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PUMP INSTRUCTION MANUAL

Valid for



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

We,

PACKO INOX LTD,
Cardijnlaan 10 – Industriepark Heernisse
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

Thank you for selecting a PACKO pump.
Please read this manual carefully and observe the information contained with respect to:

- Safety,
- Working reliability,
- Storage,
- Installation,
- Start up,
- Maintenance,
- Repair.

This manual has to be available at the location where the pump is used and for everyone who has to work with, or on the pump. If there are unclear points in this manual, please contact PACKO for further information.

1. GENERAL INFORMATION

1. 1. Manufacturer and country of origin

PACKO INOX LTD
Cardijnlaan 10 – Industriepark Heernisse
B-8600 Diksmuide
BELGIUM
TEL + 32 51 51 92 80
MAIL pumps.packo.be@verder.com

1. 2. Copyright

This manual has been prepared to ensure correct and safe installation, use and maintenance of the pump in accordance with the EC directives “Machinery”. It is originally written in Dutch, English, French and German by the manufacturer. All other languages are translations of the original manual.

PACKO INOX LTD has the copyright on this document. This manual can be copied completely for the manual of the machine or installation in which the pump is used and can be used for the instruction of the personnel who have to work with or on the pump. Any other publication, copying or use is prohibited.

This manual has been prepared carefully. However it does not contain all the possible accidents that could happen during installation, operation and maintenance of the pump. It is important that the pump is not used for any purpose other than the specified application given when ordering the pump and for those that the pump was built. This might cause material damage and injuries.

1. 3. Product information

The ZL, ZLC, ZW, ZP, HP, LH, LU, LT, LTE and 55 series are rotary lobe pumps, delivered either with motor and coupling, mounted on a baseplate (pump-motor unit) or as bare shaft pump. All these pumps are bidirectional. Therefore, either port can be used as suction or discharge. The pumps are used for transferring a wide range of low or high viscous products. Above mentioned Packo rotary lobe pump types meet the hygiene requirements imposed by the food industry and are suitable for handling food products and others. The ZLC, LU and 55 series have a high-grade finish, which is agreed when the pump is ordered, under circumstances they meet requirements imposed by the pharma industry.

1. 4. Model Designation

The model designation is given on the order confirmation, CE declaration, invoice and also on the nameplate:

PACKO INOX LTD DIKSMUIDE BELGIUM	Packo	
TYPE: ZL/120-213/114		
Mat.code: (5TL-120) D37SSVQ		
Year:	S/N:	kg
Max: bar		˚C
DO NOT RUN PUMP DRY OR AGAINST CLOSED VALVE	CE UK CA	

EXAMPLE:
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: (5TL-120) D37SSVQ

- 5: (digit only for ZLC series) material product wetted parts. 5 = low ferrite material 1.4435, no digit = standard stainless steel AISI 316L material
- TL: Lobe type (TL = tri-lobe, BW = bi-wing, HL = heli-lobe, SC = Scimitar)
- 120: temperature class of the pump (Deg. C)
- D: type of connection (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);
- Please note: in case a PRV (pressure relief valve) is selected, the above character appears small instead large. (e.g. “d” instead “D”)
- 37: housing size of the motor reductor
- S: seal configuration (S = standard single seal, Q = quench, D = double mechanical seal, T = triple lipseal, Y = knife edge seal, G = packed gland)
- S: mechanical shaft seal materials (S = silicon carbide / silicon carbide, T = tungsten carbide / tungsten carbide I = carbon / stainless steel)
- V: elastomer materials (E = EPDM, V = Viton, M = Teflon, P = NBR)
- Q: options (T = pump and motor reducer on trolley, U = pump and motor reducer on trolley with cover, P = bare pump, Q = pump and motor reducer aligned on base plate, R = pump and motor reducer 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. 5. Noise 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.

2. SAFETY

2. 1. Declaration

Within the meaning of the EC-directive “Machinery”: A pump never functions independently. It is intended to be incorporated into machinery. It should only be put into service if the machinery has been declared to conform to the provisions of the EC-directive “Machinery”. (2006/42/EC) PACKO INOX LTD reserves the right to carry out technical modifications that might be necessary to improve the products that are not mentioned in this manual.

2. 2. Designated use

The pump is intended to be built into a piping installation and to move the liquid coming into the inlet via the suction pipe and discharge it to the discharge pipe via the outlet of the pump. Therefore the motor must be supplied by an electrical power supply according to the nameplate of the

motor. The load of the motor depends on the pressure difference over the pump. The motor was selected for the duty point stated on the quotation of the pump. If the pump must operate at another duty point, check if the installed motor is suitable for these circumstances.

Every pump is specifically built for a particular application.
The pump parts, materials, seals and motor power have been chosen according to:

- the liquid (composition, physical and chemical properties),
- the required pump capacity (pressure, minimum and maximum flow),
- the mains voltage available,
- Operating circumstances (system pressure, presence of air bubbles or solids, place of installation).

The viscosity of the circulated liquid must be between 0.35 cP and 1000.000 cP.

The ambient temperature must be between 0°C and 40°C. The pump cannot be installed higher than 1000 m above sea level. Operating the pumps beyond these parameters necessitates an adapted motor.

For pumps supplied under guideline 2014/34/ EU (ATEX), all statements on the declaration of conformity are part of the designated use.

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. All safety notes stated in 2.3 form an integral part of the designated use.

Provision of a variable motor speed by frequency inverter, is always recommended to enable flow to be accurately set, accommodate changes in fluid viscosity, changes in temperature, or to run pump faster for cleaning.

2. 3. Warnings and safety notes

ATTENTION



It is essential that anyone who will install, operate, or be involved with this pump shall read the whole of this manual before installing the pump, as it contains important safety information.

Failure to follow these instructions could result in damage to the pump or injury to yourself or other people.

Adherence to the procedures and specifications outlined in the following chapters will assist in providing economical and reliable operation throughout the life of the pump. If service or repair other than that described in this manual should become necessary, contact your supplier for assistance.

Any pump returned to the supplier for any reason must be fully cleaned and decontaminated and accompanied by details of what fluids have been pumped, including full Health and Safety information (MSDS) if any of those fluids are hazardous.

All figures in brackets ( ) throughout this manual refer to the component position numbers used in the assembly manuals and

the spare parts lists.
Throughout this manual your attention is drawn to certain procedures which must be followed to ensure safe operation and servicing of this product.

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ATTENTION



DO NOT ignore safety instructions.

DO NOT use this equipment if the end cover is removed, guards are missing or inlet & outlet pipework is not connected.

DO NOT forget the hazards of moving parts, high fluid pressure, extremes of temperature, hazardous, liquids, electricity.

ALWAYS isolate and lock-out pump drive motor before inspecting or servicing pump.

2. 4. ATEX Safety Measures

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

Pump type	Risk / Liquid	Dry running mechanical seal (overheated seal faces are an ignition source	Leakage (Inflammable liquid can reach the atmosphere
Flooded suction pump	Non ignitable liquid	• Flushed mechanical seal • or flow monitoring to be installed by customer	No danger
	Ignitable liquid		• Flushed mechanical seal • or single seal with preventive maintenance by customer

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 seals have to be replaced. The mechanical seals have to be replaced preventively every 3.000 operating hours.

Pumps with Pressure Relief Valve (PRV)
The purpose of a PRV is protection of the pump by suddenly increasing the discharge pressure. The PRV´s used in Packo pumps are not intended to use as by-pass valve! Due to the rapid temperature increase of the liquid circulating in an open PRV, it must not be operated open longer than 3 seconds!

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 indicated on the pump's nameplate.

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

2. 5. Guards and safety

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All moving parts must be guarded, and in accordance with EC-directive "Machinery". (2006/42/EC)

Local safety regulations and codes of practice will specify the minimum acceptable standard but as a guide:

- Couplings, belts and pulleys must be enclosed to prevent fingers, clothing or tools from touching moving parts.
- Guards must be made from corrosion resistant materials.
- Guards must be securely fixed.
- Pump must not be operated with guards removed.

3. TRANSPORT AND TEMPORARY STORAGE

3. 1. Transport

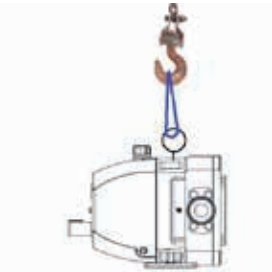
The pumps are packed in our dispatch department so that they will be free from any transport damage, except in case of improper treatment. The pump is to be transported in the original packaging to the installation, where it is to be unpacked. If the packaging is damaged, the supplier or PACKO is to be notified of any damage that may have occurred before unpacking.

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3. 2. Temporary storage

The pump must be stored in a dry (air humidity lower than 60%) and clean environment, free from shocks and vibrations, at a temperature between 5 ° C and 40 ° C. Motor windings and metal parts may be affected by condensation.
In that case, the warranty will be invalid.
When the pump is stored for a long time, the shafts must be turned by hand every two months. This will prevent the sealing faces from sticking together and the motor bearings from being damaged.



Straps with sufficient load capacity must be used. Make sure you set the pump down on a stable horizontal surface.

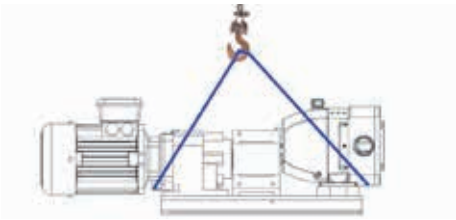
4. INSTALLATION

4. 1. Preliminary

In order to check if the pump you received is exactly the pump you need and ordered, check during unpacking if the model on the nameplate of the pump is the same as on your order. Check voltage, frequency and power on the nameplate of the motor.

4. 2. Lifting the pump

The pumps need to be transported and secured with care to ensure no damage is caused. Smaller pumps without motor weigh less than 20 kg and can be lifted by hand. Larger pumps with lifting eye bolt and complete units should be lifted as shown on the below pictures.



4. 3. Location & Orientation

Pump should be located:

- As close as possible to the fluid source and as low as possible to maximize the net inlet pressure available to the pump.
- In a clear area allowing access all around pump and drive for easy servicing.
- With space above for lifting equipment required.
- With port axis vertical if pump is required to be self-draining.

All Packo rotary lobe pumps are equally suitable for both directions of rotation.

Packo rotary lobe pumps can be rotated to give horizontal port orientation with top or bottom input shaft positions or vertical port orientation with left or right input shaft positions.



For HP/40 - 60, LH70, LT, LTE and LU types, this is achieved with the bolt-on feet and re-positional gear cover. (Ensure gearbox is drained of oil prior to gear cover removal). After re-positioning the gear cover, also put breather, oil sight glass and plug in the right position.

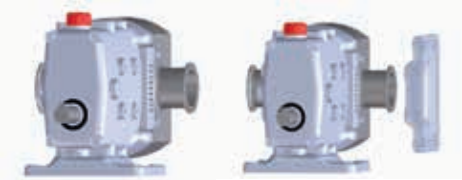
To change any pump from vertical to horizontal pipework or vice versa, the correct foot kit needs to be applied. Foot kits contain all components required to change orientation.

HP/30 type is fitted with a one-piece foot, which can be assembled in 4 different positions, gear cover must not be re-positioned. Breather, oil sight glass and plug need to be re-positioned.



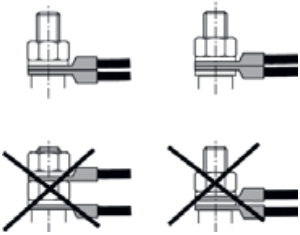
55 series pumps can be rotated to give vertical or horizontal port orientation with top/bottom or right input shaft positions. This is achieved by re-positioning the gear cover/foot.

ZL(C)/ZW and ZP types are fitted with a one-piece foot and have mounting positions on all 4 sides of the gearbox. The gear cover can remain in its position. Breather, oil sight glass and plug need to be re-positioned.

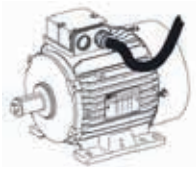


4. 4. Electrical connection of the motor

The electrical connection of the motor should only be carried out when the power supply is switched off. This should be done by qualified personnel and according EN 60204 and local national rules and standards. Special attention should be paid to good earthing which must conform to your local national rules. Check on the nameplate of the motor if it is suited to operate on the available voltage and frequency.
Select the protection system and the feed cables according to the details on the identification plate of the motor. The drop in voltage during the starting phase must be less than 3 %. Tighten the nuts of the terminals, connectors and supply cables to the torque indicated below (Nm):



Terminal	M4	M5	M6	M8	M10	M12
Steel	2	3.2	5	10	20	35
Brass	1	2	3	6	12	20



Do not place either washers or nuts between the motor connectors and the supply cable connectors.
Ensure that the cable gland is dust and damp proof: the cable gland must correspond to the diameter of cable used.

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Bring the cables into the terminal box with a radius that prevents water from penetrating via the cable gland. (The cable must leave the motor downwards.)

Connect according to the coupling information on the identification plate and the diagram in the terminal box. Do not connect the motor if you do not understand the wiring diagram. Please contact PACKO in that case. Never check the direction of rotation of the pump with an opened terminal box of the motor. The installer is responsible for following the rules on electrical compatibility applicable in the country where the pump will be used. Comply with the voltage and frequency indicated on the nameplate. (Do not deviate by more than 5 % from the voltage indicated or by more than 1 % from the frequency.)

For pumps with a motor power of more than 7.5 kW, special starting provisions must be taken (stardelta starter, soft starter or starting with frequency converter).
Motors are equipped with built-in PTC thermal protection. When the motor senses danger of heat, the resistance of this PTC (which comes out in the terminal box of the motor with two threads) increases strongly. The PTC has to be connected to a PTC relay or frequency converter that switches off the motor when the motor becomes too hot.

The installation of a thermal protective device is always required.

4. 5. Ports and Pipework

HP/40 – 60, LT and LTE series have bolted ports. To add or change any pump ports, the correct port kit needs to be applied. Port kits contain all components required to assemble the ports to the pump.

The correct port gasket (elastomer type) is supplied with the pump.

HP3, 55, LH, LU, ZL/ZLC, ZW and ZP types have welded ports.

Pipe runs and sizes should be established at the time the pump is selected.
When installing the pump do not deviate from this design without rechecking pump selection:

- Keep pipe runs short and pipe diameters large; pipes may need to be larger diameter than pump ports especially when pumping viscous liquids to prevent cavitation.
- Use large radius bends and full bore valves.
- Fit vacuum/pressure gauges each side of the pump to monitor pressure conditions. Once process is established (and will not change), these can be removed.
- Avoid filters on the inlet side of the pump if possible. A clogged filter will cause cavitation.
- Use hot water/steam jackets or electrical resistance tape to heat pipes carrying liquids which thicken when cool.
- Provide an interlock to prevent pump from running unless liquid in pipes is at correct temperature to avoid over pressure, cavitation, or excessive drive shaft loads.
- Clean the pipe work before connecting to the pump so that no foreign particle can come into the pump during starting up.
- The pipe work must be carried out according to good manufacturing practice and connected to the pump without mechanical forces.
- The suction and discharge pipe must be supported, do not allow weight of pipe

(and the fluid within) to be taken on pump ports.
- Provisions for the expansion and contraction of the pipes due to warming up and cooling down must be taken (e.g. placing compensators).

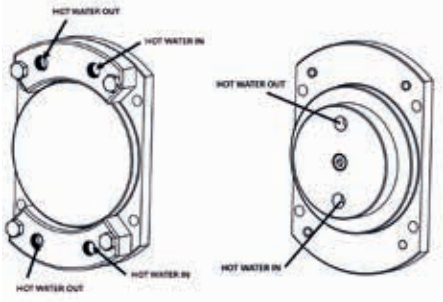
4. 6. Enlarged rectangular inlet

Packo ZL, ZP, HP and LH series are available with optional enlarged rectangular inlet. The weight of the hopper (Including the product it contains) must be supported separately and not allowed to rest entirely on the pump as this would affect the rotor clearances leading to pump seizure. The mating flange of a hopper or screw feeder should be machined to the identical dimensions of the rectangular inlet and sealed. This will avoid ledges where product could 'hang up'. Ensure effective flow of viscous fluid into the pump.

4. 7. Heating/Cooling jackets

Packo rotary lobe pumps are available with optional heating/cooling jacket on front cover and/or rotor case. These allow hot or chilled water, oil or steam to be piped to the pump to maintain product temperature in the pump or to heat the pump prior to starting.

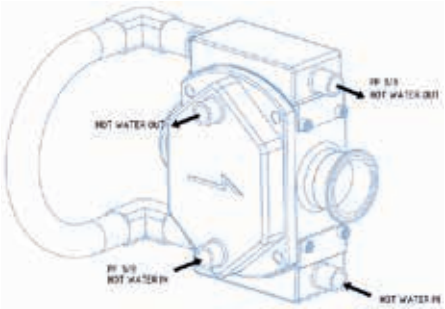
Configuration of heating/cooling jackets for HP, LH, LU, LT, LTE and 55 series:



Application limits are:
- Jacket Pressure: 2 bar.
- Temperature: 120 °C for ATEX pumps.130ºC for non-ATEX pumps.

Jacket connection dimensions: 1/4" BSP female (HP3 – 1/8" BSP female)

Configuration of heating/cooling jackets for ZL(C), ZW and ZP series:



Application limits are:
- Jacket Pressure: 4 bar.
- Temperature: 120 °C for ATEX pumps.150ºC for non-ATEX pumps.

Jacket connection dimensions: BSP 3/8" female

Note:
for steam use opposite direction to evacuate condensation water.

4. 8. Seals and flushing

Several types of shaft seals are available on the Packo rotary lobe pumps.
The correct type of shaft sheal should have been selected when the pump was originally selected but you must check that the seal fitted is suitable for the application before starting the pump.

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Provide flushing system as required.

The **Single Mechanical Seal** is suitable for many clean fluids which do not require a more sophisticated seal type.

Pumps fitted with single seals require no special installation. However, pumps must never be run completely dry for more than 30 seconds, as this will cause excessive heating of the seal faces.

Use flushed seals in pumps that need to run dry.

The **Flushed Mechanical Seals** fitted to Packo rotary lobe pumps are run with a low-pressure liquid flush between the primary mechanical seal and a lip seal to form a barrier between the pump and the atmosphere.
This allows the pump to be used for applications where the single seal is unsuitable.

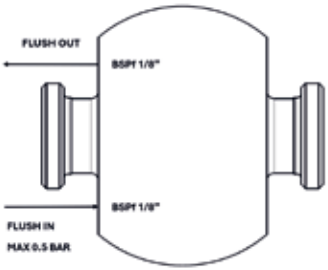
Flushed seals are used when:

- Pumped fluid changes state in contact with air, i.e. crystallizes, forms a film, dries out or precipitates solids. The flush dissolves and rinses away the small amount of reside which could build up on the edges of the seal faces.
- Pumped fluid is close to its boiling point, e.g. water over 80°C . The flushing fluid is used to cool the seal faces.
- Pumped fluid is temperature sensitive and degrades when heated by the shearing action of the seal faces. The flushing fluid is used to cool the seal faces.
- Pump may run “dry”, i.e. no liquid in pump chamber for very short periods.
- Pump is under high vacuum.
- A low pressure sterile barrier is required.
- The pumped fluid is toxic or hazardous and must not escape from pump even in minute quantities.

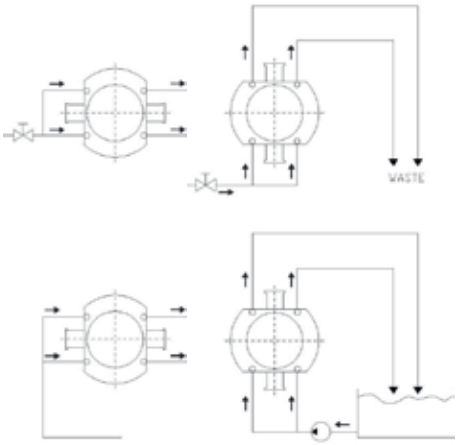
A low-pressure flushing fluid system must be installed as follows (flushed seals and pressureless double mechanical seal):

- Liquid must be compatible with the pumped fluid; water is the most commonly used liquid.
- Pressure may not exceed 0.5 bar gauge.
- Temperature shall be maximum 70ºC for water, less for volatile liquids (minimum 20ºC below boiling point of liquid).
- Flow rate shall preferably be 2 to 3 litres/ min. per seal.
- Flush fluid should be connected to flow in at the lowest point on the seal housing and out at the highest point to vent air pockets.
- ZL(C), ZW and ZP types have an internal liquid distribution between both seals and require only one in/outlet connection.

Connection scheme:



All other types provide an in- and outlet connection on each seal. Connection scheme:



Flush connection dimension: BSP 1/8" female.

The Double Mechanical Seals fitted to HP, LH, LU, LT, LTE and 55 pumps provide the facility to contain a high pressure fluid behind the primary seal (pressurized barrier). This allows the pump to be used for applications where the single seal is unsuitable.

Note: Double Mechanical Seal of other types than HP, LH, LU, LT, LTE and 55 are not suitable for high pressure operation!

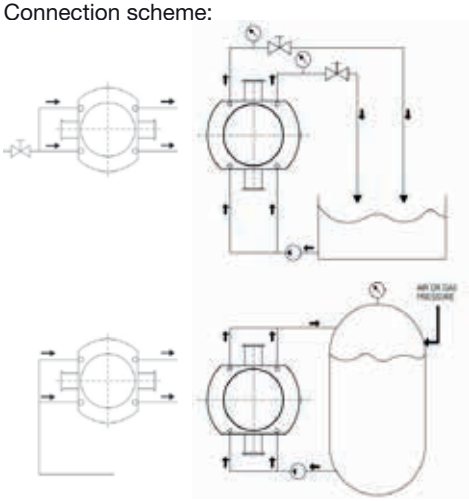
Pressurized barrier double Mechanical Seal are used when:

- The pumped fluid has no lubricating properties and cannot be allowed onto seal faces
- Pumped fluid is highly viscous, i.e. over 150,000 cps.
- A high pressure sterile liquid barrier is required.

When the double seal is used with a high pressure liquid flush for the reasons described above, a flushing system must be installed as follows:

- The flushing liquid used must itself be compatible with the pumped fluid and must itself not require a complex seal, i.e. must be non-hazardous, non-abrasive and lubricating.
- Flush liquid must be at a pressure of 1 bar above the discharge pressure of the Packo rotary lobe pump and should flow at 35 to 55 litres/hour per seal.
- Flush fluid should be connected to flow in at the lowest point on the seal housing and out at the highest point to vent air pockets.

Connection scheme:



Flush connection dimension: BSP 1/8" female.

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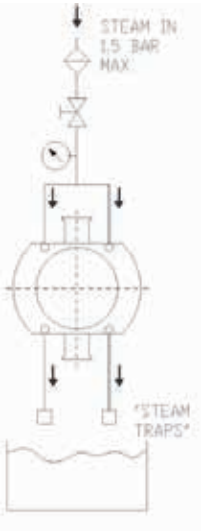
Double Mechanical Seal with steam when:
No bacteria or contamination can be allowed to enter pump, i.e. an aseptic system.
A steam barrier system must be installed as follows:

ATTENTION

- Wherever possible, sterile liquid i.e. steam condensate should be used as a flush. Condensate should be connected to flow in at the lowest point on the seal housing and out at the highest point to vent air pockets.
- Where steam is essential, great care must be taken with the design of pipework, steam traps and controls.
- Steam must be clean, filtered and wet, i.e. not superheated.
- The pressure of steam should be as low as possible consistent with the desired temperature
- Steam should be connected in at the highest point on the seal housing and out at the lowest point to allow any condensate to drain from the lowest point.

Connection scheme:

ATTENTION



Flush connection dimension: BSP 1/8" female.

Silicon carbide on silicon carbide seals are not recommended for steam flushed applications.

Note: Steam barrier flushing is only applicable for double mechanical shaft seals for HP, LH, LU, LT, LTE and 55 types!

4. 9. Front Cover pressure relief valves

Some Packo rotary lobe pumps can optionally be fitted with a front cover pressure relief valve, which can be set to protect the PUMP ONLY from overpressure.

Spring loaded pressure relief valves are kept closed by the adjusted spring force, and opened by exceeding pump pressure.

Spring loaded pressure relief valves

ATTENTION

This valve is not designed to protect the system or to provide long term by-pass of liquid.

If this is required then an IN-LINE relief valve should be fitted which can by-pass

the liquid back to the suction vessel during overpressure situations.

ATTENTION



The maximum pressure rating of the pump is stated on the pump name plate.

The relief valve should be set so that is open before it reaches this pressure. Be aware that there may be a piece of equipment in the system that is limited to a lower pressure than the pump. If this is case then the pump end cover relief valve should be set so that the pump cannot exceed this pressure.

Setting the relief valves
(should be done, using liquid to be pumped):

- Turn the adjusting screw of the pressure relieve valve counter-clockwise so that it leaves the housing as far as possible. This ensures that the valve is fully open.
- A pressure gauge is required to be fitted in the pipe system directly after the pump.
- Start the pump running.
- Increase the pressure on the pump by slowly closing the pressure relieve valve by turning the adjusting screw clockwise. Continue until the desired relief valve pressure setting is achieved.

ATTENTION



Make sure that the maximum pressure of the pump is not exceeded. Check the pump name plate.

The valve is now set.

If setting procedure is done

- Check the relief valve setting by opening the downstream valve or reducing the pump speed. It will be necessary to reduce the pressure to approximately 10% of the set pressure to ensure full closure of the relief valve.
- Alternatively stop the pump.
- Re-start the pump or increase the pressure as stated in relation to the setting of the relief valve.
- The relief valve should open at the set pressure.
- Make further adjustments as necessary.

4. 10. Overload protection

ATTENTION



To prevent injury to personnel or damage to pump or system caused by excessive pressures, a protection device should be fitted such as:

- Pressure switch or sensor wired to stop the drive motor. Ideally, the motor should be fitted with a brake.
- Pressure relief valve or bursting disc fitted downstream of the pump and piped to direct excess fluid away safely.
- Relief Valve fitted to pump end cover.
- Torque limiting coupling between drive and pump shaft.
- Motor current sensor.

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ATTENTION

Protection devices must be set to operate at, or below, the safe operating pressure of the pump or of the system, whichever is the lower.

NOTE that maximum pressure varies with temperature.

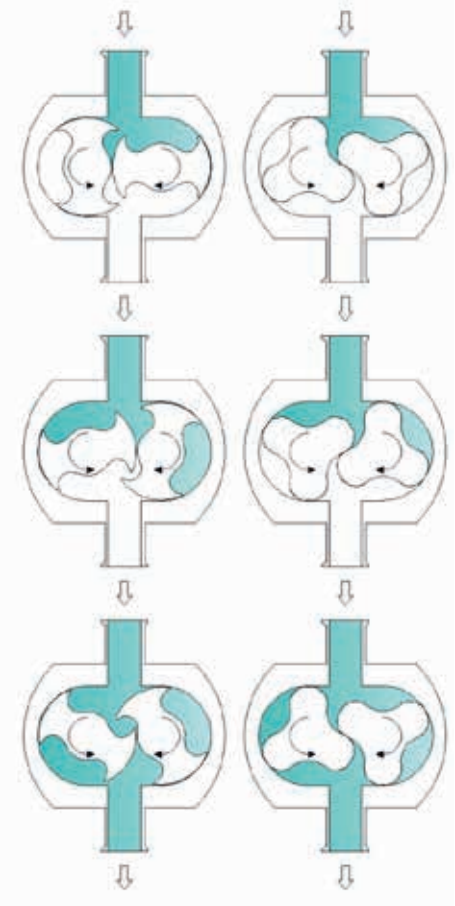
ATTENTION

Due to the rapid temperature increase of the liquid circulating in an activated PRV, it must not be active (open) longer than 3 seconds!

5. OPERATION

5. 1. Principle of Operation

Packo rotary lobe pumps have 2 rotors which turn in opposite directions. Fluid enters the pump from the inlet port and fills the space between the rotors. This fluid is carried around the outside of the rotors and is forced out of the discharge port as the rotor lobes mesh together. Each rotor is supported on a shaft and when the pump is running within its operating limits, the rotors never touch the inside of the rotor case, or each other.



Careful attention to correct installation of Packo rotary lobe pumps, and recognition of certain limitations to the operating conditions of the pump, will ensure long life and trouble-free running.

ATTENTION



Failure to follow these instructions could result in personal injury or loss of life. Take particular care over the following:

PRIMING: Packo rotary lobe pumps are not truly self-priming and should be installed in a “flooded inlet” pipe arrangement i.e. with the pump lower than the level of liquid to be pumped and with the supply pipe falling continuously to the pump with no loops.

PRESSURE: Do not operate the pump above the maximum differential pressure mentioned on the nameplate of the pump, not even for a few seconds, as damage to the pump components will result, leading to metal particles in the pumped fluid, ineffective cleaning and possibly complete pump seizure.

ATTENTION



NEVER run the pump against a closed valve. Note that the pressure limit varies with temperature.

SOLIDS: Packo rotary lobe pumps can handle soft solids in suspension but will be damaged by hard particles. Take care when pumping solids, crystals, etc.

NEVER allow metal parts to enter pump, i.e. weld metal, screws, tools, etc. as these will stop the pump, leading to damaged rotors, rotor case and shafts.

CAVITATION: The pumps cannot operate without sufficient pressure of liquid at the inlet port to supply the pump. Normally atmospheric pressure is sufficient but the actual pressure needed is higher for:

- High Viscosities
- High Temperature
- High Pump Speeds
- Volatile Liquids

Insufficient inlet pressure will cause the pump to cavitate leading to low performance, noise and short pump life. Ensure inlet pipes are short, large bore and do not collapse under vacuum.
If in doubt consult Packo before operating the pump.

5. 2. Start up

Before starting the pump for the first time or after servicing or maintenance work, check the following - failure to do so could damage the pump or cause injury to personnel.

- Pump and pipes are clear of welding flash or other debris.
- All pump head and mounting bolts are tight.
- All pipe connections are secure
- All guards, safety and protection devices, are in place and effective.
- Check motor is wired for correct direction of rotation
- Flushing fluid, if required, is flowing.

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ATTENTION



Do not use Packo rotary lobe pumps to flush the system the first time. Flush the whole system with suitable cleaning agents before starting the pump, using another more suitable pump if necessary.

Be aware that heavy or metal debris tends to collect at the lowest point in the system.

- All valves are open - NEVER run pump against a closed valve.
- Pipes and pump head, if heated, are to normal operating temperature.

When possible, start pumps slowly and increase speed gradually.

- Listen for unexpected noises.
- Check for leaks.
- Check that the pump gives desired flow rate, using pumped media at normal operating speed.
- Do not continue to run the pump if fluid is not flowing; dry running can damage seals.

ATTENTION



- Observe the pump during first few hours of operation - check for noises and excessive heating of the pump, e.g. if above 80°C, unless pumping hot liquids when 110°C may be reached.
- If operating at high speeds or with hot liquids, the surface of the pump can become hot.



Direction of flow		
Direction of drive shaft	Viewed from pump head end	
	Clockwise	Anti-clockwise
Horizontal ports top shaft drive	Left to right	Right to left
Horizontal ports bottom shaft drive	Right to left	Left to right
Vertical ports left shaft drive	Bottom to top (up)	Top to bottom (down)
Vertical ports right shaft drive	Top to bottom (down)	Bottom to top (up)

5. 3. Routine checks

5. 3. 1. Daily Checks

- Visual checks of all joints and for signs of leakage of product, flushing liquid (if used) and oil from the gearbox.
- Check the packed gland or triple lip seal for excessive leakage (if used)
- Listen for any unusual noises
- Check for any vibration or temperature changes.
- If minor problems are identified these should be rectified at the end of the shift and if major they should be attended to at once.

5. 3. 2. Weekly Checks
- As Daily Checks.
- Remove end cover of pump and inspect for signs of damage or wear. Repair or replace as necessary.
- If the main product shaft seals are of the packed gland type, inspect them for signs of wear. Replace or plan for replacement as necessary.
- Check lubrication level in the gearbox and top up as necessary. This must be done with the pump stopped.
- Check lubrication level on drive unit and top up as necessary. Follow the manufacturer's instructions.

5. 3. 3. Monthly Checks
- As Weekly Checks.
- Remove end cover and inspect surfaces
- Visually check rotor surfaces.
- If an end cover relief valve is fitted check its function. If the relief valve is not operating on a regular basis the diaphragm may have a tendency to stick.

5. 3. 4. Six Monthly Checks
- As Monthly Checks.
- Change end cover O-ring or end cover gasket.
- Remove rotors for visual inspection and signs of wear.
- Inspect seal faces for wear and condition of elastomers. Replace as necessary or note for planned maintenance.

5. 3. 5. Annual Checks
- Change mechanical seals if fitted, and if required.
- Replace lip seal on mechanical seal flush housings.
- Replace end cover relief valve diaphragm.
- Change packing rings on packed gland type shaft seals.
- Change all O-rings and/or gaskets on pump head.
- Inspect gearbox oil seals and gear cover gasket for signs of leakage and replace as necessary.
- Check bearing wear by seeing if there is any movement of the shaft side to side or forwards and backwards. If movement is perceived remove the gear cover and dismantle bearings for inspection, replace if necessary.
- Drain and change oil in the pump gearbox.

By ensuring a visual inspection daily and regular checks at planned intervals, pumps can be maintained to maximum performance for many years.

Failure to maintain the pump by carrying out the above checks may invalidate warranty.

5. 4. Temporary decommissioning

After switching off the pump in the case of shutting down the installation, the suction and discharge valves should be closed. For pumps with heating jackets, this heating also has to be turned off. If the liquid remains in the installation, the valves should be locked so that they cannot be opened in error. When there is a risk of frost, in the case of prolonged stoppages or when the liquid can coagulate inside the pump, the pump is to be emptied, cleaned and protected against frost.

5. 5. Permanently decommissioning

Although Packo pumps are extremely durable, after many years of service, a moment comes when the pump will be permanently put out of service. Apart from

the seals and smaller parts of the motor, the pump is completely built in metal. This metal can be recycled via the scrap trade. With smaller pumps, the motor fan and fan cover are made of plastic, these can also be recycled. The seals, and electronic components of an optional frequency converter built on the motor, must be scraped and disposed of in accordance with the applicable local environmental legislation.

5. 6. Directives in case of failure

Loud noises, severe vibrations or leakage indicate a malfunction or failure of the pump. Try to find the reason for failure. If there is a malfunction you do not recognize or you cannot repair yourself, PACKO must be notified immediately. During the warranty period, you are not allowed to make repairs yourself without previous permission of PACKO.

5. 7. Clearing a blockage

When the rotors cannot turn freely anymore, the pump must be switched off and the valves on the suction and the pressure side must be closed. Let the pump return to ambient temperature, empty, take out of the piping system and decontaminate if necessary. Disassemble the front cover according the disassembly instructions in chapter 10.

Remove the source of the blockage: check for any foreign particle in the pump and replace all parts that show burrs or any other damage due to the blockage. After replacing all damage parts according to the assembly manual reassemble the front cover. Before reinstalling the pump back into the piping system, check with your hand that the shaft is free to rotate. If this is not the case, the pump must be completely disassembled and checked for any damaged components, which must then be replaced by original Packo parts. When the cause of the blockage has been found and is prevented for the future, assemble the pump again according to the assembly manual.

6. LUBRICATION

Packo rotary lobe pumps have oil lubricated shaft bearings and timing gears.

Replacement of these bearings and gears 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

The oil in the 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.
- Oil grade and filling quantities for each series are shown in the assembly manual.

7. CLEANING AND STERILISATION

Packo rotary lobe pumps are designed for use with products that require the process equipment and pumps to be cleaned. The standard (level) of cleaning or sanitization required depends on the needs of the process and product. This information is provided for guidance only. It is the responsibility of the pump user to be satisfied that the cleaning protocol chosen is adequate to achieve the desired levels of cleanliness and Packo cannot accept any responsibility for contamination or loss.

In order to clean the pump it must either be dismantled (manual cleaning), or cleaned in place (CIP) as part of the procedure for cleaning the entire process. The higher the standard required, the more sophisticated the cleaning process. Pumps can be cleaned and sterilized in place, i.e. by flushing through with cleaning agents and/or steam, without the need to dismantle the pump.

Equally the pump can be quickly stripped to gain access to all fluid contact surfaces for manual cleaning or inspection if required.

7. 1. Cleaning in place (CIP) & manual cleaning

Cleaning Systems
The type of cleaning system used depends partly on the level of cleaning required but also on what is to be removed. Organic materials such as oils, fats, proteins need a different system to inorganic materials such as mineral salts. Detergent manufacturers can give advice on the correct use of chemicals and temperature. CIP usually needs a velocity of 1.5 m/sec at 1 bar back pressure through the pipeline to achieve the turbulent flow required.

Procedure for Cleaning In Place (CIP)
Each pump is supplied in a generally clean condition but it is the responsibility of the user to establish suitable cleaning and sterilizing regimes appropriate to the fluid and process.
These should be implemented before the pump is first used and as often as required thereafter. The following guidelines will help with effective cleaning of Packo rotary lobe pumps to minimize risk of damage to the pump.

- Rinse through system with a suitable liquid, usually water at approximately 50°C , as soon as possible after completion of the process to remove bulk of residues before they dry onto surfaces.
- If CIP will not be carried out immediately after rinsing, leave the pump and system full of rinse liquid.
- Choose chemical cleaning agents to suit the nature of the contamination to be removed and use them in accordance with the manufacturer's recommended dilution, temperature and circulation time but do not exceed 90°C. Confirm compatibility with the pump materials of construction.
- CIP fluid flow should result in a mean pipeline velocity of at least 1.5 m/sec at 1 bar back pressure.

If using the lobe pump to circulate the CIP fluid, refer to the pump performance curve for pump speed to give required flow, taking account of pressure losses through pipework. Note that all pumps are more susceptible to cavitation when pumping hot liquids. Ensure adequate suction pressure is available.

If using a separate pump to circulate CIP fluids, the lobe pump may need to be rotated at a speed sufficiently high to allow the fluid to pass freely through. If sufficient pipe velocity cannot be achieved, fit a by-pass loop to divert excess flow past the pump.

CIP fluid pressures must equal or exceed process pressure at all points in the system to ensure fluid reaches all contact surfaces. It may be necessary to restrict flow in discharge pipework to achieve this **but do not exceed differential pressure and temperatures shown on pump nameplate.** A minimum differential pressure of 1 bar is recommended for effective cleaning.

After CIP, rinse through with neutralizers and clean water to remove all traces of cleaning agents.

ATTENTION



Do not pass cold liquid through the pump immediately after hot – allow temperature to change slowly. Failure to observe can result in pump seizure.

Procedure for Manual Cleaning
See elsewhere in this manual for procedures to dismantle and re-assemble fluid contact parts.

ATTENTION



Take care not to scratch or damage pump parts. One part of the seal faces remains in the rotor when it has been removed. Be extremely careful not to damage this seal face.

DO NOT use steel abrasive wool or brushes on fluid wetted surfaces as particles may become embedded in the surface and cause corrosion.
Use suitable cleaning agents in accordance with their manufacturer's instructions regarding temperatures, dilutions, skin contact precautions and other safety information.

Thoroughly clean all fluid contact surfaces and rinse as required.
As a minimum it will be necessary to remove the end cover and rotors. Re-assemble the pump in accordance with this manual.

7. 2. Sterilizing in place (SIP)

It is possible to pass steam through the complete assembled system to sterilize the internal surfaces without dismantling the pump.
To achieve 100% sterility, it is important to steam through for a period long enough for the coldest part of the system to reach the correct temperature and hold for the time period required to kill off the organisms.

Procedure for Sterilizing In Place (SIP)
If using chemical sanitizers, follow the guidelines as for CIP above. If using steam, pump specification must be chosen at time of selection noting:

- EPDM elastomers offer best resistance to repeated steam contact but will need to be changed periodically.
- PTFE (Teflon) is least suitable for steam

contact - PTFE end cover joints may need to be replaced every time the pump is sterilized.

Pump should be mounted with the port axis vertical to avoid collecting liquid pools. Thoroughly clean the pump and process lines prior to sterilization.

ATTENTION



Pass clean, wet steam through the system until all component temperatures have stabilized. Steam must be free of scale, rust and particles - a filter may be necessary. Typically steam will be at 121°C and 1 bar. Soak time, to bring the pump up to temperature is typically 20 minutes but this should be established, e.g. using temperature sensors, as the required soak time will vary with individual installations.

ATTENTION



DO NOT rotate the lobe pump during this heating phase.

DO NOT loosen or remove any pump components or pipe connections during steam sterilization as escaping steam may cause serious injury.

- Continue to pass wet steam through the lobe pump and process lines during the hold time. Hold time will be determined by the user to achieve desired level sterility. Typically this will be between 20 and 60 minutes.
- The lobe pump should not be rotated during this hold time unless absolutely essential to achieve sterility, due to increased risk of pump seizure. All pump components will normally reach desired temperature by thermal conduction without rotating the pump.

ATTENTION



If essential, the lobe pump can be rotated by hand during hold time - beware of danger of hot surfaces.

ATTENTION



If the lobe pump is fitted with single silicon carbide/silicon carbide seals it must not be rotated during hold time as the seal faces can bind together.

At the end of hold time, pump must be allowed to cool naturally or can be purged with sterile air/inert gas.

Pump must not be rotated during cooling.

Do not allow cool liquid to enter the lobe pump before the pump temperature has fallen to 60°C or lower.

If the pump is fitted with silicon carbide/ silicon carbide seals, flood it with liquid to lubricate the seals before rotating it.

8. INSPECTION AND REPAIR

Packo rotary lobe pumps need no adjustment during normal operation. It is advisable though to check oil levels and inspect the pump head components (especially seals and joints) periodically so that they may be cleaned or replaced before they fail in service.

All primary fluid contact components of the pump can be inspected and serviced without removing the pump rotor case from the gearbox and without removing either the pump or drive unit from the baseplate.

ATTENTION



For your safety:
Before commencing any repair or inspection, isolate power to pump and drive motor. Depressurize, drain and isolate pipework, seal flush and temperature control jackets (if fitted).

Please refer to the respective assembly manual, for any assembly/disassembly procedure.

9. TROUBLESHOOTING

Problem	Cause	Solution
Pump not rotating	Interruption of electrical power. Key sheared or missing. Coupler is not connected. Pump shaft or gears sheared.	Reset circuit breaker, check fuses. Replace. Replace or adjust. Replace.
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. 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 temperature. Repair leaks. 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 the issue.
3. Model of pump and serial number.
4. If possible installations sketch of pump system.

10. ASSEMBLY AND DISASSEMBLY

You will find the instructions for assembly and disassembly at:
https://www.verderliquids.com/int/en/packo/packo-downloads

