Cheonsei

ISO 9001

CHEONSEI PULSELESS PLUNGER PUMPS

PKP Series

Instruction Manual

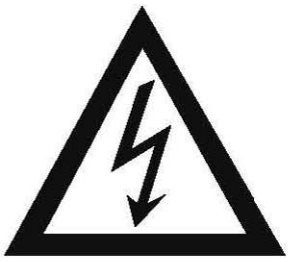
www.cheonsei.co.kr

Thank you for purchasing our PKP pump.
Read this manual before using the product. Handling and maintenance are explained in easy way. Read through this manual and use the product safely to assure pump performance and long service life. Keep this Handling Manual handy all the time.

CONTENTS

1 Cautions for safty

- Read through this Handling Manual before installing, operating, repairing or inspecting the product.
- In this Handling Manual, warnings and cautions are described as below to use the product safely. Always follow the manual. Please note that the contents described in cautions may result in dangers depending on the situation. Also, important matters in the text are marked as "Note)", so please be fully aware of them.
- "Warning" mark is attached to the front side of the terminal cover of the driver body.



⚠ Warning

- Install molded case circuit breaker(MCCB) and earth leakage circuit breakers in the main power.
  Otherwise, casualty or fire may occur due to electric shock.
- Do not disassemble the front cover when the power supplied, injury may be caused due to an eletric shock.

⚠ Warning

A dangerous situation may occur and death or serious injury may occur unless followed.

⚠ Caution

Injury or material damage may occur unless followed.

1-1 Product installation location and surrounding environment

⚠ Warning

- Installthe product at the place where outsiders and old or feeble persons except operators cannot touch it. Fire or loss of human life may occur due to electrical accident.

⚠ Caution

- Avoid a hot and humid place where condensation is easily generated, and also avoid the place which is exposed to dust, corrosive gas, explosive gas, flammable gas and/or sea wind. Install the product at a well-ventilated place without the direct rays of the sun. Otherwise, the product fault or fire may occur.
- The product may malfunction due to temperature; do not install the product at the place of which ambient temperature is over 40℃ or below -10℃.
- Do not install the product at the place where severe vibrations occur. Electronic circuit parts inside the driver box may be damaged or have loose connections due to vibration, causing malfunction by poor contact.

1-2 Electrical wiring

⚠ Warning

- Do not use no other than the rated supply voltage described in the Handling Manual. You may get injured or have material loss due to fire.
- Connect the ground line to the ground terminal(⏚). Otherwise, you may get an electric shock or fire.
- Install circuit breakers and/or earth leakage circuit breakers in the main power. Otherwise, the loss of human life or fire may occur due to electric shock.
- Electrical wiring should be done by professional electric technicians. Otherwise, the loss of human life may be caused by an electrical accident.
- Always check if the input power supply is cut off before electrical wiring work. Otherwise, an electric shock or fire may be caused.
- To install a 400V product, ground the neutral point of the power supply. Otherwise, an electric shock may be caused.

⚠ Caution

- Check if the rated voltage is matched with the input power voltage. Otherwise, a fire may be caused.
- Install the earth leakage circuit breaker in the input power. Otherwise, a fire may be caused.
- Use power line wires, earth leakage circuit breakers and magnetic contactors with appropriate rated capacity.
- Do not perform the withstand voltage test. Otherwise, semiconductor devices inside the driver body may get damaged.
- Do not remove connectors in wires or inside the driver body when the input power is applied. The product may fail, and you may get injured due to an electric shock.

1-3 Handling and operation

⚠ Warning

- Do not disassemble the front cover when the power is applied. Since high voltage is applied to the electric circuit board, the loss of human life may be caused due to an electric shock when the board is touched to the skin. Also, even if the input power is cut off, the electric circuit board still has an electric current for about 5 minutes, so pay attention to it.
- Since an electric shock may occur, do not handle the product with wet hands. Especially, when the liquid stays on the floor, wear electrically insulated shoes and gloves to handle the product.
- If the electricity is recovered (main power is recovered) after an electricity failure or after the main power cut-off and if the product was operating before the electricity failure or the main power cut-off, it will re-operate as soon as the electricity is recovered. Since an injury may occur when people is exposed to the danger, make up the circuit separately so that the machine does not re-operate after the power is returned.
- Do not send an operation command or do not stop the machine by using the magnetic contactor installed in the input power.
- To operate or stop the machine, use RUN/STOP switch in the keypad for local operation, or connect the switch (i.e., relay contact) to the control circuit terminal block for remote operation. If the machine is operated/stopped by turning on/off the main power (magnetic contactor), the semiconductor devices may be damaged.

⚠ Caution

- Do not remodel or use this equipment for no other purpose than the metering pump as applied by Cheonsei. A safety accident may occur.
- Keep clean so that the motor and the driver cable are not stained with chemicals. If chemicals are touched to the wire covering, they may invade and cause a failure and even a fire.
- Do not use the machine while the motor is separated from the driver.Otherwise, the product may fail or a fire may occur due to malfunction.
- The internal circuit of the driver uses C-MOS ICs. The semiconductor devices may bedamaged by static electric shock, so pay attention to it.

1-4 Noise

Max. Sound pressure level of this product is 75dB(A).

⚠ Caution

- Damaged or broken pump may cause an accident, so never operate it.
- Do not install the pump at a damp and/or dusty place. It may cause an electric shock or trouble.
- Do not touch the motor area with naked hands during operation. You may get burnt due to high temperature.
- To handle the liquid of which risks and features are not clear, always wear the protective equipment such as safety gloves and safety glasses during repair or inspection.
- Never use other power supply than indicated in the nameplate; otherwise, it may cause trouble or fire.
- If the product is used while it is not connected to the ground line, you may get an electric shock. Therefore, always connect to the ground line.
- Before starting repair or maintenance, release the pressure of the discharge pipe and eliminate the liquid in the wet side.
- If the pump operates when the ambient temperature is lower than the freezing point of the used liquid, it may be damaged; therefore, always eliminate the liquid in the pump and pipes after stopping the operation. Appropriate protecting measures should be ready in winter season so that the pump or pipes are safe from being frozen.
- Appropriate protective devices should be ready for the case that the pump and pipes are damaged and the liquid is released.
- Follow the relevant laws and regulations to dispose used pumps.

2 Product confirmation

2-1 Checklist after unpacking

When you receive the pump, please check below matters immediately.
If you find any defect, contact the store where you buy it. The problem will be solved soon.
[1] Does the product satisfy the specification you ordered?
[2] Is every standard part included without missing?
[3] Is any part damaged due to vibration or shock during delivery?
[4] Is any bolt or nut released?

2-2 Standard part

[1] Handling manual ---------- 1 copy
[2] Installation bolts (M10 x 40L) ---------- 4 sets

3 Overview

This pump is a plunger-type, pulseless metering pump, which largely reduces the pulse of discharged liquid. The motor revolution is reduced by the worm gear, and the liquid chemicals in the pump chamber is sucked in or discharged when the diaphragm built in the slider is producing reciprocating motions by a special cam. Basically, it has a two-head structure, and its variable flow rate by the inverter allows quick response and precise flow rate control. It is available for manual and automatic operation at sites.

4 Model Code

①	②	③a	③b	③c	④a	④b	⑤
P	K P	- 2	0	1	- S	F	- S

① Brand Name : PULSELESS KEMPION

② Type of wet side (classification by pump structure)

P : Plunger type (Reference D : Diaphragm type)

③ Discharge amount

③-a,③-b = 21 , ③-c = 2(Number of last digit 0s)
2 1 00 = 2100 (ml/min)

④ Material of wet side

a : Material specification of wet side
(S : STS316, X : Other special)
b : Pump connection type
(F : Flange , X : Special order)

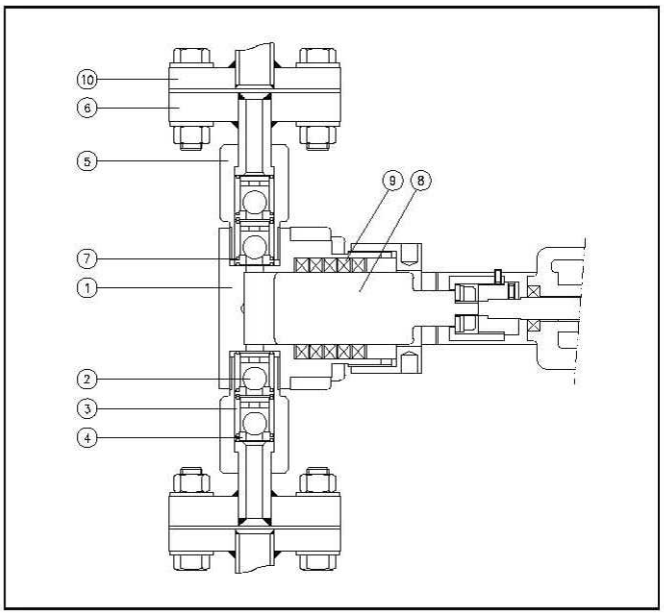
⑤ Power specification (Motor & inverter)

S : Standard Type
- Motor : 220V 3-phrase, 0.4kW/0.75kW
- Inverter : 220V 3-phrase, 50/60Hz

X : Special Type
- Motor : Other than our standard specification, i.e., explosion-proof motor etc.
- Inverter : 220V single-phrase, 440V 3-phrase

※ For other matters, contact our R&D Department.

5 Meterials of Standard Liquid End



NO	Part Name	Meterial
①	Pump Head	STS316
②	Check Ball	STS316
③	Ball Guide	STS316
④	Ball Seat	STS316
⑤	Union Nut	STS316
⑥	Joint(Flange)	STS316
⑦	Gasket	PTFE + PFA
⑧	Plunger	STS316 + Cr
⑨	Packing	G.F.O + PTFE
⑩	Juction	STS304

※ ⑩ The standard material of junction pipe is STS304. You can order STS316 material, so please contact us.

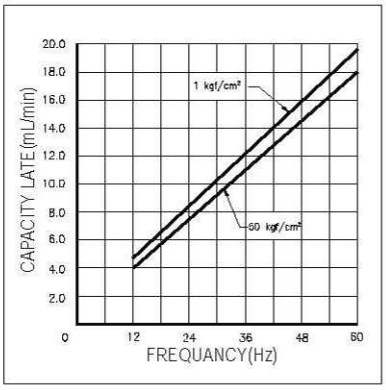
6 Specification

Type	Ma.Capacity (mL min) (60Hz)	Max. discharge pressure (kgf/cm²)	Pulse rate (%)	Diameter of diaphragm (mm)	Connection (Flange)	Inverter		Motor	Weight (Kg)
						Power Supply	Frequency setting signal		
PKP-180	18	50	±1.5 F.S	ø5	KS 20K 15A	3-phrase 200~230V 50/60Hz	• 0~5VDC • 0~10VDC • 4~20mA • Eternal variable restance (1~2KΩ,1W)	3-phrase 0.4kW/4P 220V 60Hz	40
-360	36								
-101	100			ø11					44
-201	200								
-321	326	40		ø20					48
-651	652								
-132	1,330	20						3-phrase 0.75kW 4P 220V 60Hz	
-262	2,660			ø40					

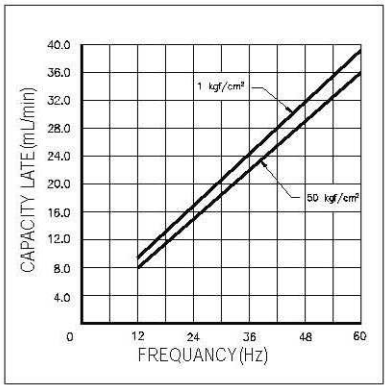
※ 1. Maximum discharge amount means the discharged amount under the maximum discharge-allowed pressure, in the standard state (room temperature, clean water).
2. The effective flow rate-controllable range is 20 ~100% (12~60Hz), and purchase of inverters and junction pipes is optional.
3. To order special motor, such as explosion-proof motor, other than the standard motor specification, please contact us separately.
4. The temperature of liquid to be handled is 0 ~ 100℃; its viscosity coefficient is within 300CP; the ambient temperature is 0 ~ 40℃.
5. The self-priming is 1M (PKP-180 and 360 need suction at first); the liquid where slurry or solids are mixed is not acceptable for pulseless and/or metering injection.
6. For coating, Munsell No. 0.6PB 4.8/10.6 or similar colored corrosion painting is used. (The motor has the standard color specified by its manufacturer)
7. To order any special inverter power supply other than the standard specification, please contact Sales Department or R&D Department. (220V single-phrase, 440V 3-phrase)
8. The specification may change without notice, for improvement.

7 Performance Curves

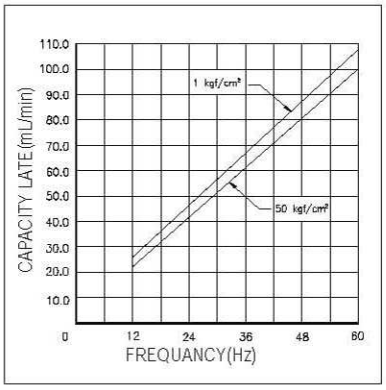
● PKP-180



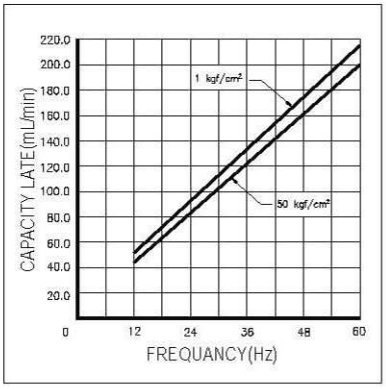
● PKP-360



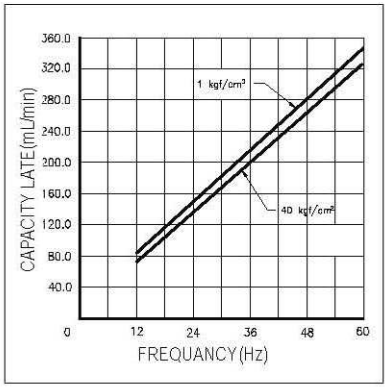
● PKP-101



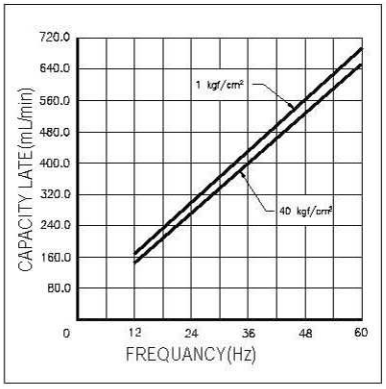
● PKP-201



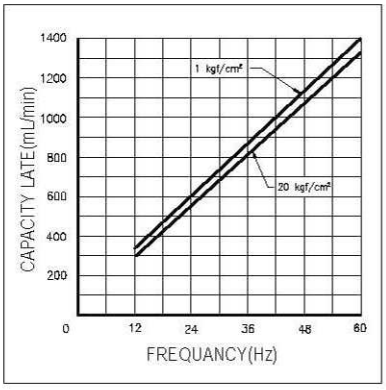
● PKP-321



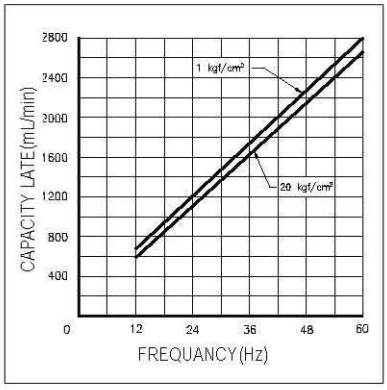
● PKP-651



● PKP-132



● PKP-262



※ Condition for experiment: Room temperature, clean water, suction (-1M)
The above performance curves are measured under the condition specified by us; therefore, they may vary slightly depending on on-site condition.

8 Operation principle and struction

8-1 Operation principle

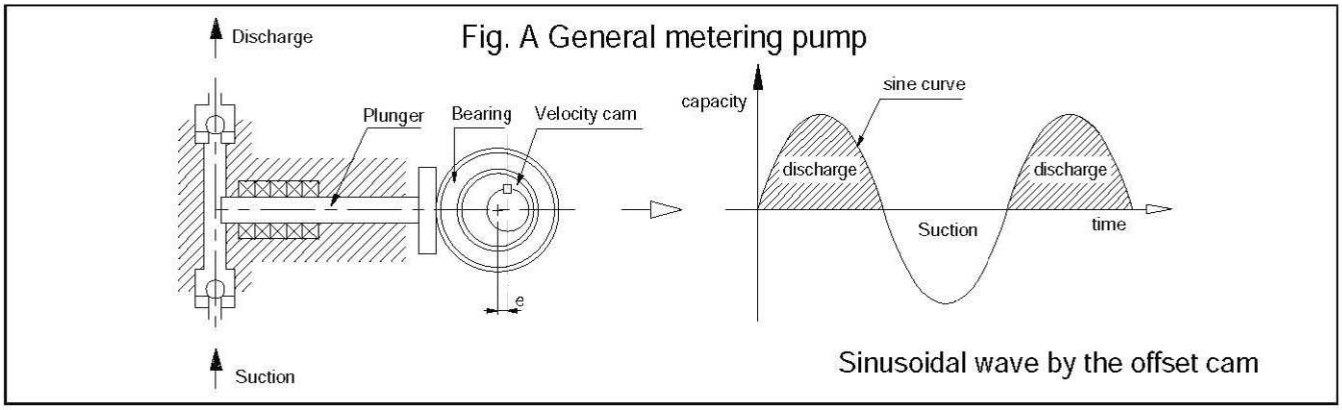


Figure A shows the pulse wave by the offset cam for a general metering pump. The pulse of metering pumps generates when an offset cam is used to convert the power of the motor into reciprocating motions. This offset cam is a circular object with the offset amount of e, so the reciprocating velocity of the plunger has sinusoidal wave. This is why the discharge flow rate has pulses.

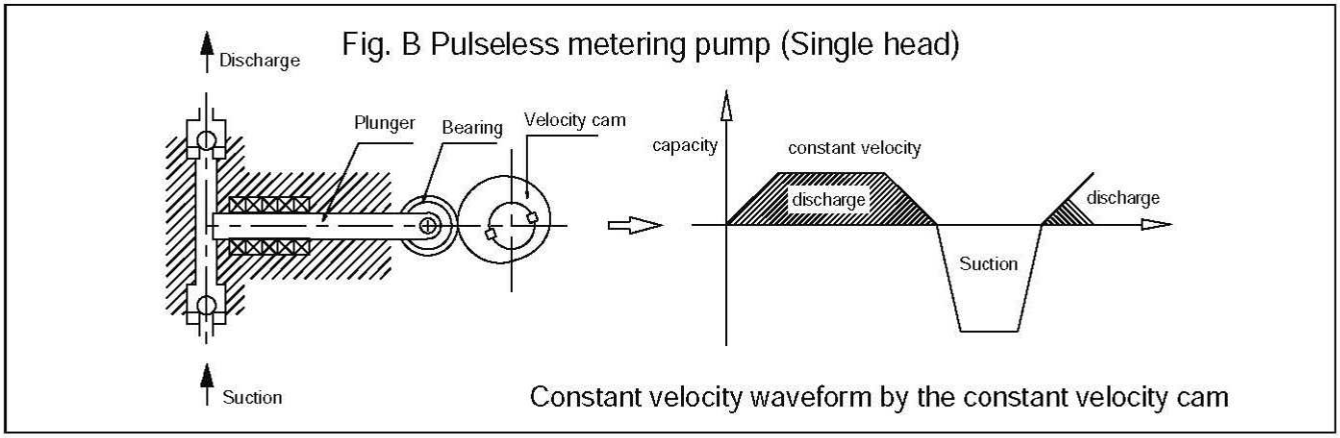


Figure B shows the pulse waveform of the constant velocity cam, having a constant velocity section in the flow rate. Because the constant velocity cam operates the plunger in a constant velocity, the discharge flow rate is constant, too. The constant flow rate in this section is the pulseless flow rate. However, the reciprocating metering pump always has a suction section if it has a discharge one, so in order to obtain constant pulseless flow rate, two wet sides should be used to have constant discharge.

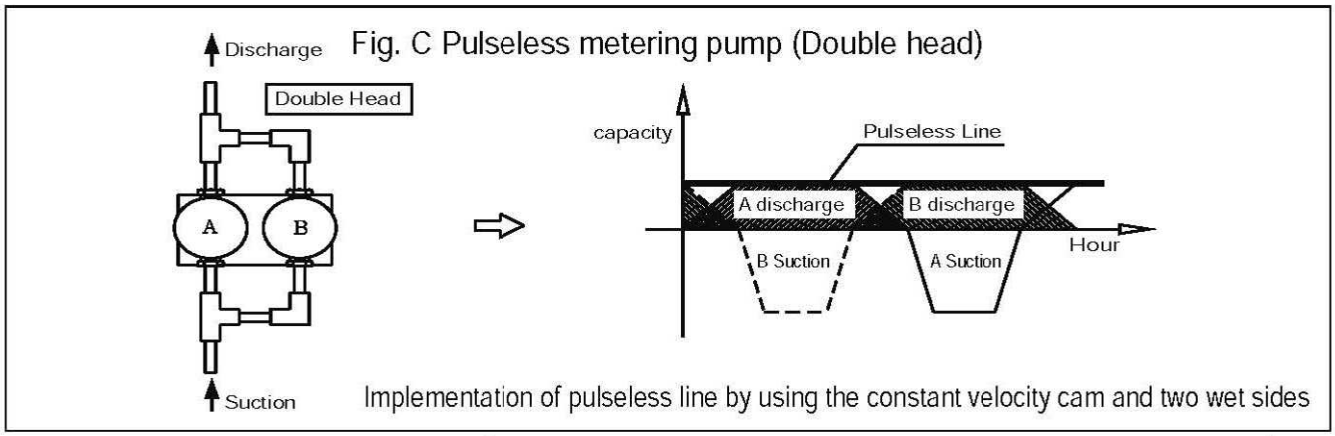
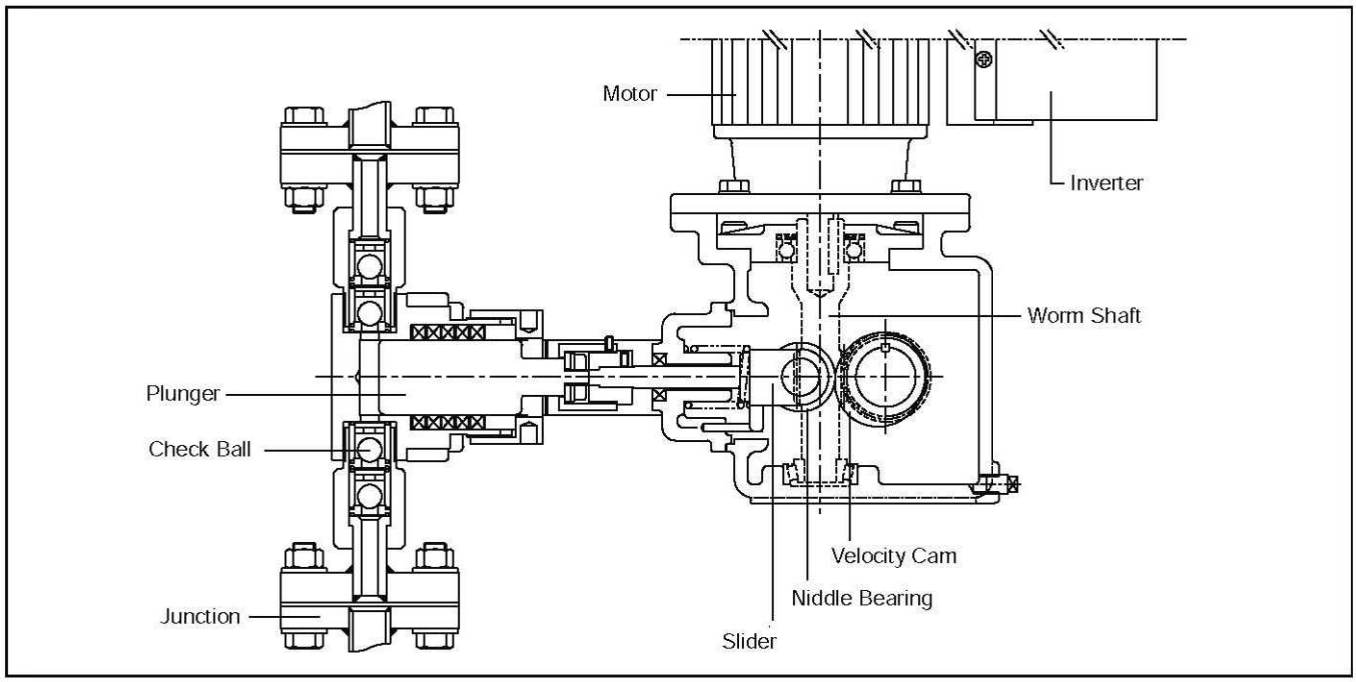


Figure C shows the implementation of pulseless line by installing a constant velocity cam to each of two wet sides.

8-2 Inside structure



9 Installation

9-1 Installation Place

⚠ Caution

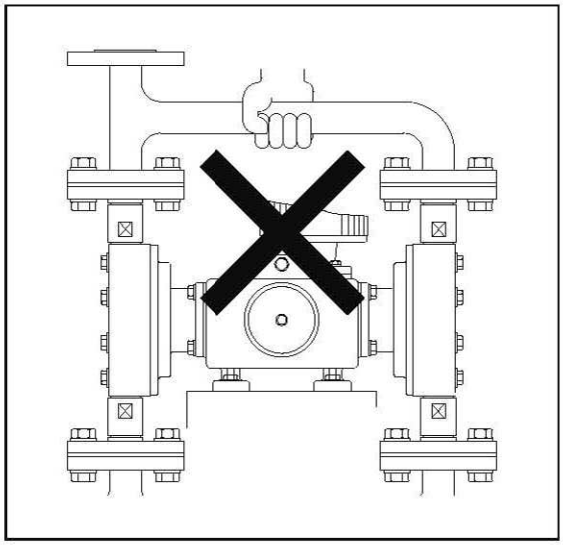
- Do not install the pump at the place of which ambient temperature is higher than 40℃ or lower than the freezing point. The inside of the pump may be damaged.
- This product is suitable for indoor purpose only, so do not install it at a dusty and damp place. It should not be exposed to rain and wind. Otherwise, electric accident or trouble may occur.
- Do not apply external force to junction pipes of the pump. The pump may be deformed or damaged.

[1] Keep the pump out of the direct rays of the sun, rain and/or wind.
[2] Install the pump at a well ventilated place in summer and at a place where the transferred liquid is not frozen in winter.
[3] If possible, install the pump at a place which is lower than the minimum surface of liquid in the tank.
[4] For easy maintenance and repair, secure enough surrounding space. Install the pump with consideration of safety of motor, inverter and electric wiring in case of flooding.
[5] The floor should be even, and the installation place should be free from vibration caused by other machines.
[6] Install the pump with props which can support the pump fully, while referring to the foundation drawing. Use the level for confirmation so that the pump can be attached horizontally.
[7] Pay attention not to have water or used liquid invade the inverter or motor during cleaning the pump. If water or used liquid invades, properties may be lost due to fire or an electrical accident may occur due to electric shock.
[8] When assembling for installation, tighten the fixating bolt with consistent power (torque: within 100kgf/Cm) into the diagonal direction so that the gap between the bed and floor surface disappear.

9-2 To move the pump

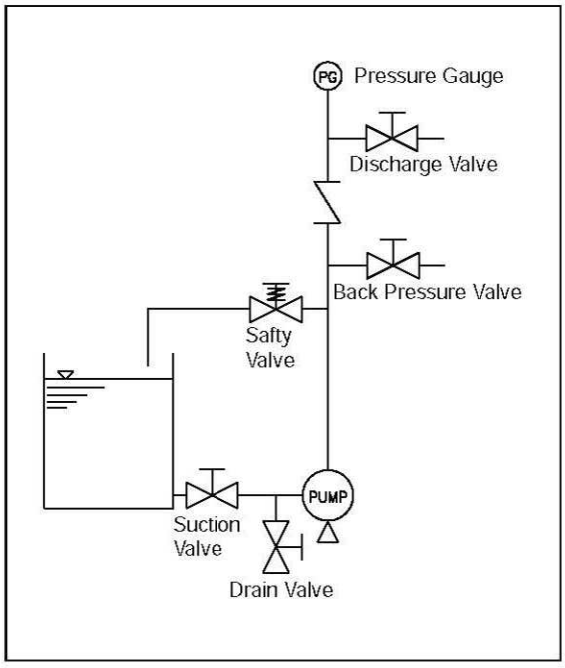
To move the pump, grab the wet side head and bed firmly. Be careful for the junction pipe not to have external force.

※ Never grab the junction pipe by hand to move it. (It may cause serious pump damage by deformation and/or crack)



9-3 Pipe (General caution)

[1] Decide the pipe system which satisfies suction/discharge conditions fully.
[2] Shorter and less curved pipes are preferred. However, it should not have the space where air stays.
[3] Install the pipe-supporting stand so that the pipe load is not applied to the pump. Especially, extra attention should be paid if the wet side is made of PVC etc.
[4] To transfer high or low temperature liquid, make sure that the thermal stress of pipes is not applied to the pump.
[5] To transfer precipitated solution, do not make U-shaped sections in pipe flow.
[6] To transfer the solution where viscous or toxic liquid may be possibly adhered, install cleansing-purpose pipes for maintenance.
[7] Pipe material should be corrosion-proof against the liquid to be handled, and it should stand the pressure applied to the pipe.
[8] Cleanse the inside of pipes before laying them. Remove the Certificate of Inspection sticker of foreign substance mixing-resistance, which is adhered to the discharge side of the pump, and then connect pipes.
[9] If there is any possibility for the solution within the pipes to be frozen, protect them with an insulating material or a warmer. Besides, install the drain valve at the suction and discharge sides so that the liquid within the pipes can be pumped out.



9-4 Suction pipe

[1] The suction pipe should be input type, if possible. Also, the suction pipe diameter should be same as or greater than the suction diameter of the pump.
[2] Connect the suction pipes carefully so that air cannot be sucked in through the junctions. Air inflow makes discharge unstable.
[3] Shorter suction pipes are preferred. If they are long, cavitation may occur, and consequently, the pulse rate cannot be assured and the accurate discharge cannot be guaranteed.
[4] When foreign substances come into the pump head, the pump may not work properly; so, install the strainer on the suction pipes.

9-5 Discharge pipe

[1] Use higher internal pressure of the discharge pipe than the setting pressure of the safety valve.
[2] If discharged at the pressure less than the atmospheric pressure, keep the pipe end higher than the water level of the tank, or install the back pressure valve to prevent siphon phenomenon.

9-6 Electrical Wiring

⚠ Warning

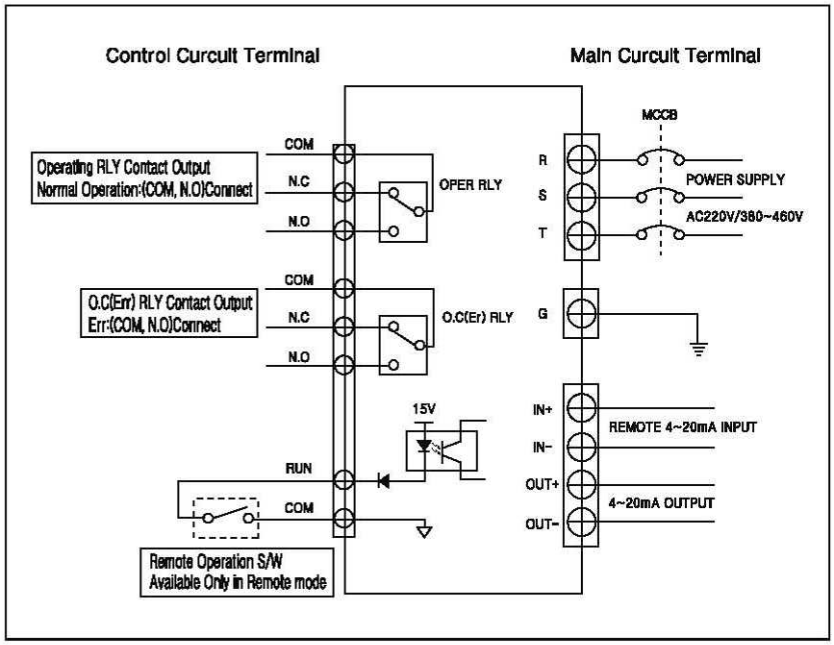
- Do not touch the product with wet hands. You may get an electric shock.

⚠ Caution

- Check the inverter, motor voltage, constant and frequency carefully, and connect the pump to the power as specified. If connected to other than the standard power supply, damage or fire may occur.
- Always connect to the ground line to prevent an electric shock.
- Let electrical technicians do the electric wiring job.
- Install the magnet switch and thermal relay as specified to control and repair the pump.
- For safety, use standardized goods for wiring in accordance with technical regulations and wiring regulations of electric equipment.
- Reverse rotation of motor may cause trouble, so connect the motor to the power supply to follow the rotating direction (clockwise).

Electrical connection

Remove four bolts from the terminal case of the front driver, and make a connection as the terminal block indicates. During connection, pay attention for the inside PCB connector not to be come off.



Note) Cautions during electrical wiring

- Use standardized electrical accessories in accordance with the electrical installation technical regulations specified by KS.
- Do not use a 30m or longer wirefor Remote Run signal line. (Refer to page 10)
- Connect the ground line.
- Use twisted shielded wire for signal line.
- Separate the main circuit (input power) line, relay and signal line (control circuit).
- For the control terminal block, use the relay with appropriate rated contact capacity.

Main circuit terminal

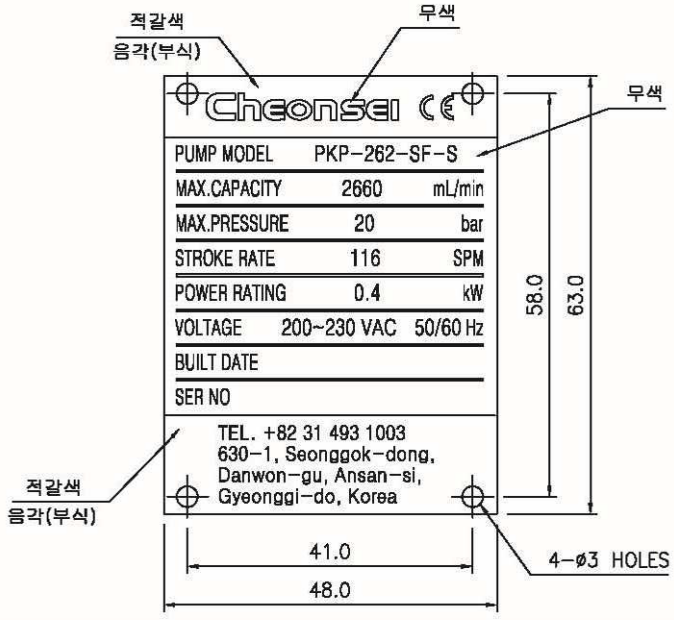
- RST (Power supply terminal): Connect as the rated supply voltage: "For a 200Vproduct, single phrase/3-phrase200~230V for a 400V product, 3-phrase 380~460V".
- IN+ IN- (Remote input signal terminal): Connect the output signal (4~20mA) of the external apparatus used for automatic proportional control operation.
- OUT+ OUT- (Output signal terminal): It is the terminal to transmit the currently operated result value as a 4~20mA isolated signal. Connect to the input terminal such as PLC, indicator etc.

Control circuit terminal

- Over current: When over-current occurs to the motor, it is outputted to the relay contact.
- Operation Status: Motor operation or stop signal is outputted to the relay contact.
- Remote Run: Operation is made by the contact signal of the external switch.(Available only in Remote mode)

Classification		Rated Specification			
Driver	Input Power	200V:Single phrase/3-phrase200~230V 50/60Hz 400V:3-phrase 380~460V 50/60Hz			
	Input Signal	Remote Operation Signal: 4~20mA	REMOTE RUN/STOP Switch Contact Signal		
	Output Signal	Isolated 4~20mA(Load resistance: Max 500Ω)			
		RELAY CONTACTOR(SPDT)	RUN/STOP	O.C(Err)	
	Indicator	Operation setting, operation value, ratio setting, OC, Err, Or			
	Protection Fuction	Over-current (overload): OC, Motor error: Err, Abnormal input signal: Or			
	Speed Control Method	3PHASE PWM	Max. applicable motor	BLDC 1.5KW or blow	
	Speed Control Range	5~100% to 1,750rpm (max)			
	Rated Current (A)	Input voltage(V)	0.4KW	0.75KW	1.5KW
		200V(single phrase	3.8/2.3	6.75/3.9	6.8(3-Phrase)
		400V(3-Phrase 380/460)	1.4/1.1	1.95/1.65	3.3/2.72
	FUSE Capacity	400V: 5A 200V: 10A(0.4KW : 5A)			
	Relay Contact Rating	RUN/STOP(OPERATING), O.C(Err) 0.5A or below			
Motor	Type and Structure	8-pole BLDC (Brushless DC), Vertical, TEFC			
	Max. rpm	1,750rpm ±3%	Insulation Class	Type B	
General Specifica-tion	Protection Type	IP54(Motor and driver)			
	Ambient temperature & humidity	R.H with -10℃~40℃: 90% or below (No condensation and dew are allowed)			
	Installation place	Free from corrosive gas, flammable, inflammable gas, sea wind, oil drop and dust			
	External Paint	Motor+Driver	Munsell No 0.6PB 4.8/10.6 or similar color, corrosion-protection paint		
	Weight(kg)		Weight(kg)	14	17	19

NAME PLATE



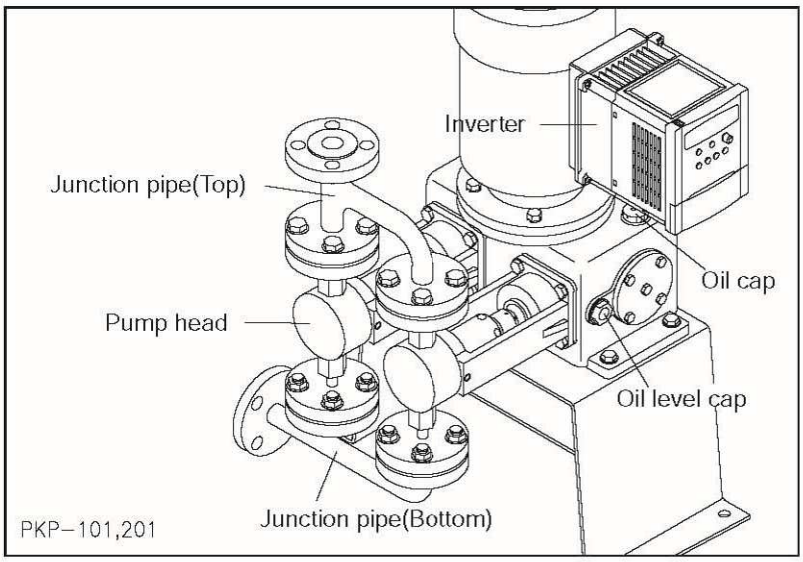
10 Driving

10-1 Driving preparation

⚠ Caution

- When foreign substances are held in the discharge pipe of the pump, the pipe may be damaged due to pressure increase and people can be hurt due to liquid burst-out, so always be careful for foreign substances not to come into the pipe.
- To handle hazardous liquid, always wear the protective equipment (i.e., protective gloves, mask, protective glasses, liquid-resistance working clothes etc.).
- The wet side of the pump may have the water used during the final performance inspection. To use the chemicals which may result in abnormal phenomenon by reacting with water, remove the water and dry it before use.
- Check if there is any leakage from the junction pipe or installation pipe of the pump during pre-operation; otherwise, there would be fatal damage or fire to the inverter or motor during operation.

[1] Check if there is any oil leakage due to damaged part or loose bolts of the pump. Excessive leakage of working oil or buffer solution may affect the discharge amount.
[2] Check the oil gauge to see if there is enough oil in the drive unit of the pump as regulated. The normal position of the oil level is the middle of the gauge.
[3] Remove the black pin of the oil cap. This is attached to prevent oil leakage during delivery.
[4] Check if all of accessories, liquid to be transferred and power supply necessary for pump operation are ready.



10-2 Driving

[1] Open the suction and discharge valves.
[2] Turn on the inverter switch. Check if the motor fan rotates clockwise when the pump works.
[3] Open the discharge side up to the atmospheric pressure, and increase the inverter frequency slowly. Check if the transferred liquid is discharged. Connect to the flange of the discharge side. Do pre-operation for several minutes.
※ When the ambient temperature is low, overload may occur temporarily due to low temperature of lubricant. Wait until the lubricant temperature increases with no load.
[4] If there is no error found during pre-operation, increase the pressure of the discharge side up to the setting one. Check if the inverter works properly (12 ~ 60Hz) or if every part works properly.

10-3 Control of discharge amount

> ⚠ Warning
>
> • Do not set the inverter to 12Hz or lower.

[1] The discharge amount can be controlled by changing the inverter frequency.
[2] The inverter is controllable within 12 to 60Hz. For safe operation, do not use it at below 12Hz. (Low velocity operation at 12Hz or lower results in low torque and low wind capacity, which may damage the motor due to heat.)

10-4 Start after stop

[1] The pump may be damaged due to freezing in cold season, so open the drain valve of the suction side and perform idle operation to discharge any liquid from pipes and the pump regardless of the duration of stop.
[2] To start the pump after a short stop (within one week), perform air-escape operation and operate the pump at any stroke length, at the discharge pressure as set.
[3] To start the pump after a long stop (longer than one week), never operate the pump directly to the normal operation setting. Operate the pump while keeping the discharge side at the atmospheric pressure for several minutes. (Inverter frequency: 60Hz)

> ⚠ Warning
>
> • To operate the pump, always open the valves of the discharge and suction side pipes. If the pump is operated when the valves are closed, the pump and pipes may be damaged due to excessive pressure increase and people may be hurt due to liquid burst-out.

10-5 Confirmation of discharge amount

If there is no error found in the pump, check the discharge amount under the real condition with measuring vessels such as measuring cylinder.
[1] The pump is normal if the discharge amounts are same after repetitive measurements.
[2] When the discharge amount increases/decreases by changing the motor speed, measure the discharge amount one minute or more after the change.
※ If you request the pump test report when you place an order, we submit the test report which has been performed at normal temperature and with clean water. The result may vary depending on on-site pipes and transferred liquid.

10-6 Pulse rate increase

The pulse of the metering pump largely depends on pipes and transferred liquid.
(Since the factory test condition is not same as your on-site condition, the result may be different.)
Besides, if the pump operates after a long stop, its metering performance and pulse rate may increase due to adherence of transferred liquid to the check valve etc., so, always cleanse the inside of the wet side to keep it for a long stop duration. The increase of the pulse rate after the warranty may result from aged parts, so please refer to "Consumption and Spare Parts". For other questions, please contact us.

11 Maintenance & inspection

⚠ Warning

- Always cut off the power and stop the pump and devices for maintenance and inspection; otherwise, you may get an electric shock.
- Be careful not to have your finger or clothes come into the rotating object. You may get hurt unless you are careful.

⚠ Caution

- Always wear the protective equipment for assembly/disassembly job.
- Remove the pressure of the discharge pipe and discharge the liquid from the wet side of the pump before maintenance and/or repair.
- Pay attention not to have water or transferred liquid invade the inverter or motor; otherwise, people may get hurt due to electric shock or properties may be lost due to fire.

11-1 Inspection before operation

[1] Check the level of the liquid chemical tank. If insufficient, fill it.
[2] Check if the valves of the suction and discharge sides are opened.
[3] Check if pipes are safe and are not damaged.
[4] Check the electrical wiring (short circuit, disconnection, not connected, wrongly connected etc.) and if there is any electric leakage.

11-2 Inspection during operation (Daily inspection)

[1] Check the level of the liquid chemical tank. If insufficient, fill it. Especially, when you are dealing with chemicals, pay extra attention.
[2] Check if liquid comes from a joint or other area; if necessary, tighten it. If it keeps leaking, check the status of joints, packing or O-rings. If damaged, replace it.
[3] Check if there is any abnormal sound coming from the motor or pump. ("Beep" sound generated when the inverter is driven is the normal electric sound when the motor is driven.)
[4] Check if the oil in the drive unit is enough and if there is any oil leakage. If insufficient, fill it until the level reaches the setting level of the oil gauge.
[5] Check if there is any change in the discharge amount and discharge pressure setting.
[6] Check if the pressure gauge works properly.

11-3 Long-term stop

[1] Clean the inside of the pump head of the suction side. Operate the pump to make a discharge through the pump head for 30 minutes by using clean water or washing liquid.
[2] Cover the whole pump with covers to protect it from dust or corrosion.
[3] To start the pump after a long stop, check if there are any foreign substances in the check ball or ball seat to maintain the performance, before operation.

11-4 Lubrication

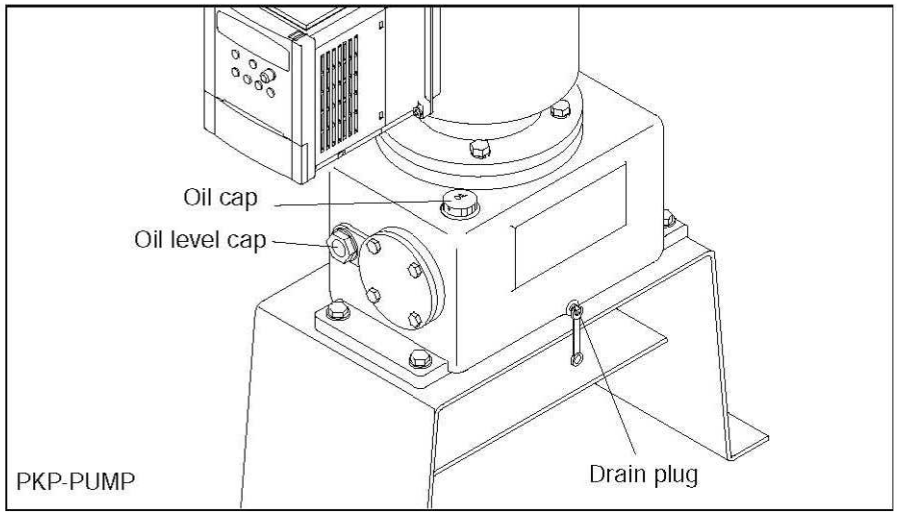
■ Exchange of lubricant in the drive unit

① Exchange time

Exchange it 500 hours after the first operation; after that, exchange it every 4000 hours. However, if any deterioration or emulsion of the lubricant is noticed, exchange it immediately.

② Exchange method

- Open the oil cap, and remove the drain plug with a wrench. Remove the old oil.
- Clean the inside with refreshing oil, and assemble the drain plug. Fill oil slowly through the oil inlet (oil cap) until new oil reaches the setting level (red dot) of the oil level cap.



For suitable oil amount for oil exchange, please refer to below table:

③ Exchange lubricant

Lubricant amount for exchange by type

MODEL	PKP-All type
Suitable oil amount	1,350mL

④ Recommended lubricant

- Shell' s Omala oil #220 (※)
- Mobile' s Gear oil #630
- Other gear oil with the viscosity grade of ISO VG220, SAE90

Note) (※) means the oil used by us.

⚠ Caution

- Always wear the protective equipment so that the skin and eyes are free from being touched by oil.
- Keep oil far away from flame or high-temperature object. Keep oil in the well-ventilated area.

12 Cause and measure of trouble

Troubles \ Causes	Motor does not rotate	Insufficient discharge amount	Excessive discharge amount	Unstable discharge amount	Excessive motor current	No liquid coming-out	No discharge pressure increase	Too much leakage	Too many vibrations and too noisy	No suction	Too high temperature of the reducer unit	Pulse rate increase	Remedies
Poor motor, inverter over-current trip	○				○				○				Exchange the motor; inspect the inverter; refer to the Handling Manual
Electrical wire disconnection, poor connection	○												Check electrical wiring; refer to the inverter handling manual
Power fuse cut-off	○												Take actions after examining causes; refer to the inverter handling manual
Low voltage	○				○								Take actions after examining causes; refer to the inverter handling manual
Insufficient NPSH (Cavitation)		○		○		○	○		○	○		○	Check the suction condition
Ball seat wear-out		○		○		○	○			○		○	Exchange
Foreign substances stuck to the valve		○		○		○	○			○		○	Disassemble and clean it
Clogged strainer of the suction pipe		○		○		○	○		○	○		○	Disassemble and clean it
Constant velocity cam wear-out		○										○	Exchange
Too much transferred liquid due to the lack of minimum necessary differential pressure			○	○								○	Check the minimum necessary differential pressure
Irregular pump stroke number		○		○									Check the power, motor and reducer
Overload (Too high discharge pressure)	○				○				○		○		Check the discharge pipe system
Improper power specification	○				○								Re-examine the power specification
Air suck-in at pipes of the suction side		○		○		○	○			○		○	Inspect the pipe
Change of liquid to be handled		○		○		○						○	Re-examine the pump specification
Pressure gauge trouble					○		○						Exchange
Clogged hole of the pressure gauge by foreign substances					○		○						Clean or exchange it
Wide gap between gland packing		○				○		○	○			○	Tighten the gland nut
Damaged plunger surface and/or packing		○					○	○				○	Exchange
Poor valve packing and/or oil		○		○				○		○		○	Exchange
Poor oil seal													Exchange
Improper lubricant in the drive unit					○	○			○		○		Check the oil amount, type and pollution
Wide space of the plunger nut		○		○		○	○						Fix the hexagon socket set screws

※ 1) Regular inspection is needed to maintain stable pulse rate.
2) For inverter, refer to "Trouble" of the Handling Manual. For other questions, please contact our R&D Department.

13 Parts exchange

⚠ Warning

- People may be hurt, so pay extra attention when you handle large and heavy parts.
- Wear the protective equipment because any liquid which remains inside the pump may come out during disassembly and cause fatal injury to human body.

⚠ Caution

- Assemble the valve parts in accordance with the right order (Top: ball guide; Middle: Check ball; Bottom: ball seat). Wrong order may cause flowing backward and damage the pump.

※ Refer to "Part structure and name" for assembly/disassembly.

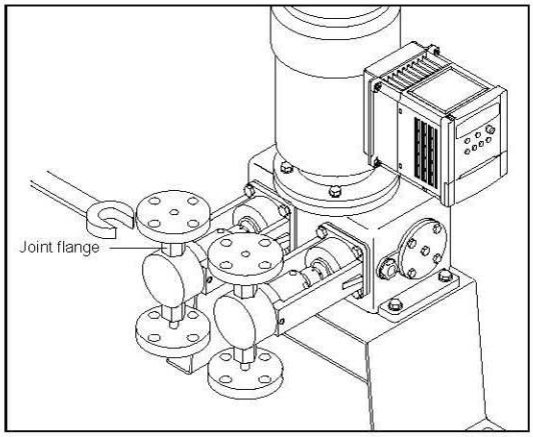
13-1 Exchange of ball seat, ball guide and check ball

[1] Disassembly

① Unfasten the pipes of the suction and discharge sides.
② Unfasten the junction pipes of the suction and discharge sides.
③ Loosen the joint flange of the suction and discharge parts, and take out the valve (ball seat, ball guide, check ball).
④ If there is any abnormal scar or wear-out in the check ball or ball seat, exchange it.

[2] Assembly

① Assemble the valve while referring to "Part structure and name".
② Assemble the joint flange of the suction and discharge parts, and tighten the valve.
③ If the packing or O-ring part is damaged, leakage may continue even if tightened.
④ Assemble the junction pipes of the suction and discharge sides.
⑤ Assemble the pipes of the suction and discharge sides.



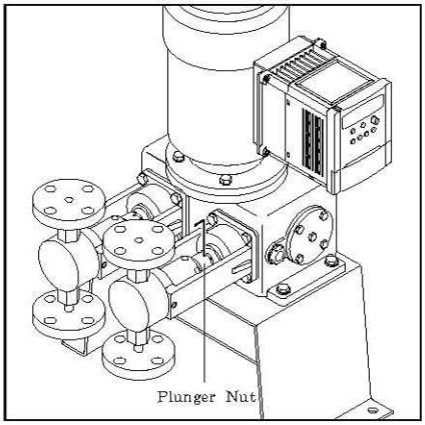
⚠ Caution

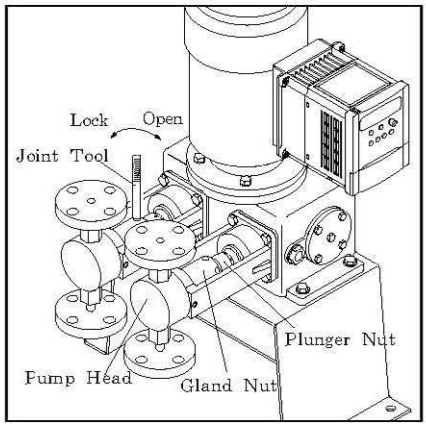
- Assemble the valve parts in accordance with the right order (Top: ball guide; Middle: Check ball; Bottom: ball seat). Wrong order may cause flowing backward and damage the pump.

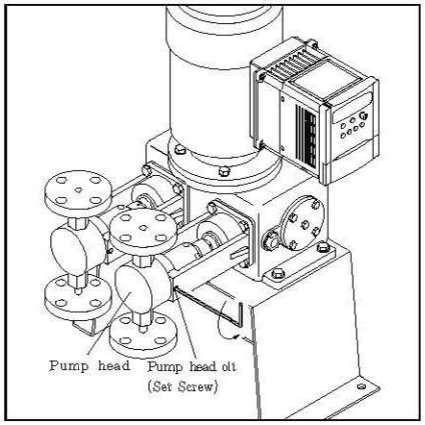
13-2 Removal and installation of the gland packing

[1] Removal

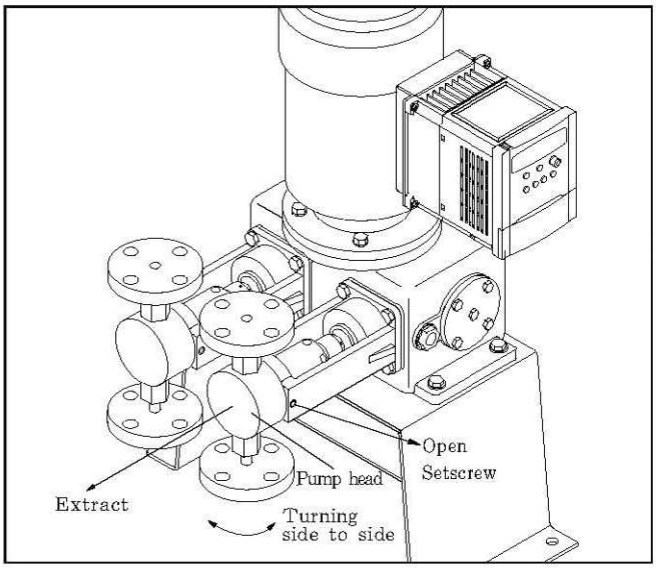
① Remove the junction pipes of the discharge and suction sides.
② Remove the bracket cover.
③ Loosen the hexagon socket set screws which fix the plunger nut.
※ The hexagon socket screw is fixed at one upward- or downward-directional place of the pump. Pay extra attention not to be confused with the hexagon socket screw of the set plunger in the pump.

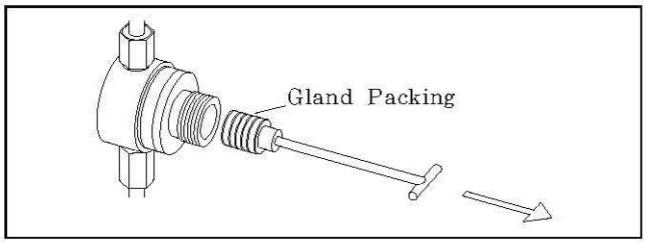


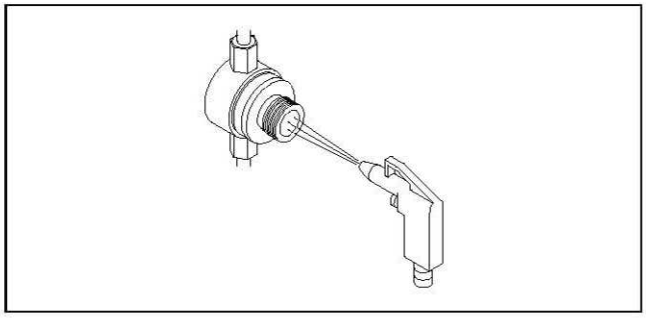




④ Remove the plunger nut from the set plunger by turning it counterclockwise (viewed from the front side of the pump).
⑤ Unfasten the gland nut by using the gland nut assembly tools.
⑥ Take out the pump head. When you unfasten two hexagon socket set screws at the sides of the bracket, the pump head will come out while the plunger is built-in. Turn the pump head to the left or right while pulling it out. It will be separated smoothly.
⑦ Remove the plunger nut, plunger and collar from the pump had. Check the plunger and cleanse it.
⑧ Remove the gland nut and gland ring from the pump head.
⑨ Remove the old packing. Be careful not to give damage to the inside of the pump head.
⑩ Once all of the old packing is removed, cleanse the inside of the pump head. If old packing is melted and stuck inside, remove it with sandpaper. In this case, use a fine paper with No. 400 or higher.







2 Installation
① Insert new packings into the pump head. (Insert the same number of packings as that of old gland packings) Prepare a plastic bar of which outer diameter is same as that of the gland packing and insert the packing one by one with the bar. The split of each gland packing should be crossed by 90 degrees. Do not insert the gland packing forcibly with the end of the driver.
② Install the plunger nut and drip collar to the plunger.
③ Install the gland ring to the pump head. Tighten the gland nut lightly with hands. Insert the plunger.
④ Insert the pump head to the bracket. Turn the pump head to the left or right while pushing it. It will be installed smoothly.
⑤ After inserting the pump head up to the end of the bracket, place the discharge and suction sides of the pump head perpendicularly. Fix it with two hexagon socket set screws at the sides of the bracket.
⑥ Assemble the plunger nut to the set plunger.
⑦ Tighten the gland nut. At first, tighten it sufficiently by using the gland nut tightening tools, and push the gland packing into the pump head. Then, unfasten the gland nut and tighten it lightly with hands.

⑧ Install the pipes of the discharge and suction sides. If the number of gland packings is more than acceptable, or if you forget tightening the gland nut, the end of the gland nut and the end of the plunger nut may touch each other (in some cases, they may be damaged) during pump operation. Therefore, check if the gap is 10mm or more as shown in the figure.

※ Assemble the joint flange of the discharge and suction sides in accordance with the reverse order of disassembly. Connect the junction pipes of the discharge and suction sides.

13-3 Removal and assembly of the constant velocity cam

The drive unit of our pulseless metering pump consists of several parts necessary for pulseless pump, such as constant velocity cam, slider and worm gear. Especially, the pulse rate largely depends on the rotating and assembly directions of the constant velocity cam. Therefore, to disassemble or assemble the drive unit, refer to the directions in the Handling Manual to keep the pump performance as well as safety.

[1] Removal

To remove the drive unit, always disassemble the wet side first.

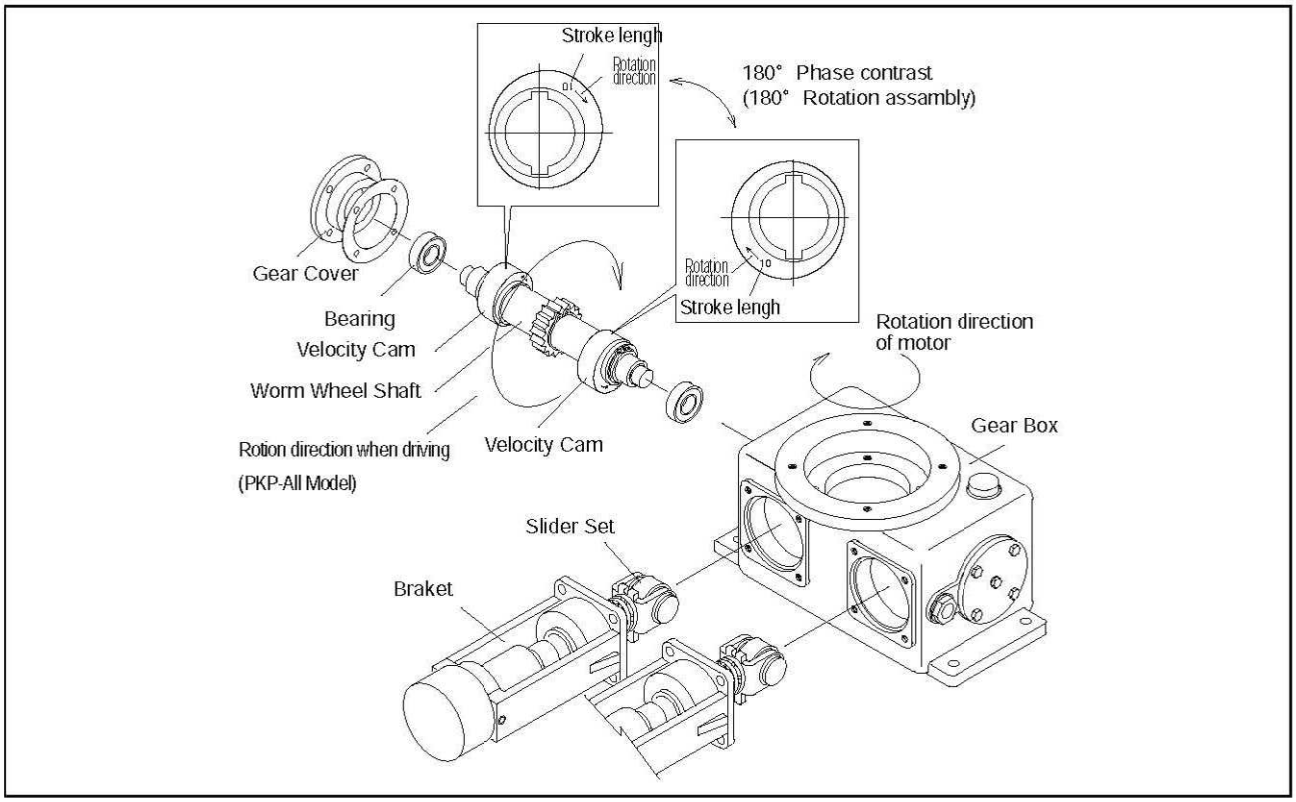
① Unfasten the pipes of the suction and discharge sides.
② Unfasten the junction pipes of the suction and discharge sides.
③ Unfasten the bracket and remove the slider from the gear box.
④ Remove the motor from the gear box. Unfasten the attachment bolt and carefully remove the worm shaft.
⑤ Disassemble the gear cover and remove the worm wheel shaft.
Disassemble other parts while referring to "Part structure and name".

[2] Assembly

As the motor has rotating direction, the constant velocity cam has direction, too. Build the constant velocity cam with consideration of the rotating direction of the worm wheel shaft as shown in below figure. The arrow showing the rotating direction and the number showing the stroke length are engraved at the side of the constant velocity cam. Make sure that the arrow direction of the constant velocity cam is same as the rotating direction of the worm wheel shaft.

(Be careful of the rotating direction of the worm wheel shaft while referring to the figure)

※ If the assembly direction (rotating direction) of the constant velocity cam is opposite, you cannot obtain the pulse rate as desired; besides, the product may be damaged, so always pay attention to the direction.



14 Spare part list

Recommended spare parts	Part No.	Part name	Q' ty	(per 1 unit)
Spare parts for one year	2	Check ball	8	
	4	Ball seat	8	
	10	Gasket (ball guide)	24	PKP-132, 262
	10 · 11	Gasket (ball guide/ ball seat)	16 · 8	PKP-180~651
	87	Gland packing	2 set	
	89	Plunger	2	
	3	Ball guide	8	
	237	Oil seal	2	
	206	Worm wheel	1	
	213	Constant velocity cam	2	

※ The exchange time of recommended spare parts depends on the on-site condition.

15 Custody and transporting method

[1] To facilitate product warehousing and shipment, products are stored by using storage stand or palette and after location for storing for each model.

[2] Load the products by each model or by the type of the box by deciding the number of units to load, and be careful so that the box is not pressed down.
A) In case of cardboard box: load in two to three layers
B) In case of wooden box: load in two layers

[3] Be extra careful when storing or transporting products since there is considerable possibility that oil may leak when the products are tilted or fall down.

16 Warranty

⚠ Warning

- If you remodel the pump at your discretion, if you do not use specified parts or if you violate the direction, we do not warrant the product. Also, we do not compensate any accident or damage caused by the above-mentioned reasons.

[1] The warranty covers one year from the purchase date.
[2] We provide free repair or exchange in case of trouble or damage caused by our fault on design and/or manufacture during the warranty period.
[3] We charge you for repair or exchange in case of trouble or damage caused by following reason, regardless of the warranty period:
① Trouble or damage after the warranty expires
② Trouble or damage caused by your carelessness
③ Trouble or damage caused by using parts other than specified by us
④ Trouble or damage caused by repair or remodeling done by other than us or our agent
⑤ Trouble or damage caused by irresistible force such as fire, natural calamity etc.

17 Repair service

⚠ Caution

- To send the pump to us for factory repair, cleanse the inside of the wet side completely before sending it.
- If you handle hazardous liquid which may affect human body fatally, consult with us before sending it to us.

[1] If you find any problem in the pump or have any other questions, contact our A/S Team or store described in the back of the Handling Manual.
[2] To request repair, please inform below information:
① Model name and manufacture number in the nameplate
② Purchase place, usage period, on-site condition, present condition, transferred liquid etc.
[3] If the warranty expires, you may have to pay for the repair depending on the part, so contact the store.
[4] You can keep our performance parts for repair for at least five years from the manufacture date. Performance part means those necessary to keep the product function.

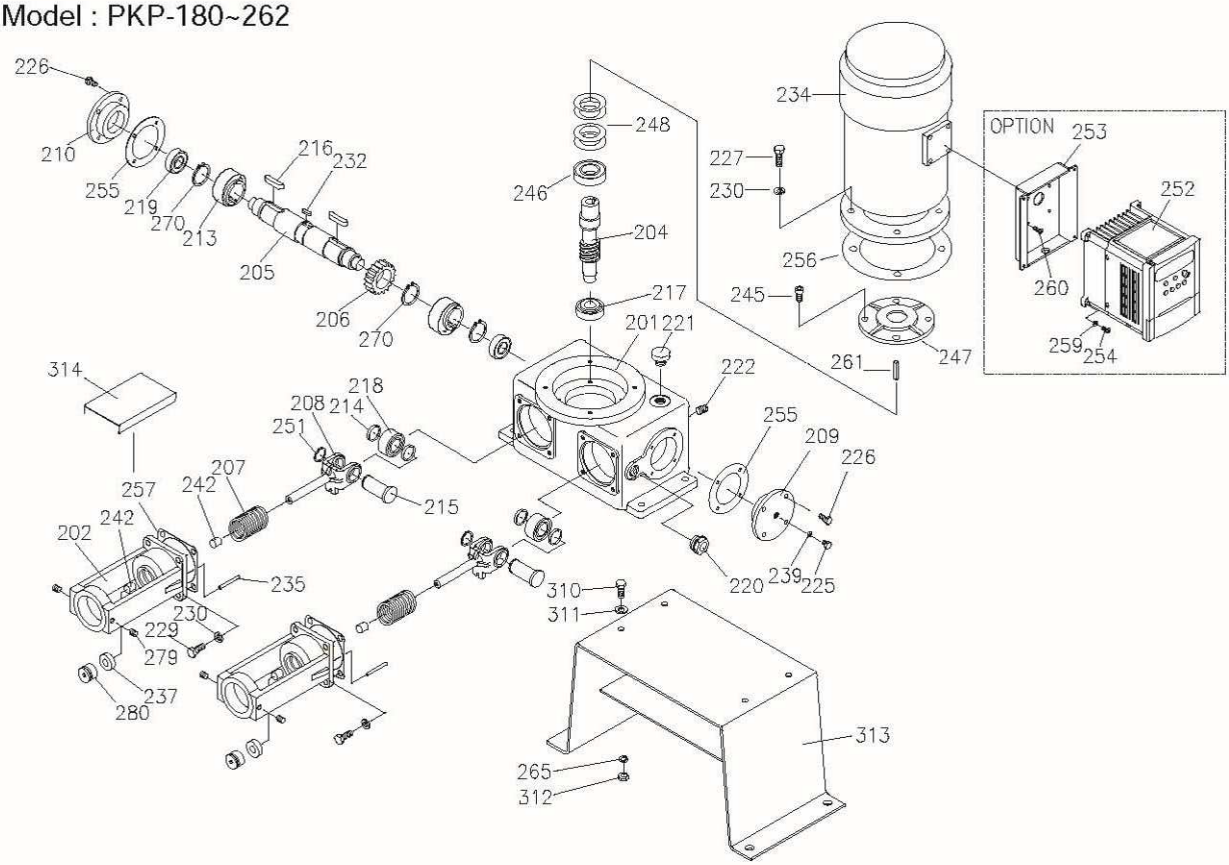
18 Accessories

[1] Back pressure valve
Depending on pipe condition, siphon may occur, resulting in discharging liquid too much during operation or flowing chemicals continuously even during stop. The back pressure valve is used to prevent this phenomenon.
[2] Safety valve (relief valve)
When foreign substances are held in the pipes of the discharge side in the pump or if the valve is closed, the pipe gets clogged, causing higher pressure than the rating one. This valve is automatically opened in this situation.

19 Structure and Name of Each Parts

19-1 Driving Parts

□ Model : PKP-180~262



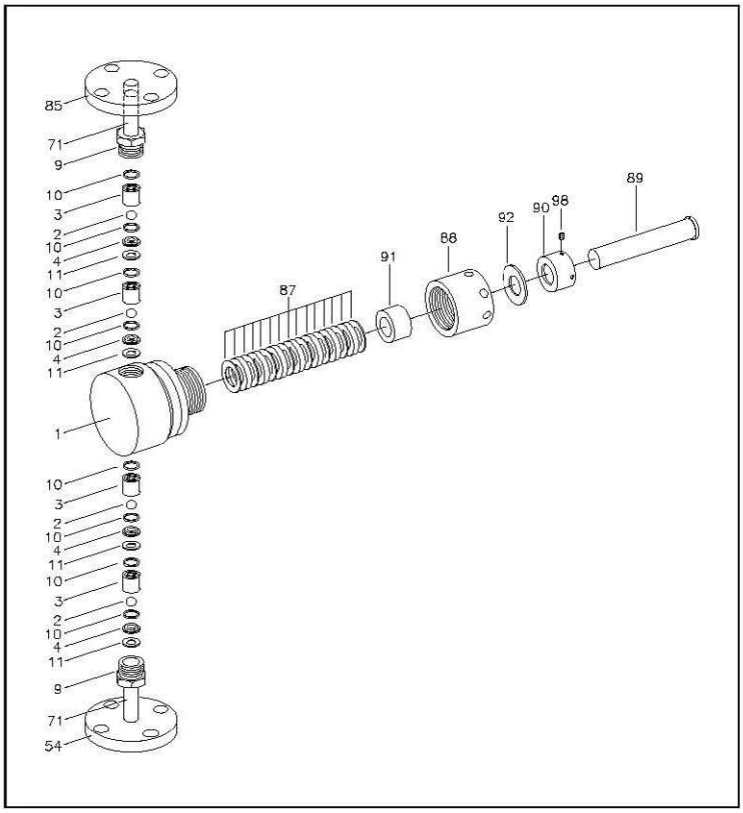
No.	Name	Q'ty
201	Gear box	1
202	Braket	2
204	Worm	1
205	Worm wheel shaft	1
206	Worm wheel	1
207	Spring	2
208	Slider	2
209	Gear cover	1
210	Gear cover	1
213	Velocity cam	2
214	Color	4
215	Pin	2
216	Key	2
217	Bearing(Taper)	1
218	Bearing(Niddle)	2
219	Bearing(Ball)	2
220	Oil level cap	1
221	Oil cap	1

No.	Name	Q'ty
222	Drain plug	1
225	Bolt(Hex. head)	1
226	Bolt(Hex. head)	8
227	Bolt(Hex. head)	4
229	Bolt(Hex. head)	8
230	Washer(spring)	12
232	Key	1
234	Motor	1
235	Spring pin	2
237	Oil Seal	2
239	Washer(Seal)	1
242	Bearing(Dry)	4
245	Bolt(Hex.)	4
246	Bearing(Ball)	1
247	Attachment	1
248	Spring(Belleville)	4
249	Snap Ring	2
250	Snap Ring	1

No.	Name	Q'ty
251	Snap Ring	2
252	Inverter	1
253	Braket(Inverter)	1
254	Bolt(Round Head)	4
255	Gasket	2
256	Gasket	1
257	Gasket	2
259	Washer(Spring)	4
260	Bolt(Round Head)	4
261	Key	1
279	Set Screw	4
280	Set Plunger	2
310	Bolt(Hex.)	4
311	Washer(Flate)	4
312	Nut(Hex.)	4
313	Bed	1
314	Braket Cover	2

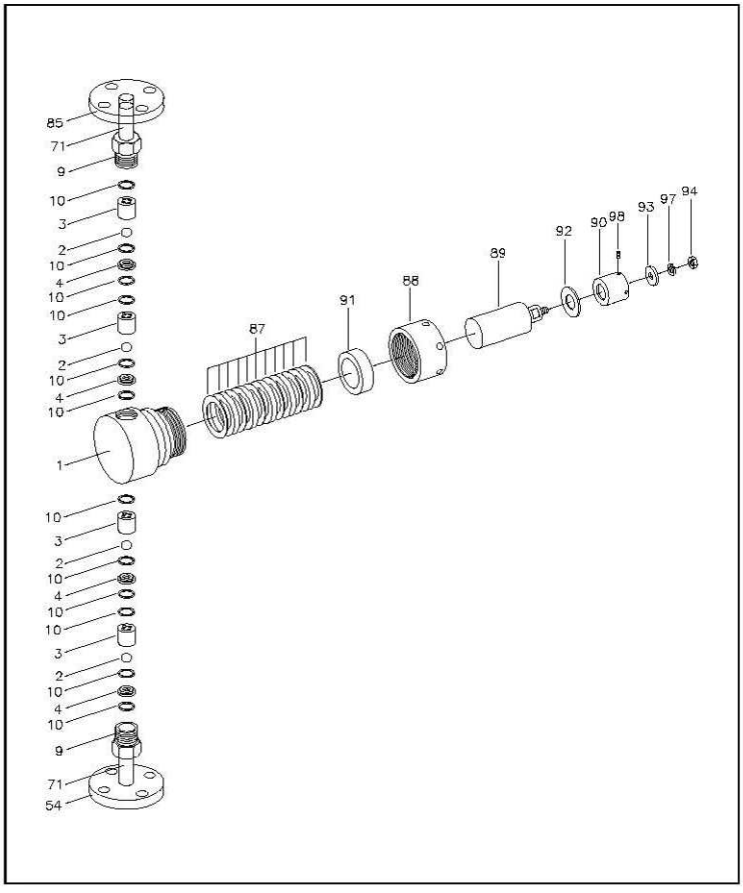
19-2 Liquid End Parts

[2] Model : PKP- 180~651



No.	Name	Q'ty
1	Pump head	2
2	Check ball	8
3	Ball Guide	8
4	Ball seat	8
(9)	Union Nut	4
10	Gasket(Ball Guide)	16
11	Gasket(Ball seat)	8
9,54,71	Joint flange(Suction)	2 set
(54)	flange(Suction)	2
(71)	Joint pipe	4
9,71,85	Joint flange(Discharge)	2 set
(85)	flange(Discharge)	2
87	Gland packing	2 set
88	Gland Nut	2
89	Plunger	2
90	Plunger Nut	2
91	Gland ring	2
92	Color	2
98	Set Screw	2

[2] Model : PKP- 132, 262



No.	Name	Q'ty
1	Pump head	2
2	Check ball	8
3	Ball Guide	8
4	Ball seat	8
(9)	Union Nut	4
10	Gasket(Ball Guide)	24
9,54,71	Joint flange(Suction)	2 set
(54)	flange(Suction)	2
(71)	Joint pipe	4
9,71,85	Joint flange(Discharge)	2 set
(85)	flange(Discharge)	2
87	Gland packing	2 set
88	Gland Nut	2
89	Plunger	2
90	Plunger Nut	2
91	Gland ring	2
92	Color	2
93	Spacer	2
94	Nut(Hex.)	2
97	Washer(Spring)	2
98	Set screw	2

MEMO

MEMO

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