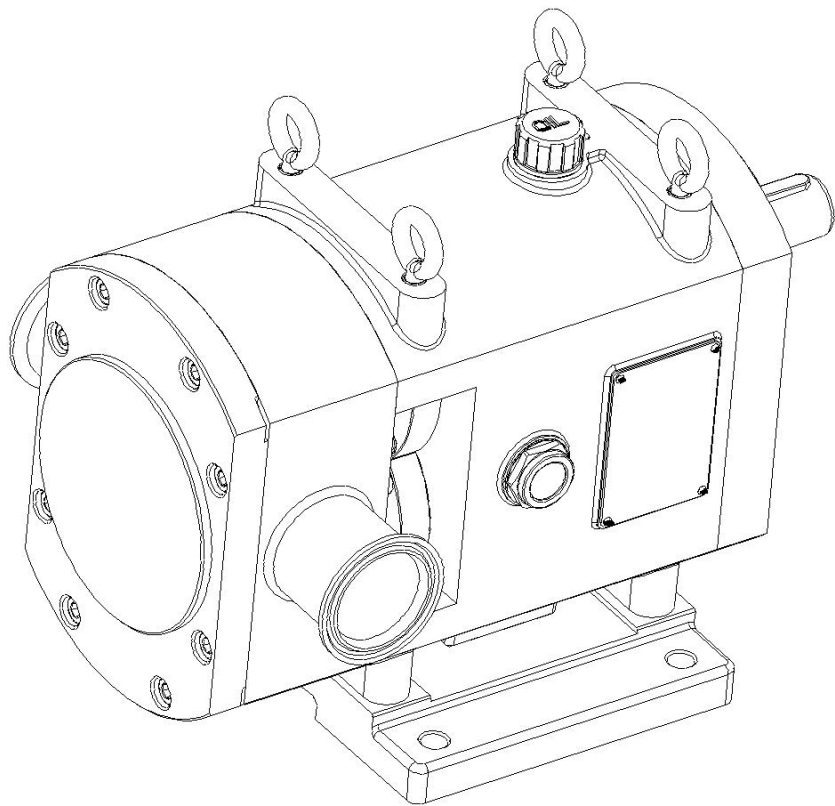




ROTOR PUMP USER'S MANUAL



Zhejiang Ligao Pump Technology Co.,Ltd.

Add: No.227 Huishu Road,
Linhai, Zhejiang, China
Tel: +86 576 85289780
Fax: +86 576 85668297
Web: www.ligaopumps.com
Mail: sales@ligaopumps.com

ATTENTION

Thank you for purchasing and using LIGAO rotor pump. For your safety and benefits, before using this equipment, please read the manual carefully.

1. This manual includes the installation, operation and maintenance information. These information must be read carefully before installation, operation or maintenance and always readability be available to the pump operator.

2. The pump must not be used with other liquids than those for which it was recommended and sold. Liquids, for which the pump is not appropriate, can damage the pump and other parts of the unit as well as cause personal injury.

3. If there are any uncertainties, contact us or local sales representative.

CONTENT

1.0 Introduction.....	- 1 -
1.1 Features.....	- 1 -
1.2 Application.....	- 1 -
2.0 Safety protection.....	- 2 -
2.1 Marking of notes.....	- 2 -
2.2 Personnel qualification and training.....	- 2 -
2.3 Dangers in case of inobservance of the safety instruction.....	- 2 -
2.4 Safety operation.....	- 2 -
2.5 Safety protection for maintenance, inspection and installation...	- 5 -
2.6 Change of spare parts.....	- 6 -
2.7 Specificity of application.....	- 6 -
3.0 Components and working principle.....	- 6 -
3.1 Pump head types.....	- 6 -
3.2. Main components in pump body.....	- 7 -
3.3. Working principle.....	- 7 -
3.4. Standard pump head weight (kg).....	- 8 -
4.0 Packing , transport and handling.....	- 8 -
4.1 Packing and transport.....	- 8 -
4.2 Handling.....	- 9 -
4.2.1 Pump head handling.....	- 9 -
4.2.2 Pump unit handling.....	- 9 -
5.0 Installation.....	- 10 -
5.1 Coupling installation.....	- 10 -
5.2 Alignment for pump shaft and motor shaft.....	- 10 -
5.3 Rotation direction of the pump.....	- 10 -
5.4 Rotation direction of the motor.....	- 10 -
5.5 Pressure.....	- 10 -
5.6 Pump unit installation.....	- 11 -
5.7 Pipe system.....	- 11 -
5.7.1 Connections types between the pump and pipes.....	- 12 -
5.7.2 Piping Support.....	- 12 -
5.7.3 Inlet and outlet expansion joints.....	- 12 -
5.7.4 Inlet position.....	- 13 -
5.7.5 Pump above the liquid level.....	- 13 -
5.7.6. Install Inlet Check Valve.....	- 13 -
5.7.7 Install Outlet Check Valve.....	- 14 -
5.7.8 Install Isolation Valves.....	- 14 -
5.7.9 Install Relief Valves.....	- 14 -
5.7.10 Install Pressure Gauges.....	- 14 -
5.8 System design and installation.....	- 15 -

5.9 Safety valves installation.....	- 16 -
5.10 Jacket.....	- 17 -
5.10.1 Water or steam jacket.....	- 17 -
5.10.2 Electricity heating jacket.....	- 18 -
5.11 Mechanical Seal.....	- 18 -
5.12 Cooling and flushing for mechanical seal.....	- 19 -
6.0 Start up.....	- 20 -
7.0 Shutdown.....	- 21 -
8.0 Maintenance.....	- 21 -
8.1 Daily cleaning.....	- 21 -
8.2 Gearbox.....	- 22 -
8.3 Lubrication.....	- 22 -
8.3.1 Suggest lubrication quantity (L).....	- 22 -
8.3.2 Recommended oils.....	- 23 -
8.3.3 Location of air breather , oil level glass and drain hole... - 23 -	- 23 -
8.4 Electrical system.....	- 23 -
9.0 Change of wear parts.....	- 23 -
9.1 Change of mechanical seals.....	- 23 -
9.2 Change of rotors.....	- 28 -
9.3 Change of Wetted part seals.....	- 29 -
10.0 Installation dimensions.....	- 30 -
10.1 Pump head installation drawings.....	- 30 -
10.2 General installation drawings.....	- 31 -
11.0 Troubleshootings.....	- 31 -
12.0 Drawings and Parts List.....	- 32 -
12.1 Horizontal Type (RP1-RP35).....	- 32 -
12.2 Horizontal Type (RP55-RP150).....	- 34 -
12.3 Vertical Type (RP1-RP35).....	- 36 -
10.4 Vertical Type (RP55- RP150).....	- 38 -

1.0 Introduction

Rotor pump is a kind of displacement pump. The working volume is changed by the relative rotation between the rotor and pump body, which leads to increase the liquid energy. Cam rotor pump is designed for transporting liquid of high viscosity or with particles, especially for medium which is easily foamed or whose structure is easily be damaged. It transports medium gently with low rpm, which can be adjusted from 40rpm to 600rpm. It is better for sanitary and sterile condition and is an ideal pump used as metering pump.

1.1 Features

a) Safe and clean

All parts of the pump that touches the medium are made of stainless steel and the seals are made from natural rubber.

b) Nice appearance

The surface of the pump head is mirror-polished, which is easy to clean and with nice appearance.

c) Advanced internal structure

The pump rotors and driving gear are separated, and all pump parts in pump head keep a certain clearance , thus they can not touch each other, which makes the pump no wearing, low noise, long service life and energy saving.

d) Transport high viscosity medium

This pump can transport high viscosity, high concentration medium and medium with particles. The medium transported by this pump keep the original character without physical and chemical reaction.

e) Good sealing

The pump adopt balance mechanical seals, which can endure high pressure with no wearing and leakage.

f) High pressure

This pump has high pressure and flow, especially used for long transportation at fix quantity.

1.2 Application

It is especially suitable for medium of high viscosity and with particles. It also can be used for transporting medium mixed with vapors, liquids and solids, and ensure its original physical and chemical character.

2.0 Safety protection

This manual includes the basic information for installation, operating and maintenance. The operator and relative persons should read this manual carefully. Always keep this manual within reach at the place of installation of the pump.

2.1 Marking of notes

Symbols and notes, e.g. arrows for direction of rotation or flow and speed changer indicator notes are fixed at the places where can be easily read. Do not demount them.

2.2 Personnel qualification and training

The personnel who operate, inspect and install the pump must be suitably qualified. Range of responsibility and supervision of the personnel are to be clearly defined. If the personnel do not have the knowledge required, they should be trained accordingly. The owner must ensure that the personnel have understood the operating instructions.

2.3 Dangers in case of inobservance of the safety instruction


Inobservance of these safety instructions can result in danger to persons, hazards to environment and damage to the pump.


Inobservance can result in:

- 1 ● Damage the pump or failure of some important part or function .
- 1 ● Failure of maintenance .
- 1 ● Danger to person through mechanical, chemical and electrical influences .
- 1 ● Hazards to the environment through leaking dangerous media .

2.4 Safety operation







The safety instructions specified in this manual, the national regulations for accident prevention, and the safety operating instructions of the owner are to be observed.

 Caution must be taken when lifting the pump. All parts with a weight of more than 20 kg must be lifted using lifting slings and suitable lifting devices.

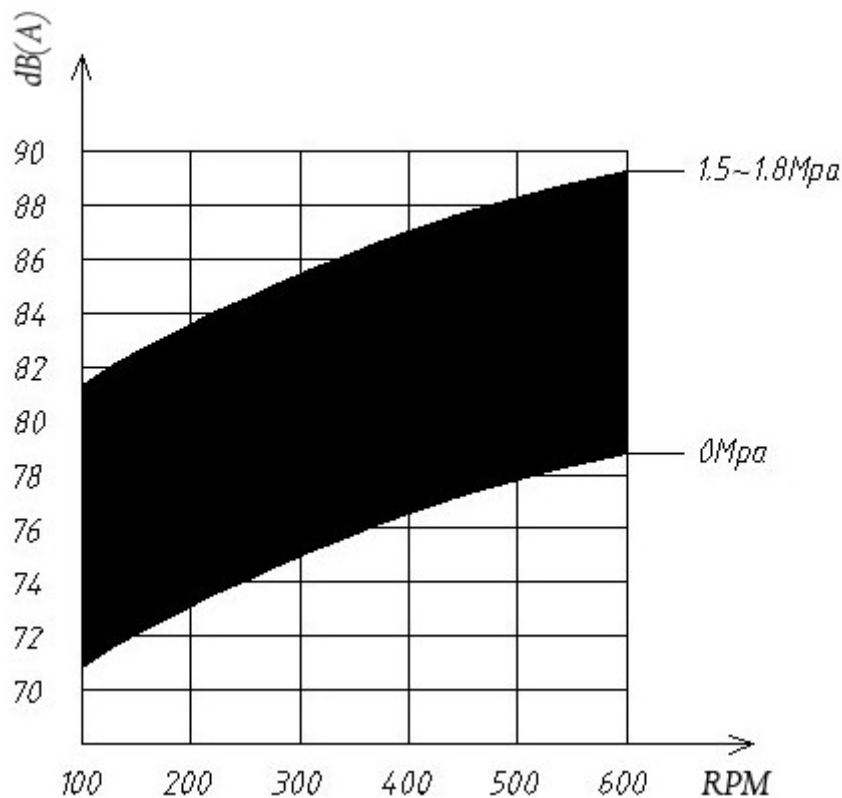
 The nameplate should always be readable, and should not be missed.

- ▲ If the pump is not installed immediately, it must be stored in a suitable environment.
- ▲ Lifting ring fitted to pump must only be used to lift the pump, not the pump with drive and/or baseplate. If the pump is baseplate mounted, the baseplate must be used for all lifting purposes.
- ▲ Never operate the pump if the pump cover or suction and discharge pipework are not in place. Likewise, never operate the pump if other protection such as coupling and touch guards are missing or incorrectly fitted.
- ▲ Never stick your fingers inside the rotor case, connections to the casing or in the end cover if there is any possibility that the pump shafts may rotate. This can lead to serious personal injury.
- ▲ Do not exceed the pump's maximum operating pressure, speed or temperature. Do not modify the operating parameters/system for which the pump was originally delivered without first consulting the manufacturer.
- ▲ Some sort of safety equipment should be connected to the pump, system or the drive to prevent the pump from exceeding maximum allowable pressure. Do not operate the pump with a closed/blocked discharge unless a safety relief valve is incorporated.
- ▲ If the pump is equipped with an integrated safety relief valve, this valve is only for short time protection, do not allow extended periods of recirculation through the relief valve.
- ▲ The installation of the pump must be sturdy and stable. Pump orientation must be considered with respect to drainage requirements. Once mounted, check the alignment between the pump and the drive assembly. Misalignment of the pump, drive and shaft coupling will result in unnecessary wear, increased operating temperatures and noisier operation.
- ▲ Fill the pump's and drive's gearboxes with the recommended lubricants and amounts. Change the lubricants at the recommended

intervals. If equipped stepless speed reducer, the speed only can be adjusted when the device is running. It will cause damage to the machine if rotate the speed hand wheel in a non-operation state.

-  Before operating the pump, make sure that it and the pipe system are clean and free from debris and that all the valves in the suction and discharge pipelines are fully opened. Make sure that all pipework connected to the pump is fully supported and correctly aligned. Misalignment and/or excessive loads will cause severe damage to the pump.
-  Do not install the pump into a system where it may run dry (i.e. without a supply of pumped media) unless the mechanical seals are equipped with flushing system.
-  Do not attempt maintenance work or disassembly of the pump without making sure that the power is off. Depressurize and purge any pressure relief valve and/or flushing system. Check that any other associated equipment is turned off and disconnected. Allow the pump and components to cool down to a safe handling temperature.
-  Do not attempt to loosen or remove the pump cover, connections to the pump, or other components until you are sure that such actions will not lead to the unsafe escape of any pressurized media.
-  The pump installation must allow for safe routine maintenance and inspection (check for leakage, change of lubricants, pressure monitoring, etc) and provide adequate ventilation to prevent overheating.
-  Pumps and/or drive units can produce sound levels in excess of 85dB(A) under unfavorable operating conditions. When necessary, personal protection against noise must be used.

Sound Level



- ⚠ Avoid any contact with hot parts of the pumps or drive units which may cause personal injury. Bad installation or poor maintenance can promote unnormally high temperatures on pumps and/or drive units.

- ⚠ During a CIP cleaning, a pump differential pressure of between 1 and 2 bar is recommended to ensure that suitable velocities are reached in the pump head. The exterior of the pumps should be cleaned periodically.
Always follow all applicable safety measures when manually cleaning the pump:
 1. Drive unit must be shut down so that it cannot be started.
 2. Any compressed air controlled, mounted safety relief valve must be closed and depressurized.
 3. Connections to flushed mechanical seals must be closed and depressurized.

2.5 Safety protection for maintenance, inspection and installation

- 1 ● Don not demount the safety cover on the shaft when the pump is under working.

- 1 ● Maintain the pump only when the pump stops and not under pressure.
- 1 ● The pump must be cleaned after transporting hazardous medium.
- 1 ● Safety and protection equipments must be installed after the maintenance.
- 1 ● The star-up of the pump must follow the in instructions in this manual strictly.
- 1 ● Protection from electricity.

2.6 Change of spare parts

Any modification or change should be permitted by the manufacture. Or the manufacturer will not take any responsibility for the risk caused by this.

2.7 Specificity of application

This pump is ensured to use under specific conditions. It is only to be deployed according to the intended purpose stated by the owner. Any other applications are not allowed.

If the pump is to be used for other medium than for which the pump was originally selected , especially hazardous medium with corrosion or poison, then the suitability of the pump for the new medium must be consulted with the manufacturer.

The specificity of applications includes:

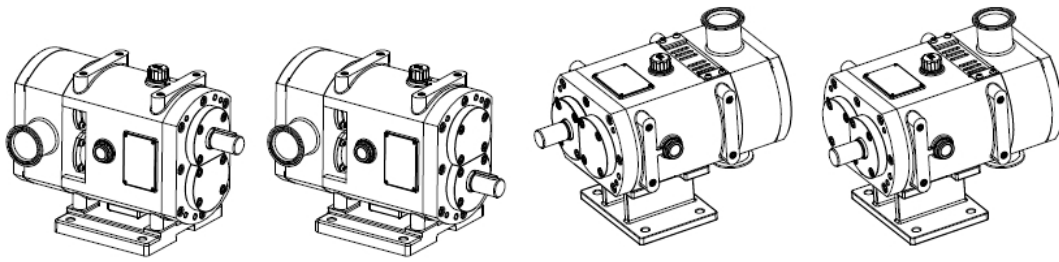
- 1 ● The pump materials which touches the medium directly are suitable for the medium ;
- 1 ● The seals are suitable, especially the mechanical seals;
- 1 ● The pump pressure and temperature ;
- 1 ● The quantity and size of the particles In the medium ;

Besides the safety instructions described in this manual, there may be other local safety codes and restrictions. The operator should be familiar with those regulations before operation.

3.0 Components and working principle

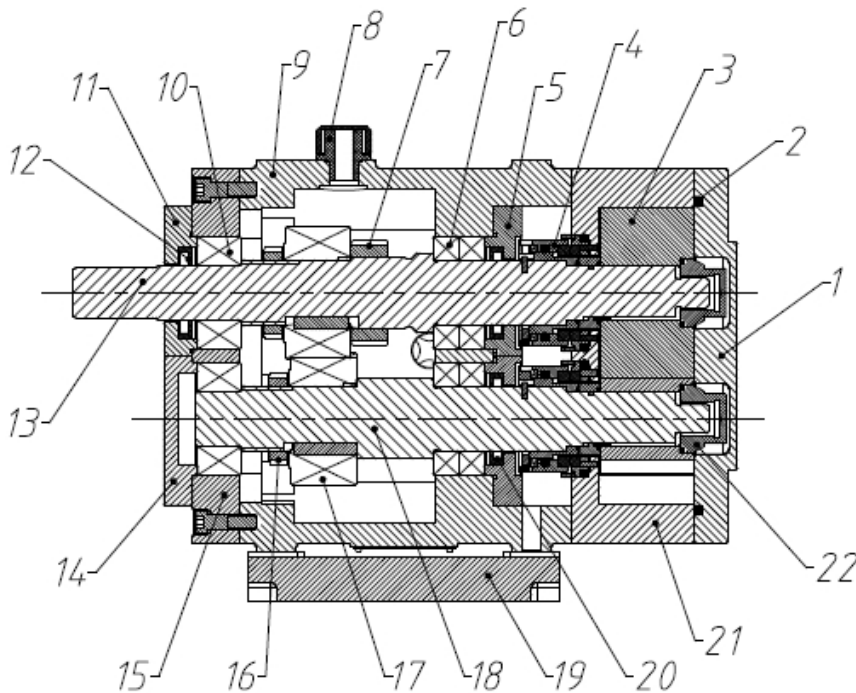
3.1 Pump head types

According to the inlet direction and driving units, there are 4 types for the pump head:



3.2. Main components in pump body

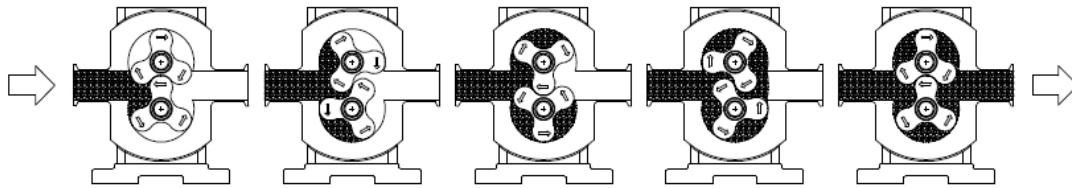
1. Pump cover 2. O ring on pump cover O-ring 3. Rotor 4. Mechanical seals 5. Bearing front cover 6. Front bearing 7. Self-lock screw 8. Air breather 9. Gearbox case 10. Rear bearing 11. Main shaft bearing rear cover 12. Framework oil seal 13. Main shaft 14. Countershaft bearing rear cover 15. Gearbox cover 16. Round screw 17. Bevel gear 18. Countershaft 19. Pump seat 20. Framework oil seal 21. Pump body 22. Rotor lock screw



3.3. Working principle

Liquid is drawn into the pump as the rotors disengage, forming cavities. The liquid is transported in the cavity of the rotors around the space of the rotor case. Liquid is pressured out from the pump as the rotors engage, closing the cavities. The following is the diagram of the working

principle:



3.4. Standard pump head weight (kg)

Model	RP1	RP2	RP3	RP5	RP8	RP15	RP25	RP35	RP55	RP80	RP120	RP150
W.G.	16	25	36	52	75	112	175	260	420	625	850	1100

The total weight for pump units will be different with different driving units.

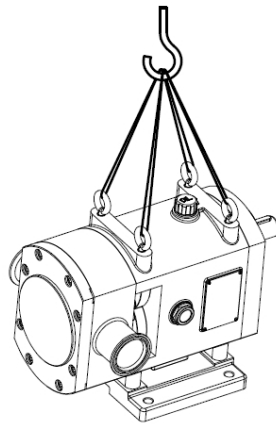
4.0 Packing , transport and handling

4.1 Packing and transport

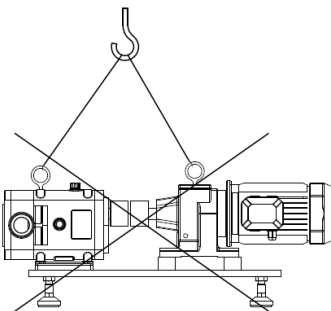
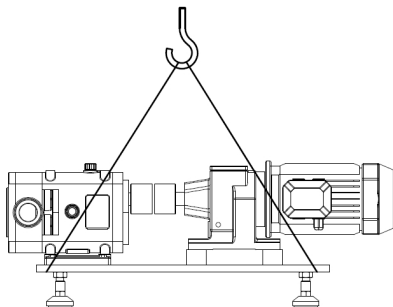
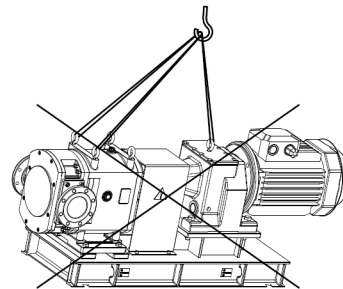
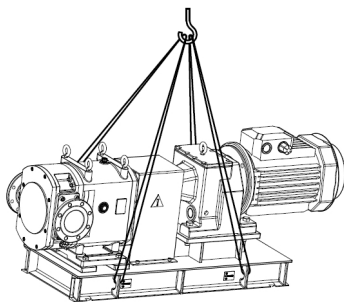
- If the users do not have special requirements, the packing will be wooden package .
 - The users have to check the product for transport damage immediately after receipt. Any damage detected is to be reported immediately to the carrier and the supplier.
- 1 ● Open the package until it reaches the place where it is used.
 - 1 ● Lifting ring fitted to pump must only be used to lift the pump, not the pump with drive and/or baseplate. If the pump is baseplate mounted, the baseplate must be used for all lifting purposes. When using slings, they must be safely and securely attached.
 - 1 ● All parts (including pump unit and other parts) with a weight of more than 20 kg must be lifted using lifting slings and suitable lifting devices.

4.2 Handling

4.2.1 Pump head handling



4.2.2 Pump unit handling



When the pump unit is equipped with mobile unit, the following must be noted:

- 1 ● Lock the motor ; Make sure the motor can not rotate.
 - Do not move the unit too fast, especially on a rough road, in case it over .
- 1 ● The pump unit must be installed steadily during operation or storage, in case the pump slides down.
- 1 ● Check the bolts on the pump before start-up. If the bolts get loose when the pump is on working, tighten them in time.

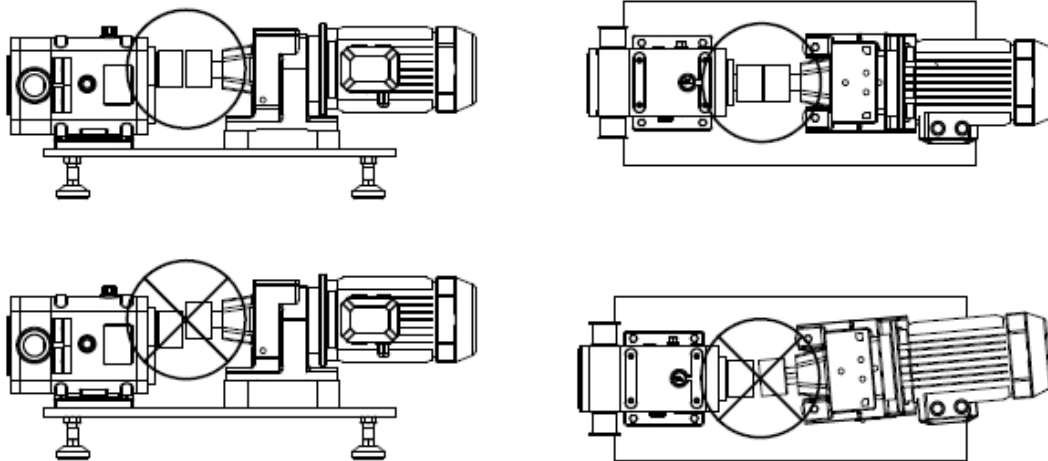
5.0 Installation

5.1 Coupling installation

When install the coupling, please use suitable tool to push it into the drive shaft . Hitting the coupling with iron hammer is forbidden.

5.2 Alignment for pump shaft and motor shaft

- The max tolerance range of the different axis between the two shaft(standard installation):
 - Radial offset : 1% (max external diameter)
 - Offset angle: $\leq 1^{\circ}30''$
- The pump unit, including the driving unit and baseplate, has been adjusted in the factory. Take off the shaft cover and check the axiality again when it is fixed. If the ground is not flat enough, it will make pump baseplate bend and will cause accidents.



5.3 Rotation direction of the pump

The rotation direction of LIGAO rotor pump can be both forward and reverse.

5.4 Rotation direction of the motor

If the driving unit with frequency conversion motor, the motor rotation must following the motor instruction, as well as the fan rotation direction.

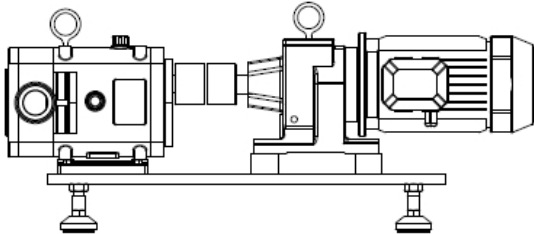
5.5 Pressure

The pump has rated pressure which has marked on the nameplate. Users should choose the pump in accordance with the pressure of your

pipe system.

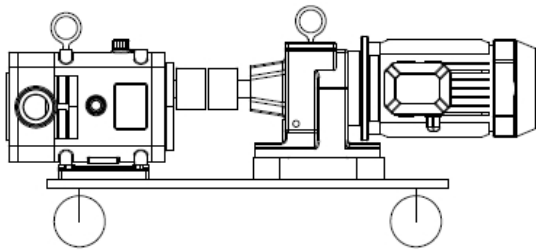
5.6 Pump unit installation

In a typical installation configuration, the pump and drive unit are mounted on a common base plate. The unit can be installed in any of the arrangements shown below:



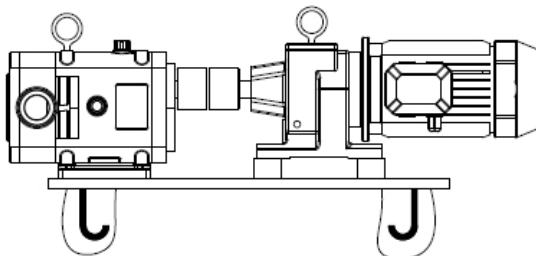
1. Adjustable leg base

The baseplate is fixed with 4 adjustable screws.



2. Portable base

The baseplate is fixed with 2 fixed wheels and 2 universal Wheels.



3. Fixed base

The pump unit permanently installed on foundation by setscrews.

5.7 Pipe system

- 1 ● Clean the pipes before the installing the pump unit.
- 1 ● No extra pressure on the pump unit when the pipes connected to it.
Make sure the inlet and outlet pipe will not influence the pump installing to the pump baseplate.
- 1 ● Keep the pipes on level, in case there is residual air in the pipes
- 1 ● For medium with high viscosity, high position feed method is suggested, which will increase the inlet pressure. The higher viscosity

of the medium is , the higher position of the medium tank should be.

- 1 • Make sure the vibration of the pipes will not do harm to the pump .

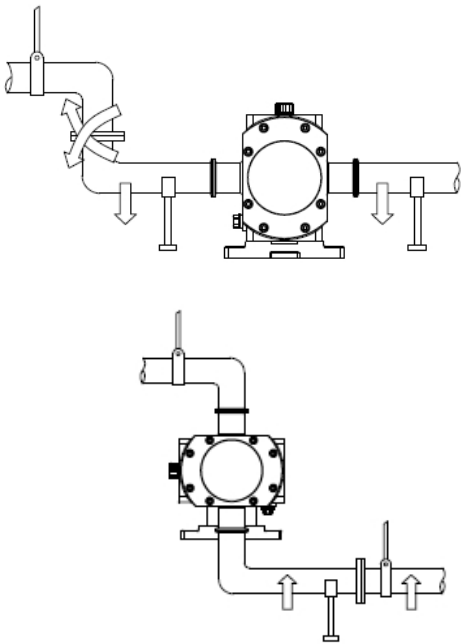
5.7.1 Connections types between the pump and pipes

Hoop connection (ISO/SMS/DIN)

Flange connection

Screw connection(DIN/ISO/SMS/NPT)

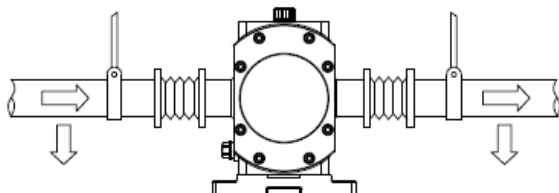
5.7.2 Piping Support



To minimize forces exerted on the pump, support all piping to the pump independently with hangers or pedestals. Such forces can cause misalignment of the pump parts and lead to excessive wear of rotors, bearings, and shafts.

The above pictures show typical supporting methods used to independently support each pipe, reducing the weight effect of piping and fluid on the pump.

5.7.3 Inlet and outlet expansion joints

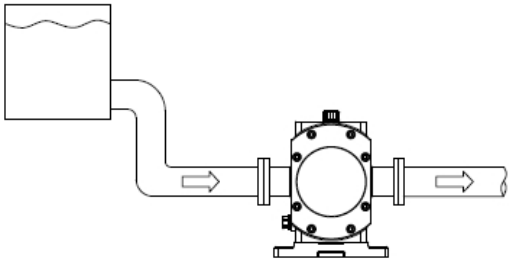


Thermal expansion of piping can cause tremendous forces.

Use thermal expansion joints to minimize these forces on the pump.

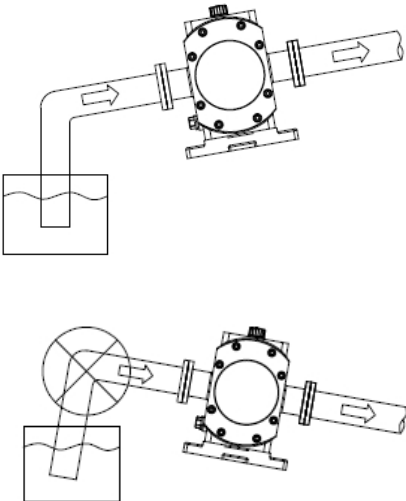
Flexible joints can be used to limit transmission of mechanical vibration. Ensure that the free ends of any flexible connections in the system are anchored.

5.7.4 Inlet position



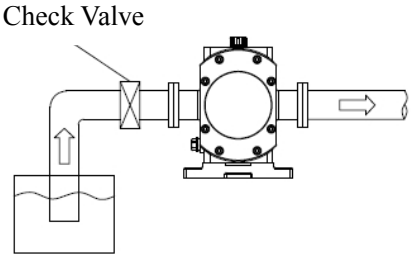
Install the pump below the supply liquid level to reduce the air in the system by flooded suction.

5.7.5 Pump above the liquid level



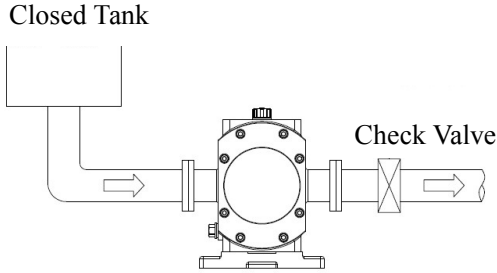
If the pump is installed above the supply liquid level, the piping on the inlet side must slope up toward the pump, preventing air pockets in the pipes

5.7.6. Install Inlet Check Valve



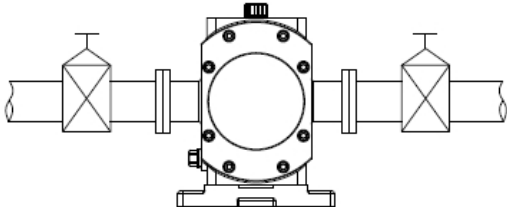
Use check valves to keep the inlet line full, particularly with low-viscosity fluids.

5.7.7 Install Outlet Check Valve



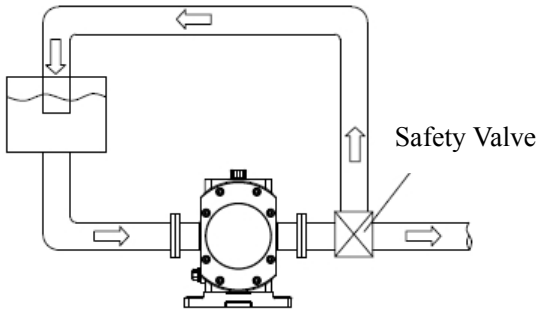
For systems with liquid under a vacuum, install a check valve on the discharge side of the pump. The check valve prevents backflow (air or fluid) to aid in the initial start-up by minimizing the required differential pressure supplied by the pump to start the flow.

5.7.8 Install Isolation Valves



Isolation valves permit pump maintenance and safe pump removal without draining the system.

5.7.9 Install Relief Valves



Install relief valves to protect the pump and piping system against excessive pressure. We recommend installing an external relief valve designed to bypass fluid from the pump outlet to the inlet side of the system.

5.7.10 Install Pressure Gauges

Pressure and vacuum gauges provide valuable information about pump operation. Wherever possible, install the gauges to help provide information on the following:

- Normal or abnormal pressures
- Indication of flow
- Changes in pump condition
- Changes in system conditions
- Changes in fluid viscosity

5.8 System design and installation

When a pump is to be incorporated in a system, it is considered good practice to, as far as possible, minimise the length of the pipes and the number of pipe fittings (tees, unions, bends etc.) and the restrictions.

When designing the suction lines, particular care should be taken.

These should be as short and straight as possible, using a minimum of pipe fittings to achieve a good product flow to the pump. Always consider the following when designing a system:

1. Ensure there is space enough around the pump to allow for:
 - a) Routine check and maintenance of the complete pump unit, seal area, drive motor, etc.
 - b) Good ventilation for the drive to avoid overheating.
2. Both the suction and the discharge ports must be provided with valves.
3. During check- up procedures or maintenance work, the pump must be isolated from the system.
4. The system design, pipes and other equipment must have independant supports to avoid heavy loads on the pump. In the case of pipe work or other equipment relying on the pump fixings for support, there is a big risk for serious damage to the pump.
5. For positive displacement pumps as LIGAO it is recommended to install some safeguards, for example:
 - a) External pressure relief valve system for recirculation to tank or suction side of the pump.
 - b) Torque device in the system, mechanical or electrical.
6. It is considered good practice to thoroughly clean all pipework and associated equipment from the suction port to the discharge port before installation of pump. This is to avoid the risk of debris entering the pump and causing damage.
7. If possible, pressure gauges should be placed at the suction port and the discharge port of the pump.
8. It is very important that the suction condition at the pump inlet meets the NPSH required of the pump. Failure to observe this can cause cavitation, which leads to a noisy operation, reduced flow and

mechanical damage on the pump and associated equipment.

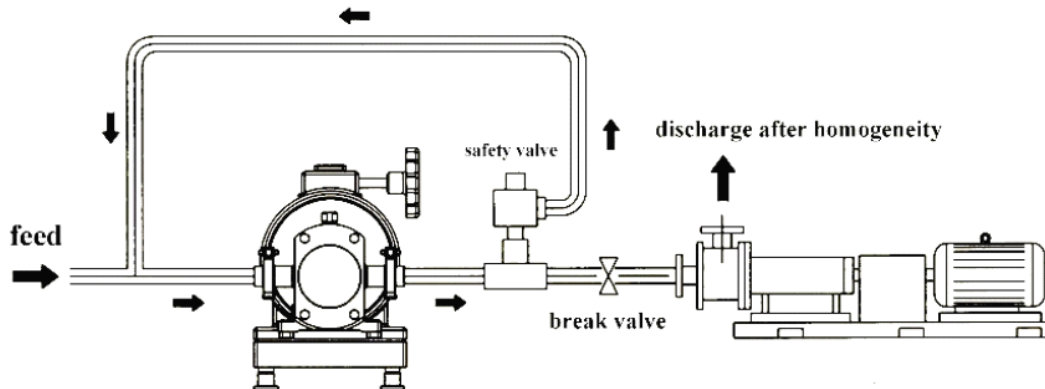
The NPSH available from the system must always exceed the NPSH required by the pump. If the following guidelines are observed it should ensure the best possible suction conditions.

- a) The suction line should have at least the same diameter as the pump connections.
 - b) The suction line should be as short as possible.
 - c) Use a minimum of bends, tees and pipework restrictions.
 - d) If a filter is used on the suction pipe, check pressure drop at the actual flow. This is important to avoid cavitation which can damage the pump.
8. When installing a pump complete with drive motor and baseplate the following guidelines must be observed:
- a) The most suitable drive for the LIGAO pumps is to use a motor with direct coupling. Please contact your local distributor if using some other method.
 - b) Flexible couplings must always be used and aligned correctly within the limits recommended by the coupling manufacturer. Turn the shaft at least one full rotation to control the alignment of the coupling and that the shaft rotates smoothly.
 - c) Couplings must always be enclosed in a suitable guard to prevent contact with rotating parts which could cause personal injury. Such guards must be of suitable material - see point d - and be of sufficiently rigid design to prevent contact with the rotating parts during normal operation.
 - d) When installing pump sets in flammable or explosive environments or for handling flammable or explosive media, special consideration must be given not only regarding the security of the drive unit enclosure, but also for the materials used both in couplings and guards to eliminate the risk of explosion.
 - e) The baseplate must be secured to a flat level surface to avoid misalignment and distortion. When the baseplate is fastened in position, the alignment must be checked again.
 - f) If the pump is driven by an electric motor, check that the motor and other electrical equipment are compatible with the drive and that the wiring is correct, i.e. Direct On-Line, Star Delta etc. Ensure that all components are correctly electrically grounded.

5.9 Safety valves installation

The safety valves on the pipes are for preventing backflow. The rotor pumps may be used for transport to fixed output equipments directly like filling machines or high pressure pump. If there is no safety valve on the pipe between the rotor pump and the equipment, the

outlet quantity may be more than the input flow the equipment needs, which may result in expand or explosion tube, or even damage the rotor pumps. The safety valve can solve this problem. If there is a break valve on the outlet pipe of the rotor pump, the safety valve is a must. The following is an example for safety valve installation.

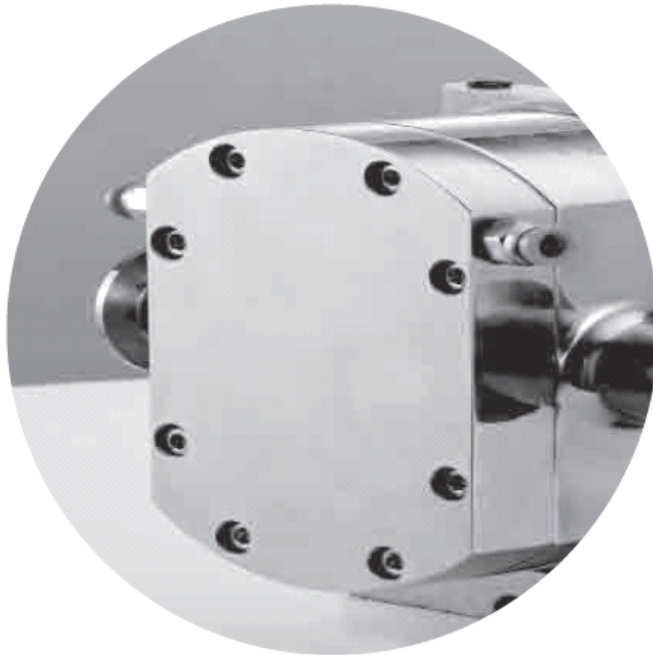


5.10 Jacket

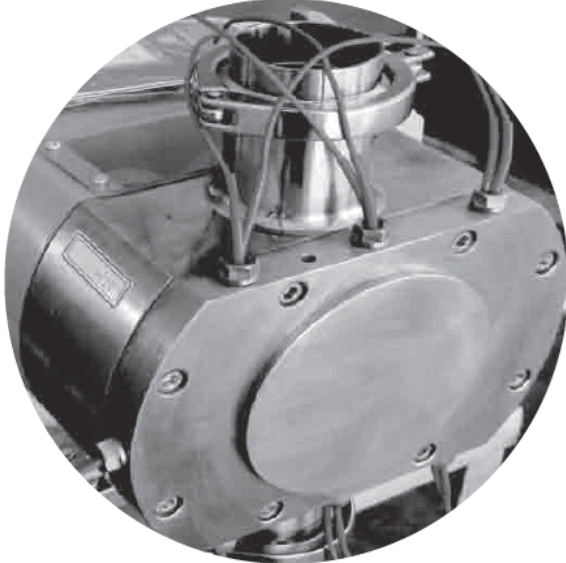
All LIGAO pump can be supplied with jacket. Water and steam jacket and electricity heating jacket are for optional. The heat jacket is mainly used for bringing the medium inside the rotor case on temperature before or after starting up the pump.

5.10.1 Water or steam jacket

The max pressure for water and steam jacket is 10 bar.



5.10.2 Electricity heating jacket

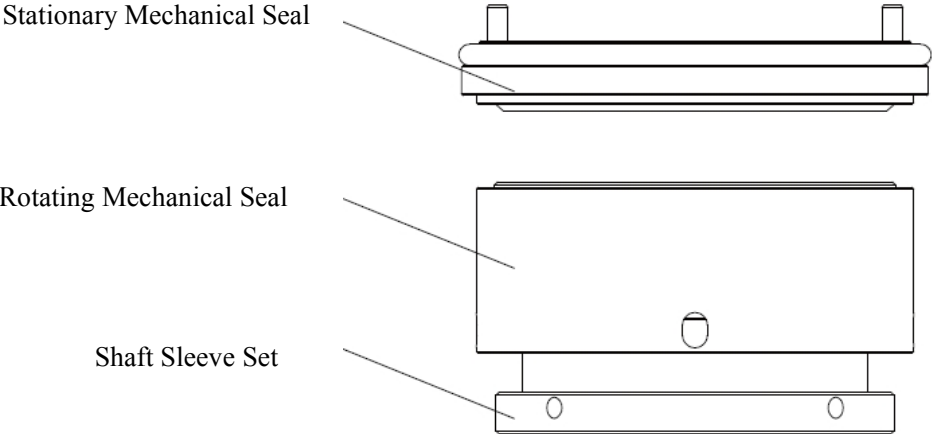


5.11 Mechanical Seal

The mechanical seal is single face balanced mechanical seal.
The materials of the mechanical seal can be: **Alloy, SiC, Graphite, Ceramic.**

As the above mentioned materials are high hardness materials, when the pump is running, the contact of the rotating ring and the stationary ring will produce great friction, resulting in a strong frictional heat. The heat will be removed by the flowed medium. But when the pump runs dry, the over friction heat will burn the surface of the mechanical seal and may cause leakage.

Machined parts:



5.12 Cooling and flushing for mechanical seal

There are two types of device:

- ※ **With coolant device;**
- ※ **External water flushing device;**

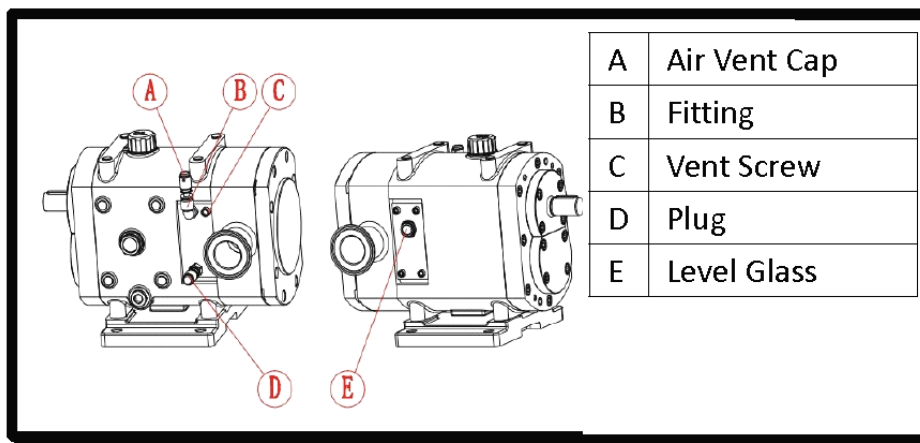
These two types are transferable, the operation instructions are as following:

1. Change from coolant device to external water flushing device for horizontal inlet and outlet pump:

→Loosen vent cap A, connect external water hose to fitting B as water outlet;

→loosen plug D, connect external water hose as water inlet;

(NOTE: D is for water inlet, A is for water outlet)

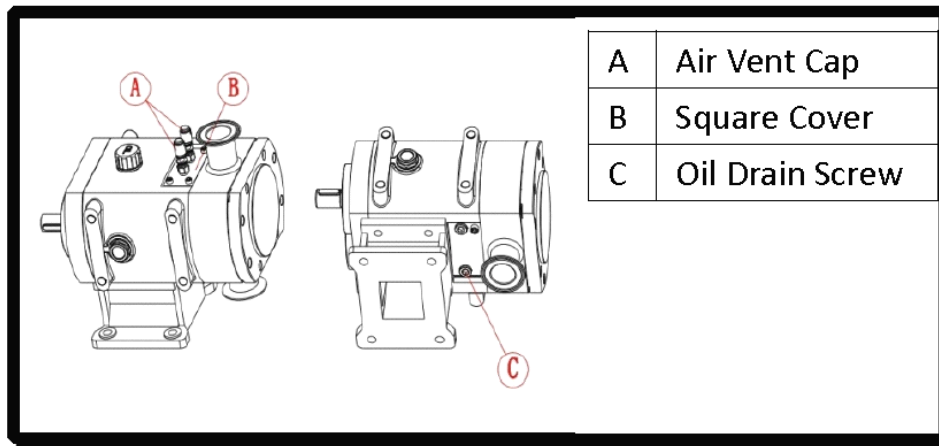


The oil in coolant device should be changed regularly(usually 6months), the operation instructions as following:

Loosen plug D, drain empty of the oil, insert back the plug D; Loosen vent screw C; Loosen air vent cap A, and adding the oil through A. Check the oil level from the level glass E. When the oil reaches its middle, stop adding oil, tighten vent screw C, insert back air vent cap A.

2. Change from coolant device to external water flushing device for vertical inlet and outlet pump:

Loosen air vent cap A, connect external water hose at the fitting as water inlet and outlet;



The oil in coolant device should be changed regularly(usually 6months), the operation instructions as following:

Loosen oil drain screw C, drain empty of the oil, insert back drain screw C; Loosen screw on the square cover B, add the oil through the square window, and check the oil level. When the oil submerge the mechanical seal, stop adding oil, and install back the square cover.

Note:

- ★ The oil for coolant device should be: Superol, Silicone oil, regular engine oil or clean water;
- ★ External water flushing device should use clean water or online delivery liquid with room temperature. The pressure in the cavity should not exceed 0.1Mpa.
- ★ When the room temperature below the coolant freezing point, the mechanical seal and the pump overflowing part need heat preservation;
- ★ When temperature over 80°C , only external flushing device can be used. To cool the mechanical seal by external circulating water.

6.0 Start up

The following regulations must be observed:

- 1 ● Make sure that all associated equipment is clean and free from debris and that all pipe connections are secure and correctly sealed.
- The drive shaft and motor shaft should be concentric, or will cause damage to the pump.

- 1 ● Dry running is forbidden, or it will burn the mechanical seals.
- Check the pump and driving unit lubrication reach the required oil level.
- 1 ● Check that the valves are completely open on both inlet and outlet and that the pipelines are free from obstructions. Rotor pumps are of the positive displacement type and should therefore never be operated against a closed valve, as this would result in pressure overload, damages on the pump and possibly damage on the pump system.
- Before operating the pump, briefly start and stop it to check the direction of rotation and to make sure that there are no obstructions of the function.
- 1 ● For sanitary pump, clean it up before start it.

7.0 Shutdown

When shutting the pump down the valves on the suction and discharge side must be closed. Following precautions must be taken:

1. Shut off the power and lock the starting device so that the pump cannot be started.
2. The connections for the flushed mechanical seals are shut off. (if with this system)
3. The pipe line is depressurised.
4. Shut off the valves on the inlet and outlet.
5. Empty and clean the pump head.
6. Clean other outside parts of the pump unit.

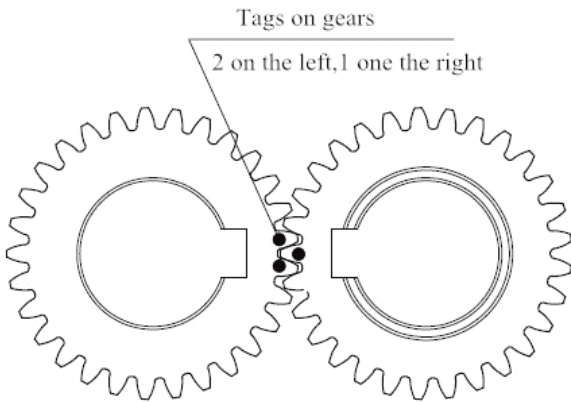
8.0 Maintenance

8.1 Daily cleaning

- 1 ● Clean the pump frequently, in order to avoid the medium solidification in the pump.
- 1 ● If clean it by opening the pump cover, disconnect the power first .l
- The cleaning terminal depends on the medium and working condition .

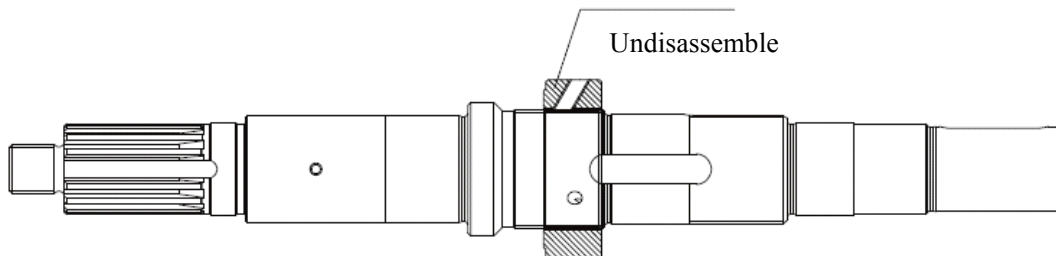
8.2 Gearbox

The work of disassembly the must be carried out by qualified worker.
The following points must be observed:



a) Gears on LIGAO pump are hard tooth bevel gears. When assembly of the left and right hard tooth bevl gears, pay a attetion to the tag on the gears. The tag on one gear must between the two tags on the other gear.

b) Should never disassemble the self-lock screw. It has been adjusted at the factory.



8.3 Lubrication

The gear box and bearing must be in good lubrication condition.
Periodically check the lubrication oil level.

8.3.1 Suggest lubrication quantity (L)

Model	RP1	RP2	RP3	RP5	RP8	RP15	RP22	RP35	RP55	RP80	RP120	RP150
Horizontal type	0.35	0.5	0.85	1.4	2	3.8	6	10	15	22	35	50
Vertical type	0.3	0.45	0.75	1.2	1.8	3.5	5.5	9	14	20	32	45

8.3.2 Recommended oils

For pump gear box and reducer:

Low temperature: Gear oil L-CKC220(ISO VG220);

Normal environment temperature: Gear oil L-CKC320(ISO VG320);

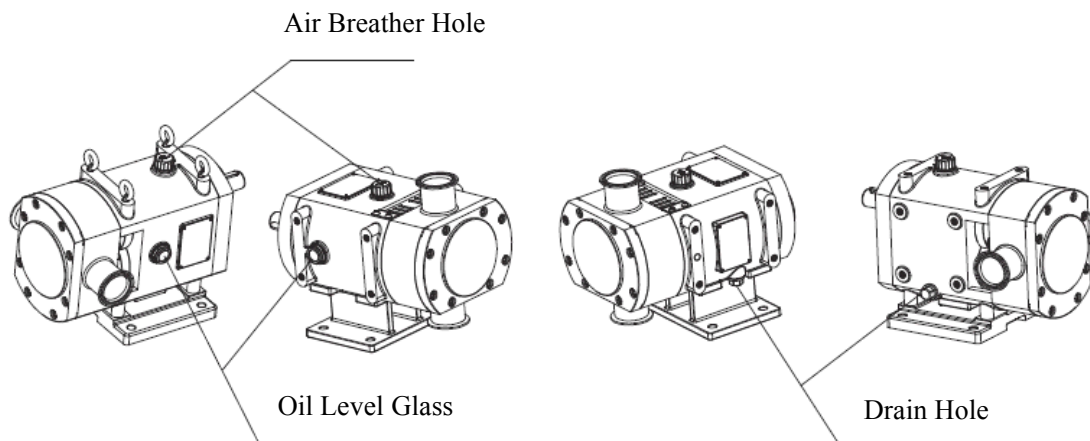
High working temperature: L-CKC460(ISO VG460);

For stepless speed reducer:

Transmission oil UB-1 or UB-3.

Change the oil after operation for 500 hours for the first time. After then, Change the oil once a year or every 3000 operating hours, whichever comes first.

8.3.3 Location of air breather , oil level glass and drain hole

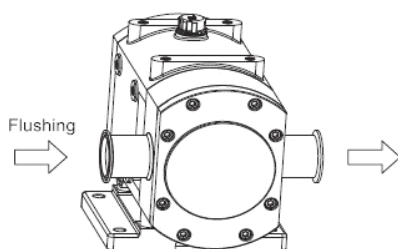


8.4 Electrical system

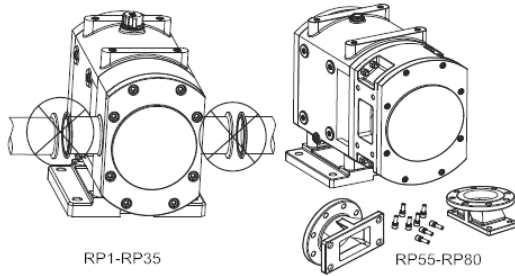
Electricity work should be carried out by the electrician according to the relevant regulations. Make

9.0 Change of wear parts

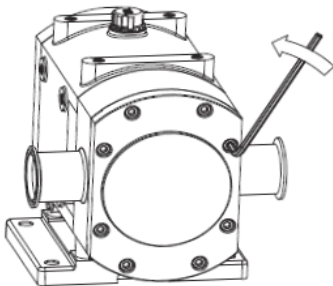
9.1 Change of mechanical seals



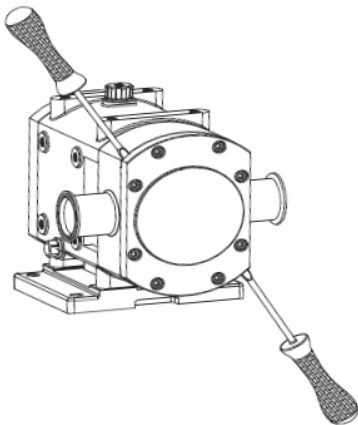
Step 1: CIP clean the pump head.



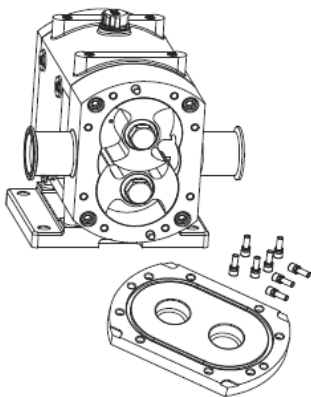
Step 2: Cut off the power and disconnect the inlet and outlet.
 (Models above RP55 unscrew the bolts on the flange by a spanner.)



Step 3: Loose the 8 hex head screws on the pump cover with a hex spanner.

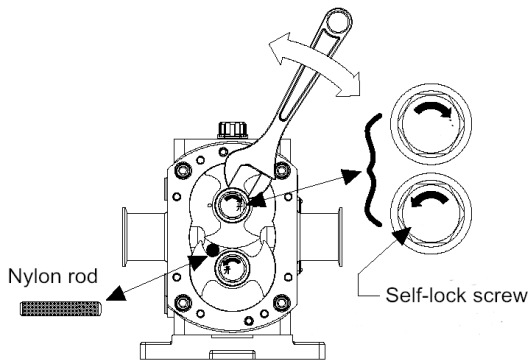


Step 4: If high viscosity medium residues in the pump head, it may difficult to take the pump cover out. Insert a flathead screwdriver into the dismounting groove on the pump cover, pull out the pump cover gently.



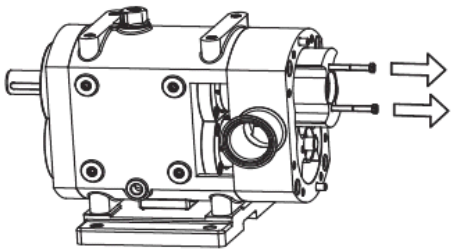
Step 5: Check clean the parts after take out the pump cover.

Step 6: Unscrew the two self-lock screws.

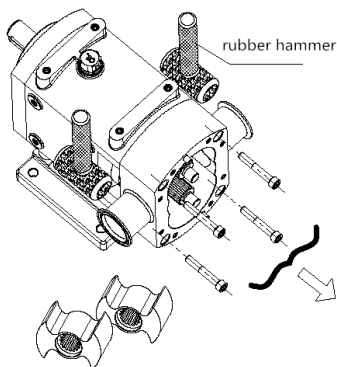


1. Insert a nylon rod or log into the gap of the two rotors (metal rod is not available); Unscrew the two screws according to the direction marked on the self-lock screw. The two screws must be in opposite direction.

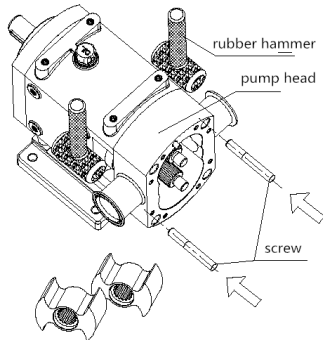
Step 7: Sometimes the rotors stick to the pump head due to high viscosity medium. There are two ways to take the rotors out:



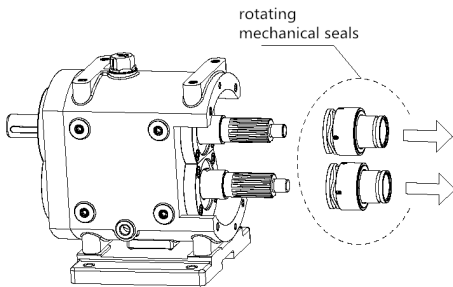
1. If there are screw holes on the rotors (except sanitary pump), pull out the rotors by screw bolts. Then take out the pump head by hammering the inlet and outlet gently with a soft hammer.



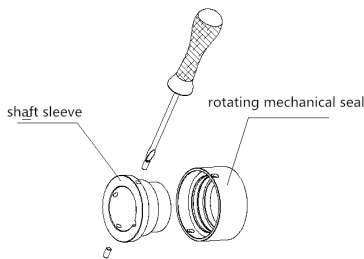
2. For rotors without the screw holes, loose the 4 screws on the pump head first. Then take out the pump head by hammering the inlet and outlet gently with a soft hammer. (Do not hammer the hoop, flange or thread on the connection.; Do not use iron hammer)



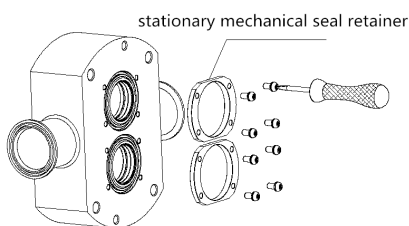
Step 8. Separate the pump head :
 The stainless head is heavy, in case prevent it from slipping the the head when separate it, and Unscrew the 4 screws and scratch the surface of the stationary Mechanical seal, screw the 2- 4 screws back on the head.(It is in the same way when install back.)



Step 9: Take out the rotating mechanical seals from the shafts.
 (Take care of the seal surface of the rotating mechanical seals. Do not scratch it.



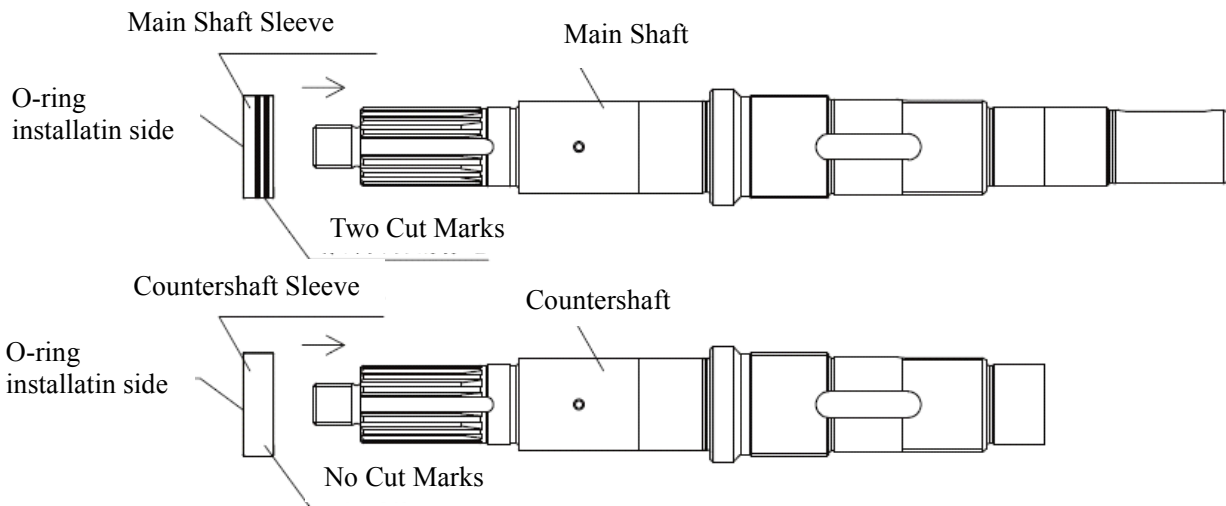
Step 10: Unscrew the screws on the rotating mechanical seal, separate the bearing sleeve from the rotating mechanical seal.(Take care of the seal surface of the rotating mechanical seals. Do not scratch it.)



Step 11: Unscrew the 4 screws on the stationary mechanical seal retainer; Take out the stationary mechanical seal (Take care of the seal surface of the stationary mechanical seals. Do not scratch

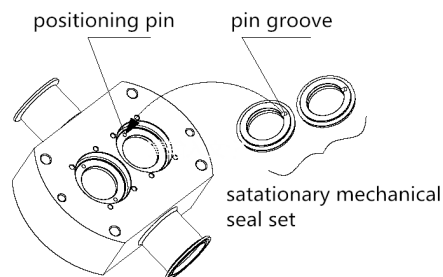
it.) The installation of mechanical seals are in reverse procedures.

Note: When install shaft shoulder, put the shaft sleeve with cut marks on the main shaft. Put the shaft sleeve without marks on the countershaft.

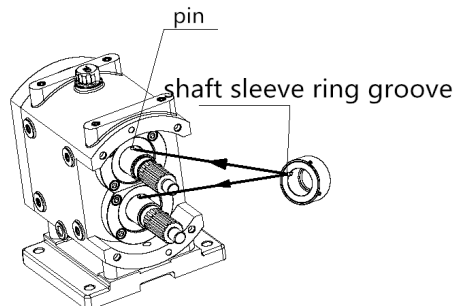


The followings must be observed when install the mechanical seals:

1. The two positioning pins on the satationary mechanical seal must point to the 2 positioning holes on the pump head.

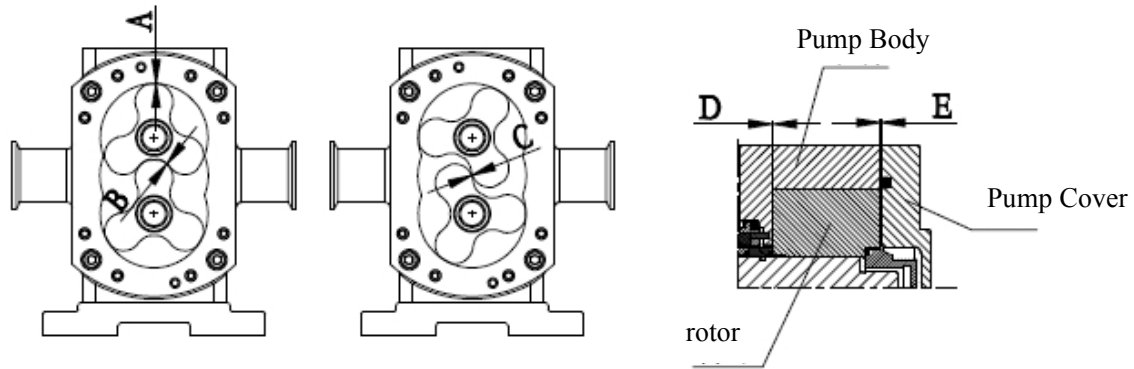


2. The pin groove on the rotating mechanical seal must point to the pin on the shaft.



9.2 Change of rotors

When change the rotors, make sure there is clearance between the two rotors and the pump head. Rotate the rotors manually after the installation. If there is no friction, turn on the power and let run for a few minutes. The operation procedures please refer to the mechanical seals change procedures step 1 to step 7.



- A: clearance between rotor and pump case
- B: clearance between rotor top and rotor root
- C: clearance between two rotors
- D: clearance between rotor backface and the pump case
- E: clearance between rotor front face and the pump cover

Standard rotor clearance (mm)

Model	A (60° C)	B (60° C)	C (60° C)	D (60° C)	E (60° C)
RP1	0.15	0.15	0.15	0.15	0.15
RP2	0.15	0.15	0.15	0.15	0.15
RP3	0.175	0.175	0.175	0.20	0.20
RP5	0.175	0.175	0.175	0.20	0.20
RP8	0.20	0.20	0.20	0.25	0.25
RP12	0.20	0.20	0.20	0.25	0.25
RP20	0.25	0.25	0.25	0.30	0.30
RP35	0.25	0.25	0.25	0.30	0.30
RP55	0.30	0.30	0.30	0.35	0.35
RP80	0.30	0.30	0.30	0.35	0.35

9.3 Change of Wetted part seals

Materials for wetted part seals:

FPM

PVMQ

FVMQ

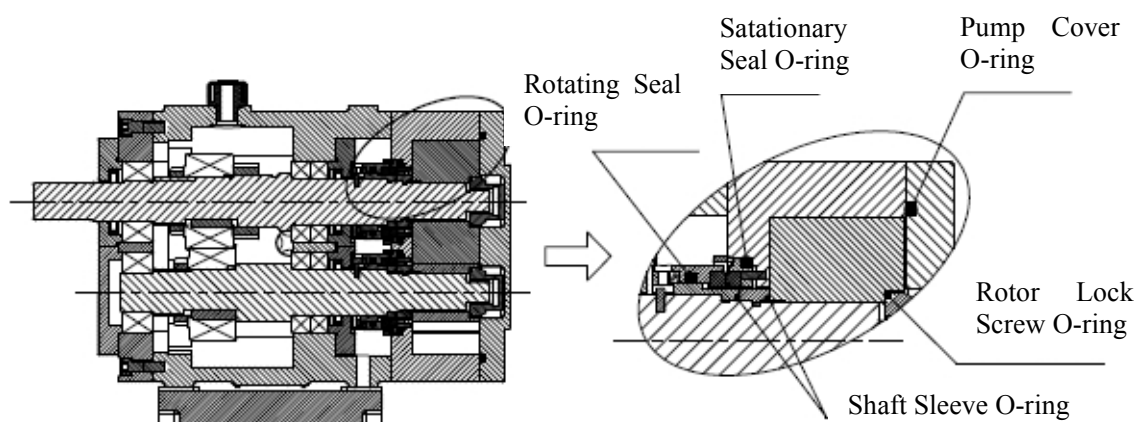
EPDM(E)

DPDM-FDA

PTFE

NBR

The procedures of o-ring change please refer to “5.3 change of mechanical seal”. The position of the O-ring as following:

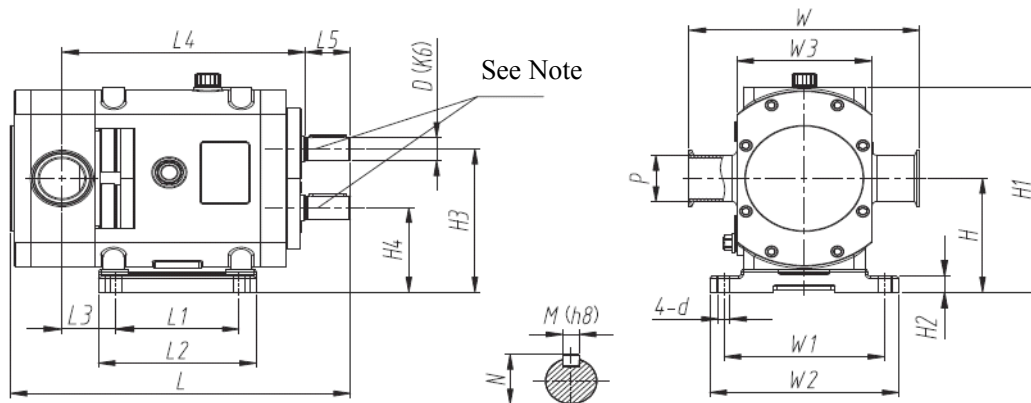


The following tips to be observed when change the O-ring:

1. When working O-rings, take care not to damage them as they pass over any sharp edges of splines, threads, etc. Be sure that the O-rings are not twisted in the groove when installing.
2. All O-rings should be lightly lubricated with a suitable lubricant before fitting, e.g. soap water.
3. For O-rings made of PTFE, it is advised to heat them up in hot water with temperature 60°C-80°C before placement. A warmed up O-ring becomes more soft, thus easier to install.

10.0 Installation dimensions

10.1 Pump head installation drawings



pump head installation dimensions:

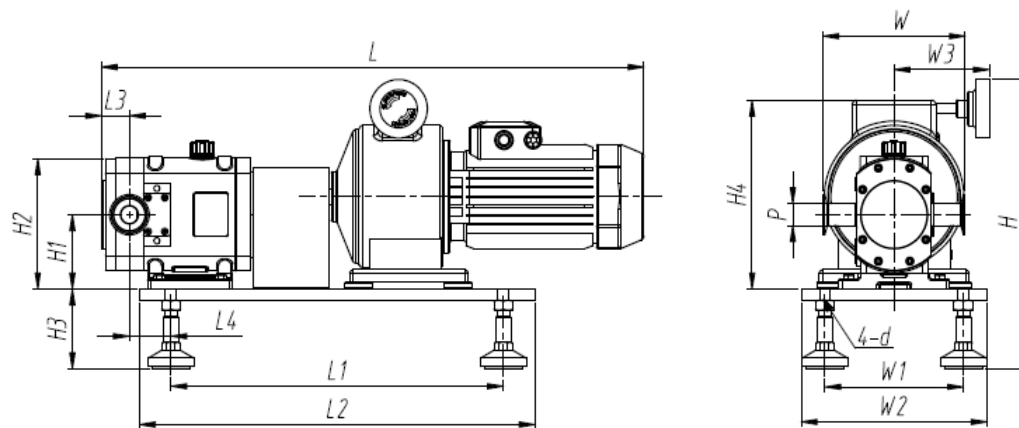
unit: mm

Model	L	L1	L2	L3	L4	L5	H	H1	H2	H3	H4	W	W1	W2	W3	M(h8)	N	d	D(K6)	P	
																				Hoop	Flange
RP1	233	78	108	37	167	30	92.5	165	13	115	70	180	115	140	94	5	18	Φ9	Φ16	25	DN20
RP2	267	92	124	45.5	193	31	105	188	14	131	79	198	132	156	110	6	20.5	Φ9	Φ19	32	DN25
RP3	313	110	143	49.5	221	43	121	217.5	17	150	92	217	144	170	125	8	27	Φ10	Φ24	38	DN32
RP5	363.5	130	170	61.5	262	46	134	241	19	168.5	99.5	240	170	202	142	8	31	Φ12	Φ28	50	DN40
RP8	413	150	192	65	295	55	155	280	21	195	115	280	195	230	164	10	35	Φ12	Φ32	63.5	DN50
RP12	477	155	215	86.5	340	62	181	328	24	228.5	133.5	320	225	270	192	12	45	Φ14	Φ42	76	DN65
RP20	544	190	250	98	390	70	209	382	26	266	152	372	268	315	232	14	53.5	Φ16	Φ50	89	DN80
RP35	614	218	278	104	436	80	239	439	26	306.5	171.5	432	298	348	266	18	64.5	Φ18	Φ60	108	DN100
RP55	727	215	295	154	513.5	102	287	527	32	369.5	204.5	522	370	430	318	20	74.5	Φ22	Φ70		DN125
RP80	818	260	340	162.5	579	120	339.5	619	37	435	239	570	410	480	366	22	85	Φ22	Φ90		DN125
RP120	945	315	410	178	660	145	398	740	42	508	270	640	470	550	425	25	95.5	Φ26	Φ110		DN150

Note:

Main driving shaft position: The height of the main driving shaft is at H3 if the driving is ordinary stepless speed reducer, frequency conversion motor or two grade gear reducer. The height of the main driving shaft is at H4 if the driving is one grade gear reducer or one grade stepless speed variator.

10.2 General installation drawings



General Installation Dimensions:

Unit: mm

Model	L	L1	L2	L3	L4	H	H1	H2	H3	W	W1	W2	W3	d	P		
															Hoop	Flange	
RP1	685	420	500	35	53	360	92.5	162	100	180	175	235	120	M16	Φ14	25	DN20
RP2	805	490	570	42	60	391	105	185	100	198	200	260	148	M16	Φ14	32	DN25
RP3	925	600	700	48.5	68	455	121	213	100	217	270	350	166	M16	Φ14	38	DN32
RP5	1050	630	750	55.5	81.5	478	134	236.5	110	240	270	350	166	M20	Φ18	50	DN40
RP8	1250	730	850	63	84	573	160	280	110	280	320	420	195	M20	Φ18	63.5	DN50
RP12	1335	780	940	74.5	116.5	490	181	323	125	320	330	420	200	M20	Φ18	76	DN65
RP20	1550	950	1110	83	119	555	209	376.5	125	372	385	475	245	M20	Φ18	89	DN80
RP35	1680	1035	1200	98	101	590	239	433	134	432	410	460	171	Φ25		108	DN100
RP55	1930	1200	1400	111	149	705	287	527	178	522	525	586	205	Φ35			DN125
RP80	2180	1400	1600	119.5	142	812	339.5	619	198	570	600	670	230	Φ40			DN125
RP120	2450	1650	1900	130	158	920	398	740	225	640	700	780	280	Φ45			DN150

The dates listed in this table are for standard model installation. if chang to ohter driving type, the installation dimensions will be different.

The above data table is subject to change without notice. See the actual products for the right data.

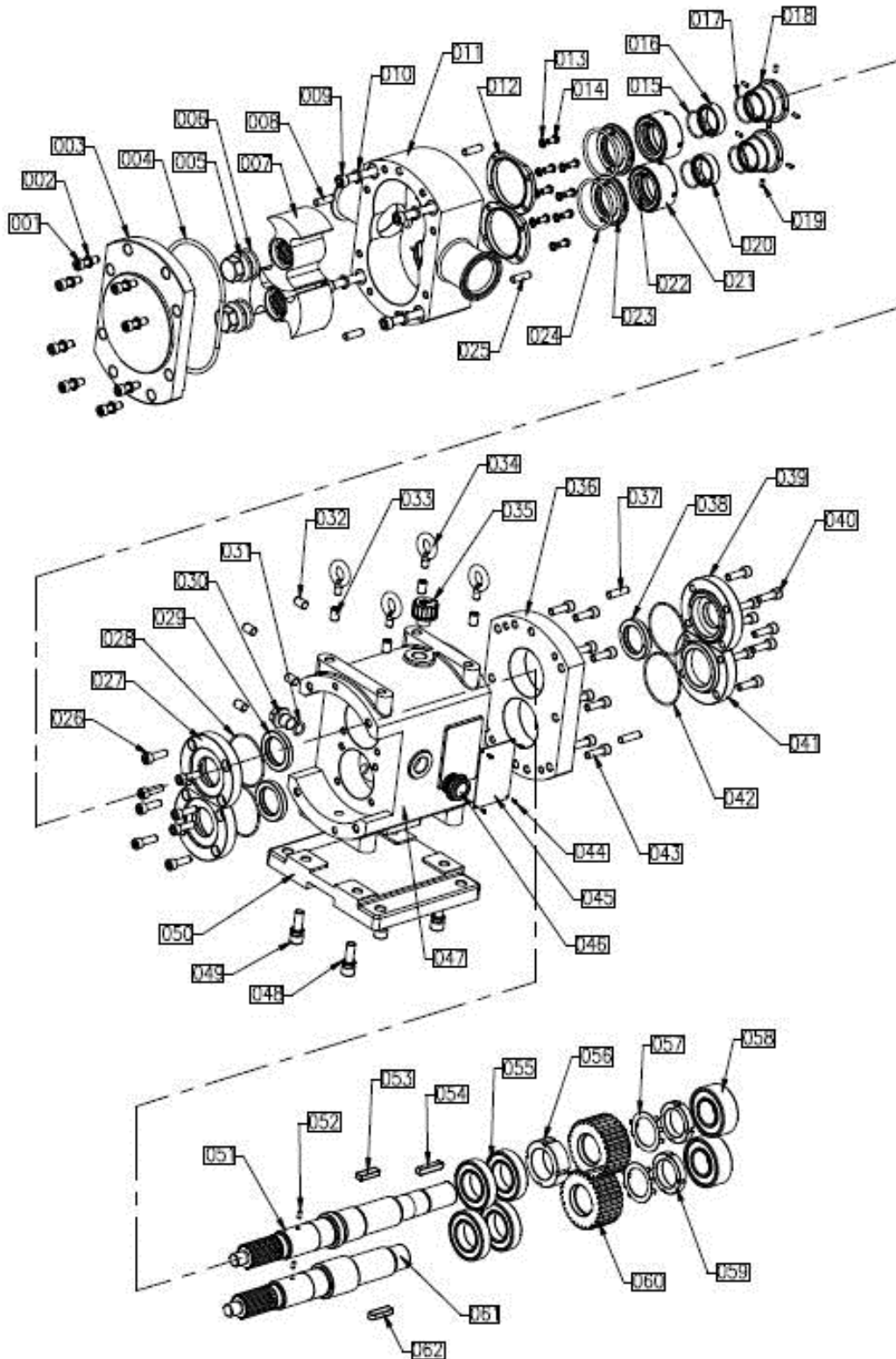
11.0 Troubleshootings

The list is troubleshootings for some probelms. If you can still can not handle the problem, cotact the manufacture or local dealer for more informations.

										Problem	Solutions
					※				※	Pump shaft and motor shaft are not in concentric	Adjust them to be concentric
※								※		Motor not match the power supply	Check the contract and your power supply
	※							※		Inlet pressure too low	High position feed the medium
	※				※					Big foreign matter block the pump	Clean the foreign matter
					※				※	Too much deposits or hard solid particles in the pump	Clean the pump
	※	※	※	※						Air in the pipes or leakage at the connection joints	Discharge the air and repair the pipes
	※	※	※	※	※					Seal leakage	Clean the seal or replace it
	※	※	※	※						Speed too low	Increase the speed if it is CVT
		※	※	※						Suction too high, suction pipe too long or perfusion pressure too low	Lower the pump installation position
※					※			※	※	Bearing broken	Change the bearing
					※				※	Coupling elastic block wearing	Change the elastic block
								※	※	Speed too high	Reduce the motor speed or change the drive system
	※	※	※	※						Medium viscosity too high or proportion too big	Reduce the viscosity or change the drive system
				※						Too much high proportion particles	Reduce the high proportion particles or change the drive system
									※	The mechanical seal material does not in accordance with the medium	Choose the suitable mechanical seal
								※	※	The two mechanical seal surface don't adjust well	Adjust them again according to this manual
		※	※	※	※				※	Mechanical seal seriously damaged	Change the seal
			※	※					※	Mechanical seal spring broken	Change the spring
		※								Outlet pressure too high	Reduce the quantity of outlet valves and bends
					※					Rotor broken	Change the rotor
	※									Filter or inlet pipe block	Cleaning and dredging
		※	※	※				※		Inlet pipe is too slim and long, too many valves and bends	Enlarge the pipe, reduce the length and the quantity of valves and bends
		※	※					※		The viscosity of medium is too high to transport	Reduce the speed, change to higher flow rotor
※									※	Reducer broken	Repair the reducer
	※								※	Inlet pipe is closed or blocked	Open the inlet pipe, or dredge the pipe
	※								※	Motor rotation direction is wrong	Adjust wiring, change the motor rotation direction

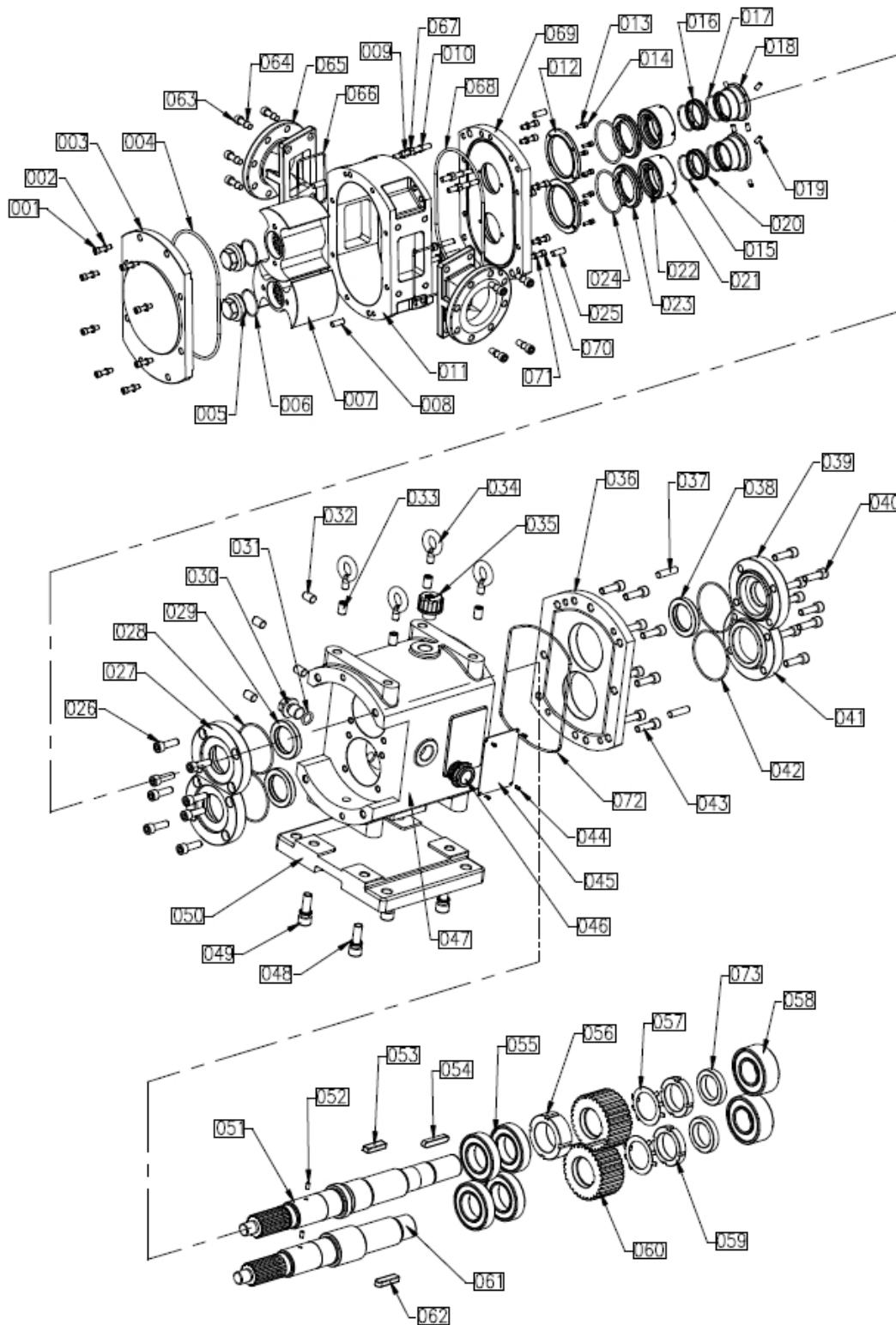
12.0 Drawings and Parts List

12.1 Horizontal Type (RP1-RP35)



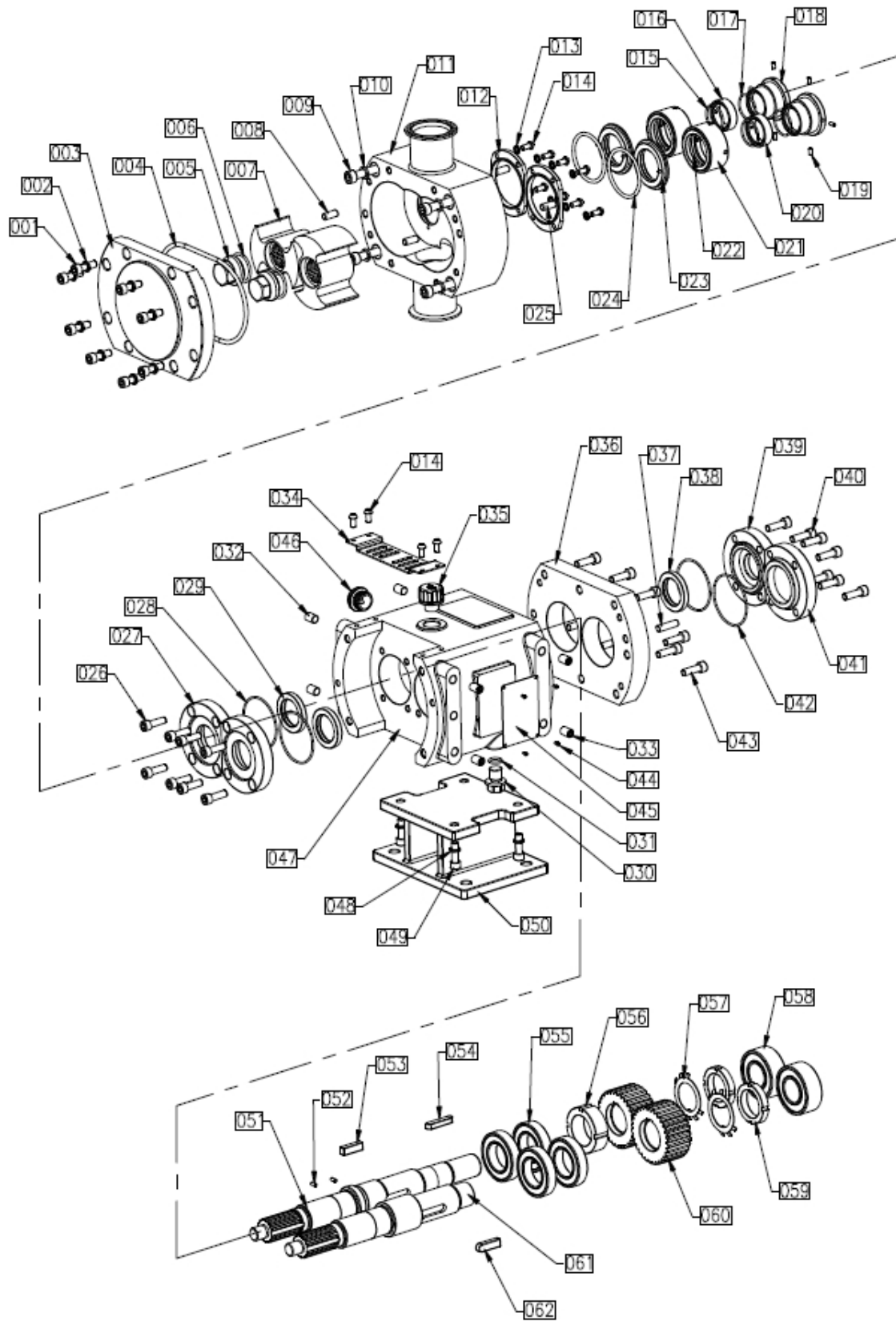
No	Name	Material	qty	No	Name	Material	qty
1	Pump cover nut	304	8	32	Plug screw	304/rubber	4
2	Spring washer	304	8	33	Plung screw	304/rubber	4
3	Pump cover	304/316L	1	34	Lift ring		4
4	Pump cover O-ring	FPM/PVMQ/PTFE	1	35	Air breather		1
5	Rotor lock nut	304/316L	2	36	Gearbox cover	QT250	1
6	Rotor lock O-ring	FPM/PVMQ/PTFE	2	37	Gearbox cover positoning pin		2
7	Rotor	304/316L	2	38	Framework oil seal		1
8	Positioning pin	431	2	39	Main shaft bearing rear cover	QT250	1
9	Pump head lock nut	304	4	40	Bearing couver nut		8
10	Spring washer	304	4	41	Countershaft bering rear cover	QT250	1
11	Pump head	304/316L	1	42	Bearing cover O-ring	NBR	2
12	Stationary mechanical seal retainer	304	2	43	Gearbox cover nut		8
13	Spring washer	304	8	44	Nameplate screw		4
14	Sunk screw	304	8	45	Nameplate		1
15	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	46	Oil level glass		1
16	Main shaft sleeve	304/316L	1	47	Gear box case	QT250	1
17	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	48	Spring washer		4
18	Shaft sleeve	304/316L	2	49	Pump baseplate nut		4
19	Shaft sleeve lock nut	304	8	50	Pump baseplate	QT250	1
20	Countershaft sleeve	304/316L	1	51	Main shaft	431	1
21	Rotating mechanical seal	304/316L	2	52	Shaft sleeve positioning pin	304	2
22	Rotating mechanical seal O-ring	FPM/PVMQ/PTFE	2	53	Main shaft key		1
23	Stationary mechanical seal	304/316L	2	54	Drving key		1
24	Stationary mechanical seal Oring	FPM/PVMQ/PTFE	2	55	Front bearing		4
25	Pump head rear positioning pin	431	2	56	Self lock screw		2
26	Bearing cover screw		8	57	Round nut washer		2
27	Bearing front cover	QT250	2	58	Rear bearing		2
28	Bearing cover O-ring	NBR	2	59	Round nut		2
29	Framework oil seal		2	60	Bevel wheel	42CrMo	2
30	Drain plug		1	61	Counter shaft	431	1
31	Drain plug O-ring	NBR	1	62	Counter shaft key		1

12.2 Horizontal Type (RP55-RP150)



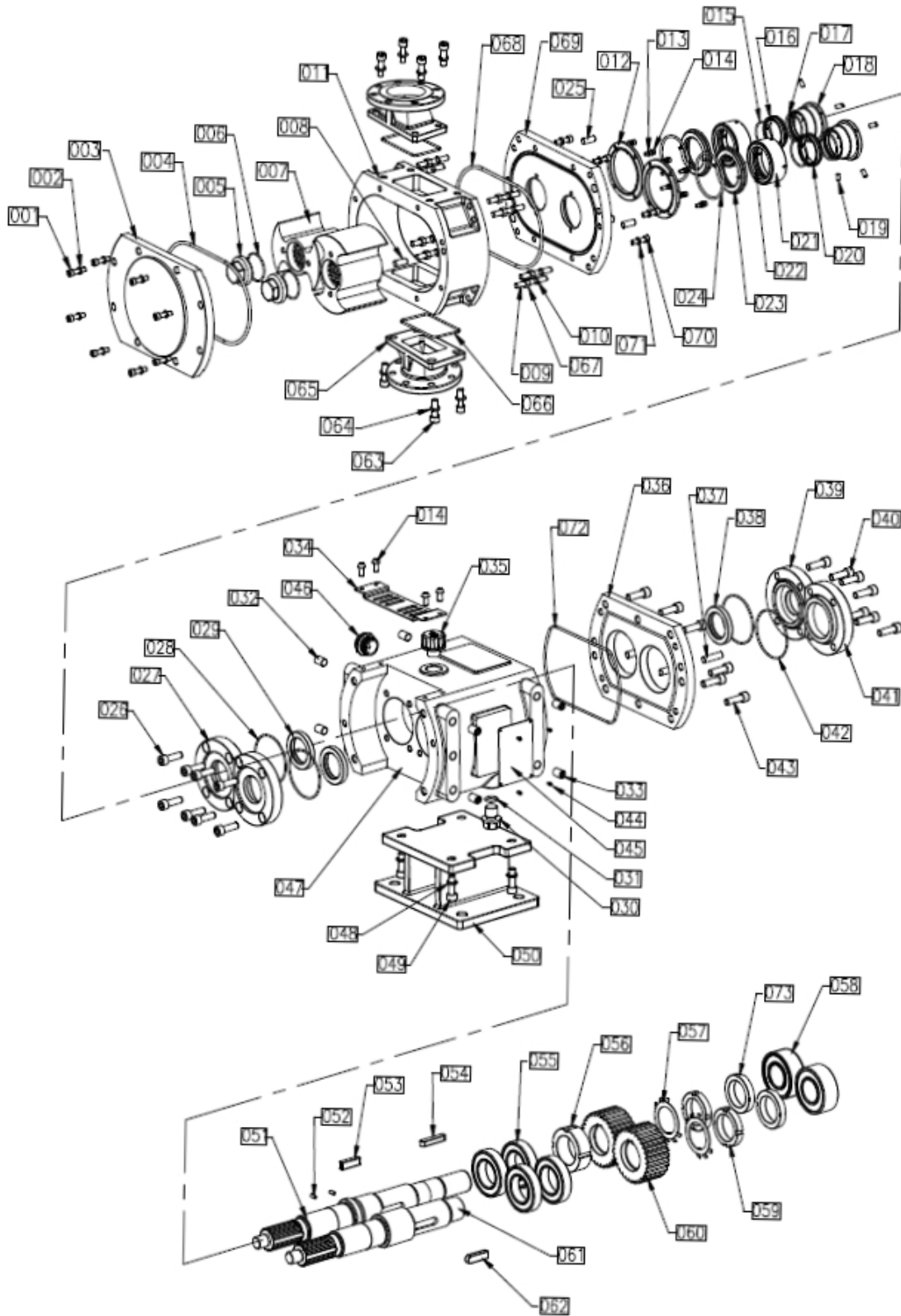
No	Name	Material	Qty	No	Name	Material	Qty
1	Pump cover nut	304	8	38	Framework oil seal		1
2	Spring washer	304	8	39	Main shaft bearing rear cover	QT250	1
3	Pump cover	304/316L	1	40	Bearing couer nut		8
4	Pump cover O-ring	FPM/PVMQ/PTFE	1	41	Countershaft bearing rear cover	QT250	1
5	Rotor lock nut	304/316L	2	42	Bearing cover O-ring	NBR	2
6	Rotor lock O-ring	FPM/PVMQ/PTFE	2	43	Gearbox cover nut		8
7	Rotor	304/316L	2	44	Nameplate screw		4
8	Positioning pin	431	2	45	Nameplate		1
9	Pump head lock nut	304	8	46	Oil level glass		1
10	Spring washer	304	8	47	Gear box case	QT250	1
11	Pump head	304/316L	1	48	Spring washer		4
12	Stationary mechanical seal retainer	304	2	49	Pump baseplate nut		4
13	Spring washer	304	8	50	Pump baseplate	QT250	1
14	Sunk screw	304	8	51	Main shaft	431	1
15	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	52	Shaft sleeve positioning pin	304	2
16	Main shaft sleeve	304/316L	1	53	Main shaft key		1
17	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	54	Drving key		1
18	Shaft sleeve	304/316L	2	55	Front bearing		4
19	Shaft sleeve lock nut	304	8	56	Self lock screw		1
20	Countershaft sleeve	304/316L	1	57	Round nut washer		2
21	Rotating mechanical seal	304/316L	2	58	Rear bearing		2
22	Rotating mechanical seal O-ring	FPM/PVMQ/PTFE	2	59	Round nut		2
23	Stationary mechanical seal	304/316L	2	60	Bevel wheel	42CrMo	2
24	Stationary mechanical seal Oring	FPM/PVMQ/PTFE	2	61	Counter shaft	431	1
25	Pump head rear positioning pin	431	2	62	Counter shaft key		1
26	Bearing cover screw		8	63	Flange connector screw	304	8
27	Bearing front cover	QT250	2	64	Srping washer	304	8
28	Bearing cover O-ring	NBR	2	65	Flange connector seat	304/316L	2
29	Framework oil seal		2	66	Flange connector O-ring	FPM/PVMQ/PTFE	2
30	Drain plug		1	67	nut	304	8
31	Drain plug O-ring	NBR	1	68	Pump head rear cover O-ring	FPM/PVMQ/PTFE	1
32	Plug screw	304/rubber	4	69	Pump head rear cover	304/316L	1
33	Plung screw	304/rubber	4	70	Pump head rear cover screw	304	8
34	Lift ring		4	71	Spring washer	304	8
35	Air breather		1	72	Gearbox cover O-ring	NBR	1
36	Gearbox cover	QT250	1	73	Dring shaft washer	45	2
37	Gearbox cover positoning pin		2				

12.3 Vertical Type (RP1-RP35)



No	Name	Material	Qty	No	Name	Material	Qty
1	Pump cover nut	304	8	33	Plung screw	304/rubber	4
2	Spring washer	304	8	34	Lift ring		4
3	Pump cover	304/316L	1	35	Air breather		1
4	Pump cover O-ring	FPM/PVMQ/PTFE	1	36	Gearbox cover	QT250	1
5	Rotor lock nut	304/316L	2	37	Gearbox cover positioning pin		2
6	Rotor lock O-ring	FPM/PVMQ/PTFE	2	38	Framework oil seal		1
7	Rotor	304/316L	2	39	Main shaft bearing rear cover	QT250	1
8	Positioning pin	431	2	40	Bearing cover nut		8
9	Pump head lock nut	304	4	41	Countershaft bearing rear cover	QT250	1
10	Spring washer	304	4	42	Bearing cover O-ring	NBR	2
11	Pump head	304/316L	1	43	Gearbox cover nut		8
12	Stationary mechanical seal retainer	304	2	44	Nameplate screw		4
13	Spring washer	304	8	45	Nameplate		1
14	Sunk screw	304	8	46	Oil level glass		1
15	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	47	Gear box case	QT250	1
16	Main shaft sleeve	304/316L	1	48	Spring washer		4
17	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	49	Pump baseplate nut		4
18	Shaft sleeve	304/316L	2	50	Pump baseplate	QT250	1
19	Shaft sleeve lock nut	304	8	51	Main shaft	431	1
20	Countershaft sleeve	304/316L	1	52	Shaft sleeve positioning pin	304	2
21	Rotating mechanical seal	304/316L	2	53	Main shaft key		1
22	Rotating mechanical seal O-ring	FPM/PVMQ/PTFE	2	54	Driving key		1
23	Stationary mechanical seal	304/316L	2	55	Front bearing		4
24	Stationary mechanical seal Oring	FPM/PVMQ/PTFE	2	56	Self lock screw		2
25	Pump head rear positioning pin	431	2	57	Round nut washer		2
26	Bearing cover screw		8	58	Rear bearing		2
27	Bearing front cover	QT250	2	59	Round nut		2
28	Bearing cover O-ring	NBR	2	60	Bevel wheel	42CrMo	2
29	Framework oil seal		2	61	Counter shaft	431	1
30	Drain plug		1	62	Counter shaft key		1
31	Drain plug O-ring	NBR	1	65			
32	Plug screw	304/rubber	4	66			

10.4 Vertical Type (RP55- RP150)



No	Name	Material	Qty	No	Name	Material	Qty
1	Pump cover nut	304	8	38	Framework oil seal		1
2	Spring washer	304	8	39	Main shaft bearing rear cover	QT250	1
3	Pump cover	304/316L	1	40	Bearing cover nut		8
4	Pump cover O-ring	FPM/PVMQ/PTFE	1	41	Countershaft bearing rear cover	QT250	1
5	Rotor lock nut	304/316L	2	42	Bearing cover O-ring	NBR	2
6	Rotor lock O-ring	FPM/PVMQ/PTFE	2	43	Gearbox cover nut		8
7	Rotor	304/316L	2	44	Nameplate screw		4
8	Positioning pin	431	2	45	Nameplate		1
9	Pump head lock nut	304	8	46	Oil level glass		1
10	Spring washer	304	8	47	Gear box case	QT250	1
11	Pump head	304/316L	1	48	Spring washer		4
12	Stationary mechanical seal retainer	304	2	49	Pump baseplate nut		4
13	Spring washer	304	8	50	Pump baseplate	QT250	1
14	Sunk screw	304	8	51	Main shaft	431	1
15	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	52	Shaft sleeve positioning pin	304	2
16	Main shaft sleeve	304/316L	1	53	Main shaft key		1
17	Shaft sleeve O-ring	FPM/PVMQ/PTFE	2	54	Driving key		1
18	Shaft sleeve	304/316L	2	55	Front bearing		4
19	Shaft sleeve lock nut	304	8	56	Self lock screw		1
20	Countershaft sleeve	304/316L	1	57	Round nut washer		2
21	Rotating mechanical seal	304/316L	2	58	Rear bearing		2
22	Rotating mechanical seal O-ring	FPM/PVMQ/PTFE	2	59	Round nut		2
23	Stationary mechanical seal	304/316L	2	60	Bevel wheel	42CrMo	2
24	Stationary mechanical seal Oring	FPM/PVMQ/PTFE	2	61	Counter shaft	431	1
25	Pump head rear positioning pin	431	2	62	Counter shaft key		1
26	Bearing cover screw		8	63	Flange connector screw	304	8
27	Bearing front cover	QT250	2	64	Spring washer	304	8
28	Bearing cover O-ring	NBR	2	65	Flange connector seat	304/316L	2
29	Framework oil seal		2	66	Flange connector O-ring	FPM/PVMQ/PTFE	2
30	Drain plug		1	67	nut	304	8
31	Drain plug O-ring	NBR	1	68	Pump head rear cover O-ring	FPM/PVMQ/PTFE	1
32	Plug screw	304/rubber	4	69	Pump head rear cover	304/316L	1
33	Plug screw	304/rubber	4	70	Pump head rear cover screw	304	8
34	Lift ring		4	71	Spring washer	304	8
35	Air breather		1	72	Gearbox cover O-ring	NBR	1
36	Gearbox cover	QT250	1	73	Driving shaft washer	45	2
37	Gearbox cover positioning pin		2				



Add: Huishu Road, Linhai, Zhejiang, China

Tel: 86-576-85289780 / 86-576-85229208

Web: www.ligaopumps.com

Email: Sales@ligaopumps.com