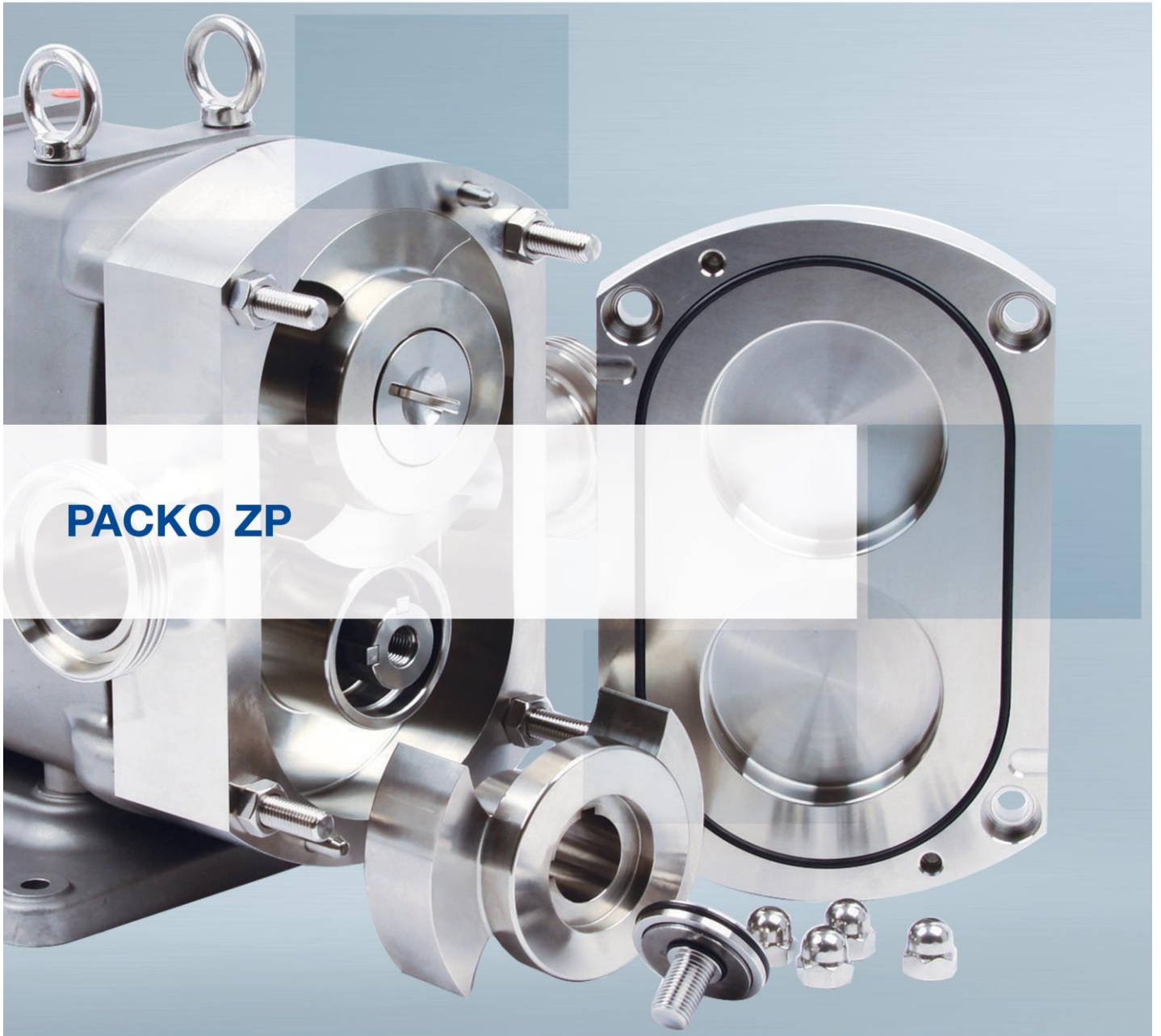


PACKO ZP

**Packo**  
A VERDER COMPANY



**PACKO ZP**

**Instruction manual**

# CONTENTS

<b>1</b>	<b>GENERAL</b>	
1.1	General Information	2
1.2	Manufacturer	2
1.3	Copyright	2
1.4	Declaration of conformity	3
1.5	Intended Use	4
1.6	Type designation	4
1.7	Sound pressure level	5
1.8	Construction	5
1.9	Packaging & Transport	7
1.10	Storage	7
<b>2</b>	<b>SAFETY</b>	
2.1	DO'S and DON'TS	8
2.2	ATEX safety measures	9
<b>3</b>	<b>INSTALLATION</b>	
3.1	Installation	10
3.2	Connection of the motor	10
3.3	Connecting the mechanical seal flush	11
3.4	Start Up	11
<b>4</b>	<b>CHECK THE PUMP ROTATION</b>	
4.1	Principle of operation	12
4.2	Direction of rotation	12
<b>5</b>	<b>OPERATION</b>	
5.1	Troubleshooting	13
5.2	Cleaning	14
<b>6</b>	<b>MAINTENANCE</b>	
6.1	Rotor Case Disassembly	15
6.2	Inspection	17
6.3	Seal Maintenance	18
6.4	Rotor Case Assembly	23
6.5	Rotor Clearance	25
6.6	Rotor Timing	26
6.7	Gearbox Maintenance	28
6.8	Lubrication	32
<b>7</b>	<b>TECHNICAL INFORMATION</b>	
7.1	Technical Data	33
<b>8</b>	<b>EXPLODED VIEWS</b>	
8.1	Exploded view ZP015	34
8.2	Exploded view ZP018, ZP030, ZP060, ZP130	37

# **1 GENERAL**

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## **1.1 GENERAL INFORMATION**

Thank you for purchasing PACKO products!

This manual for the ZP series Circumferential Piston 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 the 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**

PACKO INOX LTD  
Cardijnlaan 10  
B-8600 Diksmuide  
Belgium  
Telephone: + 32 51 51 92 80  
Telefax: + 32 51 51 92 99  
E-mail: [pumps.packo.be@verder.com](mailto:pumps.packo.be@verder.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 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		<b>Packo</b>	
TYPE:			
Mat. code:			
Year:	S/N:	kg	
Max:	bar	°C	
DO NOT RUN PUMP DRY OR AGAINST CLOSED VALVE		CE	

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

Type: ZP/120-213/114

- ZP: 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: (BW-120) D37SSVQ

- BW: rotor type (BW = bi-wing)
- 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, D= double mechanical seal)
- 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

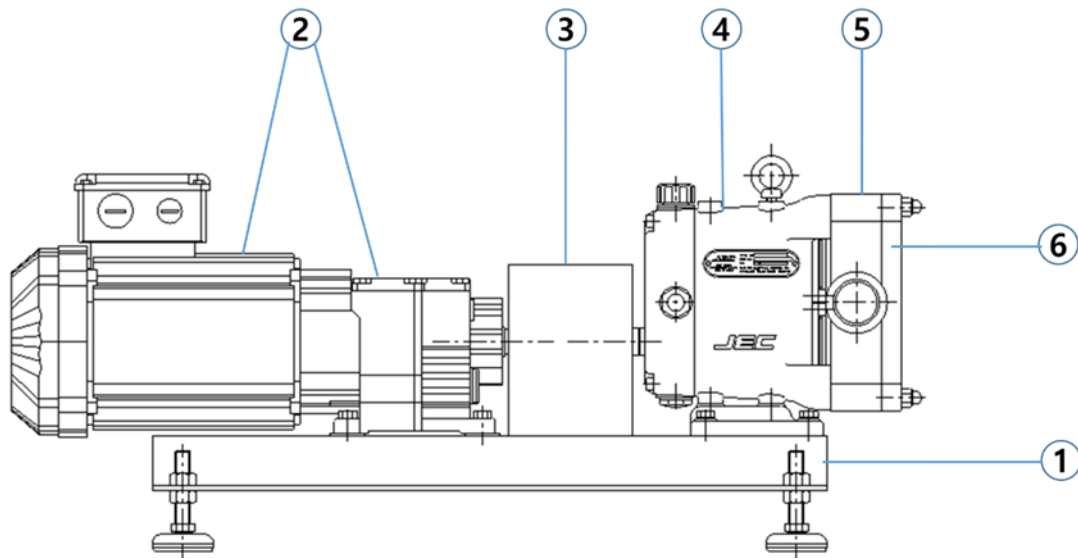
The sound-pressure level of the pump, operating at 50Hz without cavitation measured at 1m is less than 70dB(A). In order to minimize noise and vibration, no other parts of the machine may vibrate at the same time as the pump. The best solution is therefore to allow the pump to rest directly on the concrete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

## 1.8 CONSTRUCTION

ZP series Circumferential Piston 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, base plate (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

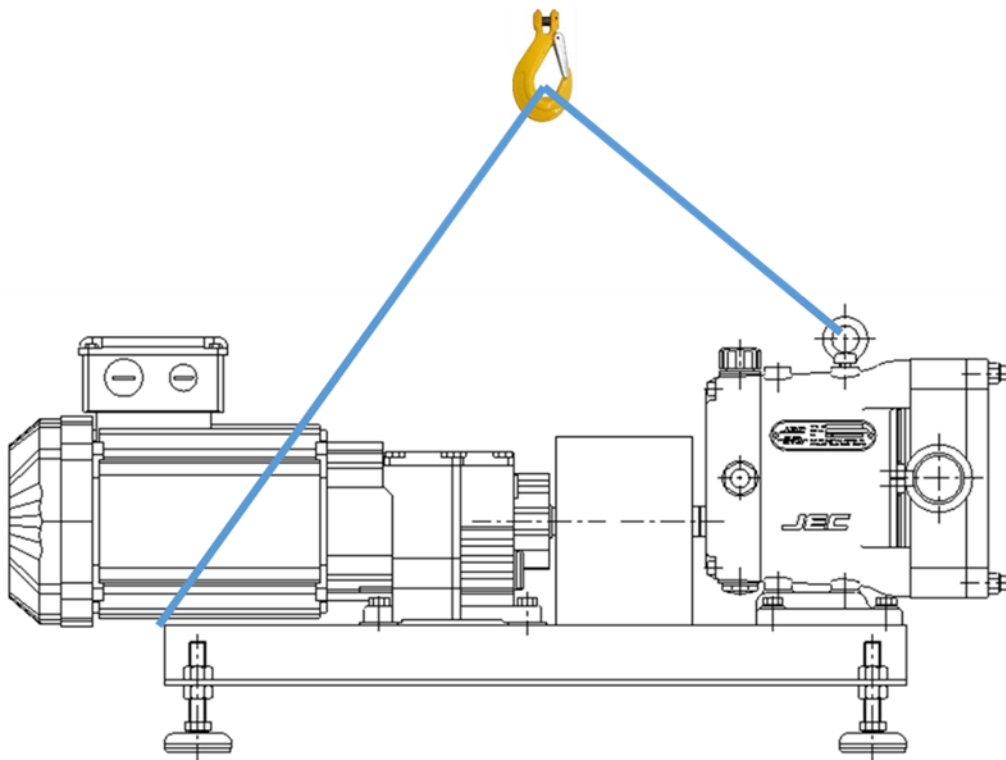
ZP series are shipped in non-returnable wooden packaging.

Unpack the pump/unit upon delivery and inspect it for visible transport damage.

Any damage occurred during the transport 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 is 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 a picture of a complete unit with drive & baseplate 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.

1. Protect pumps against dust, dirt, water or any other harmful environmental factors. 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.
- DO NOT** run the pump at a temperature or differential pressure higher than specified on the pump nameplate.

### **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 THE 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 or outlet blocked will cause serious damage to the pump.
- DO ALWAYS** check the 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 THE PUMP**

- DO** ensure the pump is cool to touch before performing service.
- DO** relieve all pressure and drain all fluids from the 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"> <li>• Flushed mechanical seal</li> <li>• or flow monitoring to be installed by the customer</li> </ul>	No danger
	Ignitable liquid		<ul style="list-style-type: none"> <li>• Flushed mechanical seal</li> <li>• or single seal with preventive maintenance by the customer</li> </ul>

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 60°C. If necessary an external cooling system should be used to keep the flushing temperature under 60°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. The mounting surface should be flat and level.
2. Ensure at least 0.5 m 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 the 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 the 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 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.**

### **3.3 CONNECTING THE FLUSHING MECHANICAL SHAFT SEAL**

In a pump with flushing, the sliding surfaces of the mechanical seal are lubricated and/or cooled by a different liquid than the pumped liquid. This flushing liquid is supplied and discharged via the two connections in the pump casing.

Either connect the water supply to one of the connections. Adjust the flow so that the water drips slowly from the other connection ( $\pm 10$  liters / hour). Preferably, a hose is placed at the outlet to drain the leak next to the pump. Never provide a valve or throttle in the flushing liquid outlet to prevent pressure build-up in the flushing chamber.

Or connect the flush to a quench reservoir of at least 5 liters. To ensure adequate circulation of the flushing liquid, its viscosity must not exceed 100 centiPoise, the hoses used must have an internal diameter of at least 14 millimeters and the hoses together must not be more than 2 meters in length. There must be no bridges in the hoses where air can accumulate and thus hinder circulation. Place the reservoir approximately 70 centimeters above the pump. The connection of both hoses to the reservoir must be below the fluid level. Refill the quench container regularly and check for proper circulation. When the temperature in the reservoir rises above 60 ° C, it must be cooled or switched to a flow-through quench as described above.

In both cases, the pressure in the flushing chamber must never exceed 0.5 bar!

### **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. (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 on the nameplate of the pump. The installation of a pressure relieve valve is recommended.

#### **Pay attention to circumstances that could indicate pump cavitation:**

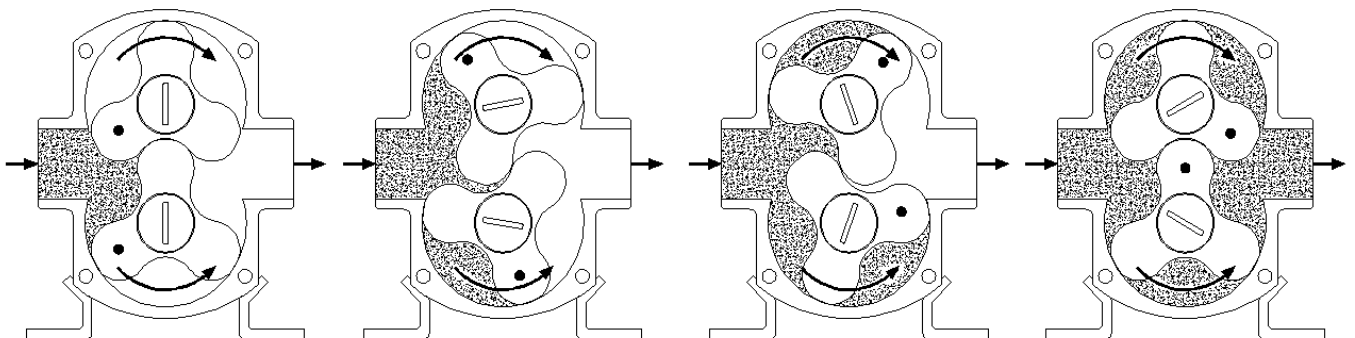
1. Low pressure in the suction line due to bad suction conditions.

2. Air in the suction inlet line.
3. Pumping temperature is too high.
4. Pump is oversized.

## 4 CHECK THE PUMP ROTATION

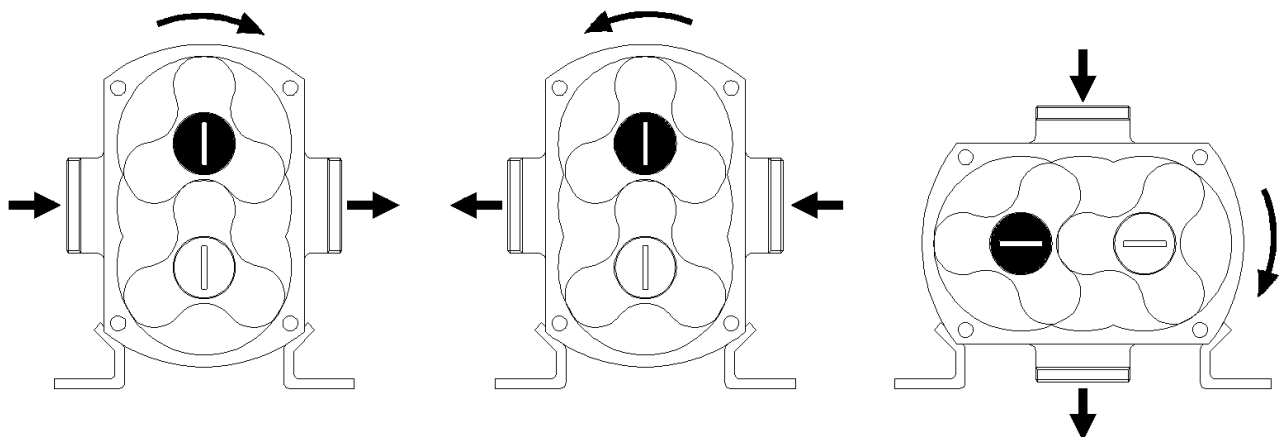
### 4.1 PRINCIPLE OF OPERATION

- 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 casing 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 rotating	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.

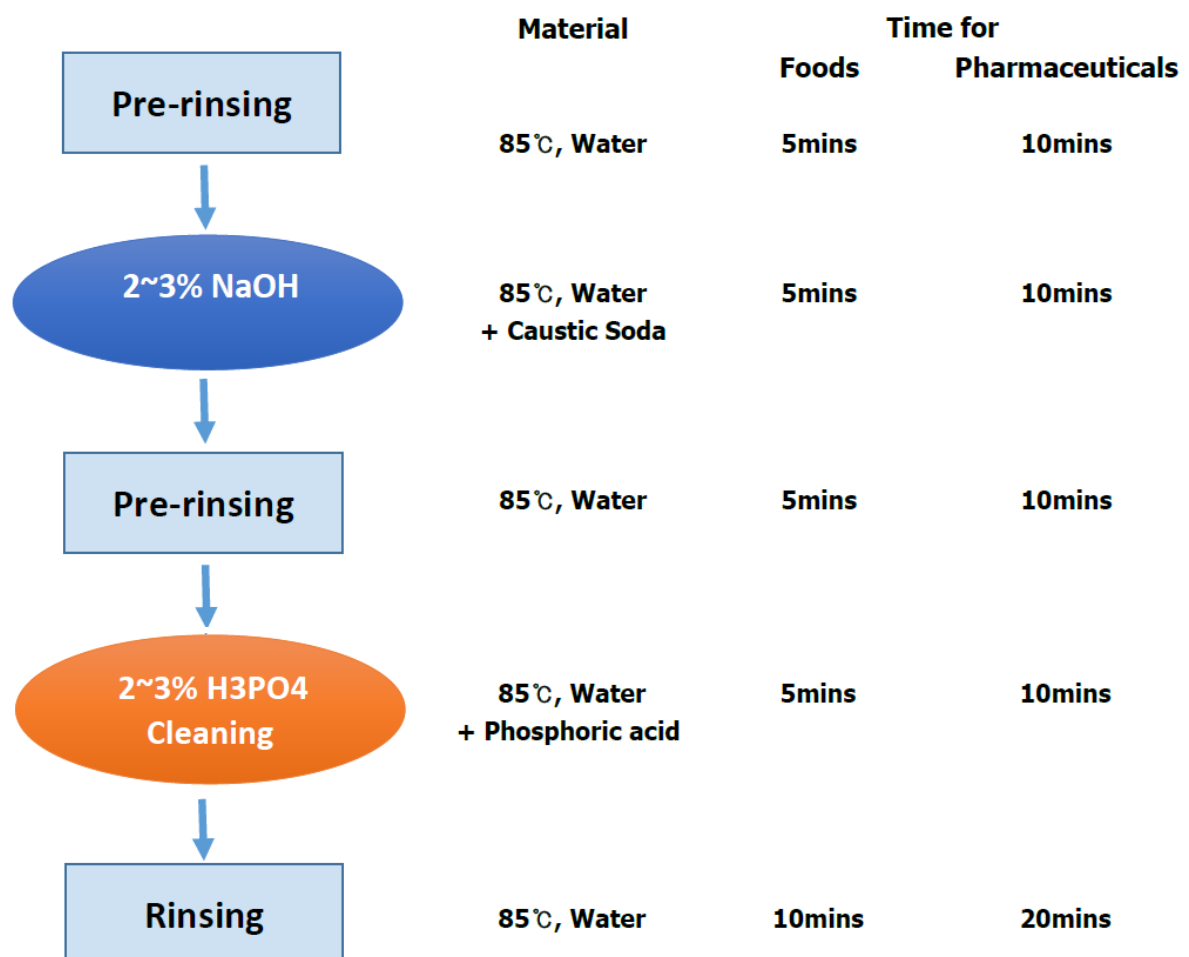
If assistance is required, please contact your local sales office with the following information:

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. During 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 the 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 indicated in the exploded view in chapter 8.

Remove the front cover and O-ring after removing the four cap nuts from the front cover. If it is stuck, tap on the front cover with a soft mallet and pull out.

If the front cover was stuck at the dowel pins, insert a flat driver in the two grooves between front cover and rotor case to open the pump.



Fig. 1

Place a plastic round bar between the rotors and remove the rotor bolts with the rotor bolt extraction tool. To avoid damaging the rotor bolt, the extraction tool should be positioned in the groove properly and pushed in strongly. Turn the rotor bolts counter-clockwise and remove them.

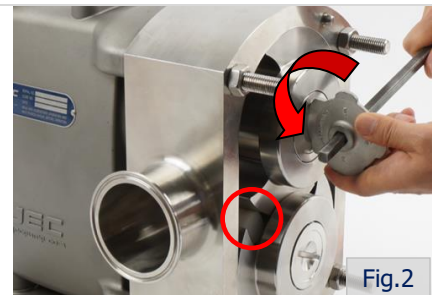


Fig.2

The rotors can be removed from the pump casing by pulling straight.

If they are stuck tight, alternately tap on the back of the inlet and outlet ports with a soft mallet after removing the four hex nuts of the stud bolts securing the case to the gearbox. Treat the rotors carefully to avoid damage.

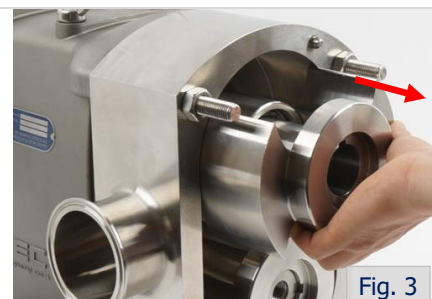


Fig. 3

Remove the rotating seal rings from the backside of the rotors as shown in Figure 4. Then, the O-rings can be removed.



Fig. 4



***Clean and examine all of the pump components for damage. Replace damaged components as required. PACKO recommends replacing all the wetted elastomers during reassembly.***

***If you want to replace the seal ring only, you can remove the old one & insert the new one easily just after removing the rotors without dismantling the rotor case. Refer to chapter 6.3 for the further procedure.***

In case you want to remove the seal body, it can be easily dismantled from the rotor case after removing the stationary seal ring and O-ring of the rotor case.



Fig. 5

After pulling out both rotors and four hex nuts, 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 to seal maintenance (Refer to chapter 6.3), if needed.



Fig. 6

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



Fig. 7

After the rotor case has been removed, handle and place carefully the top & bottom shim(s). Keep track of their position in order to avoid misalignment and to keep the right clearances between rotors and rotor case.

They are installed accordingly at the factory for that particular body.



Fig. 8

## 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 a serious issue. 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. Check the mating faces of the shaft and rotor for any damage.
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

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Check & inspect all components of the 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 9), Double mechanical seal (Figure 10) and PTFE Triple lip seal with ceramic coated sleeve (Figure 11).



Fig. 9



Fig. 10



Fig. 11

The seal ring can be easily removed from the rotor by hand. 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 and O-ring from the rotor.



Fig. 12

Pre-assemble the NEW O-ring and seal ring and then insert into the rotor. When inserting the seal ring, the pin of the rotor has to fit in the hole of the seal ring.



Fig. 13

## Single Mechanical Seal Maintenance

Remove the Seal ring from the rotor case & rotor 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. After rotor case assembly, push the replacing NEW Seal ring into the rotor case O-ring and turn it until the seal pins on the seal body fit in the groove in the seal ring (Refer to 'chapter 6.4').

In order to disassemble the current seal body, pull out the current O-ring and seal body sequentially.

Insert the replacing NEW seal body and O-ring into the rotor case sequentially.

See 'Rotor Case Assembly' (chapter 6.4) to continue.



## Double Mechanical Seal Maintenance

Remove the Seal ring from the rotor case & rotor (shown in Figure 17) 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 until it fits into the seal pins on the seal body after Rotor Case Assembly on chapter 6.4.



Fig. 17

In order to replace the product side of mechanical seal, refer to Figure 16. While, in order to replace the flushing side of mechanical seal, refer to Figure 18~23.

After the rotor case has been removed (Figure 6 & 7), 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. 18

### (ZP015)

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 19.

Apply some soap on the double seal body and insert it in the backside of the rotor case. Make sure the pins in the rotor case fit in the seal body properly.

See 'Rotor Case Assembly' on page 23 to continue.



Fig. 19

### (ZP018-ZP130)

Place the rotor case face down on the table and loosen bolts to disassemble the Double seal fixing ring.



Fig. 20

Remove the double seal fixing ring carefully.  
If any double seal fixing ring is damaged, do not re-use and replace it.



Remove the double seal ring, treat carefully the Double seal ring (53) because carbon is fragile material.  
Apply some soap on the seal face of the secondary mechanical seal and insert it in the backside of the rotor case. Make sure the pins in the rotor case fit in the bolts in the seal body properly.



After removing the Double seal ring (53), check whether the wave springs (61) has been damaged or not. If wave springs (61) were damaged, replace it as shown Figure 23.

See 'Rotor Case Assembly' on 'chapter 6.4' to continue.



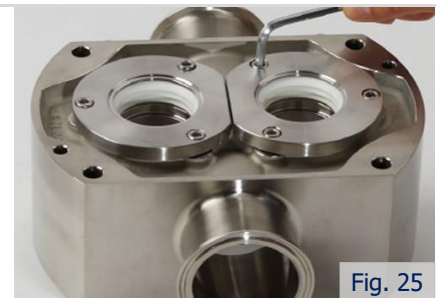
## Triple Lip Seal Maintenance

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After the rotor case has been removed (Figure 6), pull out and remove the Ceramic coated sleeves from the shafts 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 they seat on the shaft shoulder. Align the slot in the shaft sleeve to the drive pin on the shaft.



Place the rotor case face down on the table and loosen the wrench bolts and washers using appropriate wrench as shown in Figure 25.



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.



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 a soft mallet or fasten the Stud nut to make the assembly easier.

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## 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 & 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	ZP015 & ZP018	ZP030	ZP060	ZP130
Nut size	M8	M10	M14	M14
Torque (Nm)	30	34	80	80



Fig. 27

Insert the stationary seal body inside the hub in the rotor case as Figure 28, and make sure the pins on the seal body are engaged firmly inside the seal pins on the Seal Body Stop Ring.

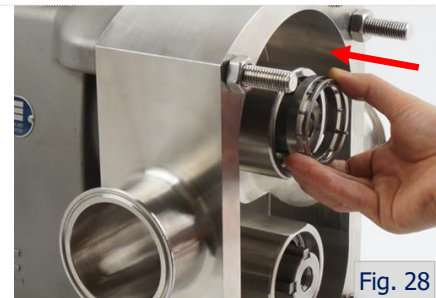


Fig. 28

Insert the new case O-ring inside the groove with lube.



Fig. 29

Assemble the seal ring inside the hub of the pump casing.

Put the rotor O-ring in advance and the rotating seal rings on the back of the rotors.

Make sure that the seal pin fits into the slot in the seal ring.



Fig. 30



Insert the rotors along the shaft and make sure that the seal rings do not fall out of their seats in the rotors.

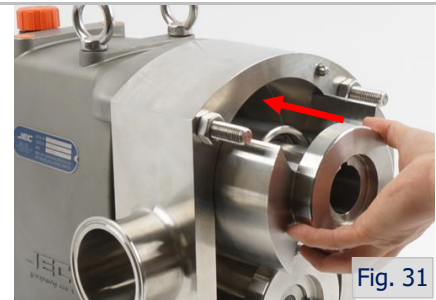


Fig. 31

Tighten the rotor bolts with the rotor bolt extraction tool firmly. Be sure not to make any burr on the rotor bolt groove during this process. It may cause a serious problem such as galling on the front cover and if it happened, it must be removed.



Fig. 32

Series	ZP015 & ZP018	ZP030	ZP060	ZP130
Bolt size	M10	M14	M18	M18
Torque (Nm)	20	40	100	100

***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.***

Install the NEW O-ring inside of the front cover (32) and slide the front cover over the stud. Screw the cap nuts (33) on the studs and tighten using an appropriate wrench in an opposing manner shown in Figure 33.



Fig. 33

Series	ZP015 & ZP018	ZP030	ZP060	ZP130
Nut size	M8	M10	M14	M14
Torque (Nm)	14	17	30	30

## 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.

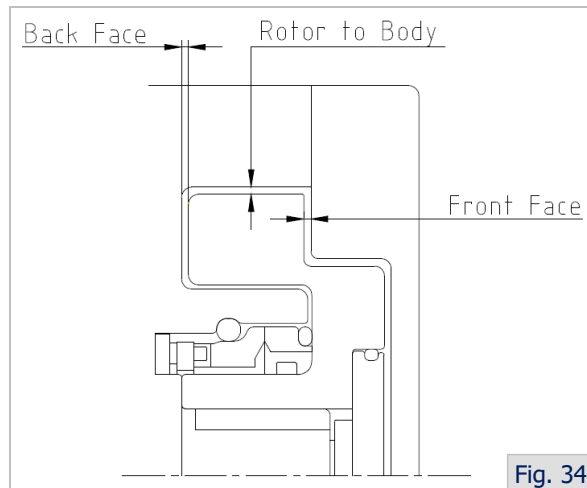


Fig. 34

Standard Rotor Clearances (mm)					
Material	Clearance \ Model No.	ZP015 & ZP018	ZP030	ZP060	ZP130
Non-galling	Back Face	0.05	0.05	0.10	0.10
	Rotor to Body	0.05	0.05	0.13	0.13
	Front Face	0.13	0.13	0.20	0.20

There are two areas of rotor clearances as illustrated above:

- 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 the 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 35. 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 (16) are used to adjust the location and the timing. When adjusting timing, move only one of the two gears.

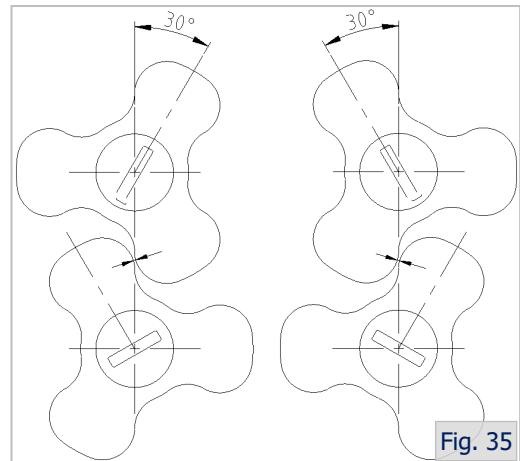


Fig. 35

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

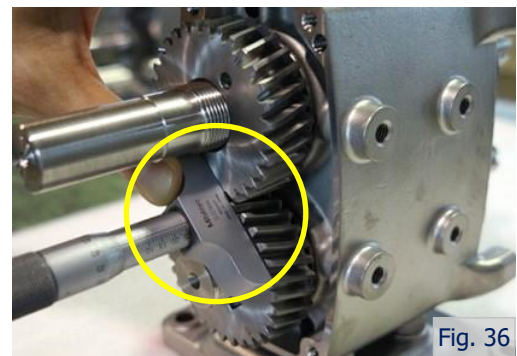


Fig. 36

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 36. Adjust the gap using a spacer and shim(s) according to the below cases.

- \* If the gear on the idle shaft is more forward than the gear on the drive shaft, as shown in Figure 38, add a 6 mm spacer and shim(s) on the idle shaft to fill the gap.
- \* If the gear on the driving shaft is more forward than the gear on the idle shaft, as shown in Figure 37, add a 5 mm spacer and shim(s) on the driving shaft to fill the gap.

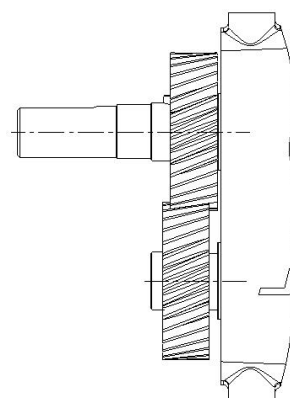
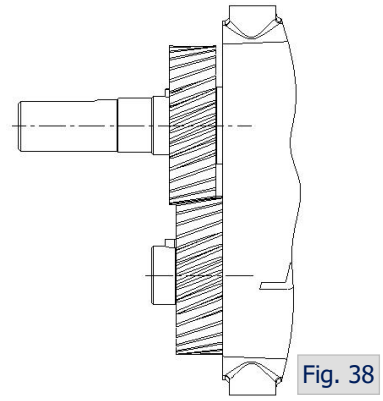


Fig. 37



7. Reattach the gears to the shafts with the locknut and bend one lip of the locking lip into a groove of the locknut.

## 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 is 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. 39

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. 40

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



Fig. 41

6. Remove the front bearing gland set bolts (23) as shown in Figure 42.

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.

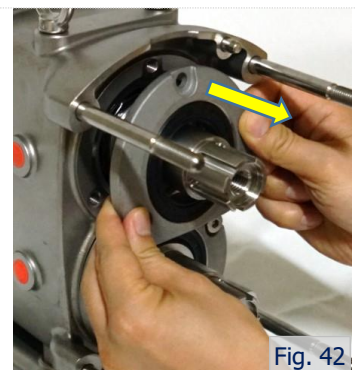


Fig. 42

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



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 44.



## Gearbox Assembly

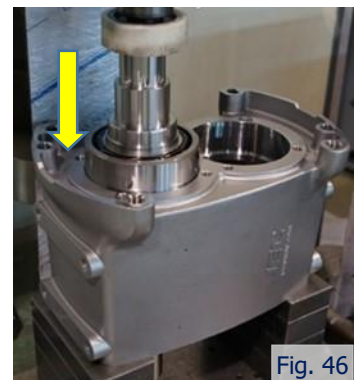
1. Clean and lubricate the front & rear bearing areas of the drive & idle shafts with oil.

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 the bearings are fully seated.



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

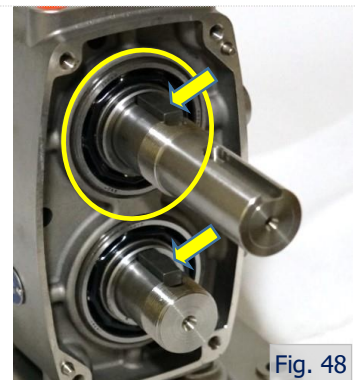
Place the front bearing gland set on both shafts. Take care for the Oil seal spring inside of the gland set: it should not be deflected during insertion. Set the Bolt & washer, and tighten.



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 keys (10) slots are on to the 12 o'clock position shown in Figure 48.



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.



Fig. 49

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'.**



Fig. 50

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 (12-1) on the idle shaft, following the previous steps.

7. Lubricate and install the rear oil seal cover (11) into the gearbox (1). 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.



Fig. 51

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.



## 6.8 LUBRICATION

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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 required for particularly difficult operating conditions, such as:

- High temperature variations
- High pressure fluctuations

The oil in the gearbox is recommended to be changed once a year or every 2,000 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 for each series are shown as follows.

Series	ZP015 & ZP018	ZP030	ZP060	ZP130
Q'ty(liter)	0.34	0.95	2.30	2.30

### Food Grade Gear Oil

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

- The formulation of 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)
015	15
018	12
030	10
060	15
130	8

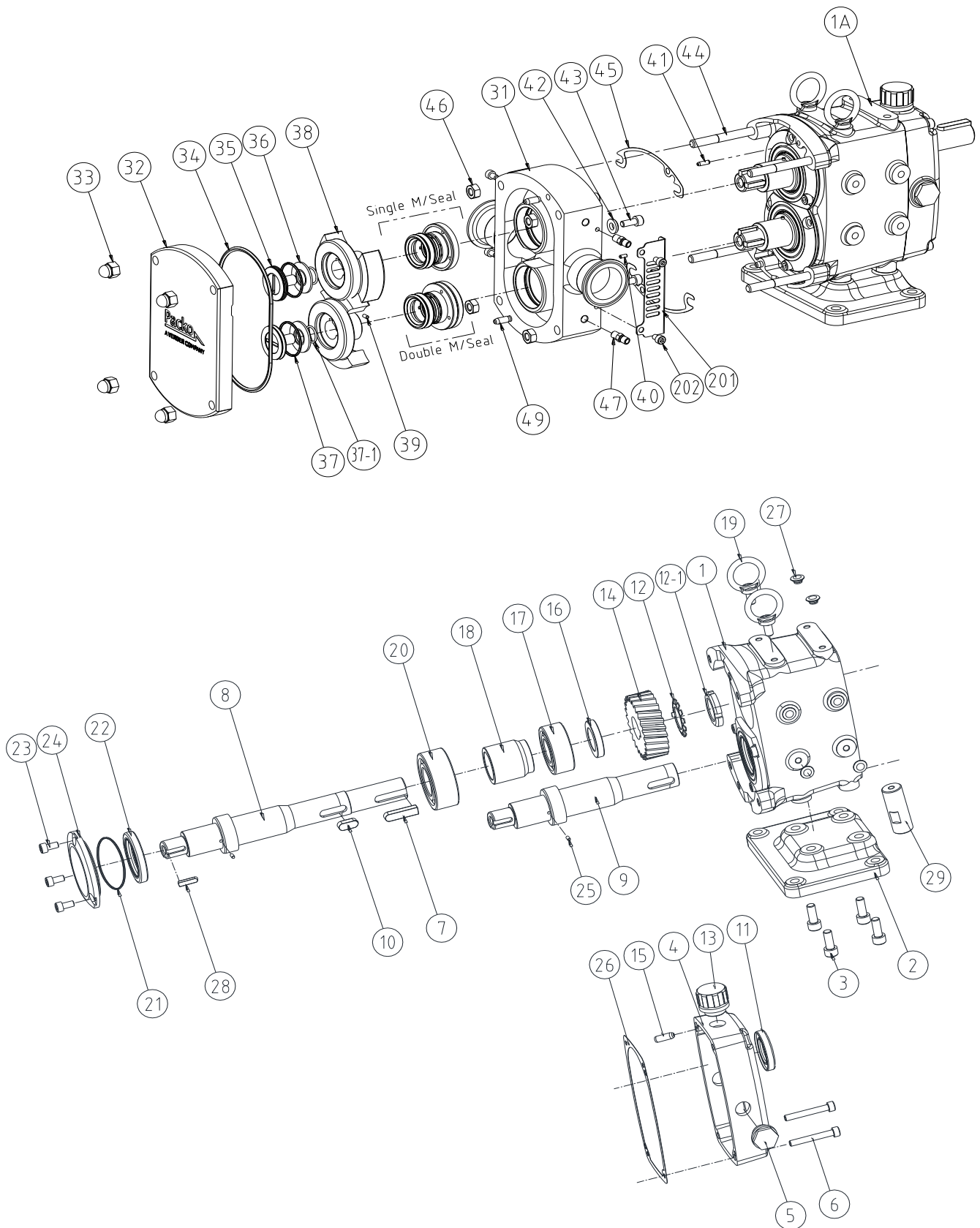
- Temperature Range: depending on temperature class of the rotors: max 120°C or max 180°C, see nameplate. **For ATEX pumps, the maximum temperature of the pumped liquid is 108°C.**
- Viscosity Range: max 1.000.000cPs

#### 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

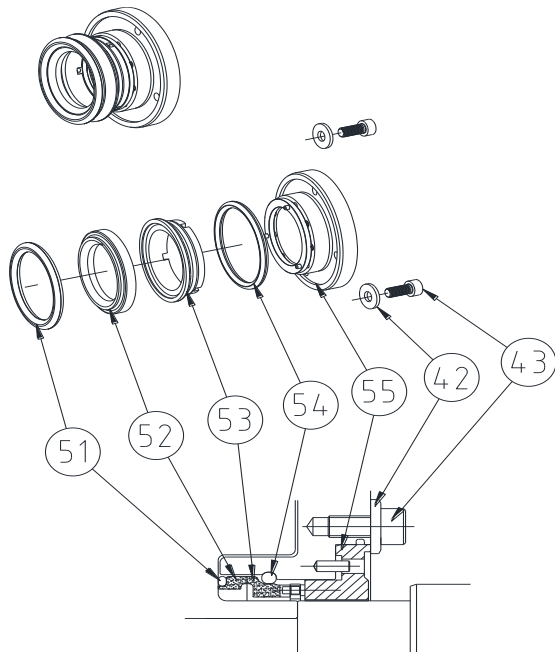
### 8.1 EXPLODED VIEW / ZP015



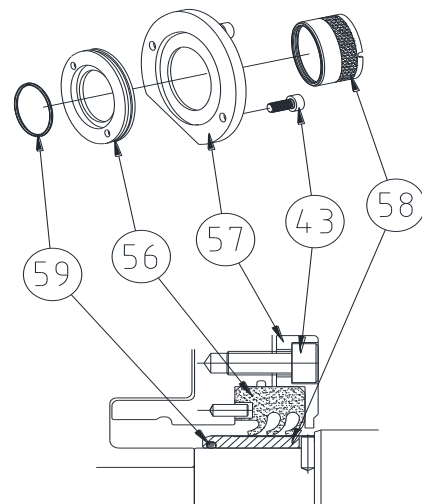
All orders for repair parts must contain the following:

1. Complete model number (located on nameplate).
2. Pump serial number (located on nameplate).
3. Description and position number from the exploded view.

## **SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL / ZP015**

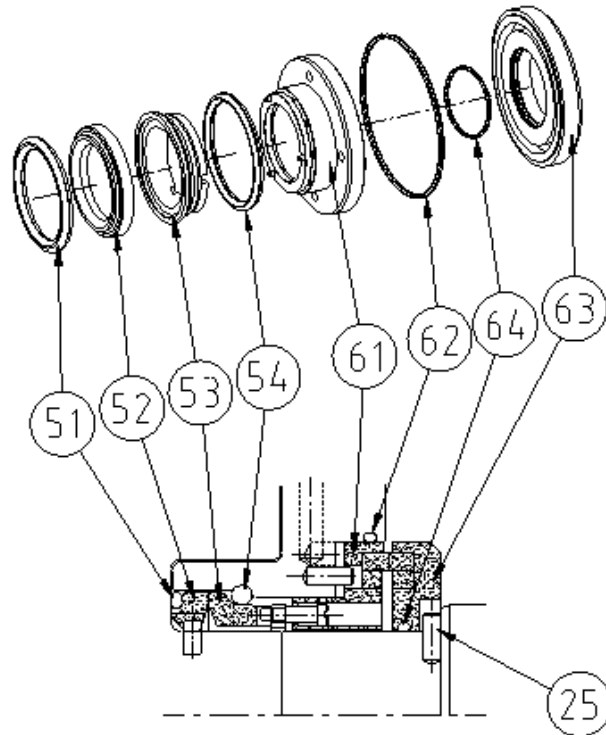


**Single Mech. Seal**

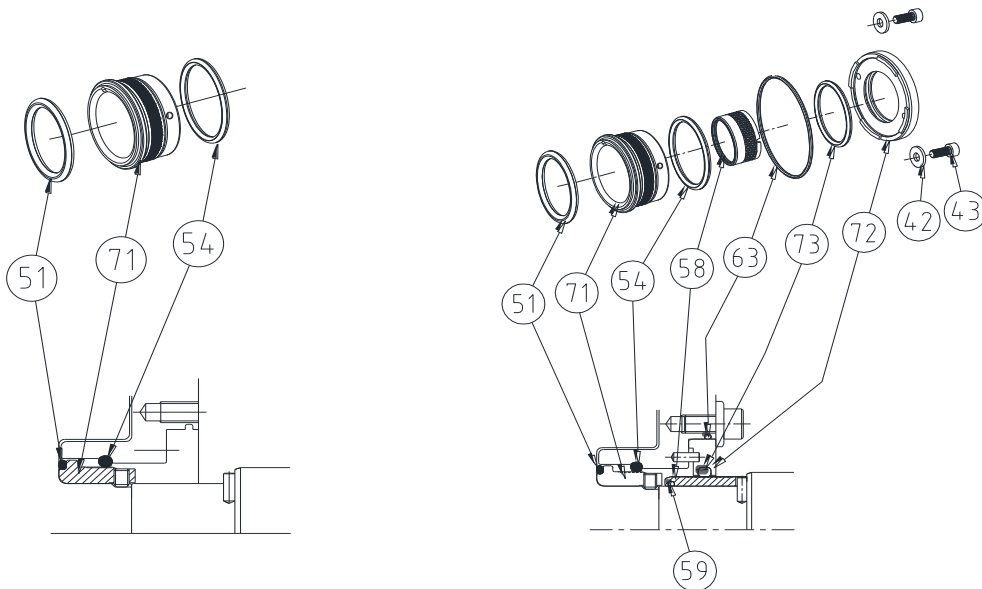


**Triple Lip Seal**

## DOUBLE MECHANICAL SEAL / ZP015



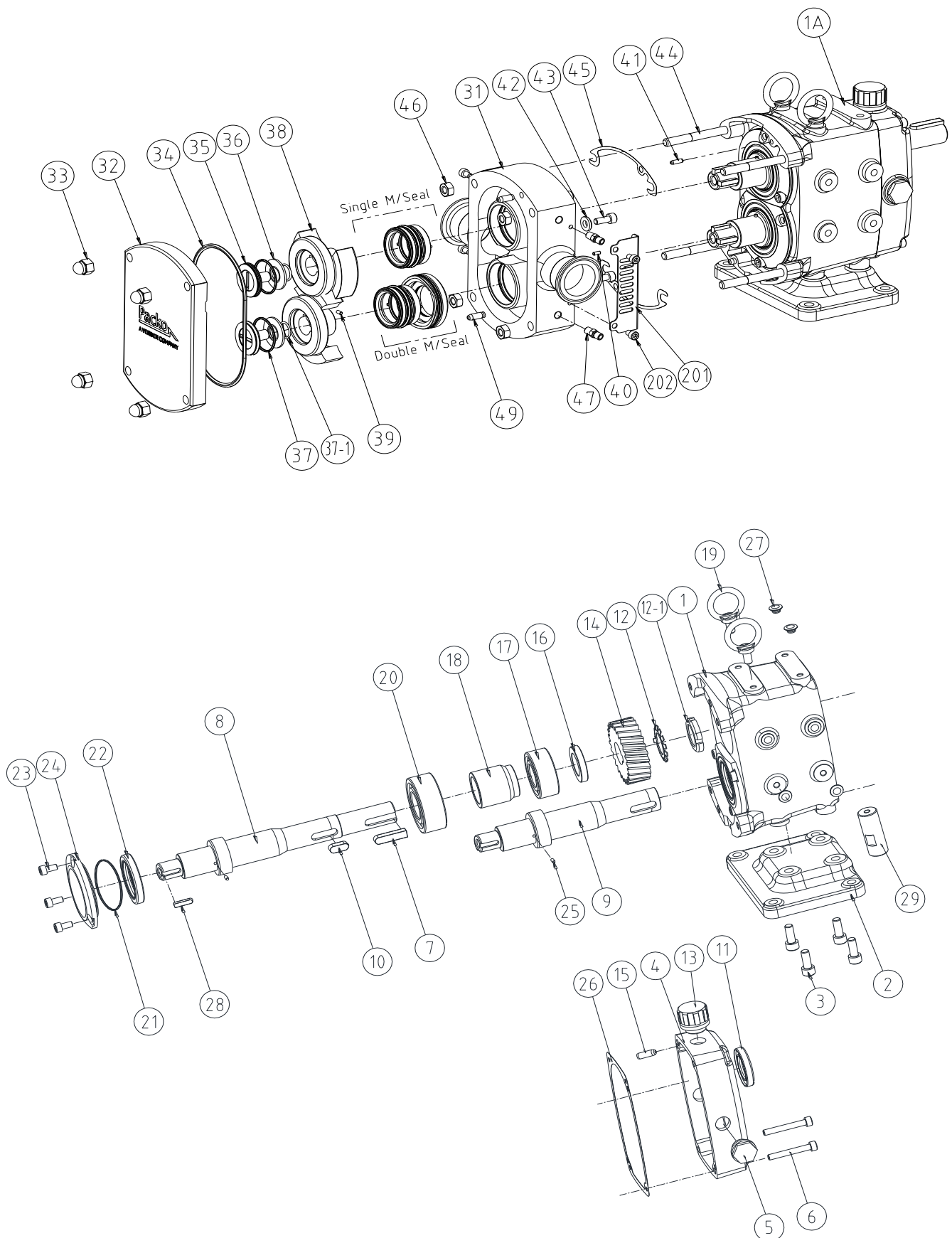
## O-RING SEAL & DOUBLE O-RING SEAL / ZP015



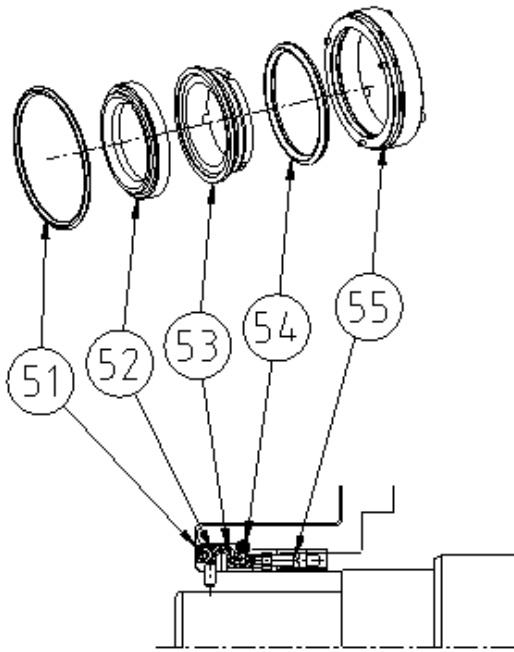
**O-ring Seal**

**Double O-ring Seal**

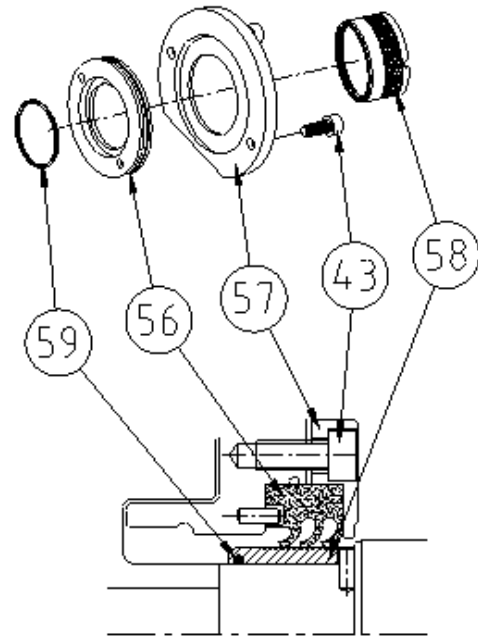
## 8.2 EXPLODED VIEW / ZP018, ZP030, ZP060, ZP130



**SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL / ZP018, ZP030**

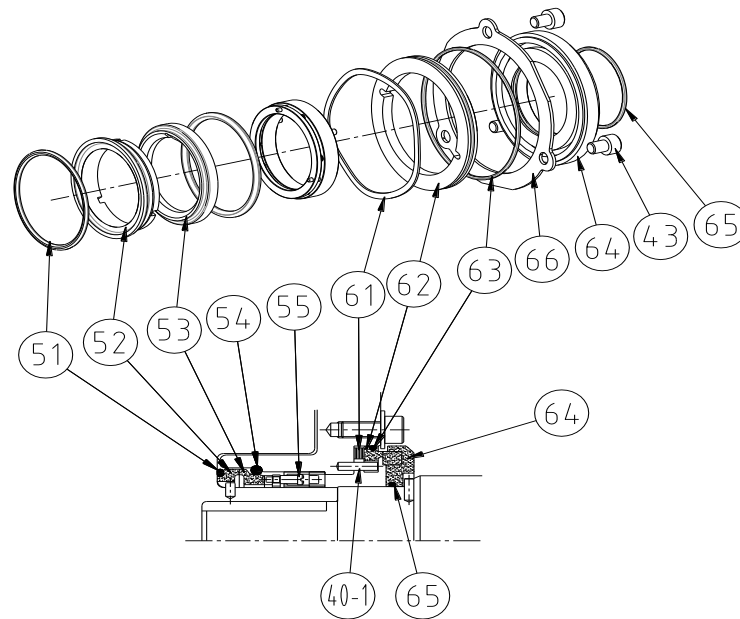


**Single Mech. Seal**

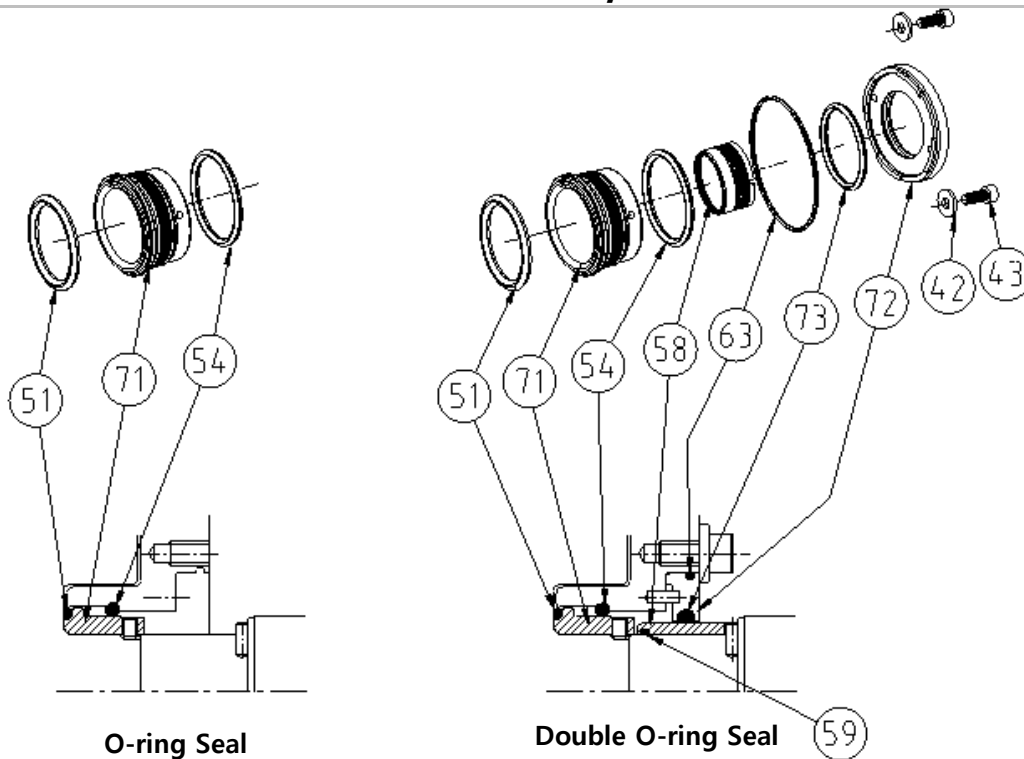


**Triple Lip Seal**

## DOUBLE MECHANICAL SEAL / ZP018, ZP030

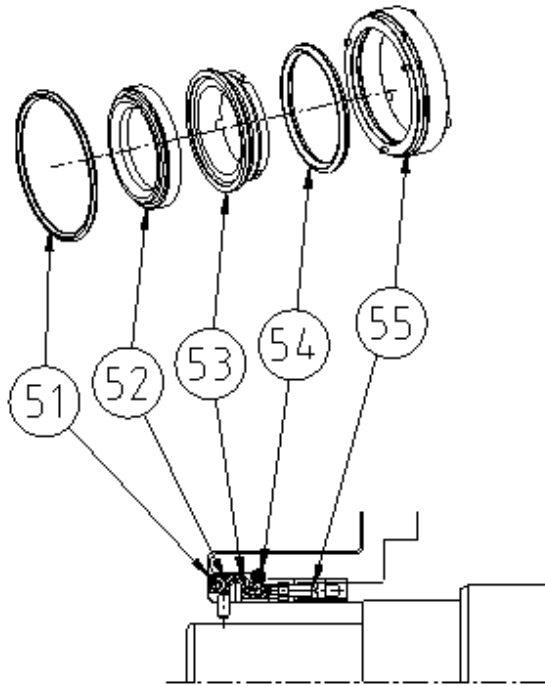


## O-RING SEAL & DOUBLE O-RING SEAL / ZP018 & ZP030

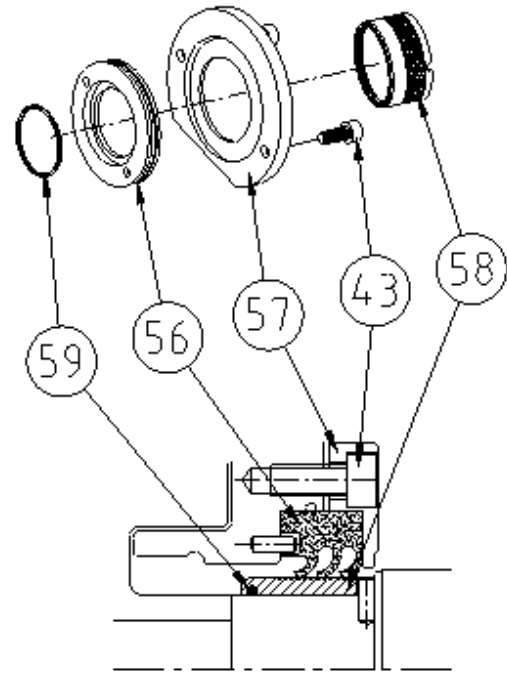




## SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL / ZP060

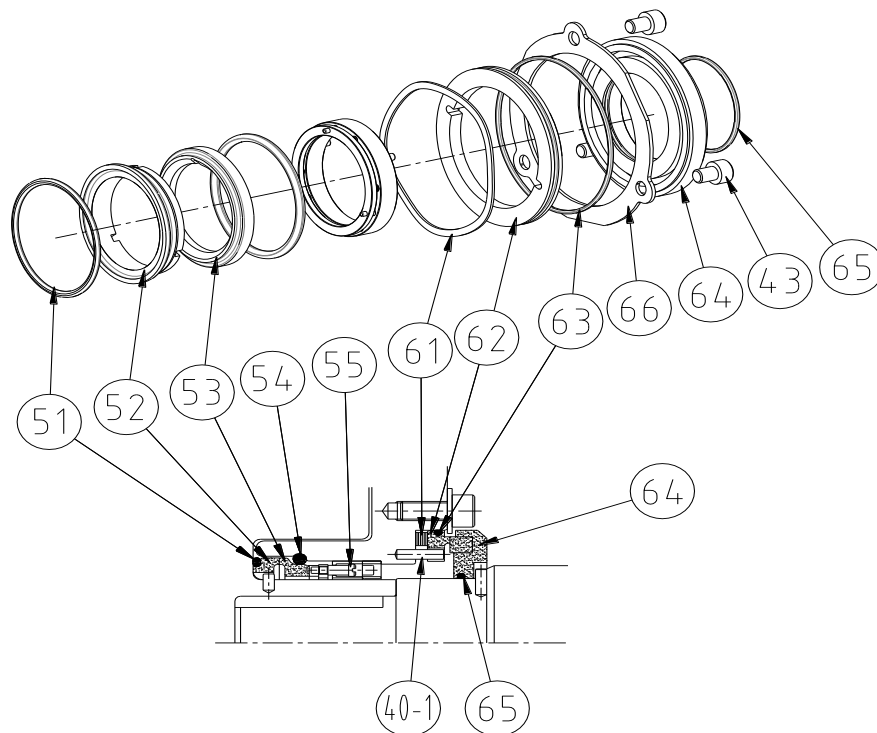


**Single Mech. Seal**

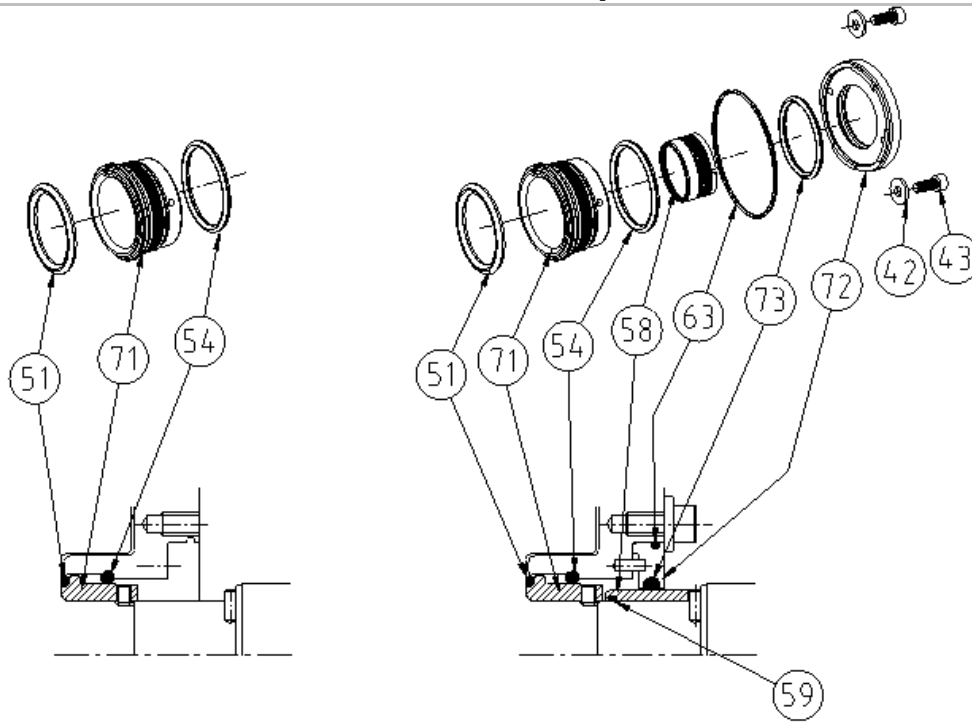


**Triple Lip Seal**

## DOUBLE MECHANICAL SEAL / ZP060



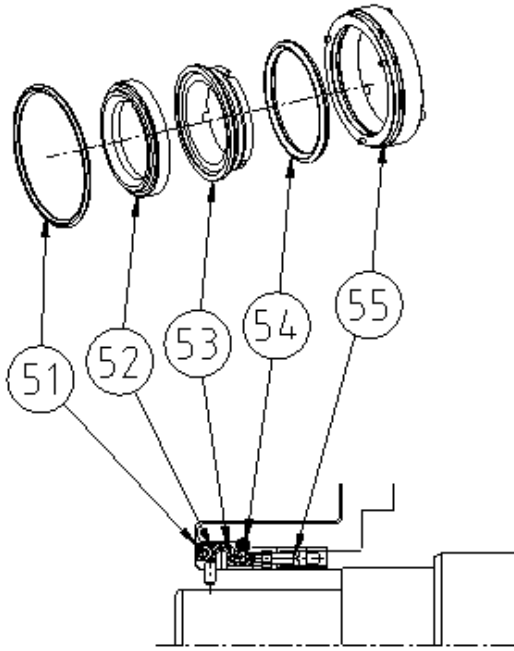
## O-RING SEAL & DOUBLE O-RING SEAL / ZP060



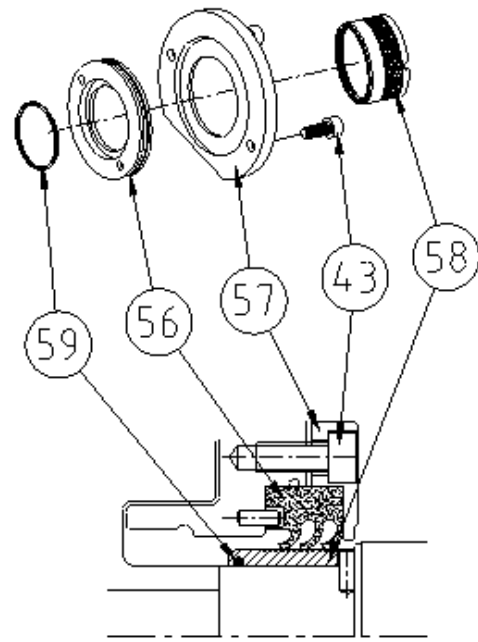
**O-ring Seal**

**Double O-ring Seal**

## SINGLE MECHANICAL SEAL & TRIPLE LIP SEAL / ZP130



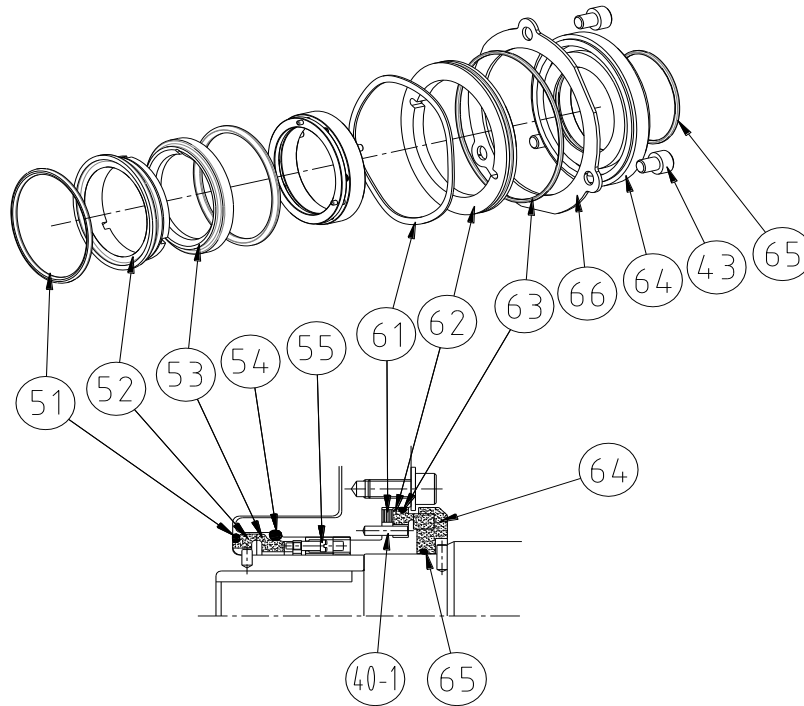
**Single Mech. Seal**



**Triple Lip Seal**

## DOUBLE MECHANICAL SEAL / ZP130

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## O-RING SEAL & DOUBLE O-RING SEAL ZP130

