
<ul style="list-style-type: none"> Power and/or torque too weak, drive too small 	<ul style="list-style-type: none"> Change to bigger drive

Pump does not self prime

Possible problem	Help
<ul style="list-style-type: none"> Wrong direction of rotation 	<ul style="list-style-type: none"> Change rotation direction of the drive
<ul style="list-style-type: none"> Suction pipe blocked 	<ul style="list-style-type: none"> Clean of suction pipe
<ul style="list-style-type: none"> Suction connection leaky 	<ul style="list-style-type: none"> Check gaskets and tightness of connections
<ul style="list-style-type: none"> Air bubble inside the pump or pipe system 	<ul style="list-style-type: none"> Fill up pump with fluid or release air out of the system
<ul style="list-style-type: none"> Rubber coating of rotors destroyed 	<ul style="list-style-type: none"> Replace rotors; check temperature and chemical compounds of fluid. Change rotor to a suitable material.

Pump cavitates

Possible Problem	Help
<ul style="list-style-type: none"> • Rotation speed too high: The cavities inside the pump are not filled (cavitation). 	<ul style="list-style-type: none"> • Decrease rotation speed and/or increase suction - pressure
<ul style="list-style-type: none"> • Solid is blocking suction side 	<ul style="list-style-type: none"> • Remove solid

Oil leakage at the top of the intermediate chamber

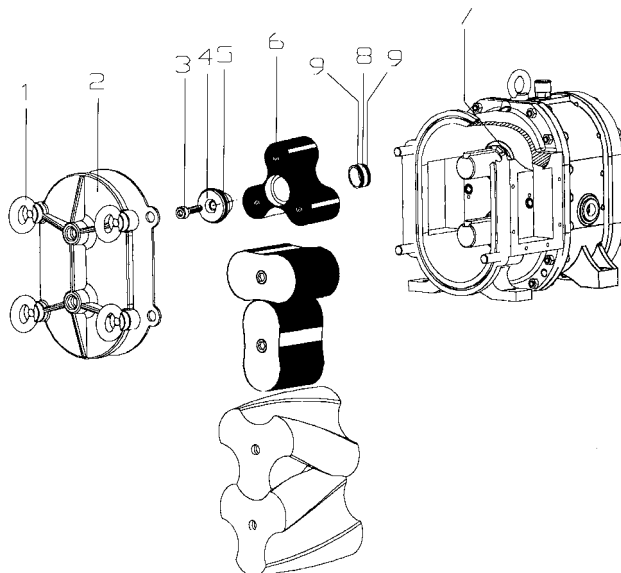
Possible Problem	Help
<ul style="list-style-type: none"> • O-rings of the mechanical seal are damaged 	<ul style="list-style-type: none"> • Replace the o-rings of the mechanical seal (see 6.4; 6.6)
<ul style="list-style-type: none"> • Mechanical seal defect 	<ul style="list-style-type: none"> • Change of mechanical seal (see 6.4; 6.6)

Technical information mechanical seal

The single acting mechanical seals used in Rotary Lobe Pumps consist of each two seal faces positioned against each other. The mechanical seals are quenched with the fluid (standard: hydraulic oil) in the intermediate chamber. With capillary and centrifugal force created by the rotation the oil is forced between the seal faces and lubricates the seal gap and removes developing heat from the mechanical seal. Pumped fluid is not needed to lubricate and/or cool the mechanical seal.

If the mechanical seals had to be opened during maintenance it is recommended to exchange the mechanical seal, even if the wear limit has not been reached.

6.2 Changing the piston type PL



- a) Switch off the pump and lock the drive unit. Seal off the suction and pressure pipes using the shut-off valves. (see 5.1)
- b) Uniformly unscrew the four ring nuts (1) by 5 mm and slide the lid (2) back a little to allow any pressure to get rid of.



Remaining pressure in the pump can splash fluid out of the gap between pump casing and cover. Cover gap with suitable rag.

- c) Unscrew the hexagon socket screws (3) of the two pistons using a 14 mm hexagon socket key. (Shafts can be retained by clamping with a part which has no sharp edges).
- d) Pull off the seal washer (4) in case they are existent.
- e) Unscrew the grub screws from the threaded bores (6), screw the piston withdrawal tool (see: 7. Spare parts list, item no. 90-91) into the threaded bores (6) and pull off the piston.
- f) Check (if necessary replace) and oil the O-rings (5) and (7).

g) Oil the shafts and slide on the new pistons. If several pistons have to be pushed on the shaft the sealing shell [8] with the two o-rings [check damages!] must be provided. Screw the grub screws back into the threaded bores (6) of the front pistons.

Note: Check the quality symbol on the front sides of the old and new pistons.

h) Unscrew the two screws (3) again and slide on the sealing washer (4).

i) Screw in the cylinder screw (3) and tighten with a torque wrench:

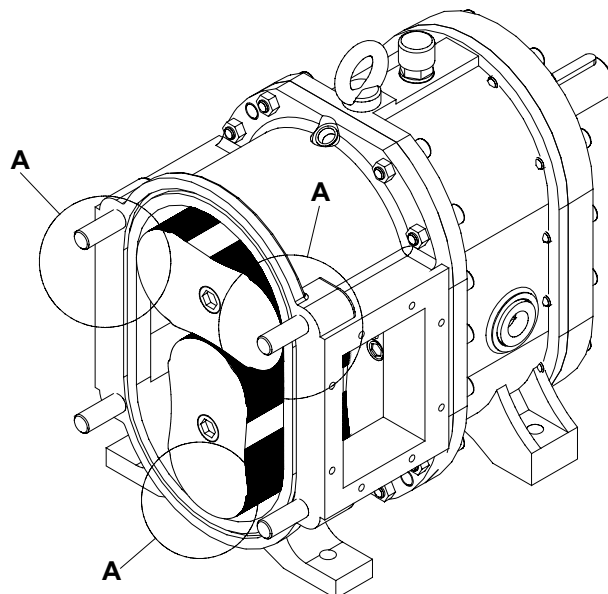
- Torque: 180 Nm for standard screws, 8.8
- Torque: 180 Nm for stainless steel screws, A4

j) Turn the piston by hand and check for easy running.

k) Replace the lid (2) and tighten the ring nuts (1).

l) Before restarting the pump, test it by carefully tipping the motor switch to ensure the function of the pump.

6.3 Readjustment of Rotary Lobes (Optional Feature)



- Shut down pump unit and close valves surrounding the pump (**see 5.1**)
- Loosen ring nuts of the quick release cover equally app. 5 mm and move the cover slowly of the pump casing. Pressure may still exist inside the pump. Clean or flush the pump casing

Caution: Remaining pressure in the pump can splash fluid out of the gap between pump casing and cover. Cover gap with suitable rag.

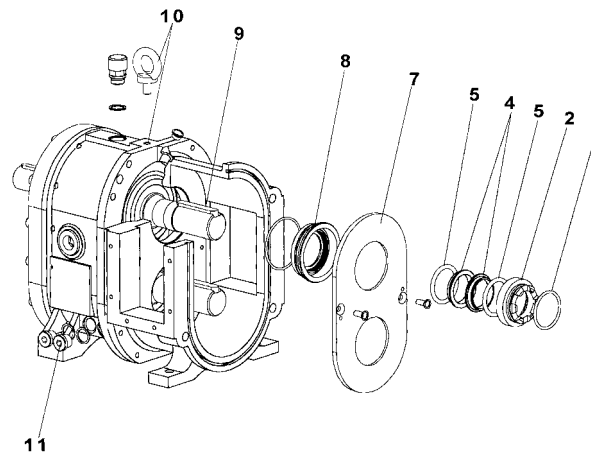
- The rotors may only be readjusted when being positioned as shown in the above illustration. Turn the shafts until the rotors are in a vertical and horizontal position.
- At the marked points carefully drill holes with a 10 mm twist drill through the rubber coating until you reach the socket head cap screw for adjustment.
- Readjust the rotors by turning the socket head cap screw until the sealing line between rotor radius and pump casing is readjusted to a tolerance of 0 – 0,1 mm. Use a thickness gage for checking the tolerances. During and after readjustment check easy movement of the rotors.



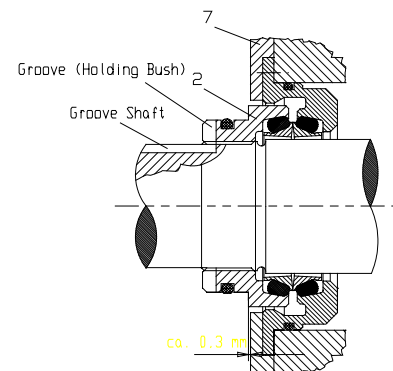
Attention: No possibility of reversing the adjustment!

- Control the cover O-ring and tighten the quick release cover with the wear plate to the pump casing with the ring nuts.
- Before restarting the pump, test it by carefully tipping the motor switch to ensure the function of the pump.

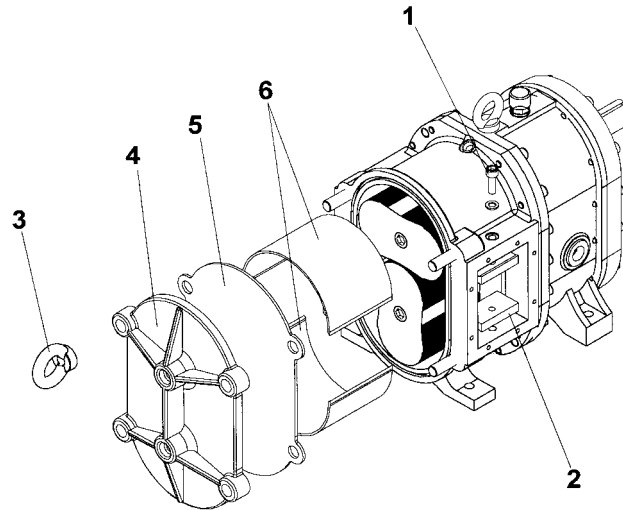
6.4 Exchange of Mechanical Seal



- a) Drain the lubricant from the intermediate chamber through the lubricant drain (11).
- b) Remove the rotors as described under 6.2.
- c) Remove the feather key (9) from the groove. Unscrew the holding bush with thread (2) by using the special tool (spare part list Pos. 95).
- d) Remove the mechanical seal rings (4) with O-rings (5) from the holding bush with thread (2) and from the stationary holding bush (8). Clean and oil the O-ring seats of the holding bushes. Flush the intermediate chamber for cleaning purpose.
- e) Push the O-rings (5) onto the new mechanical seal rings (4). Press one seal ring (4) into the stationary bush (8) and the other into the holding bush with thread (2).
- f) Screw the holding bush with thread (2) onto the shaft until aligned with the wear plate (7), then turn it backwards app. 1/6 revolution. The holding bush projects app. 0,3 mm to the wear plate. Ensure that one groove of the bush (2) is aligned with the groove on the shaft for the feather key (see 7.2).
- g) Place the feather key (9) into the aligned grooves of the holding bush with thread (2) and of the shaft.
- h) Check (replace if necessary) and oil the O-ring (1). Clean and oil the counter surfaces for the rotors.
- i) Refit the rotors (see 6.2)
- j) Fill fluid into the intermediate chamber through the oil inlet opening (10) (minimum to the level of the top shaft). Close intermediate chamber with plastic stopper for dirt protection.



6.5 Exchange of MIP Radial Liners (Optional Feature)



1. Disassembly of MIP Radial Liners

- a) Shut down pump unit and close valves surrounding the pump (see 5.1).
- b) Loosen ring nuts (3) of the quick release cover equally app. 1/5" and move the cover (4) slowly of the pump casing. Pressure may still exist inside the pump. Clean or flush the pump casing.

Caution: Remaining pressure in the pump can splash fluid out of the gap between pump casing and cover. Cover gap with suitable rag.

- c) Remove the axial wear plate (5).
- d) Now open the clamps (2) holding the MIP Radial Liners (6) in position by loosening the screws (1).

Attention: Check the CU-Rings and replace them if necessary.

- e) The MIP Radial Liners (6) can now be removed.

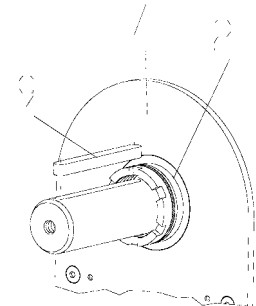
2. Assembly of MIP Radial Liners

- a) Clean the pump casing from any particles.
- b) Push the MIP Radial Liners (6) into the pump casing symmetrically.
- c) Now fasten the MIP Radial Liners (6) by equally alternate tightening of the clamps (2). Observe an equal tolerance at both sides of the flange openings.
- d) Check easy motion of the rotors, if necessary, correct the alignment of the MIP Radial Liners.
- e) Control the cover O-ring and tighten the quick release cover with the wear plate to the pump casing with the ring nuts.
- f) Before restarting the pump, test it by carefully tipping the motor switch to ensure the function of the pump.

6.6 Adjustment of the axial Tolerance of the Rotors

1. Remove the lobes as described under 6.2.
2. Take the feather key (9) out of the shaft groove.
3. a) The rotors are too tight to the **quick release cover**:

Turn the holding bush with thread (2) **clockwise** 1/6 revolution until the next groove is aligned with the shaft groove by using the special tool.



- b) The rotors are too tight to the **rear wear plate (7)**:

Turn the holding bush with thread (2) **counter clockwise** 1/6 revolution until the next groove is aligned with the shaft groove by using the special BÖRGER tool.



Do not unscrew the threaded bush (2) more than 1/6 turn! Danger of fluid leakage from the intermediate chamber!

4. Place the feather key (9) into the aligned grooves of the holding bush with thread (2) and of the shaft.
5. Refit the rotors (see 6.2).

6.7 Gland Packing

Please refer to separate operation and maintenance instructions.

6.8 Special Pump Constructions

Please refer to separate operation and maintenance instructions.

6.9 Spare Parts List

The Spare Parts List contains position numbers referring to the explosion drawing, the name of the part, material, article number (important for spare part orders) and quantity per pump. The Rotary lobe pump is furnished with fluid wetted parts according to the code number (see 7.1).

Exchange of Rotary Lobes

2/4/6/8x	rotor	Pos. No.:	9
2/4x	O-ring; 54 x 4	Pos. No.:	31
0/4/8/12 x	O-ring; 55 x 3	Pos. No.:	34

Exchange of Mechanical Seal

2x	mechanical seal	Pos. No.:	15
2x	O-ring 54 x 4	Pos. No.:	31
2x	O-ring 80 x 3	Pos. No.:	33
0/4/8/12 x	O-ring; 55 x 3	Pos. No.:	34

Exchange of wear plates

1x	front wear plate	Pos. No.:	10
1x	rear wear plate	Pos. No.:	11
2x	radial casing liners	Pos. No.:	12.1
1x	O-ring 792 x 7	Pos. No.:	30
2/4x	O-ring 54 x 4	Pos. No.:	31
0/4/8/12x	O-ring 55 x 3	Pos. No.:	34
2x	countersunk screw; M8 x 20	Pos. No.:	52

Exchange of fluid wetted parts

1x	pump casing	Pos. No.:	5
1x	front wear plate	Pos. No.:	10
1x	rear wear plate	Pos. No.:	11
2x	radial casing liners	Pos. No.:	12.1
4x	clamping part	Pos. No.:	12.2
2/4x	socket head cap screw; M10 x 25	Pos. No.:	12.3
4x	Sealing washer; A 10 x 16	Pos. No.:	12.4
2x	stationary holding bush	Pos. No.:	13
2x	holding bush with thread	Pos. No.:	14
2x	mechanical seal	Pos. No.:	15
2/4/6x	distance bushing	Pos. No.:	22
0/2x	cover disc	Pos. No.:	24
2x	gasket	Pos. No.:	25
1x	O-ring 792 x 7	Pos. No.:	30
2/4x	O-ring 54 x 4	Pos. No.:	31
2x	O-ring 80 x 3	Pos. No.:	33
0/4/8/12x	O-ring 55 x 3	Pos. No.:	34
2x	countersunk screw; M8 x 20	Pos. No.:	52
2x	hexagon head screw; M16 x 40	Pos. No.:	64
2x	sealing washer; A 21 x 26	Pos. No.:	74

As special tools use the withdrawal tool (Pos. No. 90/91), the special tool for the holding bush (Pos. No. 95).

7. Spare Parts regarding the Code Number

7.1 Code Number

The code number stamped to the pump nameplate identifies all fluid wetted parts the pump is furnished with. The code number is also recorded on the cover page of this operation and maintenance manual. To decode the pump code, refer to the attached code table.

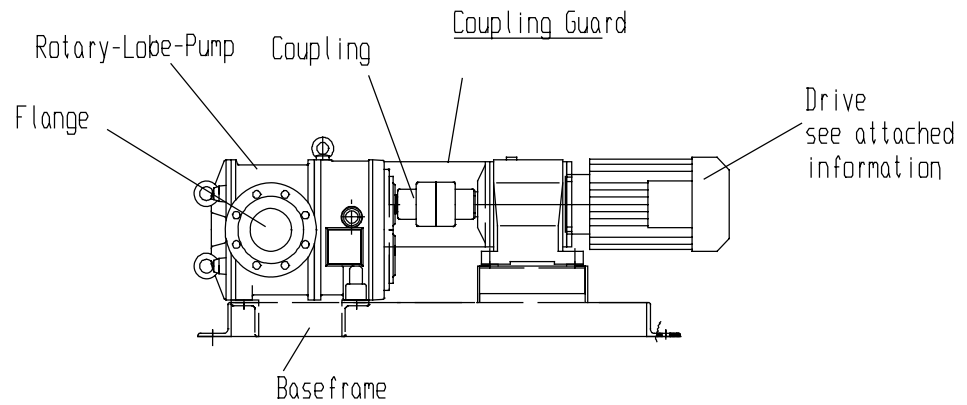
7.2 Spare Parts List

The attached spare parts list is universal and contains all available combinations. Please use the pump code for identification.

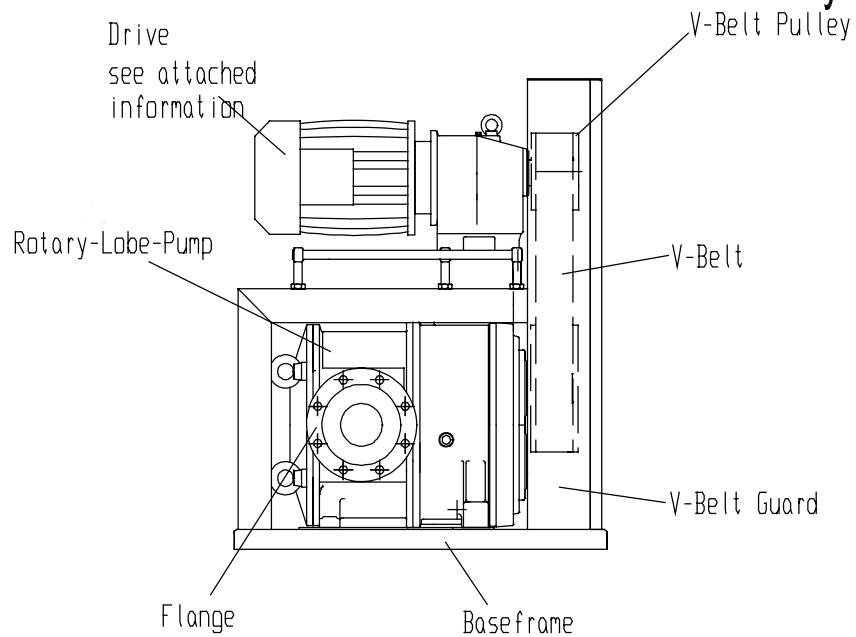
Please order required spare parts at (please mention the article numbers):

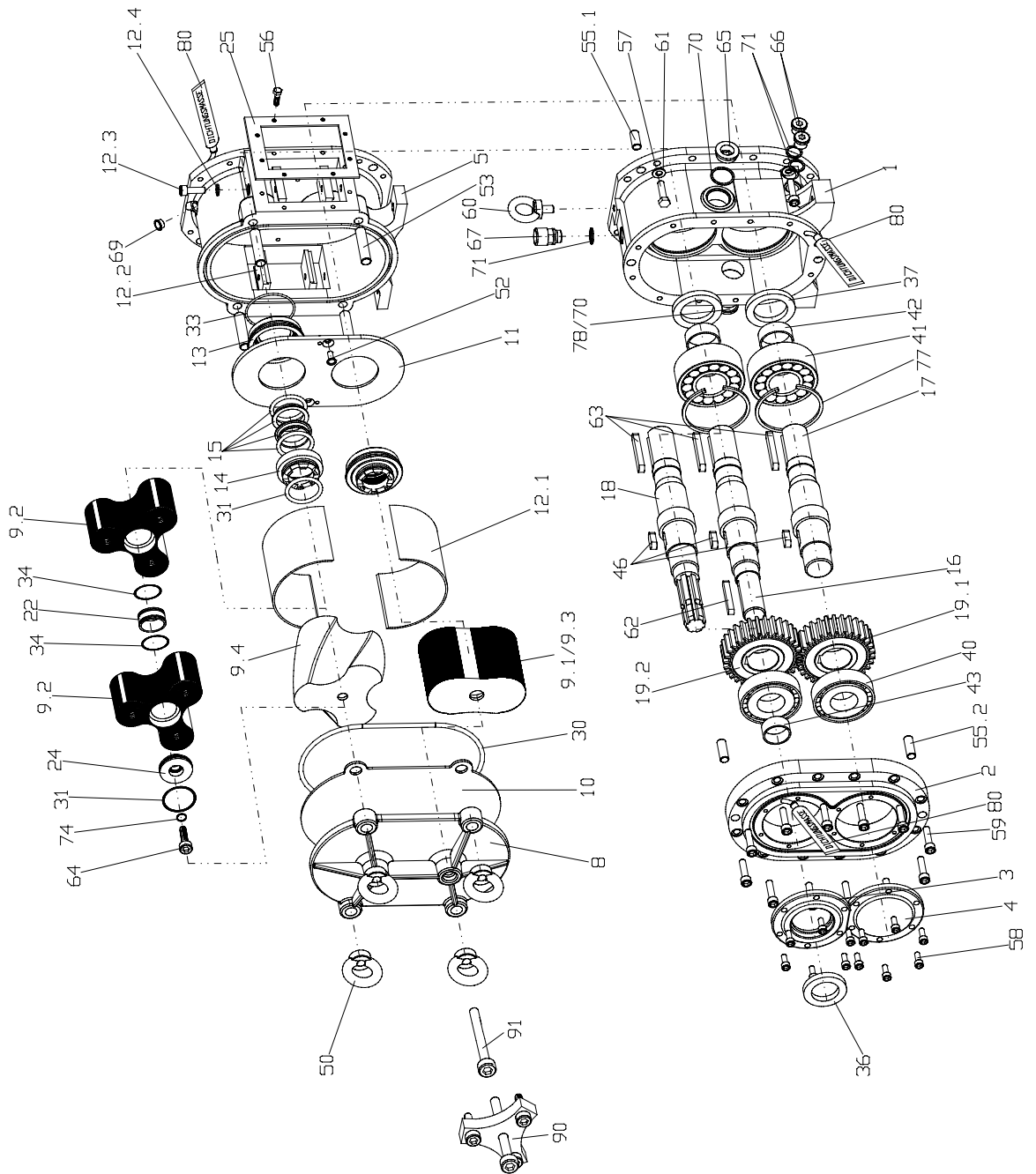
Transairvac Int Ltd
Units 12-17 Croft Road Industrial Estate
Newcastle-under-Lyme, Staffordshire
ST5 0TW
UK
E – mail : office@transairvac.com
Telefon : +44 (0)1782 710282
Fax : +44 (0)1782 710126

Standard-Assembly



Overhead mounted Drive Assembly





Spare part list PL pumps				quantity			
item	description	material	article-No.	100	200	300	400
1	gear case PL	0.6020	A20008	1	1	1	1
2	gear case cover	0.6020	A20108	1	1	1	1
3	bearing cap open	0.6020	A20208	1/2	1/2	1/2	1/2
4	bearing cap closed	0.6020	A20218	1/0	1/0	1/0	1/0
5	pump casing PL 100; FERROCAST	0.6025	B40118	1	-	-	-
	pump casing PL 200; FERROCAST	0.6025	B40218	-	1	-	-
	pump casing PL 300; FERROCAST	0.6025	B40318	-	-	1	-
	pump casing PL 400; FERROCAST	0.6025	B40418	-	-	-	1
	pump casing PL 200; nitrided hardening*	0.6025	B40228	-	1	-	-
	pump casing PL 100; stainless steel	1.4517	B40138	1	-	-	-
	pump casing PL 200; stainless steel	1.4517	B40238	-	1	-	-
	pump casing PL 300; stainless steel	1.4517	B40338	-	-	1	-
	pump casing PL 100; MIP; FERROCAST	0.6025	B40430	1	-	-	-
	pump casing PL 200; MIP; FERROCAST	0.6025	B40440	-	1	-	-
	pump casing PL 300; MIP; FERROCAST	0.6025	B40450	-	-	1	-
	pump casing PL 400; MIP; FERROCAST	0.6025	B40460	-	-	-	1
	pump casing PL 100; MIP; stainless steel	1.4571	B40130	1	-	-	-
	pump casing PL 200; MIP; stainless steel	1.4571	B40230	-	1	-	-
	pump casing PL 300; MIP; stainless steel	1.4571	B40330	-	-	1	-
8	quick release cover	0.7040	B41008	1	1	1	1
9.1	rotor; 2-lobe; PL 100	NBR	R82468	2	-	-	-
	rotor; 2-lobe; PL 100	EPDM	R82478	2	-	-	-
	rotor; 2-lobe; PL 100	FPM	R82458	2	-	-	-
	rotor; 2-lobe; PL 100	Haberflex; green	R82781	2	-	-	-
	rotor; 2-lobe; PL 100	Haberflex; red	R82782	2	-	-	-
	rotor; 2-lobe; PL 200	NBR	R82568	-	2	-	-
	rotor; 2-lobe; PL 200	EPDM	R82578	-	2	-	-
	rotor; 2-lobe; PL 200	FPM	R82558	-	2	-	-
	rotor; 2-lobe; PL 200	Haberflex; green	R82791	-	2	-	-
	rotor; 2-lobe; PL 200	Haberflex; red	R82792	-	2	-	-
	rotor; 2-lobe; PL 300	NBR	R82618	-	-	2	-
	rotor; 2-lobe; PL 300	EPDM	R82628	-	-	2	-
	rotor; 2-lobe; PL 300	FPM	R82608	-	-	2	-
	rotor; 2-lobe; PL 300	Haberflex; green	R82801	-	-	2	-
	rotor; 2-lobe; PL 300	Haberflex; red	R82802	-	-	2	-
9.2	rotor; 3-lobe	NBR	R82208	2	4	6	8
	rotor; 3-lobe	EPDM	R82308	2	4	6	8
	rotor; 3-lobe	FPM	R82408	2	4	6	8
	rotor; 3-lobe, auxiliary rotor	1.4571	R82908	-	2	4	6
	rotor; 3-lobe, front side	1.4571	R82908K	2	2	2	2
	rotor; 3-lobe; PL 100	PTFE	R82913	2	-	-	-
	rotor; 3-lobe; PL 100	PTFE, conductive	R82915	2	-	-	-
	rotor; 3-lobe; PL 200	PTFE	R82923	-	2	-	-
	rotor; 3-lobe; PL 200	PTFE, conductive	R82925	-	2	-	-
	rotor; 3-lobe; PL 300	PTFE	R82933	-	-	2	-
	rotor; 3-lobe; PL 300	PTFE, conductive	R82935	-	-	2	-
	O-Ring 23x3 FEP/FPM (PTFE-Rotor)	FEP/FPM	O45900	2	2	2	2
9.3	rotor; 2-lobe; readjustable; PL 100	NBR	R82668	2	-	-	-
	rotor; 2-lobe; readjustable; PL 100	EPDM	R82658	2	-	-	-
	rotor; 2-lobe; readjustable; PL 100	FPM	R82678	2	-	-	-
	rotor; 2-lobe; readjustable; PL 200	NBR	R82718	-	2	-	-
	rotor; 2-lobe; readjustable; PL 200	EPDM	R82708	-	2	-	-

* without MIP liners

Spare part list PL pumps				quantity			
item	description	material	article-No.	100	200	300	400
9.3	rotor; 2-lobe; readjustable; PL 200	FPM	R82728	-	2	-	-
	rotor; 2-lobe; readjustable; PL 300	NBR	R82758	-	-	2	-
	rotor; 2-lobe; readjustable; PL 300	EPDM	R82768	-	-	2	-
	rotor; 2-lobe; readjustable; PL 300	FPM	R82778	-	-	2	-
9.4	screw rotor; ccw; PL 100	NBR	R9323L9	1	-	-	-
	screw rotor; cw; PL 100	NBR	R9323R9	1	-	-	-
	screw rotor; ccw; PL 100	EPDM	R9324L9	1	-	-	-
	screw rotor; cw; PL 100	EPDM	R9324R9	1	-	-	-
	screw rotor; ccw; PL 100	FPM	R9325L9	1	-	-	-
	screw rotor; cw, PL 100	FPM	R9325R9	1	-	-	-
	screw rotor; ccw; PL 100	NR-SBR	R9326L9	1	-	-	-
	screw rotor; cw, PL 100	NR-SBR	R9326R9	1	-	-	-
	screw rotor; ccw; PL 200	NBR	R9327L9	-	1	-	-
	screw rotor; cw, PL 200	NBR	R9327R9	-	1	-	-
	screw rotor; ccw; PL 200	EPDM	R9328L9	-	1	-	-
	screw rotor; cw, PL 200	EPDM	R9328R9	-	1	-	-
	screw rotor; ccw; PL 200	FPM	R9329L9	-	1	-	-
	screw rotor; cw, PL 200	FPM	R9329R9	-	1	-	-
	screw rotor; ccw; PL 200	NR-SBR	R9330L9	-	1	-	-
	screw rotor; cw, PL 200	NR-SBR	R9330R9	-	1	-	-
	screw rotor; ccw; PL 300	NBR	R9331L9	-	-	1	-
	screw rotor; cw, PL 300	NBR	R9331R9	-	-	1	-
	screw rotor; ccw; PL 300	EPDM	R9332L9	-	-	1	-
	screw rotor; cw, PL 300	EPDM	R9332R9	-	-	1	-
	screw rotor; ccw; PL 300	FPM	R9333L9	-	-	1	-
	screw rotor; cw, PL 300	FPM	R9333R9	-	-	1	-
	screw rotor; ccw; PL 300	NR-SBR	R9334L9	-	-	1	-
	screw rotor; cw, PL 300	NR-SBR	R9334R9	-	-	1	-
10	cover liner plate	1.8714	B41018	1	1	1	1
	cover liner plate	1.4571	B41028	1	1	1	1
11	axial casing liner plate	1.7225	B41058	1	1	1	1
	axial casing liner plate	1.4571	B51054	1	1	1	1
12.1	radial casing liners; PL 100	1.8714	B41060	2	-	-	-
	radial casing liners; PL 200	1.8714	B41070	-	2	-	-
	radial casing liners; PL 300	1.8714	B41080	-	-	2	-
	radial casing liners; PL 400	1.8714	B41090	-	-	-	2
	radial casing liners; PL 100	1.4571	B41100	2	-	-	-
	radial casing liners; PL 200	1.4571	B41110	-	2	-	-
	radial casing liners; PL 300	1.4571	B41120	-	-	2	-
	radial casing liners; PL 400	1.4571	B41130	-	-	-	2
12.2	liner clamp; PL 100; left	1.0037	B41140	2	-	-	-
	liner clamp; PL 100; right	1.0037	B41143	2	-	-	-
	liner clamp; PL 200	1.0037	B41150	-	4	-	-
	liner clamp; PL 300	1.0037	B41160	-	-	4	-
	liner clamp; PL 400	1.0037	B41170	-	-	-	4
	liner clamp; PL 100; left	1.4571	B41270	2	-	-	-
	liner clamp; PL 100; right	1.4571	B41273	2	-	-	-
	liner clamp; PL 200	1.4571	B41280	-	4	-	-
	liner clamp; PL 300	1.4571	B41290	-	-	4	-
	liner clamp; PL 400	1.4571	B41300	-	-	-	4
12.3	socket head cap screw; M10 x 30	DIN 912, 10.9	Z93000	-	-	8	8
	socket head cap screw; M10 x 30	DIN 912, A4	Z93100	-	-	8	8
	socket head cap screw; M12 x 30	DIN 912, 10.9	Z49430	4	4	-	-
	socket head cap screw; M12 x 30	DIN 912, A4	Z49432	4	4	-	-

Spare part list PL pumps				quantity			
item	description	material	article-No.	100	200	300	400
12.4	sealing washer; 10x16x1,5	CU	Z31309	-	-	8	8
	sealing washer; 12x18x1,5	CU	K32505	4	4	-	-
	sealing washer 10x16x1,6; PTFE	PTFE	K34001	-	-	8	8
	sealing washer 12x19x1,6 PTFE	PTFE	K34002	4	4	-	-
13	stationary holding bush	1.7225	D45218	2	2	2	2
	stationary holding bush	1.4571	D45213	2	2	2	2
14	holding bush with thread	1.7225	D45114	2	2	2	2
	holding bush with thread	1.4571	D45214	2	2	2	2
15	mechanical seal; cast iron; O - Ring; NBR	Hartg./NBR	D45008	2	2	2	2
	mechanical seal; cast iron; O - Ring; EPDM	Hartg./EPDM	D45104	2	2	2	2
	mechanical seal; cast iron; O - Ring; Viton	Hartg./FPM	D45204	2	2	2	2
	mechanical seal; cast iron; O - Ring; FEP	Hartg./FEP/FPM	D45307	2	2	2	2
	mechanical seal; SSic/Sic; O - Ring; NBR	SSic/NBR	D45504	2	2	2	2
	mechanical seal; SSic/Sic; O - Ring; EPDM	SSic/EPDM	D45604	2	2	2	2
	mechanical seal; SSic/Sic; O - Ring; Viton	SSic/FPM	D45704	2	2	2	2
	mechanical seal; SSic/Sic; O - Ring; FEP	SSic/FEP/FPM	D45807	2	2	2	2
	mechanical seal; SiSic/NBR; O-Ring	SiSic/NBR	D45333	2	2	2	2
	mechanical seal; SiSic/EPDM; O-Ring	SiSic/EPDM	D45343	2	2	2	2
	mechanical seal; SiSic/FPM; O-Ring	SiSic/FPM	D45353	2	2	2	2
	mechanical seal; SiSic/FEP/FPM; O-Ring	SiSic/FEP/FPM	D45363	2	2	2	2
	O - Ring; 47,5 x 6,5 FEP/FPM	FEP/FPM	D55307	4	4	4	4
	O - Ring; 47,5 x 6,5 NBR	NBR	D55317	4	4	4	4
	O - Ring; 47,5 x 6,5 EPDM	EPDM	D55327	4	4	4	4
	O - Ring; 47,5 x 6,5 FPM	FPM	D55337	4	4	4	4
16	driving shaft; PL 100	1.7225	W41114	1/2	-	-	-
	driving shaft; PL 200	1.7225	W41214	-	1/2	-	-
	driving shaft; PL 300	1.7225	W41314	-	-	1/2	-
	driving shaft; PL 400	1.7225	W41414	-	-	-	1/2
17	short shaft; PL 100	1.7225	W41124	1/0	-	-	-
	short shaft; PL 200	1.7225	W41224	-	1/0	-	-
	short shaft; PL 300	1.7225	W41324	-	-	1/0	-
	short shaft; PL 400	1.7225	W41424	-	-	-	1/0
18	shaft with SAE - profile; PL 100	1.7225	W41104	2	-	-	-
	shaft with SAE - profile; PL 200	1.7225	W41204	-	2	-	-
	shaft with SAE - profile; PL 300	1.7225	W41304	-	-	2	-
	shaft with SAE - profile; PL 400	1.7225	W41404	-	-	-	2
19.1	gear wheel with parallel keyway	1.7225	E12111	1	1	1	1
19.2	gear wheel with parallel keyway	1.7225	E12110	1	1	1	1
22	distance bushing, 3-lobe; rotorl	1.7225	C79904	-	2	4	6
	distance bushing, 3-lobe; rotor	1.4571	C79919	-	2	4	6
24	cover disc for 3-lobe rotor	1.7225	C80004	2	2	2	2
	cover disc for 3-lobe rotor	1.4571	C80104	2	2	2	2
25	gasket; PL 100	NBR	F82018	2	-	-	-
	gasket; PL 100	EPDM	F82134	2	-	-	-
	gasket; PL 100	FPM	F82144	2	-	-	-
	gasket; PL 100	Klingerit	F82057	2	-	-	-
	gasket; PL 200	NBR	F82028	-	2	-	-
	gasket; PL 200	EPDM	F82234	-	2	-	-
	gasket; PL 200	FPM	F82244	-	2	-	-
	gasket; PL 200	Klingerit	F82067	-	2	-	-
	gasket; PL 300	NBR	F82038	-	-	2	-
	gasket; PL 300	EPDM	F82334	-	-	2	-

Spare part list PL pumps				quantity			
item	description	material	article-No.	100	200	300	400
25	gasket; PL 300	FPM	F82344	-	-	2	-
	gasket; PL 300	Klingerit	F82077	-	-	2	-
	gasket; PL 400	NBR	F82048	-	-	-	2
	gasket; PL 400	EPDM	F82434	-	-	-	2
	gasket; PL 400	FPM	F82444	-	-	-	2
30	O - ring; cover; 792 x 7	NBR	O45408	1	1	1	1
	O - ring; cover; 792 x 7	EPDM	O45424	1	1	1	1
	O - ring; cover; 792 x 7	FPM	O45418	1	1	1	1
	O - ring; cover; 792 x 7	FEP/FPM	O45438	1	1	1	1
31	O - ring; 54 x 4	NBR	O45508	2/4	2/4	2/4	2/4
	O - ring; 54 x 4	EPDM	O45524	2/4	2/4	2/4	2/4
	O - ring; 54 x 4	FPM	O45518	2/4	2/4	2/4	2/4
	O - ring; 54 x 4	FEP	O45537	2/4	2/4	2/4	2/4
33	O - ring; 80 x 3	NBR	O45708	2	2	2	2
	O - ring; 80 x 3	EPDM	O45724	2	2	2	2
	O - ring; 80 x 3	FPM	O45718	2	2	2	2
	O - ring; 80 x 3	FEP	O45737	2	2	2	2
34	O - ring; distance bushing; 55 x 3	NBR	O55705	-	4	8	12
	O - ring; distance bushing; 55 x 3	EPDM	O55715	-	4	8	12
	O - ring; distance bushing; 55 x 3	FPM	O55725	-	4	8	12
	O - ring; distance bushing; 55 x 3	FEP/FPM	O55735	-	4	8	12
36	oil seal; 45 x 70 x 10	NBR	S16508	1/2	1/2	1/2	1/2
37	double lip oil seal; 55 x 80 x 10 DUO	NBR	S16108	2	2	2	2
	double lip oil seal; 55 x 80 x 10 DUO	FPM	S16118	2	2	2	2
40	cylindrical roller bearing	DIN 5412	S14608	2	2	2	2
41	spherical roller bearing	DIN 635	S14508	2	2	2	2
42	hardened sleeve; 50 x 55 x 20	DIN 5405	S16008	2	2	2	2
43	hardened sleeve; 40 x 45 x 20	DIN 5405	S16708	1/2	1/2	1/2	1/2
46	parallel key; 14 x 9 x 32	DIN 6885	S14324	2	2	2	2
50	cover nut; M16	DIN 582	Z32208	4	4	4	4
52	countersunk screw; M8 x 20	DIN 7991	Z38208	2	2	2	2
53	screw stud M16 x 45	DIN 939	Z32108	4	4	4	4
55.1	dowel pin; 14 x 32	DIN 7979	Z33508	2	2	2	2
55.2	dowel pin; 14 x 40	DIN 7978	Z33608	2	2	2	2
56	socket head screw; M8 x 20;	DIN 933	Z39108	12	16	20	24
57	socket head screw; M10 x 30	DIN 933	Z39208	12	12	12	12
58	socket head cap screw; M8 x 20	DIN 912	Z39308	12	12	12	12
59	socket head cap screw; M10 x 40	DIN 912	Z39408	12	12	12	12
60	lifting eye bolt; M20	DIN 580	Z39508	1	1	1	1
61	spring washer; A10	DIN 127	Z39525	12	12	12	12
62	parallel key; driving shaft; A10 x 8 x 70	DIN 6885	Z39018	1/2	1/2	1/2	1/2
63	parallel key for 2-lobe rotors; 14 x 9 x 24	DIN 6885	S14338	2	-	-	-
	parallel key for 2-lobe rotors; 14 x 9 x 79	DIN 6885	S14348	-	2	-	-
	parallel key for 2-lobe rotors; 14 x 9 x 70/64	DIN 6885	S14358	-	-	2	-
	parallel key for 3-lobe rotors; 14 x 9 x 32	DIN 6885	S14324	2	-	-	-
	parallel key for 3-lobe rotors; 14 x 9 x 90	DIN 6885	Z39034	-	2	-	-
	parallel key for 3-lobe rotors; 14 x 9 x 80/63	DIN 6885	Z39044	-	-	2	-
	parallel key for 3-lobe rotors; 14 x 9 x 100/99	DIN 6885	Z39054	-	-	-	2
64	socket head cap screw; M16 x 40	DIN 6912, 10.9	Z39608	2	2	2	2
	socket head cap screw; M16 x 40	DIN 6912, A4	Z39603	2	2	2	2
65	oil sight glass, brass; R1"	brass	Z18508	1	1	1	1
66	oil drain plug; R 1/2"	DIN 908	Z19308	2	2	2	2
67	breather; R 1/2"	brass	Z19108	1	1	1	1
69	stopper B 146	PE	Z19508	1	1	1	1

