

PACKO ROTARY LOBE PUMPS

VERDER
passion for pumps



PACKO ZL SERIES

Hygienic rotary lobe pumps

Operation & maintenance manual

Packo
A VERDER COMPANY

CONTENTS

1	GENERAL	
1.1	General Information	1
1.2	Manufacturer	1
1.3	Copyright	1
1.4	Declaration of conformity	2
1.5	Intended Use	3
1.6	Type designation	3
1.7	Sound pressure level	4
1.8	Construction	5
1.9	Packaging & Transport	6
1.10	Storage	6
2	SAFETY	
2.1	DO'S and DON'TS	7
2.2	ATEX safety measures	8
3	INSTALLATION	
3.1	Installation	9
3.2	Adjustment Pressure Relieve Valve	9
3.3	Connection of the motor	11
3.4	Start Up	12
4	CHECK PUMP ROTATION	
4.1	Principle of operation	13
4.2	Direction of rotation	13
5	OPERATION	
5.1	Troubleshooting	14
5.2	Cleaning	15
6	MAINTENANCE	
6.1	Rotor Case Disassembly	16
6.2	Inspection	17
6.3	Seal Maintenance	18
6.4	Rotor Case Assembly	21
6.5	Rotor Clearance	22
6.6	Rotor Timing	23
6.7	Gearbox Maintenance	25
6.8	Lubrication	29
7	TECHNICAL INFORMATION	
7.1	Technical Data	30
8	EXPLODED VIEWS	
8.1	Exploded view ZL100, ZL200 and ZL300	31
8.2	Exploded view ZL400	34

1 GENERAL

1.1 GENERAL INFORMATION

Thank you for purchasing PACKO products!

This manual for the ZL series Rotary Lobe Pumps describes safe and appropriate operation during operating and in all life cycles.

This manual contains instructions for installation, operation, disassembly and assembly, maintenance procedures and troubleshooting.

Read and completely understand this manual to learn how to service these pumps prior to operating or servicing product and observe to pay special attention to the warnings.

This manual must always be available at the installation location since no liability will be assumed for any damage or operational malfunctions arising from non-compliance with these operating instructions.

1.2 MANUFACTURER

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Cardijnlaan 10
B-8600 Diksmuide
Belgium
Telephone: + 32 51 51 92 80
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E-mail: pumps@packo.com

1.3 COPYRIGHT

These operating instructions are written to support the installation, the use and the maintenance of the pump in accordance with the European machinery directive. They are originally written in Dutch, English, French and German by the manufacturer. All other languages are translations of the original operating instructions.

PACKO INOX LTD has the copyright on this document. These operating instructions may be reproduced in full in the operating instructions of the machine or installation in which the pump is installed and may be used for training personnel who must work on or with the pump. Any other publication, reproduction in full or parts thereof is prohibited.

Although these operating instructions have been carefully drawn up, they do not however cover all possible eventualities that can occur during the installation, operation or the maintenance of the pump. In any event, the pump must not be used for purposes other than those stated when ordering and for which the pump has been constructed, as this could result in physical damage and injuries.

1.4 DECLARATION OF CONFORMITY

Declaration of conformity according to annex IIA of the
“Machinery” Directive 2006/42 EC

We,

Packo Inox Ltd
Cardijnlaan 10
B-8600 DIKSMUIDE
BELGIUM

confirm that the Packo pump type, with serial number
fully complies with the Directive Machinery and with the (harmonised) standard EN 809,
ENISO12100.

It must be brought to your attention that our product is intended to be built into a machine,
and that, on the basis of the “Machinery” Directive, the complete (compound) machine can
only be applied after matching the stipulations of the European demands.

PACKO Inox Ltd, Cardijnlaan 10, B-8600 DIKSMUIDE, BELGIUM is authorized to make up the
technical construction file.

Date

.....

Signature:

.....

Wim Bonte
BU Manager pumps
Packo Inox Ltd

1.5 INTENDED USE

The pump should only be used for pumping the media it was selected for and within the limits specified in the technical datasheets. Any other application beyond the intended use or conversion of the pump without written agreement with the manufacturer shall be deemed to be not in accordance with the intended use.

The pump may only be started up for the first time if it has been ensured that all safety devices are completely fitted and functional.

If any areas are subject to have the risk of explosion, the relevant explosion-proof designed pumps should be used.

Intended use also covers compliance with the conditions of operation, servicing and maintenance specified by the manufacturer.


The pump is only to be put into operation filled with medium to be pumped.

Before starting up ensure that;

- Open the valves on the suction side completely to avoid cavitation and,
- Open the valves on the discharge side open completely to avoid exceeding the permitted differential pressure of the pump
- Discharge-side safety measures should be done (e.g. safety valve) to protect the pump from non-permitted excess pressure
- Protection against contact for hot, cold and moving parts must not be removed during operation

1.6 TYPE DESIGNATION

The type designation can be found on the pump name plate and also on both the order confirmation and customer invoice.

PACKO INOX LTD DIKSMUIDE BELGIUM		Packo	
TYPE:			
Mat. code:			
Year:	S/N:		kg
Max:	bar		°C
DO NOT RUN PUMP DRY OR AGAINST CLOSED VALVE			

Example (an X in the code denotes a special version):

Type: ZL/120-213/114

- ZL: pump series
- 120: pump type
- 213: Speed of the pump when the motor operates at 50Hz
- 11: motor power in kW multiplied by ten (11 = 1.1 kW)
- 4: number of poles of the motor

Mat. Code: (TL-120) D37SSVQ

- TL: Lobe type (TL = tri-lobe, BW = bi-wing, HL = heli-lobe)
- 120: temperature class of the pump (Deg. C)
- D: type of couplings (D = DIN 11851, B = BSP, E = DIN 2642, F = DIN 2576, R = RJT, S = SMS, I = IDF, T = Tri-Clamp ISO2852, M = Tri-clamp ASME BPE, O = Tri-clamp ISO, N = ANSI flanges, V = DIN 11864-1, A = DIN 11864-2)
- 37: housing size of the NORD reductor
- S: seal configuration (S = standard single seal, Q = quench)
- S: mechanical shaft seal materials (S = silicon carbide / silicon carbide, T = tungsten carbide / tungsten carbide)
- V: elastomer materials (E = EPDM, V = viton, M = teflon)
- Q: options (T = pump and motor reductor on trolley, U = pump and motor reductor on trolley with cover, P = bare pump, Q = pump and motor reductor aligned on base plate, R = pump and motor reductor aligned on base plate with cover)

Moreover, the year and week of construction, the pump serial number (to be stated when ordering spare parts), the weight, maximum operating temperature and maximum differential head are also marked on the name plate.

1.7 SOUND PRESSURE LEVEL

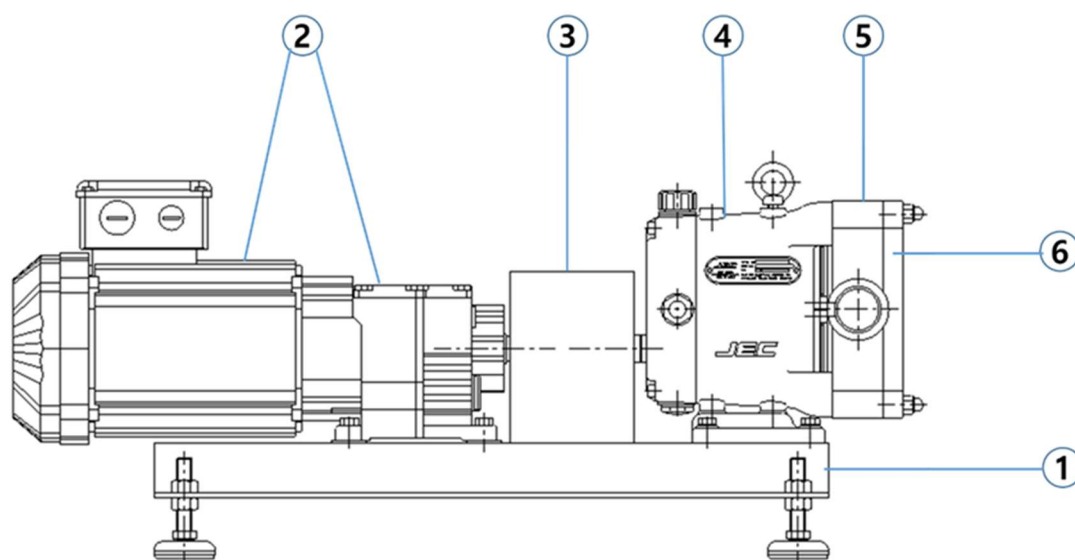
The sound-pressure level of the pump, operating at 50Hz without cavitation measured at 1m is less than 70dB(A). In order to minimize noise and vibration, no other parts of the machine may vibrate at the same time as the pump. The best solution is therefore to allow the pump to rest directly on the concrete floor, or to fit shock absorbers between the pump and the frame of the machine.

1.8 CONSTRUCTION

ZL series Rotary Lobe Pumps can be ordered with bare shaft, i.e. pumps without motor or base plate.



Or, ordered as a complete unit with drive motor, coupling & guard, common bed (or trolley) and layout described as below.



Example Layout of pumps with complete unit

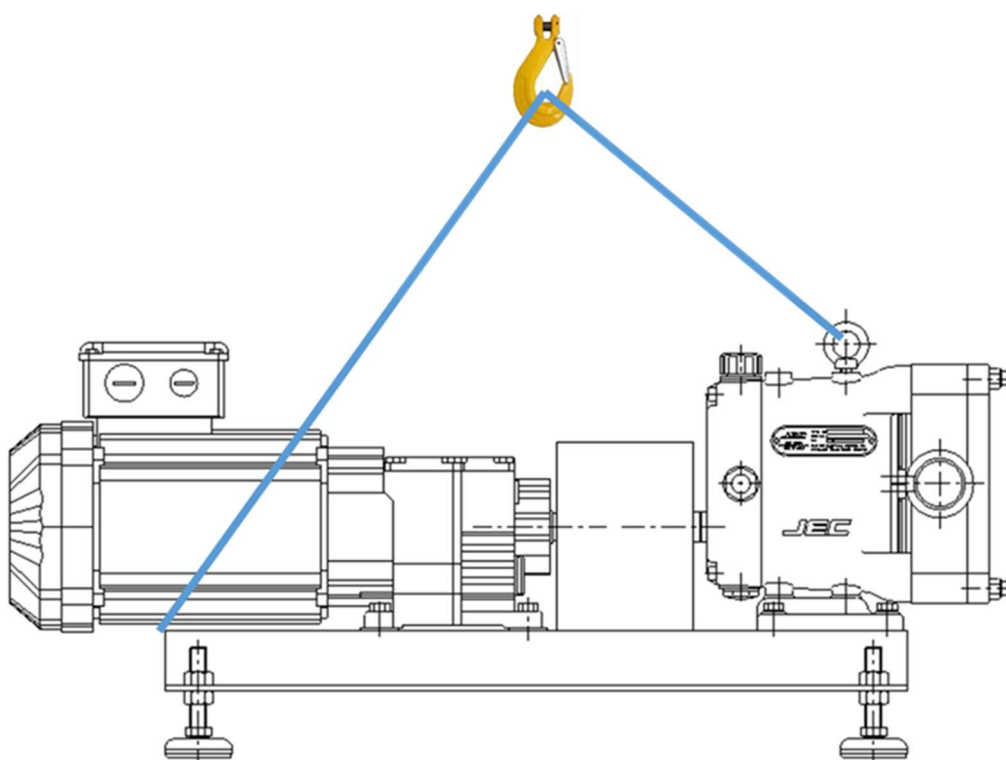
- ① Base plate, ② Drive unit, ③ Coupling & coupling guard,
- ④ Gearbox, ⑤ Rotor case with inlet & outlet ports, ⑥ Front cover

1.9 PACKAGING & TRANSPORT

ZL series are shipped in non-returnable wooden packaging. Unpack the pump/unit upon delivery and inspect it for visible transport damage. Any damage occurred during the transporting has to be immediately reported to the transport agent after receipt of the consignment. Do not put the damaged products into operation.

The pumps need to be transported and secured with care to ensure no damage caused. Lifting equipment (hoist) and load securing straps must be placed with sufficient load capacity. Make sure you set the pump down on a stable horizontal surface.

Below picture of complete unit with drive & common bed is shown as an example.



1.10 STORAGE

If the pumps need to be stored temporarily, they should be preserved under normal environmental conditions and must not be exposed to the weather for any significant period of time.

Heed below measures when a longer storage period is required.

Protect pumps against dust, dirt, water or any other harmful environmental factors.

1. Coat all non-painted surfaces with acid-free and resin-free grease.
2. Do not grease stainless steel parts and non-metallic parts.
3. Cover all openings of pressure and suction ports.
4. Drain water when using it as flushing/quench medium for the shaft seal.

2 SAFETY

2.1 DO'S & DON'TS

- DO** read and understand these instructions before installing or using the pump.
- DO** use PACKO spare parts when replacing a component of the pump.
- DO NOT** service the pump while it is running.
- DO NOT** place the pump in an application where the service ratings are exceeded.
- DO NOT** modify the pump. Modifying the pump creates unsafe conditions and voids all warranties.

SAFETY PRECAUTIONS WHEN INSTALLING THE PUMP

- DO** use an authorized electrician when connecting the pump.
- DO** observe the mechanical limits of the pump (refer to the pump performance sheet).
- DO** earth the base plate of the pump to avoid the potential buildup of static electricity.
- DO NOT** install a throttling valve in the suction line.

SAFETY PRECAUTIONS WHEN OPERATING PUMP

- DO** only qualified personnel should operate this pump.
- DO NOT** start the pump as long as someone is working on or touching the pump.
- DO NOT** touch the pump or the lines when pumping hot fluids or when performing Clean In Place (CIP) procedures.
- DO NOT** run the pump with BOTH the suction inlet and discharge outlet blocked. Running the pump with the inlet blocked will cause serious damage to the pump.
- DO NOT** check pump rotation with liquid in the pump.
- DO NOT** run the pump with the front cover removed. The rotors and rotor case could be damaged or may cause severe injury.
- DO NOT** operate the pump with removed safety guard or shroud.

SAFETY PRECAUTIONS WHEN SERVICING PUMP

- DO** ensure the pump is cool to touch before performing service.
- DO** relieve all pressure and drain all fluids from pump and connected piping before performing service.
- DO ENSURE POWER TO THE UNIT HAS BEEN UNPLUGGED PRIOR TO PERFORMING ANY PUMP MAINTENANCE OR CLEANING.**
- DO** exercise caution and wear protective clothing when using lye or acid for cleaning.

2.2 ATEX SAFETY MEASURES

Pump type	Risk	Dry running of mechanical seal (overheated seal faces are an ignition source)	Leakage (inflammable liquid can come into the atmosphere)
Flooded suction Pump	Liquid		
	Non ignitable liquid	<ul style="list-style-type: none"> Flushed mechanical seal or flow monitoring to be installed by the customer 	No danger
Ignitable liquid	<ul style="list-style-type: none"> Flushed mechanical seal or single seal with preventive maintenance by the customer 		

The flashpoint of a combustible liquid is the lowest temperature at which sufficient vapor is created above a combustible liquid so that it can ignite when mixed with air. However, be aware that the temperature of certain spots on the pump (e.g. the mechanical seal or motor) could be warmer than the temperature of the circulated liquid. Therefore, if the flashpoint of the liquid is above the temperature the liquid is pumped but below 135°C, it should also be considered as ignitable when considering the risk leakage.

Please be aware that if a mechanical seal runs dry, the temperature of the seal faces can rise above 400°C.

Pumps with flushed mechanical seal:

You have to make sure there is a continuous circulation of the flushing liquid and the motor is stopped immediately in case of lack of flushing liquid. Otherwise the mechanical seal can run dry and generate dangerous high temperatures. When a quench reservoir is applied, the level of the flushing liquid in the quench reservoir must be guarded by an ATEX approved level sensor. If the level becomes too high or too low, the pump must be stopped. The temperature in the quench reservoir should be guarded by an ATEX approved temperature sensor. The temperature of the flushing liquid should be kept below 75°C. If necessary an external cooling system should be used to keep the flushing temperature under 75°C. It is the responsibility of the end user to use a suitable flushing liquid for the mechanical seals. The mix of the flushing liquid and the pumped liquid must not create any dangerous or explosive gasses.
The pump should never run with closed valve.

Pumps with single mechanical seal:

You must monitor the flow (e.g. with an ATEX approved flow sensor on the inlet of the pump). If there is no flow detected, you must stop the motor immediately.
Leakage of an ignitable liquid is a serious safety risk. The end-user has to evaluate the consequences of the leak and adjust the check frequency for leak of the mechanical seal. In case leak is detected, the pump must be stopped and the mechanical seal has to be replaced. The mechanical seal has to be replaced preventively every 3000 operating hours.

The baseplate of the pump must be earthed in order to prevent a build-up of static electricity.

The pump must not pump liquids warmer than 108°C.

The pump should not be started before compliance with all these safety measures.

3 INSTALLATION

3.1 INSTALLATION

1. Mounting surface should be flat and level.
2. Ensure at least 0.5m clearance around the pump.
3. Normally, pump and drive unit are assembled on a baseplate. If you want another configuration, feel free to contact PACKO.
4. To check the direction of rotor's rotation, start and stop the motor for a short time.
5. Before connecting pipelines, check the location of suction and discharge.
6. Ensure the pipelines are connecting correctly and tightly.
7. The suction line should be kept as short as possible and present minimum friction loss.
8. To check working condition correctly, we recommend installing a pressure relieve valve and pressure gauge at discharge line.
9. Suction and discharge lines must be fully supported and installed so that no expansion or shock forces act on the pump which could lead to distortion.
10. Ensure sufficient clearance around the motor and pump.
11. The coupling alignment must be checked and readjusted if necessary.

3.2 Adjustment Pressure Relieve Valve

Instructions for the adjustment of the pressure relief valve for the PACKO rotary lobe pumps

Pressure ratios of the individual pump types:

There are two types of pressure relief valves for each model, high and low pressure. These differ in the type of spring used. To convert the pumps from high to low pressure or from low to high pressure, the spring marked in the drawing below must be replaced. The respective part numbers of the springs can be found in the parts list of your pump.

Classification of the spring types:

ZL110

0 bar ~ 10 bar: low pressure

12 bar ~ 20 bar: high pressure

ZL115 - ZL120

0 bar ~ 7 bar: low pressure

8 bar ~ 12 bar: high pressure

ZL220 & ZL225

0 bar ~ 7 bar: low pressure

8 bar ~ 12 bar: high pressure

ZL330 & ZL340

0 bar ~ 5 bar: low pressure

6 bar ~ 12 bar: high pressure

ZL440 AND ZL450

0 bar ~ 10 bar: only one spring type

(Due to the pressure limitation, the ZL440 - ZL450 has only one spring type up to 10 bar, here are other options.)

How it works:

The spring marked in red exerts pressure on the pump cover. The further this spring is compressed with the hex screw, which is also marked in red, the higher the pressure on the pump casing cover.

Example ZL110: If the screw is screwed in so far that the marked distance between the hex nut and the hex screw corresponds to 58 mm, the valve is opened at 2.5 bar.

ZL110

0 bar ~ 10 bar: low pressure

2,5 bar : 58 mm, 3 bar : 57 mm, 4 bar : 52 mm, 5 bar : 48 mm, 8 bar : 45 mm, 10 bar : 43 mm

12 bar ~ 20 bar: high pressure

12 bar: 51 mm, 14 - 15 bar: 50 mm, 16 bar: 49,5 mm, 18 bar: 49 mm, 20 bar: 48 mm

ZL115 AND ZL120

0 bar ~ 7 bar: low pressure

2 bar: 55 mm, 2,5 bar: 54mm, 4,5 bar: 50mm, 6 bar: 45,5 mm

8 bar ~ 12 bar: high pressure

7,5 bar: 52 mm, 8 bar: 51,5 mm, 10 bar: 50mm, 12 bar: 48,5 mm

ZL220 & ZL225

0 bar ~ 7 bar: low pressure

3,5 bar: 47 mm, 7 bar: 39 mm

8 bar ~ 12 bar: high pressure

8 bar: 48 mm, 10 bar: 46mm, 12 bar: 44 mm

ZL330 & ZL340

0 bar ~ 5 bar: low pressure

5 bar: 46,5 mm

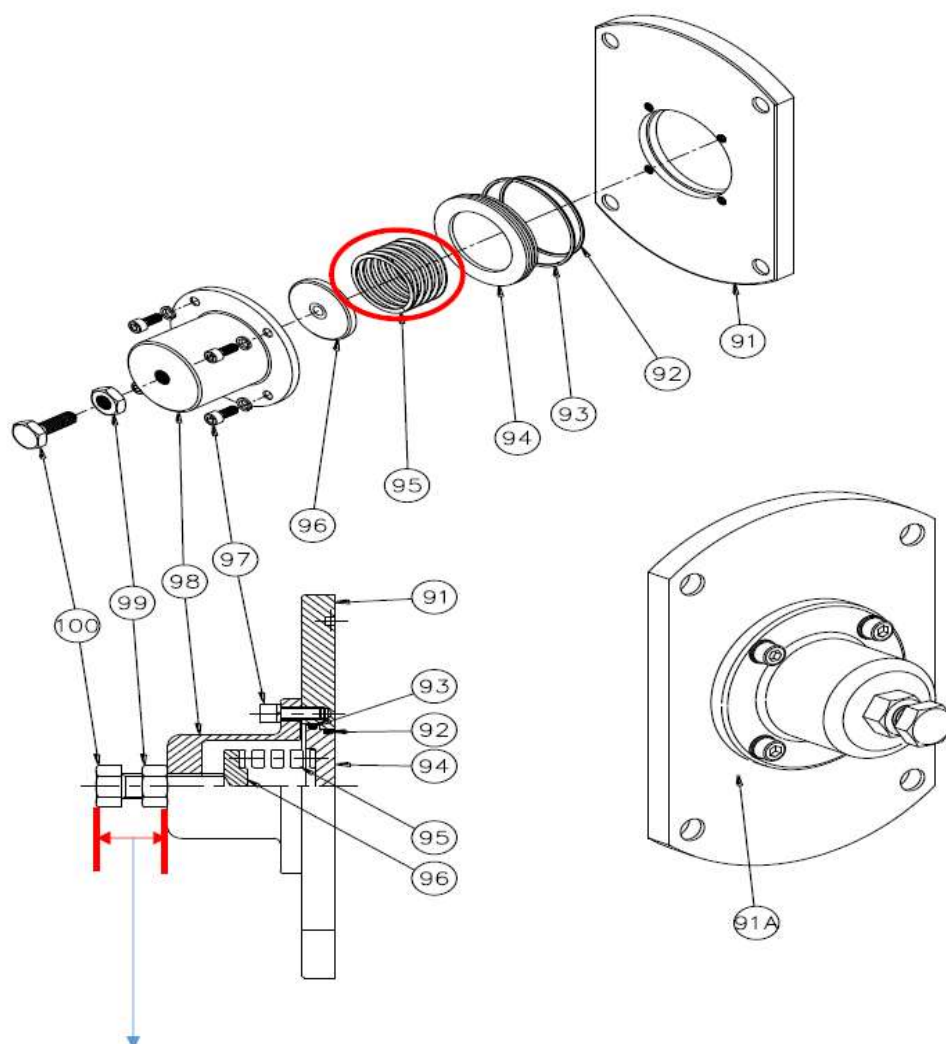
6 bar ~ 12 bar: high pressure

8 bar: 54 mm, 10 bar: 51mm, 12 bar: 47 mm

ZL440 UND ZL450

0 bar ~ 10 bar: only one spring type

3 bar : 58 mm, 5 bar : 54 mm, 7 bar : 53 mm, 8 bar : 51,5 mm, 9 bar : 50,5 mm, 10 bar : 48,5 mm



Distance in mm

3.3 CONNECTION OF THE MOTOR

The electrical connections may only be made when no electrical power is connected and by qualified personnel in accordance with EN 60204 and the local regulations. Special attention must be paid to optimal earthing of the motor; this must be performed in accordance with the applicable regulations in the relevant country. Check on the name plate of the motor whether the motor can operate from the available voltage and frequency.

The connecting cables and the protection system against excessive currents must be chosen according to the data on the name plate of the motor. The voltage drop during the starting of the motor may not exceed 3 %.

Tighten the nuts of the connector terminals in accordance with the torque values (Nm) stated below:

Terminal	M4	M5	M6	M8	M10	M12	M16
Steel	2	3.2	5	10	20	35	65
Copper	1	2	3	6	12	20	50

Do not install any washers or nuts between the cable lugs of the motor windings and the cable lugs of the connecting cables.

Inspect the seal of the gland. The gland must match the diameter of the connecting cable used. Bending of the cable beside the gland must not allow water to penetrate. (Allow the cable to be routed downwards when it leaves the motor.)

Connect the motor in star or delta according to the designation on the name plate of the motor and in accordance with the diagram that is installed in the terminal box. Do not connect the motor if you have any doubts regarding the interpretation of the connection diagram. If in doubt please contact PACKO. Never check the direction of rotation of the pump when the terminal box is open. The technician is responsible for complying with the regulations relating to electrical compatibility in the country where the pump is installed.

The voltage and the frequency stated on the name plate of the motor must be observed. (Tolerance of 5 % for the voltage, and 1 % for the frequency.)

For pumps whose power exceeds 7.5 kW, special starting provisions must be provided (star-delta starter, soft starter, or starting with frequency converter).

The installation of an overcurrent protection device is always mandatory.

3.4 START UP

1. Before connecting the suction and discharge pipe work the entire system must be thoroughly cleaned to prevent damage from welding, grinding and other residues.
2. Before starting, bump the motor to check if the motor fan is rotating clockwise or counterclockwise when seen from the motor back. If the motor fan cannot be seen, look through the pump case adaptor after removing motor shroud. (Bump means to momentarily apply power to the motor and then immediately remove power).
3. Direction of rotating must only be checked with a completely filled system. Where double mechanical shaft seals are installed the flush supply must be operational. Any dry running will result in seal damage.
4. The motor rating plate should be checked to ensure that it is in accordance with the available electrical supply. It is essential that the full load current is not exceeded to prevent motor overload.
5. Before start up any safety guards required by local statutory regulations should be fitted.
6. The pump must never be driven against a closed discharge valve. Please make sure the pressure at the discharge does not exceed the maximum pressure as indicated in the technical information further in this manual. The installation of a pressure relieve valve is recommended.

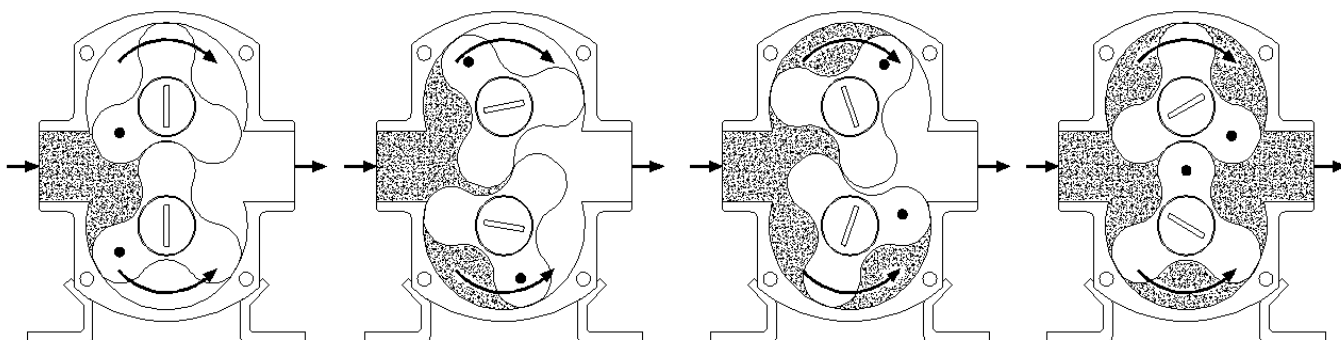
Pay attention to circumstances that could indicate pump cavitation:

1. Low pressure in the suction line due to bad suction conditions.
2. Air in the suction inlet line.
3. Pumping temperature is too high.
4. Pump is oversized.

4 CHECK PUMP ROTATION

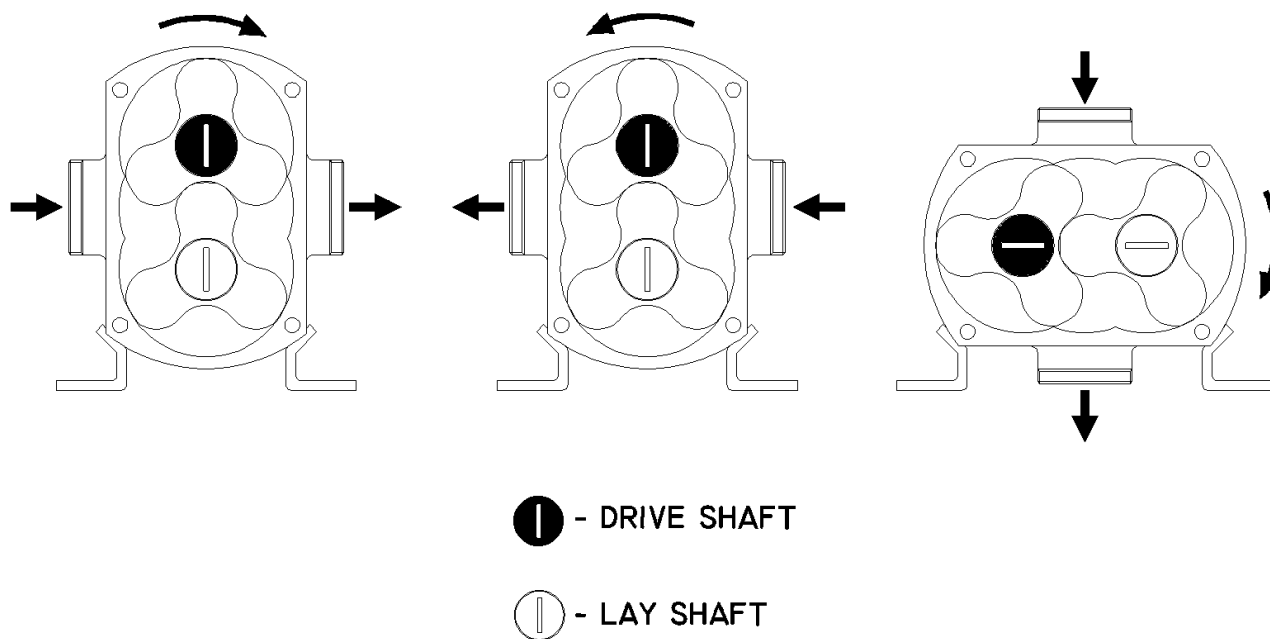
4.1 PRINCIPLE OF OPERATION

- The pumps are of the positive displacement rotary type with lobed rotors. The volume at the inlet increases when the rotors rotate and the product is drawn into the pump. It is then transported in the space between the lobes and the periphery of the pump housing to the discharge side. The volume between the rotors is reduced here and the product is forced out through the outlet.



4.2 DIRECTION OF ROTATION

- The direction of flow is dictated by the direction of rotation of the drive shaft. Reversing the direction of rotation will reverse the flow direction. Top and bottom shaft drive.



5 OPERATION

5.1 TROUBLESHOOTING

Problem	Cause	Solution
Pump not turning	Interruption of electrical power. Key sheared or missing. Coupler or belts are not connected. Pump shaft or gears sheared. Wrong rotation. Relief valve not properly adjusted.	Reset circuit breaker, check fuses. Replace. Replace or adjust. Replace. Reverse. Adjust valve.
Pump not priming	Valve closed in suction lines. Suction line clogged or restricted. Air leak in connections or seal. Pump speed too slow. Suction line does not remain flooded. Air lock. Excessive clearances in pump. Net inlet pressure low.	Open valve. Clear suction line. Repair leak. Increase speed. Install foot valve. Bleed suction line. Replace out of tolerance parts Increase suction pressure
Insufficient flow	Speed too low. Air leak.	Adjust speed as required. Repair leak.
Noisy operation	Cavitation. Viscous product. High vapor pressure, high temp. Leaks in piping or pump. Dissolved gas in product. Mechanical noise. Excessive weight from piping. Pump body distorted. Excessive discharge pressure. Worn bearing. Worn gears. Rotor-to-rotor contact.	Increase net inlet pressure. Slow pump, reduce product. Reduce temperature. Repair leaks. Reduce discharge pressure. Check tolerances. Support piping. Check align and level Reduce discharge pressure. Replace bearing. Replace gears Time rotors, replace twisted shafts, replace worn gears.
Pump overloads	Viscosity of product higher than expected. Higher pressure than expected.	Reduce pump speed, increase piping size. Reduce pump speed, increase pipe size.
Play between gears	Worn gear teeth. Gear loose on shaft.	Replace gear. Inspect gear key, keyway and shaft. If all are undamaged, retighten the gear retaining nut. Check for backlash.

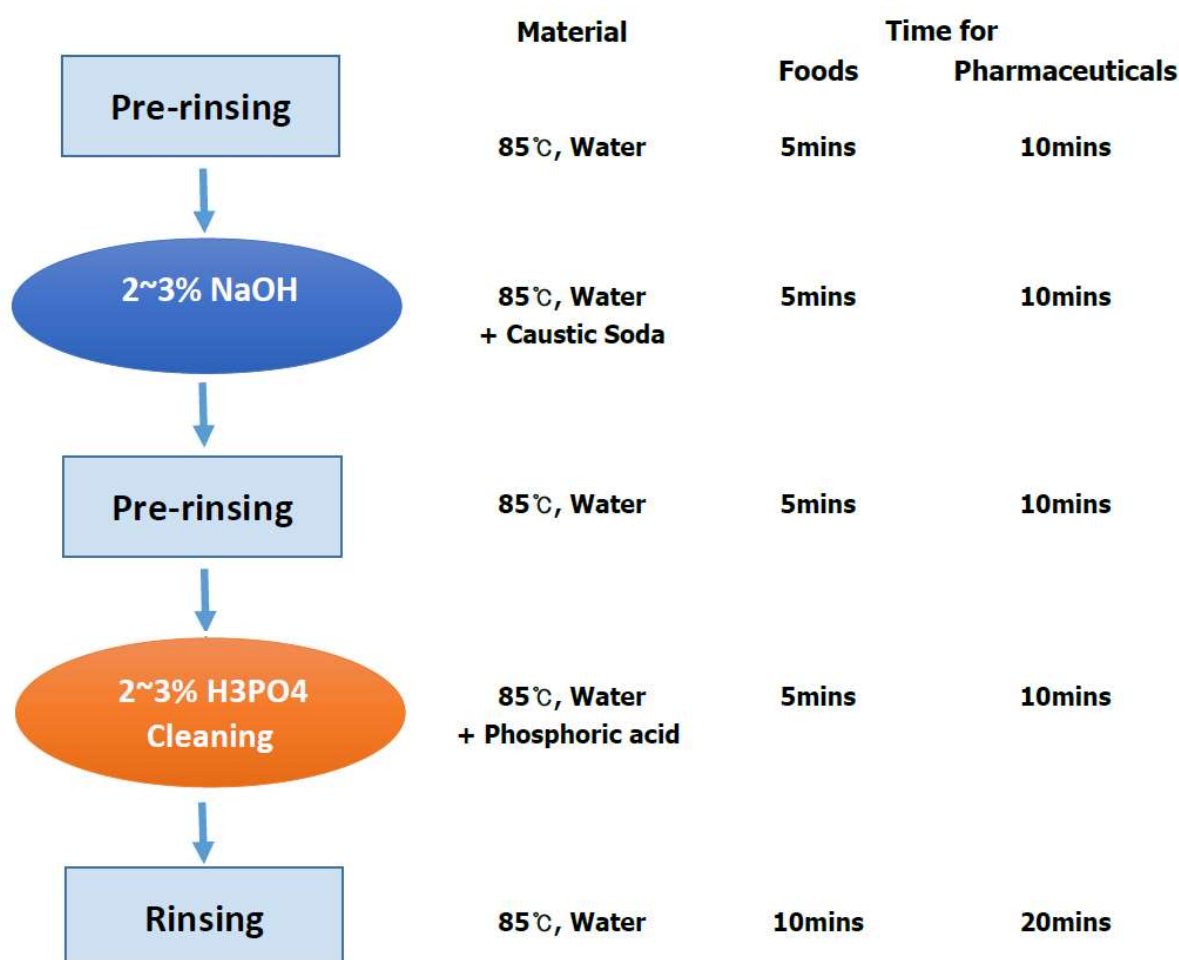
If assistance is required, please contact your local sales office with the following information:

1. Operating conditions.
2. Accurate description of default.
3. Model of pump and serial number.
4. If possible installations sketch of pump system.

5.2 CLEANING

1. Before cleaning the pump, wear rubber gloves and protective glasses.
2. While CIP and SIP process, do not touch the pump and pipelines.
3. Ensure velocity rate of the CIP solutions is adequate to clean entire circuit. For most applications a velocity of 1.5 m/sec is sufficient. For the CIP solution to achieve the proper velocity, the pump drive must have enough speed range and horsepower. The required inlet pressure also must be satisfied. If the pump does not supply enough CIP solution velocity, a separate CIP supply pump with an installed bypass may be used.
4. Refer to the below CIP and SIP process.

General C.I.P (Clean In Place) Process



* The working time is minimum time, the working time can be longer than indicated time, depends on the working conditions.

General S.I.P (Sterilization In Place) Process

1. Stop the pump's operation.
2. After cleaning the pump, sterilize it by using the steam at 115~120°C for 20-30 minutes.

* The working time is minimum time, the working time can be longer than indicated time, depends on the working conditions.

6 MAINTENANCE

6.1 ROTOR CASE DISASSEMBLY

Prior to removal of pump, the shut-off valves in the suction and discharge pipe work must be closed. If there is any risk that product may be hardened, crystallized or frozen in the pump it should be thoroughly drained and cleaned immediately after use. Similar attention must be applied to the seal flushing system. An authorized electrician should remove power before servicing to prevent from any unintended start of the pump.

Reference numbers are listed in the 'PARTS LIST' refer to the exploded view in chapter 8.

Start by removing the front cover after losing the cap nuts using the appropriate wrench. During this process, place all parts on a clean, protected surface with finished surfaces and seal faces facing up. If it is stuck, tap the cover off using a soft mallet.

And then, remove the cover O-ring and inspect.



Fig. 1

Remove rotor bolts using the special tool supplied with pump or appropriate size wrench. To remove rotor bolts, place the plastic bar between rotors to keep the rotors from moving as shown in Figure 2.

Turn in the drive rotor bolt to the counter-clockwise direction and extract rotor bolts and spring washers.



Fig. 2

Rotors can be removed from rotor case by pulling straight. It is important to be cautious with the rotors so that they are not damaged.



Fig. 3

Remove hexa-nuts on the four stud bolts securing the rotor case to the gearbox.



Fig. 4

After pulling out both rotors, the rotor case can be separated by sliding along the stud bolt and pulling out from the Gearbox. Inspect the rotor case for wear, clean and continue seal maintenance, if needed.



Fig. 5

In this step, handle and place carefully to keep the right track of position of the top & bottom shims, to avoid loss, damage or misalignment. They are installed accordingly at the factory for the particular parts.



Fig. 6

If it is stuck tight, tap alternately on the back of the inlet and outlet ports using soft mallet as shown in Figure 7.



Fig. 7

6.2 INSPECTION

While performing standard maintenance or cleaning, check for signs of damage or extreme wear. A simple inspection may show signs of a problem long before it becomes serious. Detection of such problems can avoid costly repairs and reduce down time.

1. Inspect O-rings and seals for re-use. Worn O-rings and seals should be replaced.
2. Inspect seal faces for chipping, scratches or cracks. Replace any seal faces if damaged.
3. Inspect shaft shoulder matched to rotors and other metal parts worn or damaged.
4. Inspect rotor galling sign among the rotor case front cover and rotors. Signs of galling must be removed or damaged parts must be replaced.
5. Inspect the rotor bolt groove for burrs. Burrs must be removed or damaged parts replaced.

6.3 SEAL MAINTENANCE

ZL series is designed with 'Front Loading Seal': the mechanical seal system can be changed or replaced without removing the rotor case.

Check & inspect all components of seal replacement kit carefully whether there is any damage or defect before installing. If any chipping, crack or scratch found during inspection, do not reuse them and replace the damaged one.

Below shows the Single mechanical seal (Figure 8), Double mechanical seal (Figure 9) and PTFE Triple lip seal (Figure 10).



Fig. 8



Fig. 9



Fig. 10

If only replacement for the seal rings is required, you can easily dismantle and pull them out of the rotor case and rotors by only removing the rotors, but without dismantling the rotor case thanks to the 'Front loading seal design'. Push the new seal rings into the rotor case and rotors.

The seal ring can be easily removed out of the rotor by using a small screw driver or pin as shown in Figure 11. This is common for the Single mechanical and Double mechanical seal.

Put the rotor face down on the table and pull out the seal ring from the rotor.



Fig. 11

Put the replacing NEW seal ring on the rotor and push it into the rotor (Figure 12).



Fig. 12

Single Mechanical Seal Maintenance

Remove the Seal ring from the rotor case & rotor (shown in Figure 13) and inspect them. If any seal is damaged, do not re-use and replace it.

Clean both shaft ends and the rotor case before assembling. Push the replacing NEW Seal ring into the rotor case O-ring and turn fit into the seal pins on the seal body after Rotor Case Assembly (chapter 6.4).



Fig. 13

Place the rotor case face down on the table and loosen the wrench bolts and washers using appropriate wrench.



Fig. 14

Pull out the single mechanical seal bases out of the rotor case. Insert the replacing NEW seal body into the rotor case and tighten the wrench bolts and washers.

And see 'Rotor Case Assembly' (chapter 6.4) to continue.



Fig. 15

Double Mechanical Seal Maintenance

Remove the Seal ring from the rotor case & rotor (shown in Figure 16) and inspect them. If any seal is damaged, do not re-use and replace it.

Clean both shaft ends and the rotor case before assembling. Slide and insert the replacing NEW seal ring into the rotor case after Rotor Case Assembly (chapter 6.4).



Fig. 16

After the rotor case has been removed (Figure 5), pull out and remove the Double seal rotating part from the shaft and inspect them. If any Double seal rotating part, Seal face or O-ring is damaged do not re-use and replace it.

Clean both shaft ends and the rotor case before assembling. Lubricate the replacing NEW Double seal rotating part O-ring and install it in the Double seal rotating part. Slide and insert the Double seal rotating part on the shaft making sure to line the slot on the Double seal rotating part to the pin in the shaft.



Fig. 17

Place the rotor case face down on the table and pull out carefully the Double seal body out of rotor case by hand shown in Figure 18.

Lubricate the replacing double seal body or O-ring and insert it into the rotor case and fit into the Seal pin properly. See 'Rotor Case Assembly' (chapter 6.4) to continue.



Fig. 18

Triple Lip Seal Maintenance

After the rotor case has been removed (Figure 5), pull out and remove the Ceramic coated sleeves from the shaft and inspect them. If any of them is damaged do not re-use and replace them.

Clean both shaft ends and the rotor case before assembling. Slide & insert the sleeves onto the shafts until it seats on the shaft shoulder. Align the slot in the shaft sleeve to the drive pin on the shaft.



Fig. 19

Place the rotor case face down on the table and loosen the wrench bolts and washers using appropriate wrench as shown in Figure 20.



Fig. 20

Pull the Lip seal out of the rotor case. And insert the replacing NEW Lip seal, making sure the holes in the seal to be lined up with the pins in the rotor case. Recap and tighten the Lip seal gland with wrench bolts. See 'Rotor Case Assembly' (chapter 6.4) to continue.



Fig. 21

During the assembly of the rotor case onto the Gearbox, the Lip seal will cause a tight insert of the shafts into the rotor case. Tap rotor case using soft mallet or fasten the Stud nut to make the assembly easier.

6.4 ROTOR CASE ASSEMBLY

Before installing the rotor case (31) to the gearbox (1A), make sure to clean the surface of the rotor case and the Gearbox and make sure to put the shims between rotor case and Gearbox as originally.

Assemble the rotor case (31) onto the Gearbox (1A) and secure the four hexa-nuts (46) with reference of below torque set value.

Series	ZL100	ZL200	ZL300	ZL400	ZL500
Nut size	M8	M10	M14	M20	M20
Torque (N·m)	30	34	80	120	120



Fig. 22

Assemble rotors onto the shaft, engaging the shallow groove with short spline in rotor and seal side first in to the shaft.



Fig. 23

Place the plastic bar between the rotors as shown in Figure 24. Tighten the first rotor bolt with a special tool to the below recommended torque.

Series	ZL100	ZL200	ZL300	ZL400	ZL500
Bolt size	M8	M14	M18	M18	M18
Torque (N·m)	17	35	48	56	56



Fig. 24

To tighten the second rotor, place the plastic bar on the opposite side of the rotor and tighten the second rotor bolt to the proper torque.

Be sure not to make any bur on the rotor bolt groove during this process. It may cause a serious problem such as galling on the rotor case and if it happened, it must be removed.

Install the new O-ring inside of the cover (32) and slide the cover over the studs. Thread cap nuts (33) on the studs and tighten using an appropriate wrench with reference of below torque set value in an opposing manner shown in Figure 25.

Series	ZL100	ZL200	ZL300	ZL400	ZL500
Nut size	M8	M10	M14	M20	M20
Torque (N·m)	14	17	30	52	52



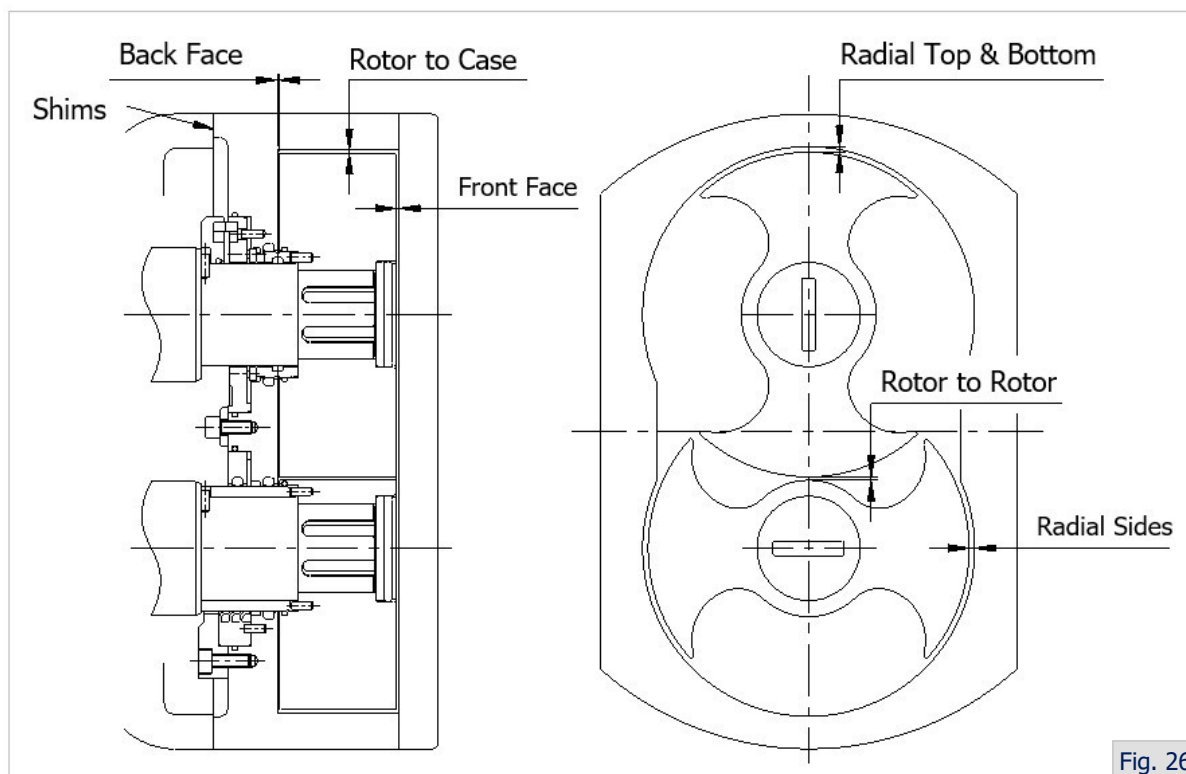
Fig. 25

Use feeler gauges and a depth micrometer to verify the back and radial clearances between the rotors and the rotor case. A depth micrometer should be used to verify the front clearance.

6.5 ROTOR CLEARANCE

Rotor clearance must be precisely maintained to provide maximum pumping efficiency, and to prevent contact between rotors, rotor case, and front cover during operation.

If pumping efficiency is lower than expected or if parts contact has occurred during operation (Within rated differential pressure), check the rotor clearances and adjust, if incorrect.



Standard Rotor Clearances (mm)					
Model	Back Face	Front Face	Radial Sides	Radial Top & Bottom	Rotor to Rotor
ZL105	0.07	0.07	0.07	0.07	0.1
ZL110	0.07	0.07	0.07	0.07	0.1
ZL115	0.15	0.15	0.27	0.12	0.15
ZL120	0.15	0.15	0.3	0.13	0.13
ZL220	0.2	0.2	0.3	0.15	0.2
ZL225	0.2	0.2	0.4	0.2	0.2
ZL330	0.3	0.3	0.4	0.2	0.3
ZL340	0.3	0.3	0.45	0.25	0.3
ZL440	0.35	0.35	0.55	0.3	0.4
ZL450	0.45	0.45	0.7	0.45	0.4

There are two areas of rotor clearances as illustrated following:

- Rotor tip clearance; not adjustable set by manufacturer

- Front and back face clearance; adjustable by shim

Rotor thickness and body depth are fixed at manufacturer. Therefore, with the correct rotor size selected, the only maintenance adjustment that can be made is the proportion of front and rear clearance. Measure the front clearance as follows:

1. The rotor to rotor housing back face clearance is maintained by the shim(s) (45).
2. Check that the rotor case is tight to the gearbox (1A). And check the rotor bolts (35) are tight.
3. Measure the clearance between the back face of the rotor case and the back of the rotor with a feeler gauge with reference of the above recommended back face clearance.
4. If incorrect, adjust by adding or removing shim(s) (45) from behind the rotor case.
5. Check each rotor and adjust as necessary.

6.6 ROTOR TIMING

Rotor timing is critical for the pump operation and must be precisely maintained to provide maximum pumping efficiency, and to prevent contact between rotors during operation. If pumping efficiency is below expectations, or if rotors contact during operation (within rated differential pressure), check rotor timing and adjust if incorrect. Also check rotor timing after any gearbox dismantling when the gears are removed and/or replaced.

Check Rotor timing as follows:

1. Assemble each rotor in its normal location on the drive shaft and the idle shaft. Assemble each rotor bolt and tighten hand tight.
2. Rotate the shafts 30 degrees and measure gap as illustrated by arrows in Figure 27. Rotate the shafts 60 degrees to the opposite direction and measure the gap as illustrated.
3. The Rotors are correctly timed when the gap measured at both locations are equal. If the gap is unequal, adjust the timing as follows.
4. Rotor timing is determined by the relative location of the two helical gears (14) on the shafts. Gear spacers (17) are used to adjust the location and the timing. When adjusting timing, move only one of the two gears.

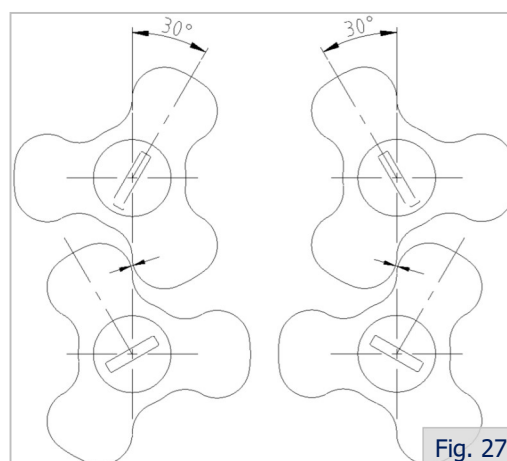


Fig. 27

5. Bend away the tab of the lock washer (12) on drive shaft, loosen the lock nut and remove gear. Insert a NEW gear spacer(6mm) on drive shaft. Place gear, lock nut and lock washer consequently and tighten referring the 'Gearbox Assembly' (chapter 6.7) Finally, adjust the rotor timing to be correct.

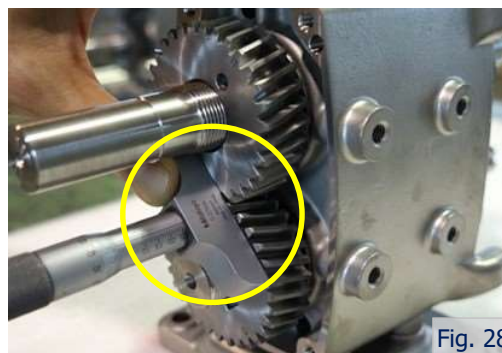


Fig. 28

6. If the rotor timing is correct, measure the position of the gear on the drive shaft relative to the gear on the idle shaft using a depth micrometer shown in Figure 28. Adjust the gap using a spacer and shim(s) according to the below cases.

- * If the gear on the driven shaft is more forward than the gear on the driving shaft, as shown in Figure 29, add a 6 mm spacer and shim(s) on the driven shaft to fill the gap.
- * If the gear on the driving shaft is more forward than the gear on the driven shaft, as shown in Figure 29, add a 5 mm spacer and shim(s) on the driving shaft to fill the gap.

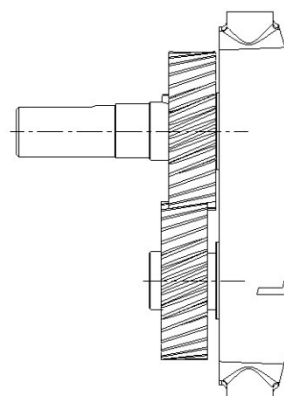


Fig. 29

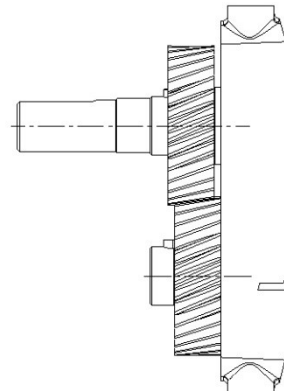


Fig. 30

7. Reassemble the idle shaft by the same procedure as drive shaft after adjustment.

6.7 GEARBOX MAINTENANCE

Gearbox Disassembly

1. Remove the drain plug and drain the oil.
Remove the shaft key (7) on the drive shaft and Gearbox cover bolts (6) from the rear cover (4).
2. Pull the cover off the drive shaft extension. If the cover stuck, use a soft mallet carefully to loosen it. Heavy hitting by mallet may cause damage to the cover and dowel (15).

Remove the rear cover oil seal (11) from the rear cover if the oil seal is needed to be replaced. Remove the paper gasket from the cover or Gearbox.



Fig. 31

3. Straighten the locking tab of the bearing lock washer. Remove the lock nut (12-1) and lock nut washer (12) from the drive shaft (8) & idle shaft (9).
4. Pull the two helical-gears (14) off from the drive shaft (8) & idle shaft (9).



Fig. 32

5. Remove the gear keys (10) for both drive & idle shafts.



Fig. 33

6. Remove the front bearing gland set bolts (23) as shown in Figure 34.

7. Place the gearbox (1), wet end (rotor side) down, under a press.

Protect the shaft ends with a wooden block and press the drive & idle shafts to pull out of the gearbox.

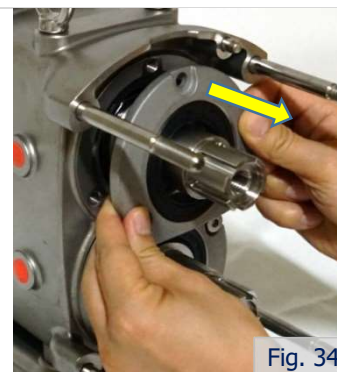


Fig. 34

-
8. Or pull out the drive & idle shafts by hitting with soft mallet the rear-end of each shaft on the gasket face of the Gearbox.



Fig. 35

-
9. Remove the bearings and spacers (16) together from the shafts by pressing the shaft out of them. Or remove bearings by puller shown in Figure 36.



Fig. 36

-
10. The taper roller bearings for ZL400 series must be kept together with in-outside spacer and separate for drive & idle shafts.



Fig. 37

Gearbox Assembly

1. Clean and lubricate the front & rear bearing areas of the drive & idle shafts with oil.

Fit the front bearing, spacer and rear bearing on the shaft sequentially by press (or heat up to 120°C (250F)).

Position the gearbox (1) with wet end side facing up and be sure to support the gasket face (downside) carefully in order not to damage it.

Clean and lubricate the front and rear bearing areas with oil.

Insert the shaft perpendicularly one by one to the gearbox properly. There should be a tight sliding fit between the gearbox and the bearing outer rings. Press the shaft into the gear case until bearings are fully seated.



Fig. 38



Fig. 39

2. Lubricate and install the front bearing oil seals set into the bearing glands.

Place the front bearing gland set on both shafts. Take care for the Oil seal spring inside of the gland set: it should not be deflected during insertion. Set the Bolt & washer, and tighten.



Fig. 40

3. Place the gear spacer (16) over the shafts.

Clean and lubricate the gear area of the shaft and the face of the lock washer with oil.

Align both shafts so that the gear keyways (10) are on to the 12 o'clock position shown in Figure 41.



Fig. 41

4. Place the gear, lock washer (12) and lock nut (12-1) sequentially onto the shafts and hand tighten.

In order to ensure proper rotor timing the gears must be installed along with the rotors. Slide the gears on the shafts aligning the slot on the gear with the gear key.



5. After the gears are installed, turn the shafts to make sure they turn freely and that the rotors (38) are timed correctly. (Rotor alignments are required)

Refer to chapter 6.6 'Rotor timing'.



6. Use a spanner wrench to tighten the gear lock nut on the drive shaft. You can install the rotors to hold the shafts in place while you tighten the nut.

Tighten the locknut (12) on the idle shaft, following the previous steps.

Lubricate and install the rear oil seal cover (11) onto the Gearbox (1).



7. Install the paper gasket (26) to the gasket face of the Gearbox and mount the rear cover assembly over the drive shaft extension onto the gearbox.
8. Set the cover bolts & oil window and fill the oil to the oil reservoir up to the middle range of the oil window. See the next page 'Lubrication' in detail.
9. Set the pressure relief valve.

6.8 LUBRICATION

Pump bearings and gear should run in an oil bath. Replacement of these bearings and gear wheels is recommended after 20,000 hours of operation.

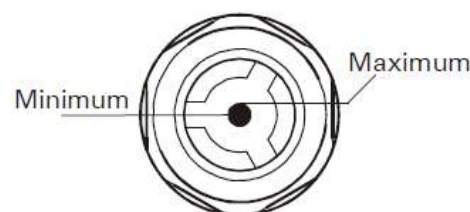
However, shorter change intervals are required for particularly difficult operating conditions, such as:

- High temperature variations
- High pressure fluctuations

Oil in Gearbox is recommended to be changed once a year or every 3,000 operating hours. However, the interval of changing oil should be adjusted according to the operating conditions. Check the oil level in the Gearbox weekly and top up the gear oil if necessary.

Filling quantities each series are shown as follow.

Series	ZL100	ZL200	ZL300	ZL400
Q'ty(liter)	0.34	0.95	2.30	5.40



'Shell Omala S2 G 150 or equivalent grade lubricants' are recommendable complying below Qualifications/Specifications.

- David Brown S1.53.101, 102, 103, 104
- Meets MAG (Cincinatti Machine) P34, 35, 59, 63, 74, 76-78
- ISO 12925-1 Type CKD, except ISO 680-1000. OSP 680 meets CKC
- DIN 51517-Part 3 (CLP), except ISO 1000
- AGMA 9005-EO2 (EP)
- US Steel 224

Food Grade Gear Oil

We recommend 'NEVASTANE XSH (150 to 460) or equivalent Synthetic (PAO) gear oils' suitable for incidental food contact complying with below Qualifications/Specifications.

- The composition of the oils complies with the FDA chapter 21 CFR, 178.3570.
- NSF H1 registered (No 147305, No 147302, No 147303, No 147304)
- Kosher, Halal and ISO 21469 certified.
- International specification: ISO 12925-1 CKD.
- DIN 51517-3 CLP
- DIN 51354-2 - FZG A/8, 3/90°C - Fail stage > 12
- ASTM D 4172 - 4 ball test - wear (scar diameter) - 0.3 mm.

7 TECHNICAL INFORMATION

7.1 TECHNICAL DATA

- Maximum outlet pressure:

Pump type	Max outlet pressure (bar)
105	20
110	20
115	12
120	8
220	12
225	8
330	12
340	8
440	12
450	8

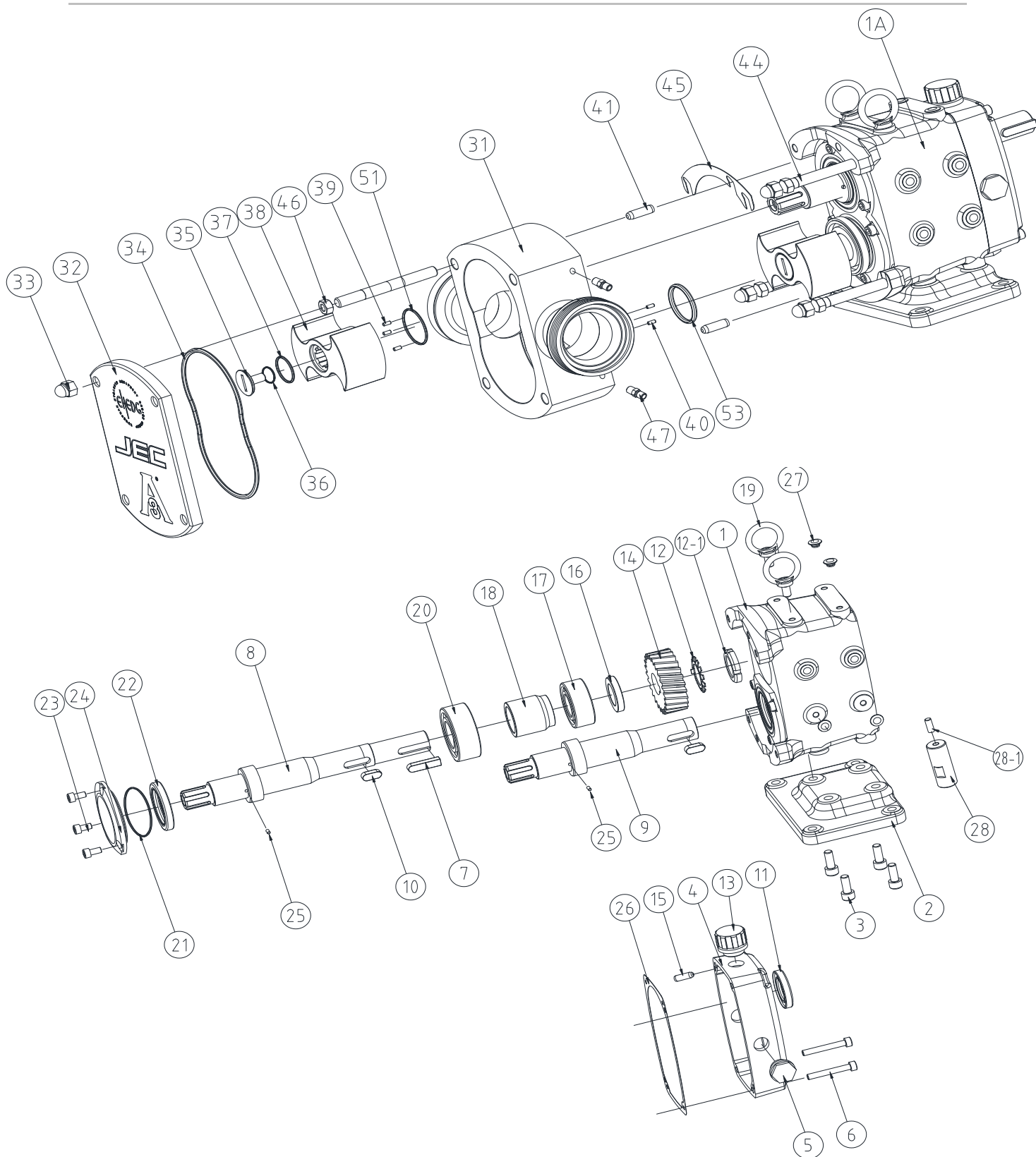
- Temperature Range: depending on temperature class of the rotors: max 120°C or max 150°C, see nameplate. **For ATEX pumps, the maximum temperature of the pumped liquid is 108°C.**
- Viscosity Range: max 1.000.000cPs

FLUSHED SHAFT SEALS

Maximum Flushing Water Pressure Maximum 0.5 bar (7 psi)
 Flushing Water Consumption 0.25~0.5 l/min (30~60 cubic inches/min)

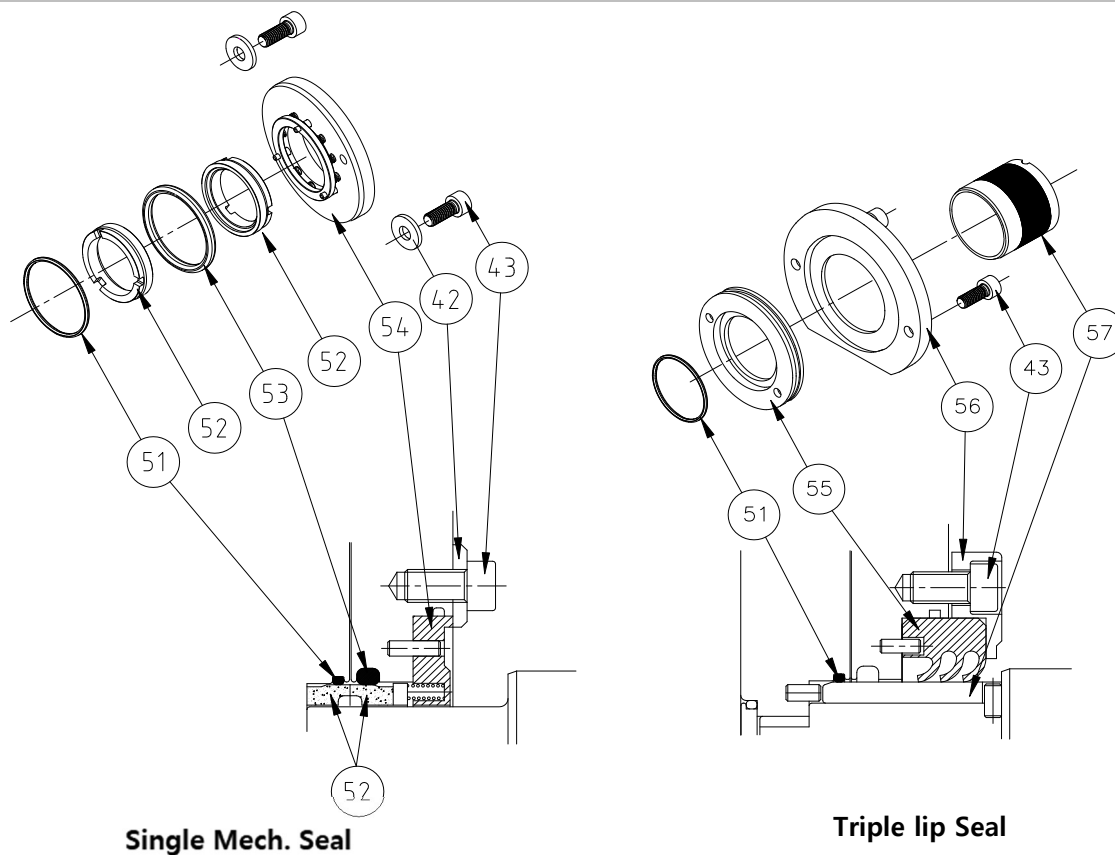
8 EXPLODED VIEWS

8.1 EXPLODED VIEW/ZL100, ZL200 AND ZL300



- All orders for repair parts must contain the following;
1. Complete model number (located on nameplate).
 2. Pump serial number (located on nameplate).
 3. Description and part number from the parts list.

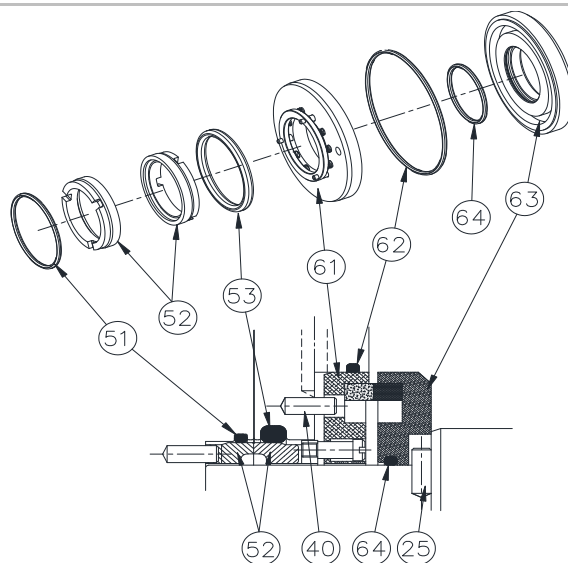
SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL



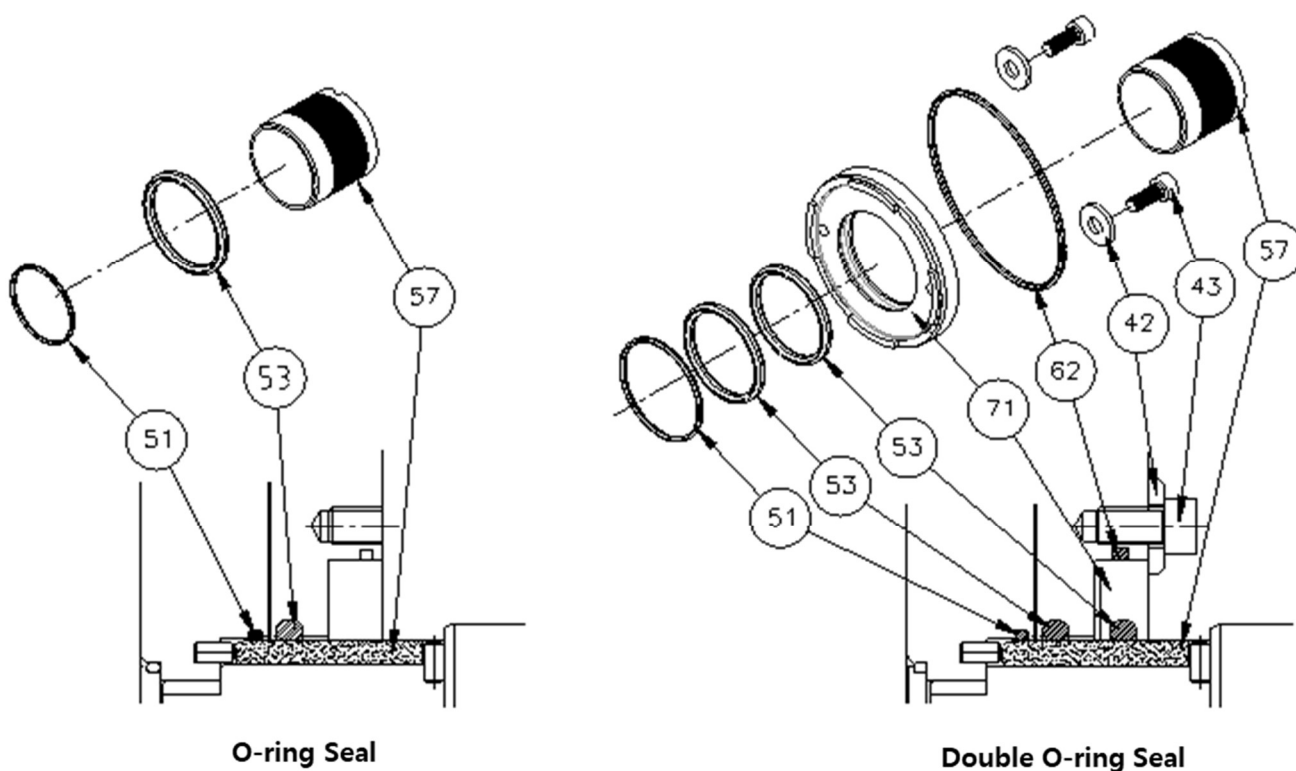
Single Mech. Seal

Triple lip Seal

DOUBLE MECHANICAL SEAL



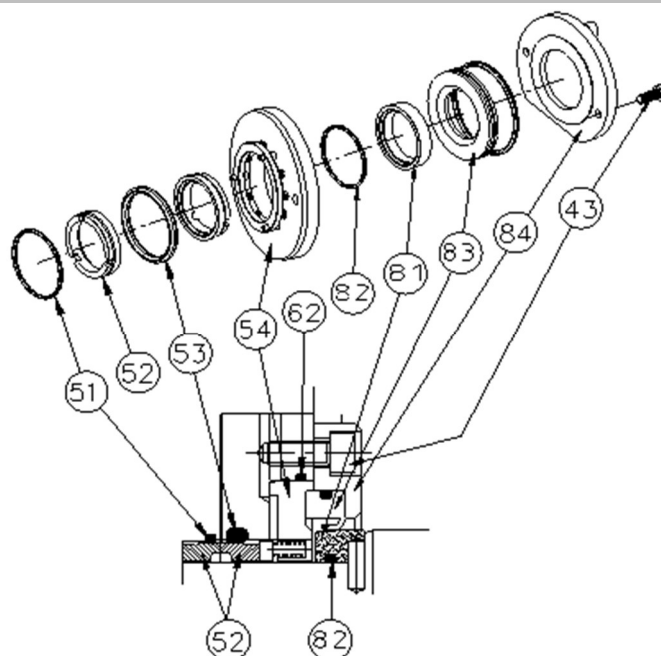
O-RING SEAL & DOUBLE O-RING SEAL



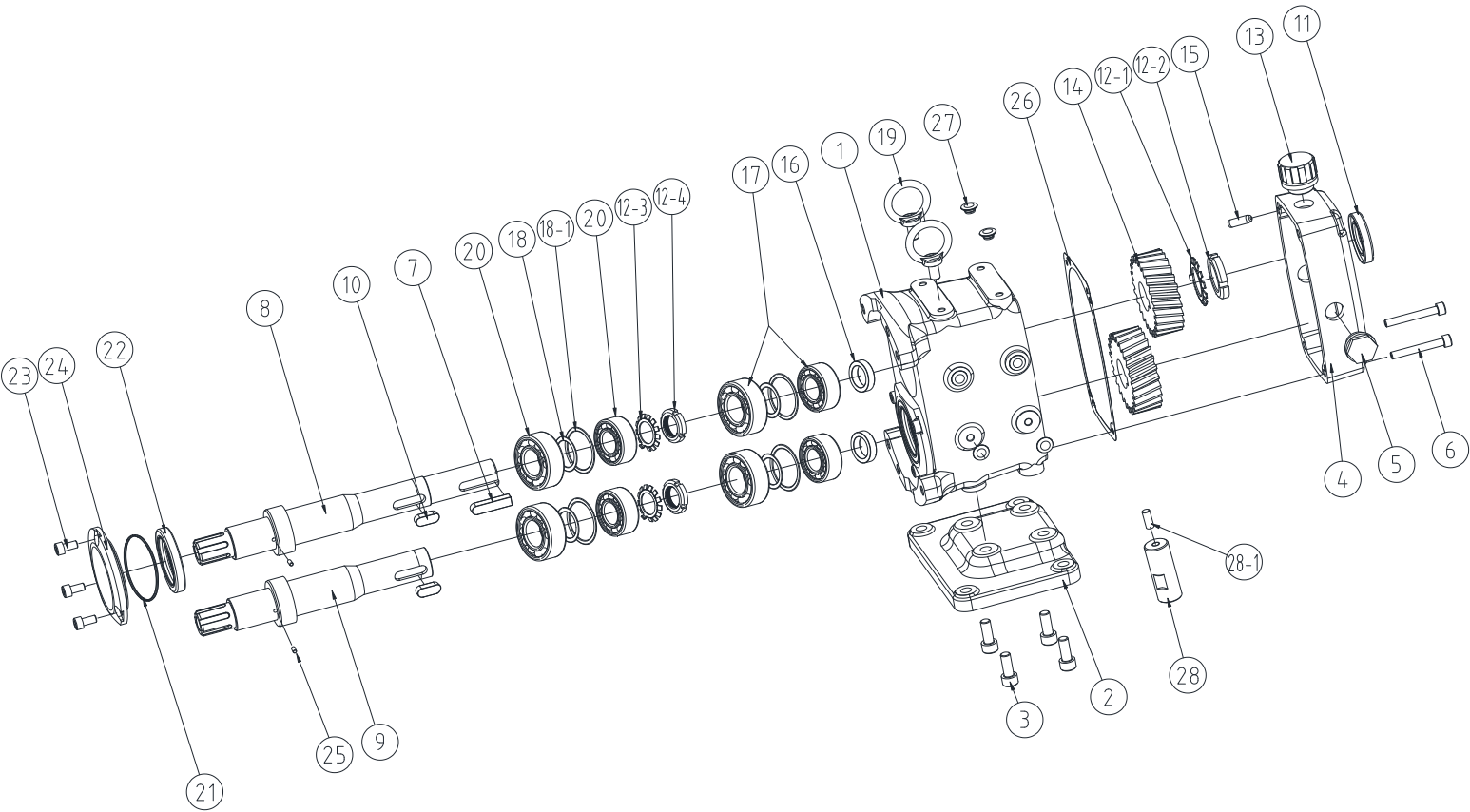
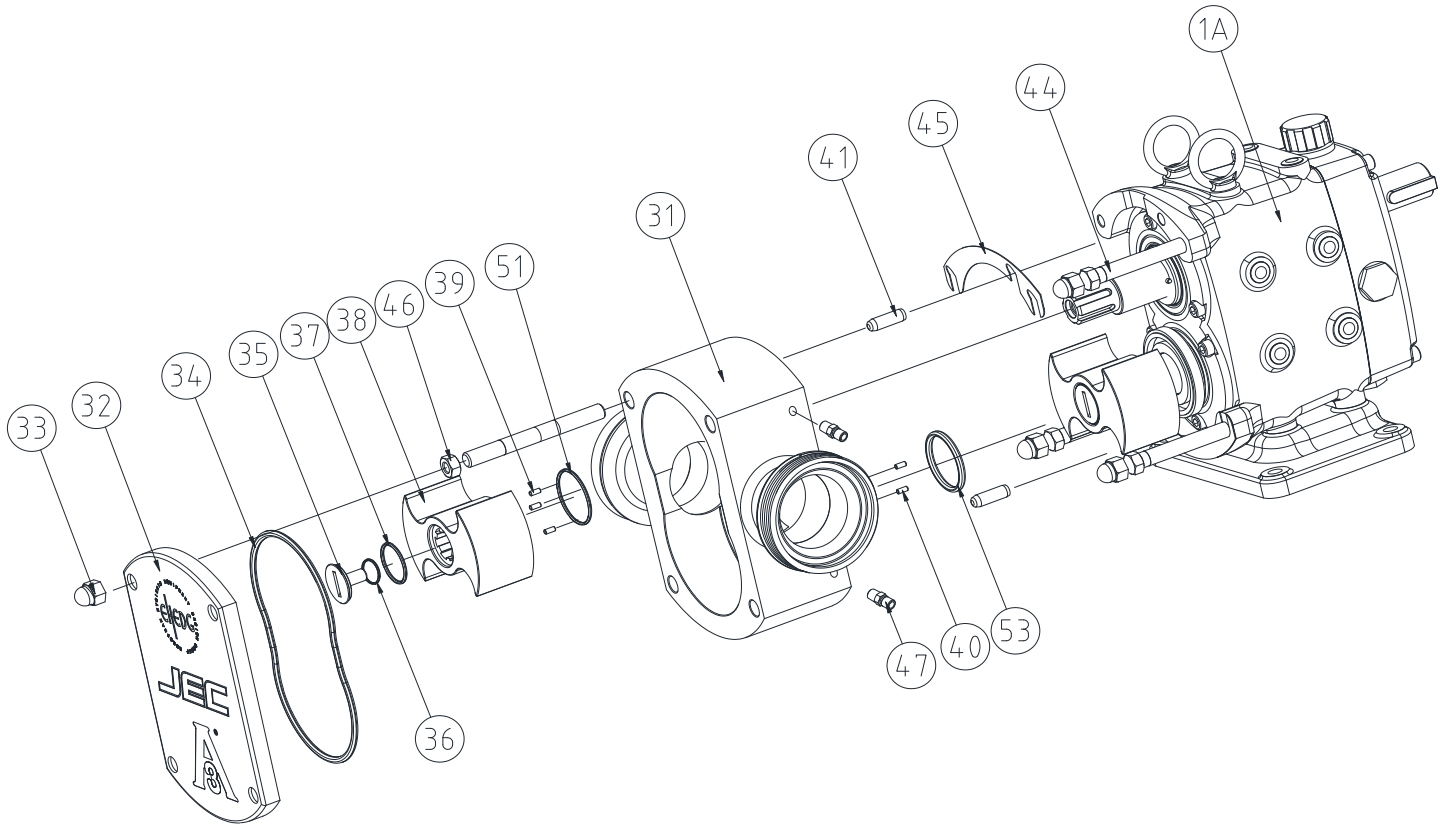
O-ring Seal

Double O-ring Seal

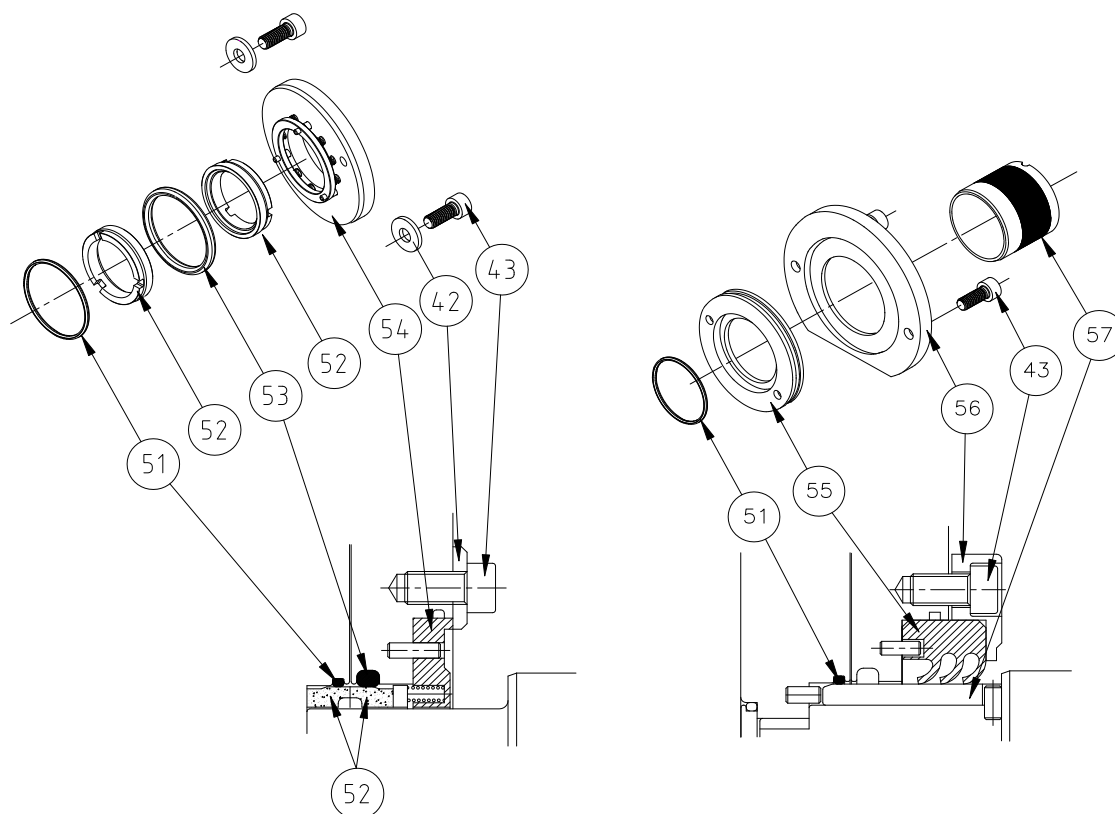
FLUSHED MECHANICAL SEAL



8.2 EXPLODED VIEW / ZL400



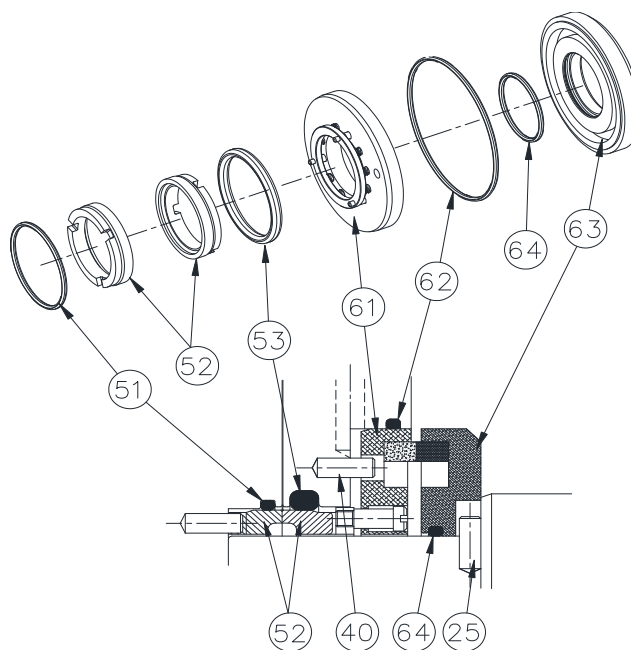
SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL



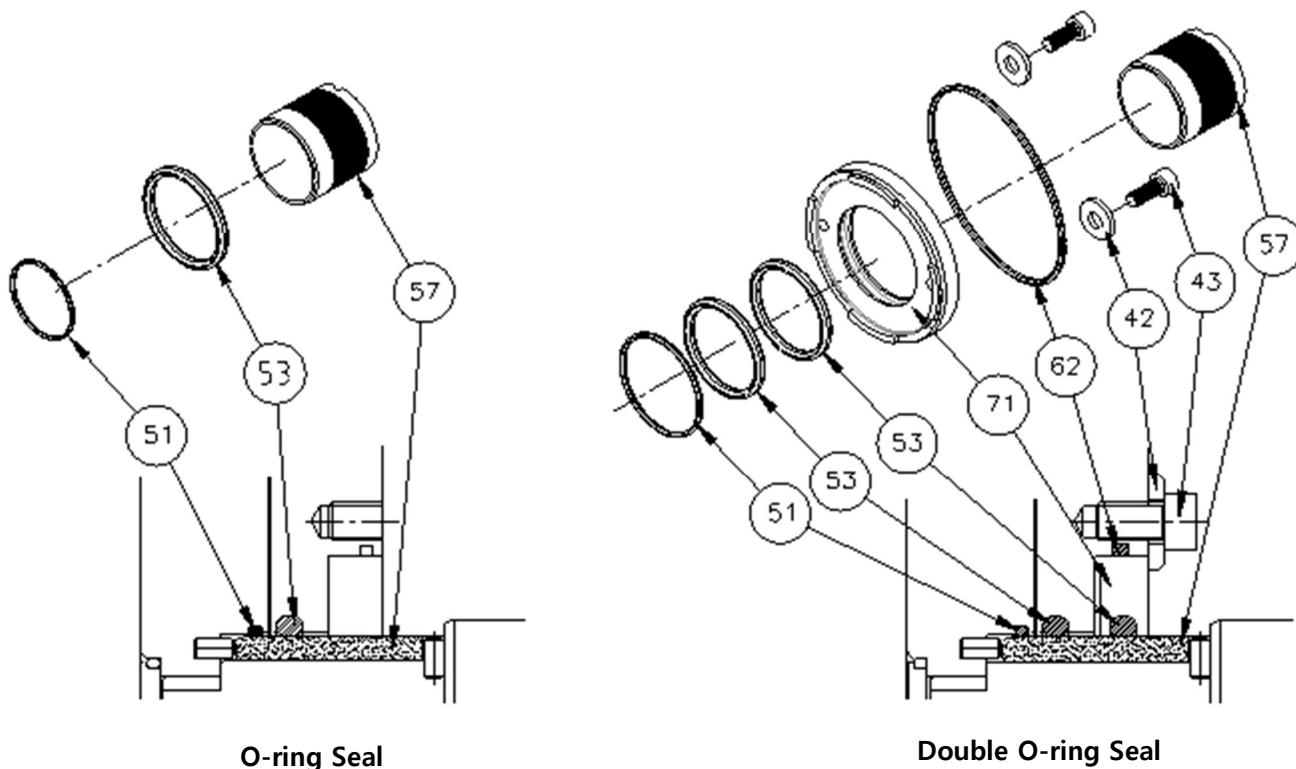
Single Mech. Seal

Triple Lip Seal

DOUBLE MECHANICAL SEAL



O-RING SEAL & DOUBLE O-RING SEAL



FLUSHED MECHANICAL SEAL

