鲍斯真空
BAOSI VACUUM

Instruction Manual

Roots pump

BSJ70L/BSJ150L/BSJ300L/BSJ600L

Ningbo BAOSI Energy Equipment Co., Ltd.

www.cnbaosi.com

1 For Your Safety

Thank you very much for purchasing our product.

You are kindly requested, upon delivery of the product, to check that the delivered product is exactly what you have ordered and it has no damage caused by transport or the like. This manual gives description on operation and maintenance procedure appropriate to use the product in safe and effective way. Please read this manual beforehand to correctly use the pump.

You are requested to install and operate the product in compliance with the laws and regulations relating to the safety, e.g. Fire Defense Law, Electric wiring regulation and so on in the country and region you use the product. Operators shall need to attend related training and have special knowledge, skill and title regarding the electricity, machinery, cargo, vacuum and so on.

Any modification of the product by the user is out of the scope of guarantee by us and not be guarantee in any manner.

Be sure to clear any energy source, e.g. electricity, coolant and so on before installing or removing the product.

Please note that any of the parts used in this product shall keep the performance at the time of the shipment but shall not survive eternally. Any of the parts cannot, performance and get easily result in causing trouble of the product. You are kindly requested consequently to take your application situation into consideration and help yourself to implement the protective maintenance so as to avoid troubles.

Please contact our company if you had any question or unclear on the use.

1.1 Acceptance of the Pump

Although we pay full attention on shipping, you are kindly requested to check the following upon unpacked the product.

1) Whether the delivered product is exactly what you have ordered.
2) Whether accessories (pump oil for one lubrication, optional parts) are attached or not.
3) Whether there is no break or damage through transport or not.
4) Whether any bolt or nut got loose or taken off through transport or not.

1.2 Ambient Condition for Storage, Install and Operation

As precise clearances are provided with this machine, be sure to fulfill the following for its storage, install and operation.

1) Ambient temperature and humidity for storage: -10℃ to50℃,less than95%RH
2) Ambient temperature and humidity for operation: 5℃ to40℃,lessthan80%RH

3) Height (for both storage and operation): Lower than el. 1,000m.

4) External vibration (for both storage and operation): Vibration acceleration less than 114dB (0.5G).

5) Miscellaneous (for both storage and operation)

a. There shall be no corrosion behavior and explosive gas.

b. There shall be no freeze or dew formation.

c. There shall be no dust.

d. It shall be in house.

e. Another pump shall not be put on the pump. The pump shall not be laid down nor put touching its motor edge face or oil gauge edge face with the ground.

f. There shall be no direct sun beam.

g. Heat source shall be away from the pump.

CAUTION 	The pump must be installed on a flat place, be sure no gaps between the pump and insta1laiion surface, tighten bolts to fix it. Mount anti-vibration rubber isolator to absorb vibration from the pump

CAUTION 	Cautions are given where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

The units used throughout this manual conform to the SI international system of units of measurement.

The following symbol is on the pump.

 Warning - refer to accompanying documentation.

 Warning – risk of electric shock.

 Warning – hot surfaces.

CE CONFORMITE EUROPEENNE - Comply with the EU "technical coordination and standardization of new method" basic requirements of the directive.

WEEE - When the end user is going to discard the product must be sent to the appropriate facilities, for recovery and recycling.

The direction of motor - Ensure that the pump-motor rotates in the correct direction.

1.3 Protective Device

The pump is equipped with the3-phase50Hz-AC380V/400V/415V, 60Hz-AC380V/400V/440V motor. This motor is not equipped with protective device. It is imperative to put protective device such as the overload protective device and leak breaker etc. under direction of the Electrical installation Technical Standard.

CAUTION 	BE sure to put an overload protective device Otherwise it would cause a burn out and/or fire of the motor

WARNING: Operations not comply with the following protective measures will result in significant personal injury!

- Be sure to turn off the power supply to execute the wiring and maintenance work. You are recommended to install a dedicated Leak breaker. You have a risk of getting electrical shock in case of failure or electric leakage.

- Do not run the pump on blocking the exhaust outlet or putting any device that might hamper gas passage onto the outlet. There is a risk that the pressure inside the vacuum pump will rise up to cause break of the casing or the oil level gauge, resulting in overload of the motor. When utilizing the oil mist trap perform the periodic maintenance so that no-resistance can be realized in passage of gas.

- Ensured pressure value of the pump is not over 0.03MPa (0.3kg/cm2) (gauge pressure). Check the exhaust side pressure of the pump. If it was over 0.03MPa, take away anything in and around the exhaust outlet that hampers gas passage.

- Do not exhaust any hazardous gas such as explosive, combustible and toxic. If any toxic gas was evacuated, not only the pump itself but also vacuum pump oil get toxic. Keep this in mind when perform maintenance, ask the special agency to do the detoxification process.

- Do not exhaust any gas which oxygen content is greater than atmospheric oxygen (the oxygen content>21%) or other strong reactive gas.
- The motor and pump become hot (temperature increase under non-load operation：40℃, temperature increase under high-load 80℃)during operation, there is a risk of burns. Do not touch the motor and pump during operation or soon after pump stopping. Apply an appropriate protection to avoid touching the surface as necessary.
- Never place combustible materials around the motor or pump. There is a risk of fire. Also, do not place objects that block ventilation around the motor. Abnormal heat generation may result in burns.
- Do not operate the pump in hazardous area (where there is a risk of creating hazardous atmosphere by explosive gas). It might cause injury and fire.
- It is imperative to put the overload protection device. Otherwise it would cause the motor burn out and/or fire.
- Any non-professional person shall be restricted from disassembling, repairing or modifying the product. It might cause a fire, be injured, or pump trouble.
- Be sure there is no debris or powder and lots of condensed gas generated or accreted in system, the pump will be damaged because of oil being deteriorated.
- You should check the oil level regularly.
- Please do not operate without oil or oil less the pump, the pump will be damaged.
- Ambient temperature for operation should be 5 to 40°C. When the pump is installed in a closed system, be sure the ambient temperature not more than 40°C.

2 Pump Outline

The mechanical booster pump is used combined with the supplementary pump to enhance the exhaust speed around the pressure range $1.3x10^{3}$~ $1.3x10^{-1}$Pa ($1.3x10^{1}$~ $1.0x10^{-3}$Torr) where the supplementary pump exhaust speed is likely to lower. It includes two rotors having a cocoon-shaped cross section and a casing that encloses them. These two rotors are designed to rotate in the opposite directions without contacting each other while maintaining a very small clearance between them by a timing gear.

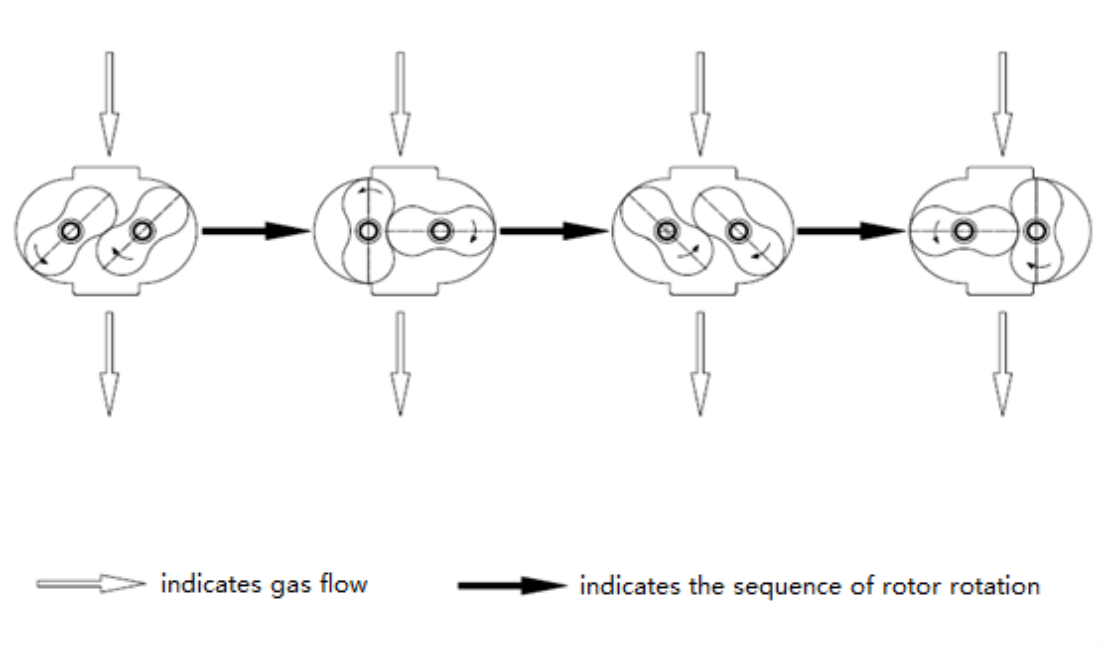


Fig.1 Pumping mechanism of mechanical booster pump

With this type of pump, there is no fear of the rotors and casing being worn out because they do not contact each other during rotation. Since no lubricating oil is used in the rotor chamber, stable pumping performance can be obtained even for water vapor and solvent vapor.

2.1 Specification

Table 1 Performance specifications

Model		BSJ70L	BSJ150L	BSJ300L	BSJ600L
Pumping speed*2 M3/h(L/S)	50HZ	280(70)	500(139)	1000(278)	
	60HZ	330(92)	600(167)	1200(333)	
Max. inlet pressure*2 (in continuous operation) Pa	50HZ	$1.2x10^3$	$1.3x10^3$		$8x10^2$
	60HZ	$9.3X10^2$	$1.1 x10^3$		$6.7 x10^2$
Max. allowable pressure difference*2 (outlet pressure-inlet pressure) Pa	50HZ	$4x10^3$	$7.3x10^3$		$5.6x10^3$
	60HZ	$3.3x10^3$	$6x10^3$		$4.7x10^3$
Ultimate pressure Pa*1		$4x10^{-1}$			
Pumping speed of standard for pump m3/h		BSV40 BSV60	BSV90 BSV175	BSV175 BSV275	BSV275
Motor(2 Pole) kW		0.75	2.2	3.7	7.5
Required oil volume(BS046) L		0.8	1.6	2	4
Cooling water	Volume L/min	2*3	2	3	3
	Water pressure difference MPa	0.1			
	Water temperature ℃	5~30*4			
Weight kg		51	79.5	115	227
inlet port diameter JIS		VG80	VG80	VG100	VG200
Outlet port diameter JIS		VF80	VF80	VF80	VF200

*1The value is measured by using a Pirani gauge. It is approx. one digit lower when a McLeod gauge is used

*2 The value changes depending on the performance of the fore pump. The above data is obtained when the pump is used in combination with a standard for pump.

*3 Air cooling will do when the pressure is lower than530Pa. Water cooling is required in continuous operation at a pressure higher than530Pa.

*4 The temperature of inlet port cooling water must be5~30℃. Keep the environment that does not cause dew formation when the cooling water temperature was lower.

2.2 Dimensional Drawing

Fig.2 BSJ70L Dimension drawing

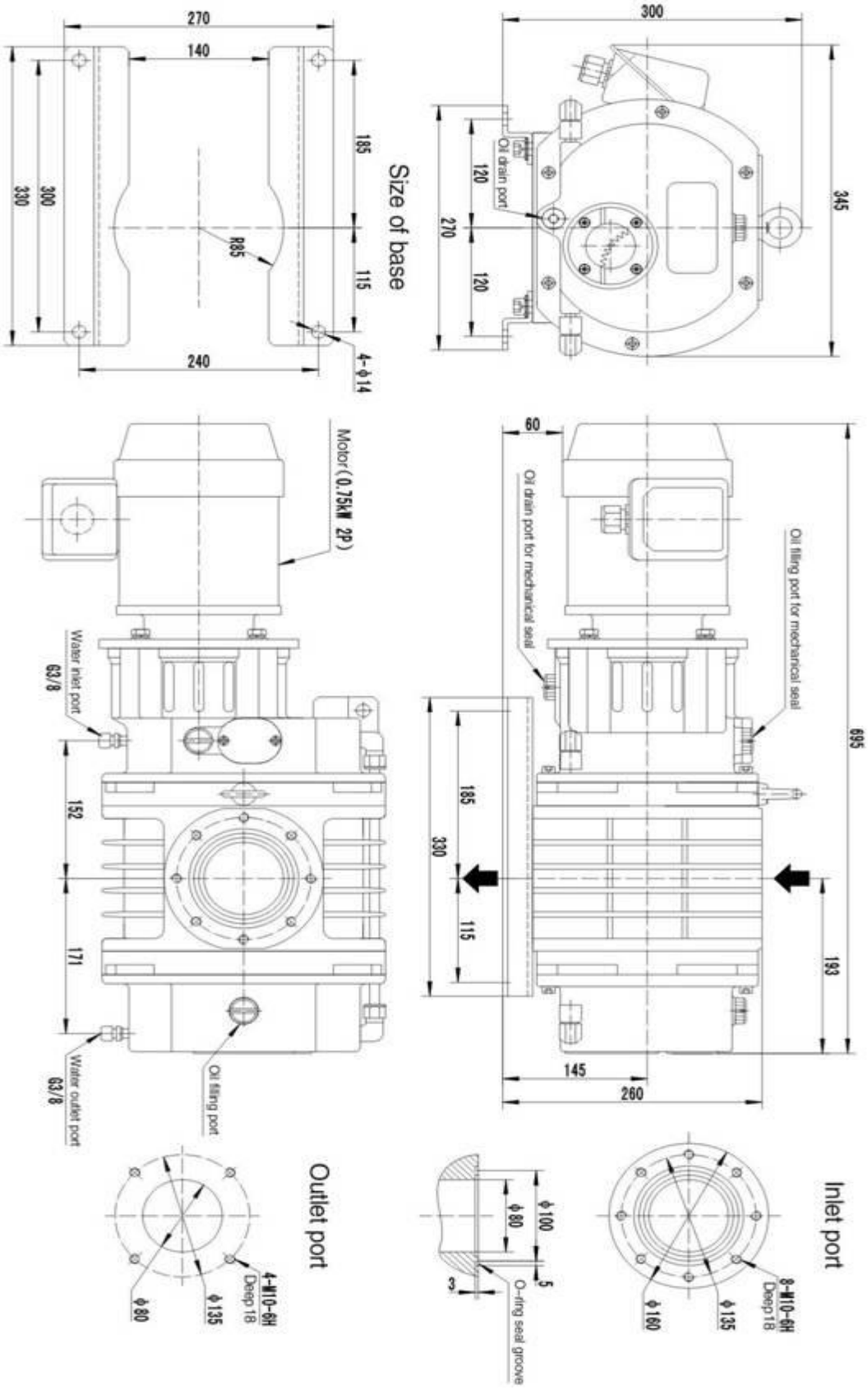


Fig.3 BSJ150L Dimension drawing

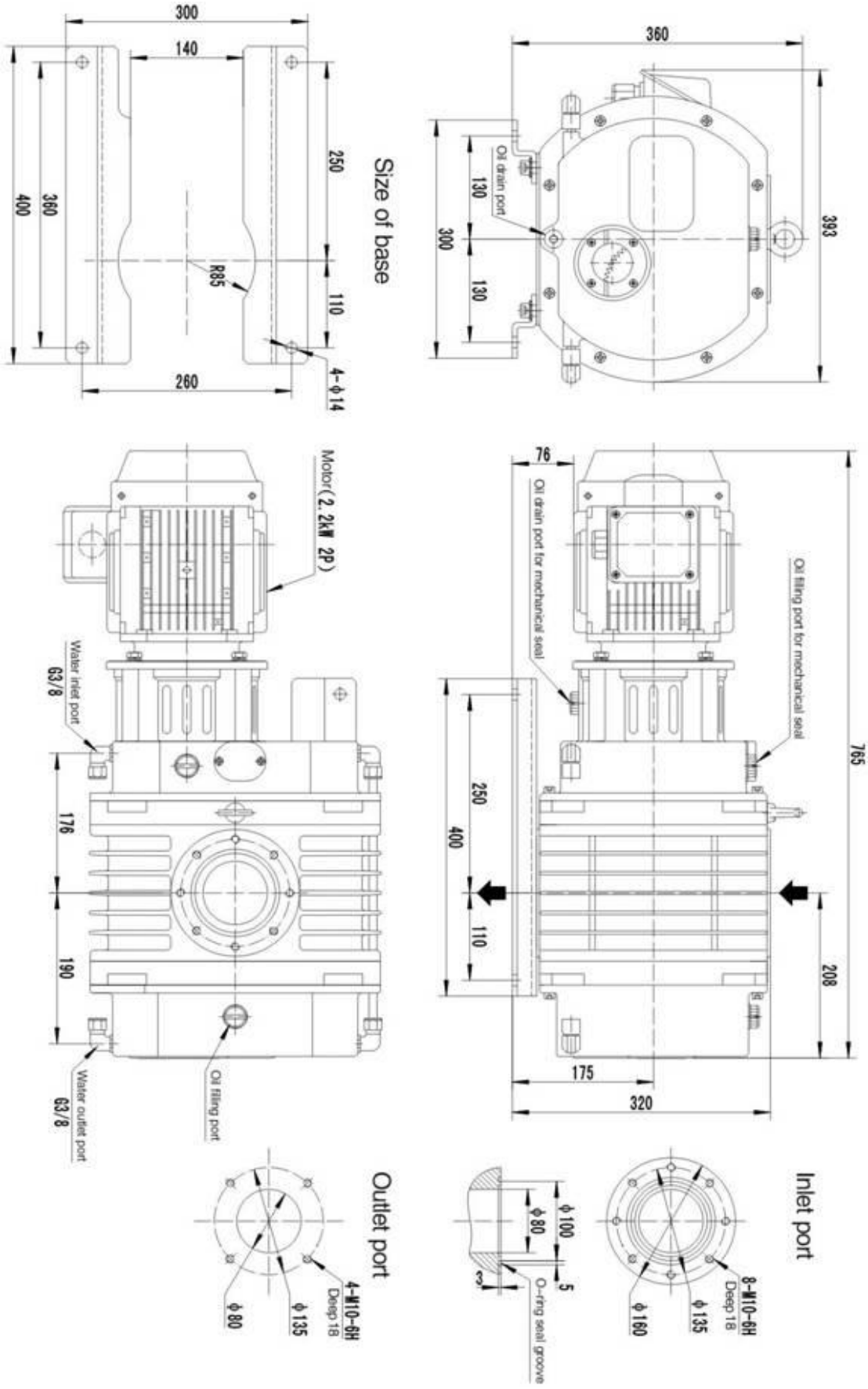


Fig.4 BSJ300L Dimension drawing

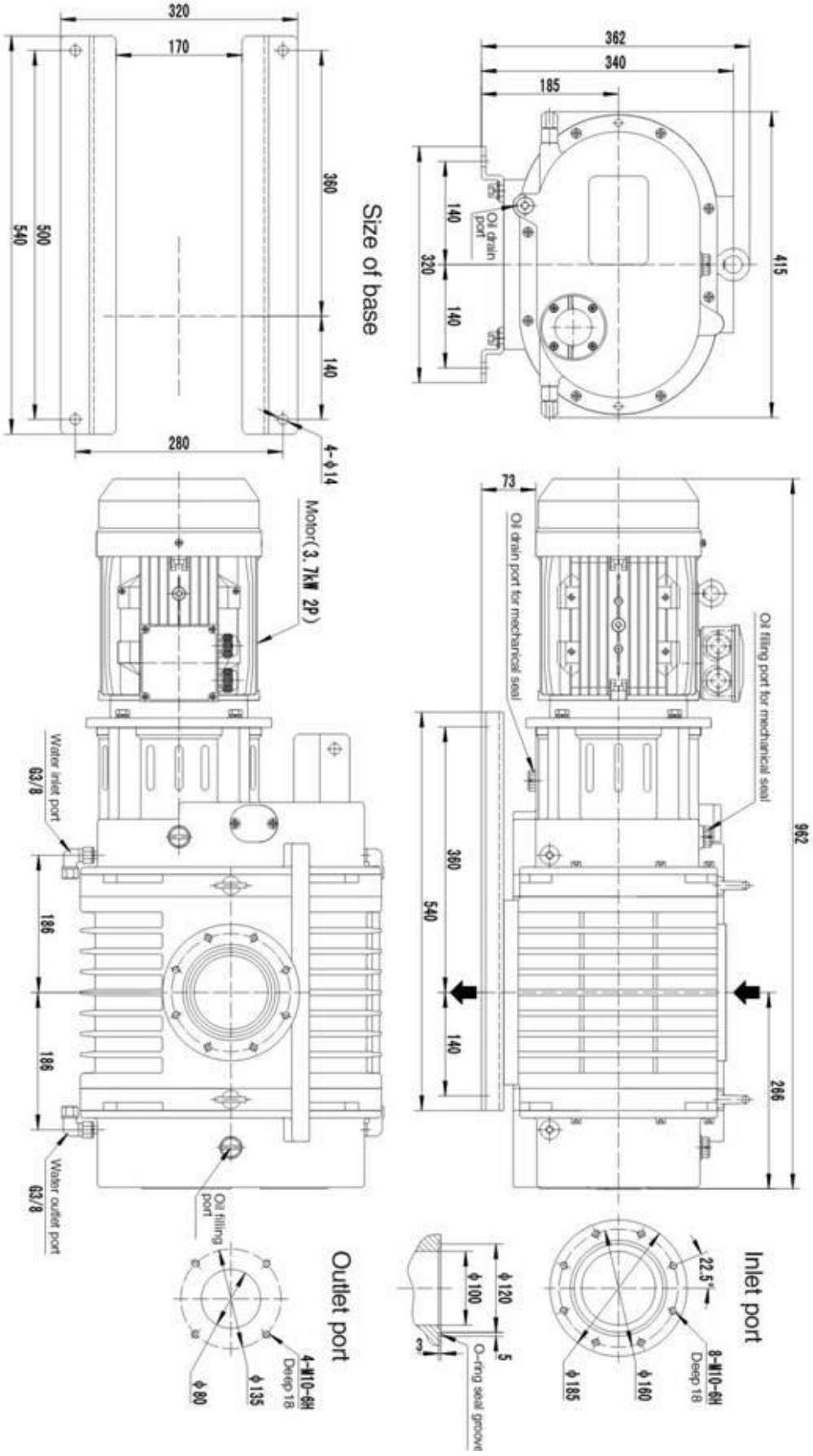
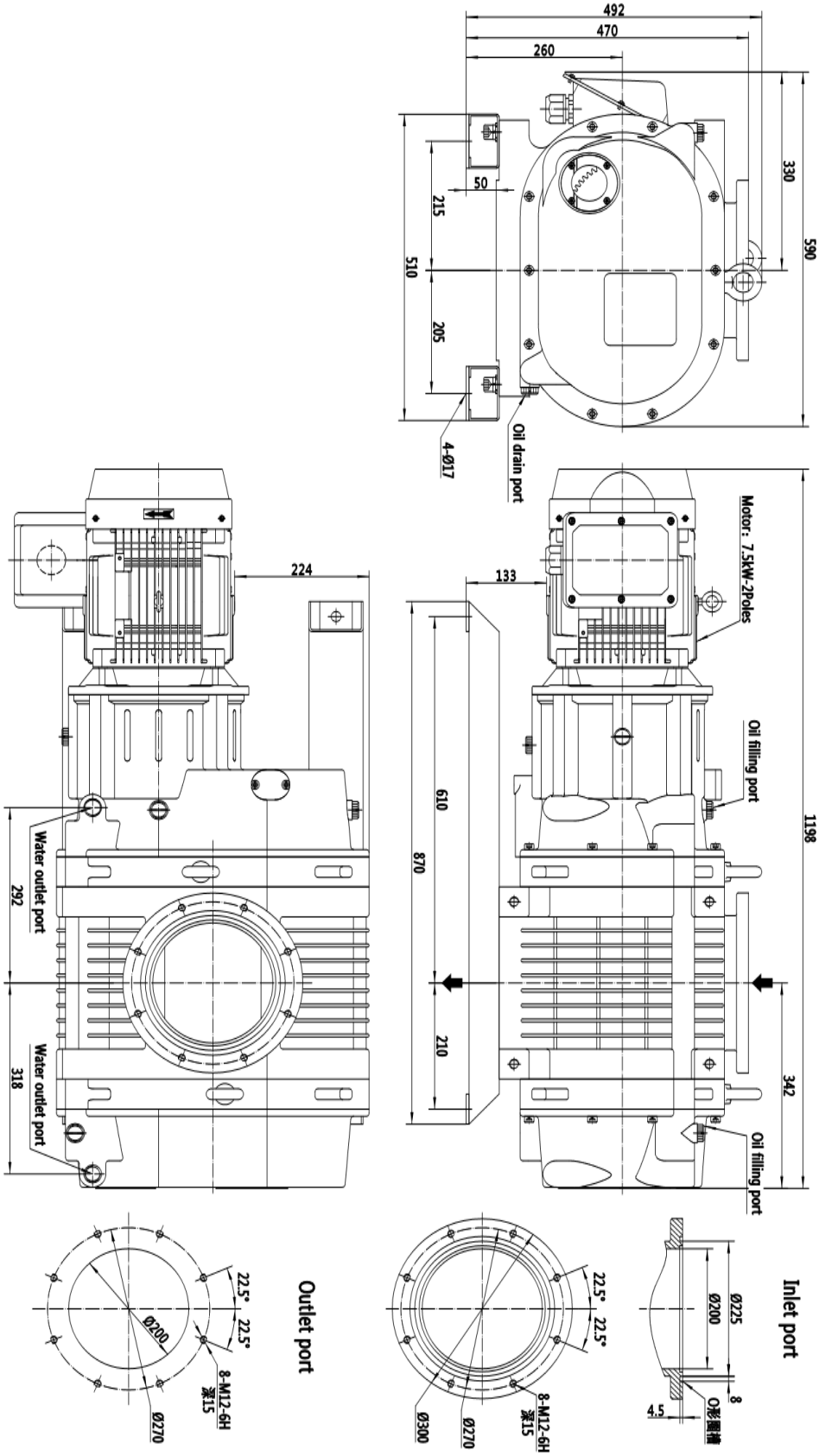


Fig.5 BSJ600L Dimension drawing



2.3 Pump Performance

2.3.1 Ultimate pressure

The ultimate pressure of the mechanical booster pump varies with the ultimate pressure of the fore pump. If the ultimate pressure becomes high, it is necessary to check the ultimate pressure of the fore pump too.

If the pump was used to pump a large quantity of moisture or was left with the inlet and outlet ports opened to atmosphere for a long time, the ultimate pressure may not lower to the prescribed value immediately after pump startup due to moisture absorption in the pump. In most cases, no-load run of the pump for about24 hours will evaporate the absorbed substance and restore the pump to normal.

2.3.2 Pumping speed

The pumping speed varies with inlet pressure, the pressure difference between the inlet and outlet ports and rotating speed. Even if the inlet pressure is the same, the difference pressure between the inlet and outlet ports can be reduced by increasing the pumping speed of the fore pump, so that the pumping speed increase in a pressure range higher than the pressure at which the maximum pumping speed can be attained. Conversely, the pumping speed of the mechanical booster pump also lowers if the pumping speed of the fore pump is low.

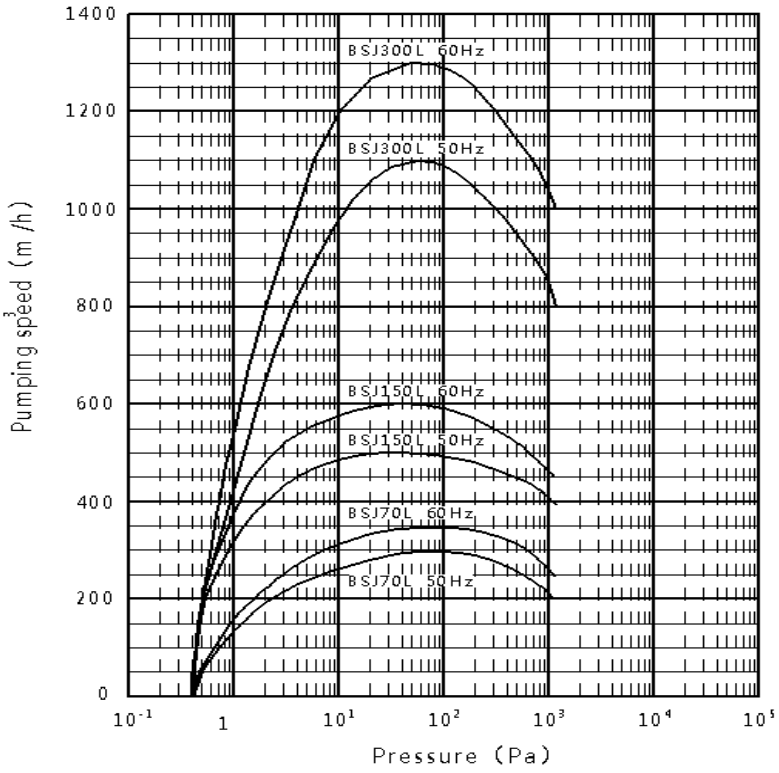


Fig.5 Pumping speed curves

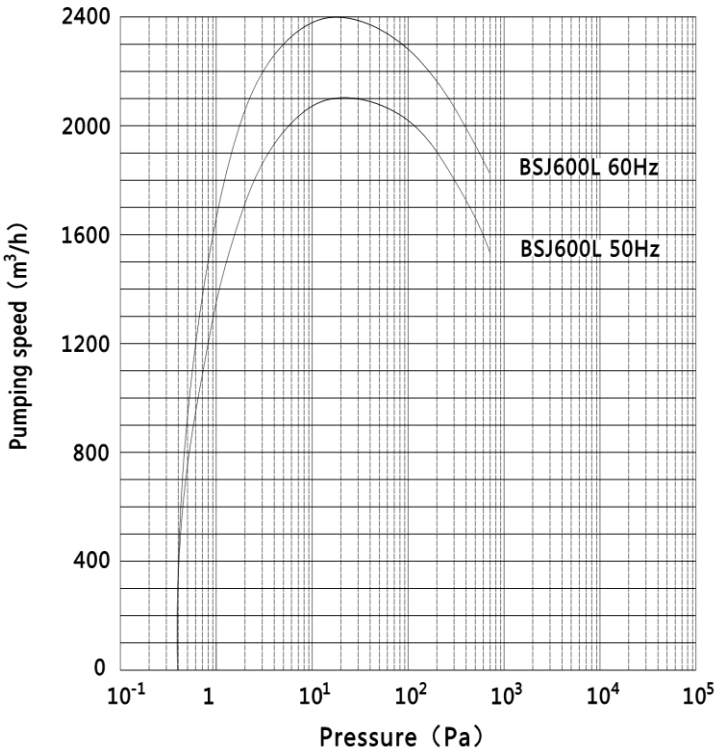


Fig.6 Pumping speed curves

2.3.3 Power consumption

If the inlet pressure exceeds the maximum inlet pressure when the standard fore pump is used, the motor will be overload and the pump will be overheated, leading to burnt motor or seized pump.

Use afore pump with which the difference pressure between the mechanical booster pump and the fore pump is smaller than the maximum permissible difference pressure (pump having a higher performance than the standard fore pump in terms of pumping speed and ultimate pressure). Since the performance of the mechanical booster pump largely depends on the performance of the fore pump as described above, be care to select the fore pump.

3 Installation

1) Be sure to clear any energy sources, e.g. electricity, coolant and so on of the product before installing or removing the product.
2) Install the machine horizontally to a place where there are less dust and humility. Make a layout taking into consideration of works such as setting, removal, check, cleaning and so on.
3) Operating the pump on laying it down or putting it reverse would give damage to the pump. Ensure to install the pump horizontally to the ground level. Be careful not to tilt the unit10° or more.
4) Put the pump on the frame mount and fix four fixing holes on the base with the bolts.

5) Wash sufficiently inside the vacuum chamber, vacuum valve and so on to connect them to the pump. If dirty unit were connected, it would cause a trouble such like raise the ultimate pressure or extend the depression time to the specified pressure. Wear a pair of gloves to touch any vacuum section. Do not touch with the bare hand. Do not give damage to the flange sheet face, gasket slot or gasket itself.

CAUTION 	To exhaust any corrosive or highly reactive (toxic) gas, install the outlet gas process device at the rear of the pump so as to prevent the toxic gas from leaking directly in the air. To exhaust any combustible, combustion susceptible or corrosive gas, be sure to use pipes made of high pressure withstanding and corrosion resistant metal. Ensure also to take the grounding. In the case of the process flowing combustible gas/susceptibility of substances to burn gas, you are requested to introduce the diluents gas from the inlet side so that the gas concentration to be exhausted becomes lower than the explosion limit.

CAUTION 	If the pump sucked the water or substance such as dust, powder and so on, it would impair the ultimate pressure and further cause a trouble. The pump has a really slight clearance to keep rotation and easily gets impossible to rotate by any foreign substance entered inside. Completely clear the welding scale and/or rust inside the pipe. If obliged to conduct a welding work close to or on the inlet, take a measure such as to remove the pump or put a cover sheet on the inlet in order not to allow any foreign substance enter inside. Clear the sand completely after having sand blasted the vacuum

CAUTION 	If the pipe connected to the outlet had a small diameter or attached foreign substance inside, it might raise the pressure inside the pipe and impair the pump operation. Take a countermeasure to avoid any direct load to the pump flange such like to choose the pipe with bellows to connect with the inlet and outlet.

6) Water piping

Connecting piping to the coolant inlet/outlet be care not mistaking the port. (Refer to Fig.2, Fig.3, Fig.4). Provide the water cooling to the BSJ70L if you run it on the inlet pressure530 Pa or more.

CAUTION 	Be sure to flow the coolant with the volume indicated on the Table. 1 or more. The pump temperature would rise up if the water volume become less than specified particularly on high inlet pressure operation and cause the pump failure. You are recommended to put a flow meter for the coolant and cause the interlock so that the pump stops if the coolant flows less than specified volume. When the operation stopped in winter, the water piping and the pump have a risk of breaking by freeze-up of the water inside. Open the coolant outlet during operation stop and storage to discharge the water inside by blowing in the pneumatic air through the water inlet. The water included little impurities (ex. Industrial Water) is recommended for cooling water. Depending on the water quality, the inside wall of cooling water tube is covered with water scale (CaC03 etc.) and cooling water flow rate may be decreased. Cooling water tube is corroded by Chlorine ion (CI) and cooling water leak may be caused. In case of using pure water, cooling water leak may be caused by metal component dissolution, too. In these cases, the repair service may be for a fee.

CAUTION 	If you use several pumps, be sure to connect the coolant pipes parallel. Cooling capacity might come down if connected them serial and cause the failure. You should put a filter at the front stage if you are obliged to use the water containing much impurity such like water stain, iron and the like. Appropriate flow might not be ensured when the supply source and discharge outlet were apart or there was level difference in the piping (discharge outlet was elevated higher than the pump). In such a case, cause a measure to ensure the flow volume, such as to change the piping layout, put a larger pipe or raise the supply pressure within the specification range. Use the soft water as the cooling water.

CAUTION 	Be sure to put in the insert if you use any plastic made product such as nylon tube. Such a tube is likely to cause deformation or get rid as secular distortion and might cause a water leakage. Keep the environment that does not cause dew formation when the cooling water temperature was lower. The machine is designed not to cause any leakage under restricted condition and demonstrated by the Leak test. However, it still has a risk of leaking under any abnormal condition other than specified, for example abnormal water pressure rise. In such case, the leakage shall remain unstopped unless the supply from system stops. You should refrain from installing electrical

	equipment or wiring beneath the pump and on the floor around the pump. We recommend you to put a Leak sensor on the floor beneath the pump and engage it with the interlock system of the equipment. Close the coolant supply valve (HWSV) immediately you noticed the leakage. Put the [Closed] tag onto the handle after having closed the valve. Put a flow meter (HWFM: for example Flow sight) applicable to visually check the flow onto the coolant supply source to make it possible to check the flow.

7) Electrical connection

Connect the wires according to the indication on the motor nameplate. Motor rotation direction is as indicated by the arrow mark casted on the motor flange (clockwise views from the motor side). If it is reversed, interchange two of the three wires.

WARNING 	Before connecting wires, you must be turn off the power switch. If not, an electric shock will occur. Connect the earth wire correctly. Install a suitable overload protector for capacity of the motor; otherwise the motor will be damaged leading to fire.

WARNING 	Use crimping terminals for the connection and tighten screws. Check also any loose on screws on the motor. Be sure also to put a safety circuit such as Electromagnetic breaker for the electrical connection. Rated current value of the motor shall vary subject to its mechanism. Use the Electromagnetic breaker applicable to operate by the rated current value of the applicable motor. Do the Direct-in start connection. The Star delta connection might have a trouble in starting.

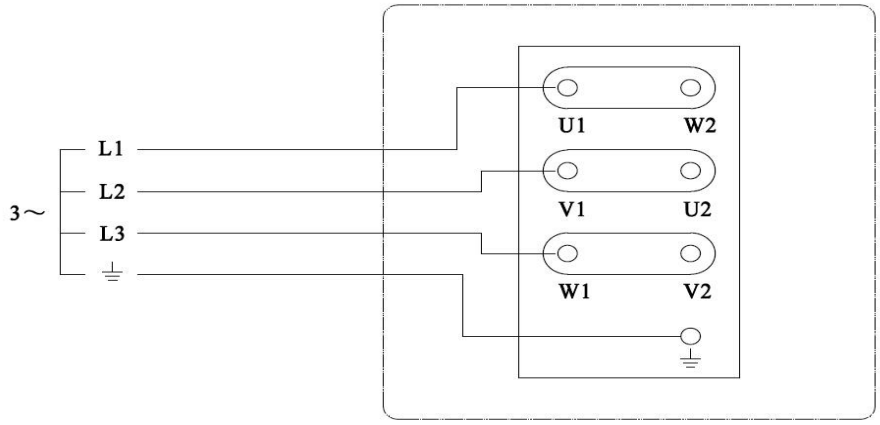
Connect the wires according to indication on the motor nameplate.

This pump can be used with no trouble practically for fluctuation range of power voltage and frequency as shown below. But this only means no significantly shortening life time of the pump, no conforming to the rating value of characteristics will cause temperature rise.

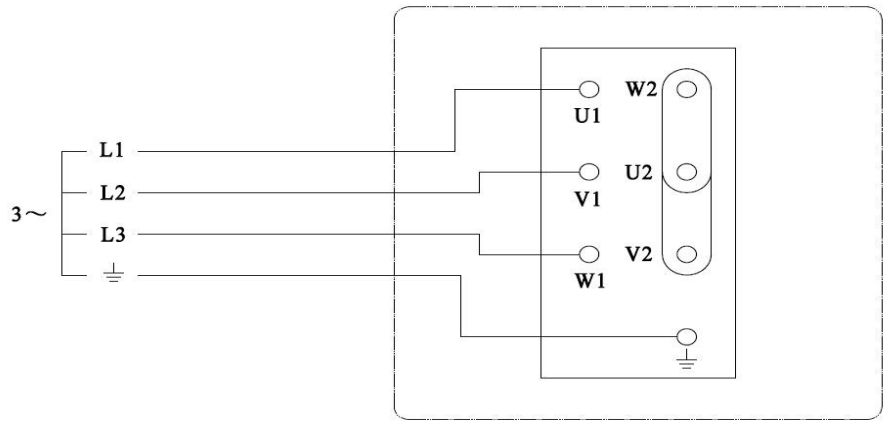
Fluctuation of power voltage ±10%

Fluctuation of frequency ±5%

Total value of simultaneous fluctuation of power voltage and frequency within±10%



Triangular connection



Y-connection

4 Operation

4.1 Lubrication

4.1.1 Lubrication to the gear chamber (lubrication chamber)

Supply the lubrication oil by specified volume through the filling port on the gear cover.

It takes approximately one minute that the lubrication oil fully spreads out. Check the oil volume by the oil level gauge after the lubrication got stabled and add the oil if it was under the specified level as far as the oil gets stabled on the upper limit level.

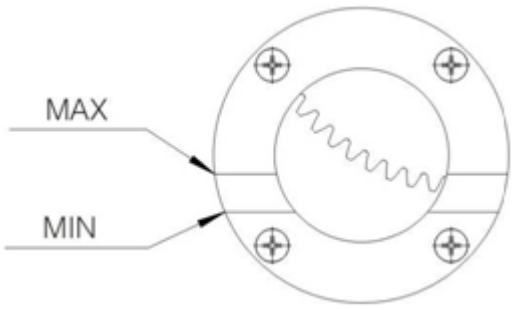


Fig.6 Oil level gauge

4.1.2 Lubrication to the mechanical seal

Onto the top of the motor cover is a plug for filling oil to lubricate the mechanical seal. Take off the plug and supply the oil BS046 around20mLthrough it.

Lubrication to the mechanical seal is necessary to avoid the oil shortage and not required during the normal operation. You are requested, however, to lubricate it to run the unit after having stopped operation three months or more or restart operation after having transferred the pump unit.

CAUTION 	The type of pump oil differs depending on vapor pressure, viscosity, etc. The use of wrong type of oil can lower the pump performance and shorten the lifecycle. Ensure to use the vacuum pump oil BS046.

WARNING 	Running the pump with the lubrication filled over the upper limit on the room temperature(around20℃) might cause the oil flowing to the casing. Discharge the oil if it is over lubrication so as to match the upper level. Be sure to check the oil level under operation stop on the room temperature. Oil level might get higher during operation due to the oil temperature rise and oil rowing, but it makes no problem.

CAUTION 	Be sure to stop running the pump and return the mechanical booster inside to the atmospheric pressure, then supply the pump oil. Chamber containing the oil becomes vacuum during operation. Taking off the plug during operation would cause a large gas leak and give damage to the pump.

4.2 Test Run

1) Check and ensure that the piping and cable connection is completed.

2) Check the lubrication oil level.

3) Check the cooling water level, ensure that the cooling water is flowing, check and ensure that there is no cooling water leakage.

4) Check the lubrication oil discharge operation and rotation direction.

a. Close the inlet valve of the mechanical booster pump or put a blind flange to the inlet to block it.

b. Run the supplementary pump to exhaust inside the mechanical booster pump. Confirm that

the Pressure of the inlet or outlet of the booster pump comes down around the ultimate pressure of Supplementary pump (13~ 1.3 Pa for the standard supplementary pump) and keep exhausting three minutes or more only by the supplementary pump under that state. Exhausting three minutes can degas the air component in the lubrication oil.

c. Flow the cooling water and run the pump around three seconds on keeping watching the oil level gauge to check the rotation direction. If it rotated reverse, check the motor wire connection. The motor is a three-phase induction motor that would rotate reverse if two of three input wires were connected reverse.

d. After checking the rotation direction, run the mechanical booster pump three minutes or more to degas the lubrication and lubrication circulation inside the pump.

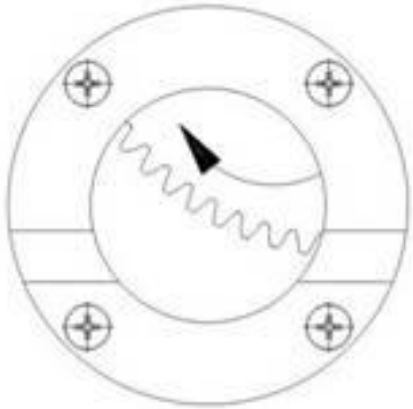


Fig.7 Gear rotation direction

CAUTION 	Never run pump on blocking up the exhaust outlet or putting any device that hampers the gas passage. There is a risk that the pressure inside rises up as far as the pump unit and/or oil level gauge breaks or the motor gets overloaded. The pump is not made as the withstand pressure structure. Ensured pressure value of the pump shall not be over 0.03MPa (gauge pressure). If any valve was put to a pipe after the exhaust outlet, check and ensure that it is open.

CAUTION 	Never fail to conduct the lubrication oil deaeration before starting operation when lubricated anew the mechanical booster pump or left it a long time after lubrication. Starting operation without deaeration might generate a lot of bubbles and cause them flow in the rotor chamber.

4.3 Operation

4.3.1 Exhaust start

1) Flow the cooling water.

2) Close the main valve of the mechanical booster pump and start running the supplementary pump to exhaust inside pipes.

3) Open the main valve of the mechanical booster pump and start exhausting the vacuum container.

4) Start the mechanical booster pump when the vacuum chamber is exhausted to below the maximum inlet pressure of the mechanical booster pump.

4.3.2 Exhaust stop

1) Close the valve of the mechanical booster pump and stop it.

2)The mechanical booster pump will keep running a while by the rotor inertia. Check and ensure that the rotation stopped through the oil level gauge, and then stop the supplementary pump.

3) Open the inlet leak valve when the supplementary pump stops to make the mechanical booster pump and supplementary pump return to atmospheric pressure.

4) Wait until the pump cools down as far as you can touch by hand to stop the cooling water.

5) Discharge the water in the pump unit and cooling water piping in case where the environment temperature comes down below5℃. If the operation stops under that state, supply the compressed air of 0.3MPaG (gauge pressure) to discharge cooling water. Residual water, if any, might freeze up and cause crack of the pump and/or cooling water pipe.

CAUTION 	The vacuum pump becomes high temperature during operation(70℃to80℃). Do not touch the motor and pump unit soon after operation stopped until the pump cools down. Apply an appropriate protection to avoid touching the surface. However if the environment was highly humid, and the mechanical booster pump warmer than the room temperature, you stopped the pump and made it return to atmospheric pressure in that case, water in the air might condense in the pump and worsen the ultimate pressure and pumping speed.

CAUTION 	To restart the pump operation after having turned OFF once the power supply, ensure that the rotor is stopped before turning 0N the power supply again.

CAUTION 	Be sure first to close the vacuum valve, and then stop the pump operation, last open the leak valve. Failure to follow this operation might cause the oil invasion in the casing from the lubrication chamber or otherwise give damage to the pump. Further the oil might flow back to the vacuum tank if used the oil rotary pump as supplementary pump. If failed in closing the vacuum valve, the vacuum might leak from the outlet system through the pump.

CAUTION 	Metal noise of high frequency might arise from the mechanical seal section during operation. That noise is indicating the oil shortage in the mechanical seal section. In such a case, stop running the pump and lubricate the mechanical seal, and then restart operation after several minutes.

CAUTION 	Ensure to flow the coolant with the specified volume. Lack of the coolant might give damage to the pump unit or evaporate the water remained in the pump to raise the pressure inside the cooling system resulting in accidentally jetting out the hot steam.

5 Maintenance and Check

5.1 Maintenance

Conduct the maintenance regularly in appropriate check interval. Maintenance period shall differ depending on the operation purpose. Normally you can set the check interval once a day, and once a week from the second week, then once a month. We recommend you, however, to conduct visual checks once a day.

You should check following points at least once per three days during continue operation. Check the machine much more frequently during high overload operation (continuous operation 1kPa or more, repeated exhaust atmospheric pressure-vacuum).

1) Whether the pump oil volume is between two level lines or not.
2) Whether the pump oil is discolored or not.
3) Whether the coolant flows by specified volume.
4) Whether there is no abnormal noise.
5) Whether there is anything strange in the current value.
6) Whether there is no water leak.
7) No oil leakage from the mechanical seal.

Remove the oil drain plug for the mechanical seal at the bottom of the motor flange and check whether the lubrication oil pooled there or not.

5.2 Inspection Items

Table2 Maintenance list

No.	Inspection item	Check	Possible cause	Corrective action
1	Oil level	To be within the level lines or not	Oil flowed into pump casing	Visual check of casing interior
2	Cooling water flow rate	Is the flow rate more than the prescribed rate	Cooling water piping clogged Drop of supply pressure	Check cooling water piping increase the water pressure
3	Oil color	Whitish(turbid) Discolored to brown Discolored to black	Mixing of water Contamination with reactants or acid Contamination with abrasion powder of bearing or other	Change oil
4	Abnormal sound	Check by hearing Measurement of sound pressure level by noise meter	Worn bearing or gear Mismatching of timing gear Motor is faulty	Refer to Table3 "Trouble check list
5	Abnormal heating	Check by hand Temperature measurement by surface temperature gauge	Insufficient cooling water or water leak Overload	
6	Motor current	Measure by ammeter	Leak High inlet pressure	
7	Oil leak from the mechanical seal	Remove the oil drain plug for the mechanical seal to see whether the lubrication oil pooled inside or not	Oil leak of 0.15mL/h or more is error Mechanical seal is deteriorated	Replace the mechanical seal
CAUTION 		Be sure to shut down the power supply before check the pump. Be sure not be turn 0N the power supply when examination the pump. Otherwise will have a hurt. Pump just stopped, the pump temperature is high. Please wait until the temperature dropped and then check the pump to avoid scalding.		

5.3 Lubrication

If vacuum pump oil was contaminated by condensable gases, pump operation will increase the temperature, and the oil will be deteriorated. Viscosity of contaminated oil will decrease, please regular replace the pump oil. To change the pump oil as follows.

1) Shut down the pump and drain the oil from the oil drain port.

You can see oil not only in the side of the oil level window, but also in the motor side cover. Discharge all the oil of the oil level window, and then screw on the oil drain plug.

2) Close the drain port and fill fresh oil through the oil filling port.

Pour oil until the oil level comes between the two level lines of the oil level window. After one minute, oil surface will become stable and then confirm oil level. If the oil level lowers the standard, fill pump oil to MAX.

3) Refuel of the mechanical seal

The oil filling port of mechanical seal is at the top of motor side cover, unscrew seal plug, and supply 20mL BS0 46.

CAUTION 	Never fail to conduct the lubrication oil deaeration before starting operation when lubricated anew the mechanical booster pump. Starting operation without deaeration might generate a lot of bubbles and cause them flow in the rotor chamber. Refueling, the pump must be stopped. Otherwise, the pump internal pressure to rise to atmospheric pressure. The occurrence of oil spills with plug during operation will damage the pump. After the oil change, make sure plug has been tightened.

Structure of the mechanical seal would allow a slight oil leak even the sealing was correct. Pooled lubrication oil shall indicate that there is an oil leakage from the mechanical seal section.

However a deterioration of the seal must considered if the lubrication oil pooled 0.15mL or more per hour at the bottom of the motor flange. Please contact our company.

5.4 Overhaul

You are requested to conduct the overhaul once a year.

If there found remarkable pump contamination or performance deterioration due to the operation condition, you are recommended to conduct the overhaul earlier than one year period. You shall be in need of replacing such parts as listed on the" Main displacement parts list" at minimum.

6 Trouble Check List

Table3 Trouble checklist

Trouble	Causes	Processing method
The pump does not run	1) Motor connection is wrong	1) Check the connection
	2) The motor malfunction	2) Replace the motor
	3)Safety circuit such as the electromagnetic breaker is not correctly set	3)Make the safety circuit conform to the motor specification
	4) Oil viscosity got higher	4) Replace the oil
	5)Foreign substance entered in the pump caused burning the rotor or the like	5)Conduct the overhaul (replace the cylinder, rotor, cover and so on)
	6) Reactive agent accumulates inside the pump while the pump was stopped after having exhausted the reactive gas	6)Conduct the overhaul (cleaning inside the pump, remove the reactive agent and so on)
	7)The power supply is not connected	7) Connect the power supply
	8) Power switch is not closed	8) Close the power switch
	9)In put supply voltage abnormal	9) Adjust to the rated voltage±10%
	10)Overload protection device acts	10) Eliminate the reason of overload protection device action, then press the reset button
	11)Water and solvent into inside of the pump produce reactants or rust	11) Repair(wash reactants or rust inside of the pump)
	12)0ther: parts of the pump had damaged	12) Repair(replace damaged parts)
	13) Phase voltage anomalies	13) Check power supply
	14) Rotor shaft rotation is not flexible	14) Repair
	15) Scratch the surface of the rotor	15) Repair(replace damaged parts)
	16)The pressure is higher than the maximum inlet pressure	16) Sure the pressure of the inlet and outlet side, check the fore pump
	17) Oil does not flow in	17)a. Recognized whether the oil flowed into the rotor chamber When an inflow of oil, repair pump b. Supply pump oil
Abnormal sound is generated	1) Motor rotation direction is reverse	1) Do the connection again to correct the rotation direction
	2) Panel screw loose	2) Tighten the screws
	3) Oil is not filled. Oil is under the lower limit of the oil level	3)Supply the oil, overhaul
	4) Foreign substance into the pump	4)Repair and remove the foreign substance
	5)Other: parts of the pump had damaged, have ordinary mechanical sound	5) Repair(replace the damaged parts)
	6) Synchronized with rotating speed sound(clattering)	6) Repair(adjust the synchronization gear, bearing)
	7) Metal sound with high frequency	7) Stop pump, add oil to the mechanical Seal

Trouble	Causes	Processing method
Pump surface temperature is abnormally high	1) Keeping continuous operation under high suction pressure	1) In continuous operation under high suction pressure, pump surface temperature will rise
	2)The oil is not supplied to the specified volume	2) Supply the oil to the specified volume
	3) The temperature of the evacuated gas is high	3) Mount cooling equipment such as a gas cooler at the inlet side
	4) Area around the pump is enclosed	4) Make the ventilation available
	5) The environment temperature is high	5) Use in air-conditioned environments
	6) Cooling water does not flow	6) Keep flowing the coolant to the specified volume
	7)The pressure is higher than the maximum inlet pressure	7) Sure the pressure of the inlet and outlet side, check the fore pump
	8) Discharge pressure is too high	8) Check the fore pump, ensure piping not clogged
	9) Rotor rotary is not good	9) Disassemble and check
Pressure does not come down	1) pump speed is too small to the vacuum chamber capacity	1) Select another pump
	2) Pressure measurement method is wrong	2) Measure correctly the pressure
	3) Vacuum gauge is not appropriate	3) Measure with a calibrated vacuum gauge which suits to the pressure range
	4) Pipe connected to the suction inlet Is thin or connection distance is long	4) Use a pipe wider than inlet diameter and shorten the distance between the chamber
	5) Metal mesh at the suction inlet is clogged	5) Remove the pipe above the inlet and wash the mesh
	6) Oil is not supplied to the specified volume	6) Supply the oil to the specified volume
	7) The oil is deteriorated	7) Replace the oil
	8) There is a leak in the pipe connecting with the pump	8) use a leak detector to locate the leakage and stop it
	9) Not use the designated oil	9) Repair pump and change the oil with BS046 oil
	10) Internal cylinder or the surface of rotor has pollution and moist	10) Repair(wash and adjust it)
	11) Pressure of the fore pump worsen	11) Replace oil or repair for pump
	12) Mechanical seal leaks	12) Replace mechanical seal

Trouble	Causes	Processing method
Abnormal motor current value	1) Foreign substance entered inside the pump 2) Abnormal sliding of the rotor 3) Keeping continuous operation under high suction pressure	1) Overhaul, remove the foreign substance 2) Overhaul, check and repair inside 3) Adjust the pressure
The oil leaks outside the pump	1) Deterioration of the 0-ring and seal of the case and cover 2)The oil drain plug is loose 3) Mechanical seal is leak a. Over 0.15mL/h b. Under0.15mL/h	1) Check the 0-llng and seal. Replace them if necessary 2)Tighten the oil drain plug again 3) a. Replace mechanical seal b. After confirm oil level, continue to operate

7 Disposals

Make sure to keep in compliance with the laws and regulations established by the local governments to dispose the vacuum pump. You should ask the dedicated disposal agency for the disposal particularly if the pump has exhausted any toxic gas. For the disposal of pump oil, follow the instructions in" Material Safety Data Sheet". Note that you are requested to bear the cost and charges relating to the disposal.

8 Warranty Clauses

We warrant each product sold after strict inspection and to be free from defects in manufacture or other failure caused by our faults. Please contact our sales departments or distributors or agents for free repair or replacement.

Warrantable Items

Mechanical booster pumps BSJ70L, BSJ150L, and BSJ300L.

Warranty Period

Domestic purchase: one year after the shipping date from our factory.

Overseas purchase: one year after the date of B/L signed.

Warranty Scope

Products not satisfying meet the standard specification although the product is used under the service conditions described in this document such as temperature range and power etc.

Response Procedure

1) Domestic business in Chinese mainland:

Send a replacement or please go to near service center for repair. If you need field service, please contact our sales department or agents.

2) Export transaction:

Send a replacement. Return charge shall be paid by buyer.

9 Disclaimer

1) Products which extend warranty period;

2) Failure and defects caused by forced majority, such as floods, fire, typhoon, lightening and earthquake etc;

3) Failure and defects due to misuse or abuse;

4) Products which had been repaired disassembled or reconstructed without our approval;

5) Failure and defects under unusual conditions (strong electromagnetic, radioactive environment, high temperature, high moisture, flammable gas, corrosive gases, dust etc;

6) Failure and defects caused by noise;

7) Consumable parts;

Others

1) The contents of this document are subject to change without notice in the future.

2) Any clause in contracts besides this warranty or in relative qualification memorandum will be valid.

3) Buyer shall inform our company when the pump is exported out of Chinese mainland. In the meantime buyer shall take necessary procedures according to Foreign Exchange and Foreign Trade Law.

10 Main Displacement Parts

Table4 Main displacement parts list

Model / Parts	BSJ30L	BSJ70L	BSJ150L	BSJ300L	BSJ600L	Q'ty	material
	Specification						
Coupling spider	M-63	M-84	M-84	GR-38	GR42	1	—
Reinforced seal	VCJ24366	VCJ30426	VCJ36506	VCJ44607	VCJ52707	4	—
PDR	28407	35477	36507	45628	52688	2	—
Bearing	6203-P5	6205-P5	6206-P5	6207-P5	6308-P5	4	—
Gasket	15*22*2	15*22*2	15*22*2	15*22*2	—	1	FKM
O-ring	AS568-256	AS568-268	AS568-276	AS568-278	395*5	4	FKM
O-ring	P15	P22	S28	S34	37.5*2.65	1	FKM
O-ring	S14	S22	S26	S32	S36	4	FKM
O-ring	S12	S12	S12	—	—	5	FKM
O-ring	—	—	—	S12	—	8	FKM
O-ring	—	—	—	P16	—	2	FKM
O-ring	—	—	—	—	P16	10	FKM
O-ring	P18	P18	P18	P18	—	3	FKM
O-ring	—	—	—	—	P18	6	FKM
O-ring	P9	P9	P9	P9	P9	1	FKM
O-ring	P32	P32	P32	P32	P32	1	FKM
O-ring	S50	G65	G75	85*2.65	G100	1	FKM
O-ring	G40	G55	G55	G55	G65	1	FKM
O-ring	V70	V100	V100	V120	V225	1	FKM

Check Sheet for Repair

Model		Serial		Purchase Date	
Customers					
Address					
Person in charge		Tel No.			

1 Request item

☐Scheduled inspection repairing

☐Trouble

Condition：☐Ultimate pressure ☐Unusual sound ☐Irregular action

☐Oil leak outside the pump ☐Others

Description of trouble：_____

_____

☐Others：_____

2 Service condition

✓ Whether the pump has been used： ☐Yes ☐No

Operational elapsed time：about _____

☐24hr continuous operation ☐Intermittent operation

✓ Whether exposure to pollutants： ☐Yes ☐No

Name and Chemical formula pollutants：_____

Nature and character of pollutants：_____

Cleaning solvents and methods of pollutants：_____

3 Details of the request

☐Warranty period ☐Repair quote please ☐Others：_____

4 Others：_____

Signature		Date	