KEMPION

SPEC KAB KAB-QC-18 ISO 9001 Certified Company

Smoothy Diaphragm Pumps

PDS Series

Instruction Manual

전세산업 (주)

Introduction

Thank you very much for purchasing Cheonsei PDS pumps.
Before beginning operation, please read this instruction manual carefully. Correct handling, repair, & maintenance are described easily. Please use this pumps safely to be guaranteed performance & long life of the pump after reading this instruction manual.
Please keep this instruction manual at the place where you can see it easily.

Contents

1 Notice for Safety

1-1 Introduction

- To use the products safely, the signs are showed on the manual like below.
- As it is a matter of safety, please be sure to keep the directions in manual.
- Each symbol and its meaning are described as below. Regarding the BLDC M/C UNIT supplied by us, always follow all directions (i.e., warning, caution etc.) described in the instruction manual specially provided as well as warnings and cautions in this manual.

⚠ Warning

Person death or serious injury will be occurred, if warning is not kept by wrong handling.

⚠ Caution

Person injury or property damage will be occurred, if caution is not kept by wrong handling.

1-2 Cautions for Operating Condition

⚠ Caution

- Do not use this pump for other purposes except liquid injection. Otherwise it may cause trouble.
- Do not use for kinds of liquid which cause damage to liquid end parts. Please keep the followings,
  otherwise it may cause trouble.
  Ambient temperature: 0~40°C
  Temperature of the handling liquid : 0~50°C if Liquid End material is PC or FC
  0~80°C if Liquid End material is SS
  Piping pressure : Below the max. discharge pressure indicated on the Specifications.
  ※ Pressure over the allowable one may cause damage to the product, so install safety valves (i.e relief valve) and strainers at pipes.

1-3 Cautions for Handling Condition

⚠ Warning

- Install this pump beyond the reach of children and/or unauthorized person
- Turn off the power and stop the pump & other equipments when repairing or disassembling pumps. If power is on during work, it may cause electric shock.
- Please do not operate when the discharge and suction valve are closed. Also, do not close the valve during operation. Pump and piping may be damaged
- Be careful not to insert fingers or any foreign substances into rotating or reciprocating objects during operating pump. If you touch it during operation, you may get injury.
- Do not touch with wet hands. Electric shock may occur.
- Use only designated parts. If undesignated parts are used to the pump, it may cause accident & trouble.
- Do not arbitrarily reconstruct the pump and BLDC M/C UNIT. If the pump is arbitrarily reconstructed, it may cause accident & trouble, and we are not be liable for the problems.

⚠ Caution

- Do not use damaged pump. It may cause accident.
- Do not install pump in the heavy moist or dusty place. It may cause electric shock and trouble.
- Do not touch motor with bare hands during operation. High temperatures can cause burns.
- Wear suitable protective clothing(gloves, mask, goggles, working clothes, & etc.) during assemble and disassemble work when pumping hazardous liquids or uncertain liquids.
- Do not use power other than that specified in the motor nameplate. Otherwise, it may cause malfunction or fire.
- Pump should be properly grounded. If pump is not grounded, it may cause electric shock.
- Work after releasing pressure from discharge piping and remove liquid from Liquid End Part prior to repair or maintenance of pump.
- Pump may be damaged when ambient temperature go down below freezing pont of liquid. Be sure to remove the liquid in the pump and piping after operation stop. Provide adequate protection against freezing the pump and piping during winter season.
- Make proper protection in consideration of indeliberate leakage from damage of pump & Piping.
- Dispose of waste pump in accordance with related national law.

2 Confirmation of Product

2-1 Check Point When Unpacking

Please check following points immediately after receiving the pump.
If the defect is found from pump, please request it to local agent or Cheonsei.
1 Is specification correct as ordered?
2 Is there any missing parts?
3 Is there any visible damage caused by vibration or shock during transport?
4 Is there any loosened bolt or nut?

2-2 Standard Accessories

1 Instruction Manual ..... 1 Copy
2 Mounting bolts (M10×40L Including Washers & Nuts) ..... 4 Set

3 General

These pumps are a pulseless diaphragm metering pump which pulse rate of discharge capacity is reduced. Chemical is sucked and discharged by reciprocating diaphragm which is attached to Rod by special cam after reducing the rotation of motor by Gear. In case of BLDC M/C UNIT installed, stable capacity is maintained in low-speed, and feedback is quick.

4 Model Code

PDS	–	10	–	S	S	–	F	W	S	–	0	1
❶		❷		❸-a	❸-b		❹	❺	❻		❼	❽

❶	**MODEL**	PDS (PULSELESS DIAPHRAGM METERING PUMP)
❷	**DIS. CAPACITY**	02 : 0.2 L/min 05 : 0.5 L/min 1 : 1.2 L/min 3 : 2.5 L/min 5 : 5.5 L/min 10 : 10.5 L/min 20 : 23 L/min 40 : 37 L/min
❸	**LIQUID END MATERIAL**	a. Head(P : PVC, F : PVDF, S : SSC14A, X : Special) b. Check Ball(C : CERAMIC, S : STS316, X : Special)
❹	**CONNECTION**	F : Flange, C : Clamp, X : Special
❺	**VALVE TYPE**	W : Standard, V : High Viscosity
❻	**POWER**	S : 3Phase/380~480V, A : 3Phase/1Phase/200~240V, X : Special ※ BLDC motor is standard. If requested, motor for inverter is available.
❼	**OPTION(LIQUID END)**	1 : Diaphragm Damage Detection Device 0 : None
❽	**REMOTE CONTROL**	1 : Inverter, 2 : BLDC M/C UNIT(Auto) 3 : BLDC M/C U NIT(Manual), 0 : None

5 Standard Liquid End Material

NO	Part / Code / Type	PC	FC	SS
❶	Head	PVC	PVDF	SSC14A
❷	Diaphragm	PTFE		
❸	Check Ball	CERAMIC		STS316
❹	Ball Guide	PVC	PVDF	STS316
❺	Ball Stopper	PVC	PVDF	STS316
❻	Joint	PVC	PVDF	STS316
❼	O-ring·Packing	FKM	FEP(+SIL)	

Notes) 1. In case of special materials other than the standard, please contact separately.
2. Above standard material can be revised for improvement without prior notice.

6 Specification

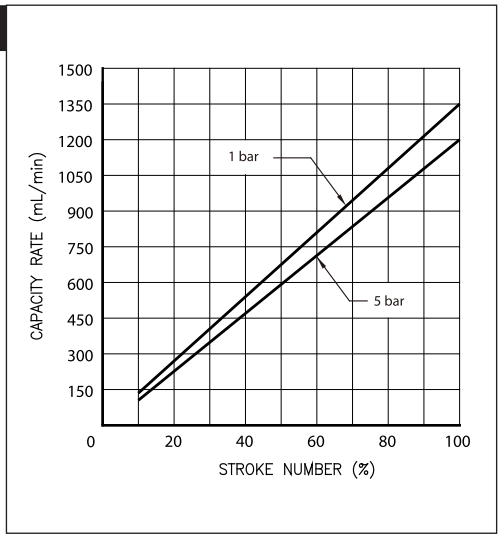
<table>
<tr><td colspan="2"></td><td>PDS-02</td><td>PDS-05</td><td>PDS-1</td><td>PDS-3</td><td>PDS-5</td><td>PDS-10</td><td>PDS-20</td><td>PDS-40</td></tr>
<tr><td>Max. Discharge Capacity</td><td>L/min (L/h)</td><td>0.2(12)</td><td>0.5(30)</td><td>1.2(72)</td><td>2.5(150)</td><td>5.5(330)</td><td>10.5(630)</td><td>23(1380)</td><td>37(2220)</td></tr>
<tr><td>Max. Discharge Pressure</td><td>bar(PSI)</td><td colspan="2">10(145)</td><td colspan="7">5 (72.5)</td></tr>
<tr><td>Pulse Rate(F/S)</td><td>%</td><td colspan="9">± 3.0</td></tr>
<tr><td>Stroke Length</td><td>mm</td><td colspan="2">4</td><td colspan="2">6</td><td colspan="2">8.5</td><td colspan="2">15.5</td></tr>
<tr><td>Max. Stroke Number</td><td>spm</td><td colspan="6">96</td><td colspan="2">87</td></tr>
<tr><td rowspan="2">Connection Discharge / Suction (High viscosity type)</td><td>FLANGE</td><td colspan="2">KS 10K 15A / KS 10K 15A</td><td>KS 10K 15A / KS 10K 15A (25A)</td><td>KS 10K 15A / KS 10K 15A (25A)</td><td>KS 10K 25A / KS 10K 25A (40A)</td><td>KS 10K 25A / KS 10K 40A</td><td>KS 10K 40A / KS 10K 50A</td><td>KS 10K 40A / KS 10K 65A</td></tr>
<tr><td>CLAMP</td><td colspan="2">1.5S 20A / 1.5S 15A</td><td>1.5S 20A / 1.5S 20A (25A)</td><td>1.5S 20A / 1.5S 20A (25A)</td><td>1.5S 25A / 1.5S 25A (32A)</td><td>1.5S 25A / 1.5S 32A</td><td>2S 40A / 2.5S 50A</td><td>2S 40A / 3S 65A</td></tr>
<tr><td>Temperature of the Handling Liquid</td><td>°C</td><td colspan="9">SS, FC : 0~80°C / PC : 0~50°C / Ambient temperature : 0~40°C</td></tr>
<tr><td>Max. Viscosity of the Handling Liquid</td><td>cp</td><td colspan="9">20,000</td></tr>
<tr><td rowspan="7">Controller : BLDC M/C UNIT</td><td rowspan="5">Driver</td><td colspan="2">Power</td><td colspan="7">200V: 1Phase/3Phase/AC200~240V , 400V: 3Phase/AC380~480V</td></tr>
<tr><td colspan="2" rowspan="2">Input (operation) Signal</td><td colspan="7">REMOTE: 4~20mA, LOCAL: By the keypad ▲ & ▼</td></tr>
<tr><td colspan="7">Remote control (REMOTE RUN/STOP)</td></tr>
<tr><td colspan="2">Output Signal</td><td colspan="7">ISOLATED 4~20mA/Operating & Over Current(Err) Relay Contact Output</td></tr>
<tr><td colspan="2">Effective Flow Control Range of Discharge Capacity</td><td colspan="7">Effective Flow Control Range of Discharge Capacity</td></tr>
<tr><td colspan="2">Others</td><td colspan="7">RATIO (Setting range: 0~100% based on remote input signal)</td></tr>
<tr><td rowspan="2">Power</td><td colspan="6">0.25KW / FR63</td><td>0.55kW/ FR71</td><td>0.75kW/ FR80</td><td>1.5kW/ FR90</td></tr>
<tr><td colspan="9">8 Poles Brushless DC / Max. rpm : 1750 / Insulation Class : F</td></tr>
<tr><td colspan="2">Painting</td><td colspan="9">Munsell No. 6.51B 4.99/9.55 (However, motor follows the manufacture's</td></tr>
<tr><td>Weight</td><td>kg</td><td>25</td><td>25</td><td>42</td><td>42</td><td>48</td><td>56</td><td>175</td><td>180</td></tr>
</table>

Notes) 1. Max. capacity is the value when Max. discharge pressure is applied(with room temperature & pure water).
2. The weight is based on a standard motor and a flange connection(SS Type).
3. Specifications above can be changed for improvement without prior notice.
4. Please refer the instruction manual enclosed separately for BLDC M/C UNIT operation.

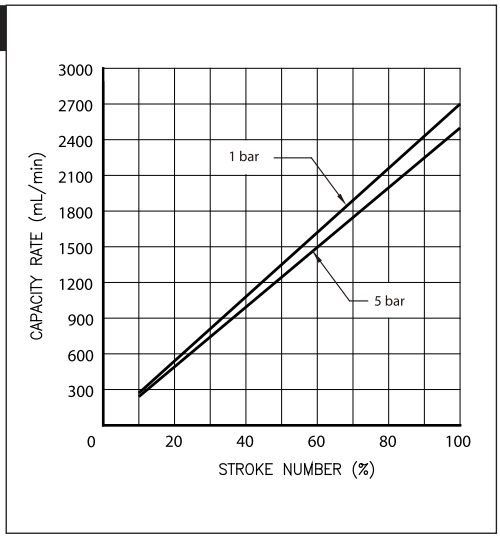
7 Performance Curves

• Condition: Clean Water, Room Temperature, Suction Head - (1M) BLDC TYPE

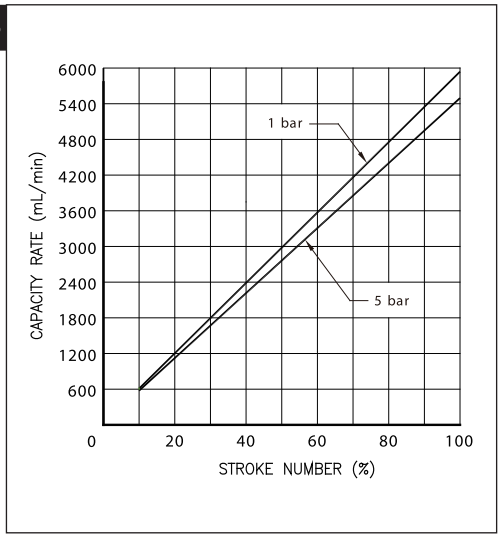
● PDS-1



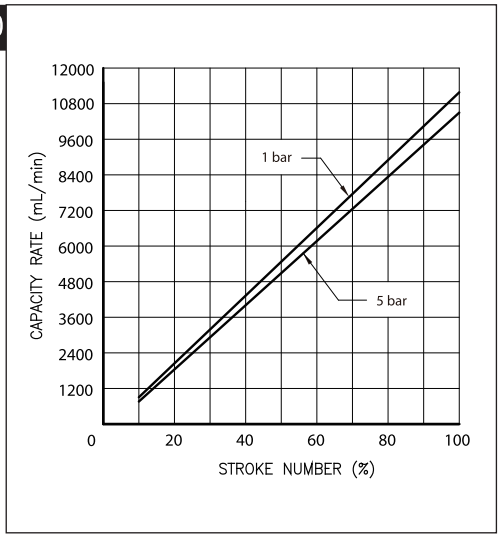
● PDS-3



● PDS-5



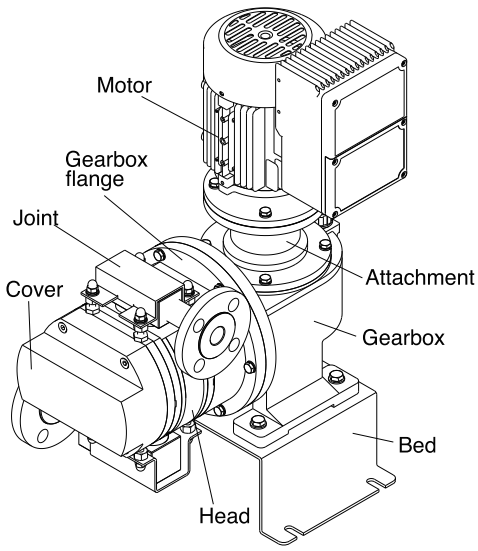
● PDS-10

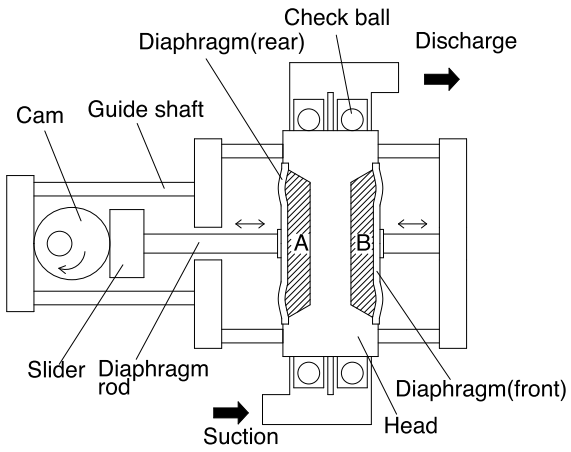


Notes) 1. Above performance curves were tested at our testing equipment under the fixed condition(Clean Water, Room Temperature, & 1m of Suction Head). Therefore, performance curves can be somewhat different in accordance with condition of job site after installation.
2. Check the discharge capacity(drawing the performance curve) in test operation after installation because discharge capacity can be changed according to piping condition and chemical's characteristic.

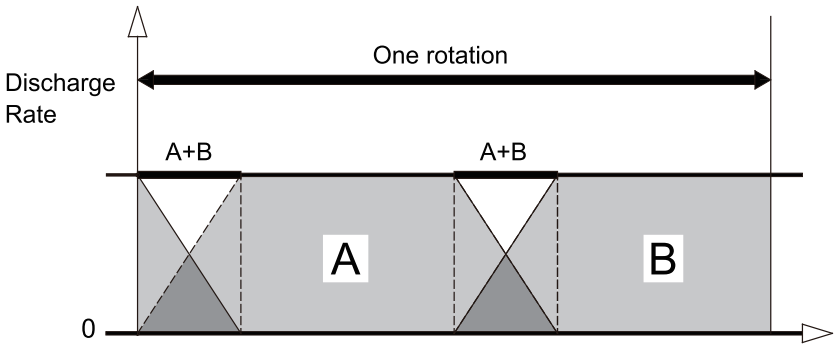
8 Operation Principle and Structure

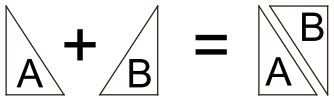
The rotation of the Motor is reduced by the Worm Gear and the rotational motion is converted to reciprocating motion by Eccentric Device(Eccentric Cam, Slider, Rod & etc.). This reciprocating movement changes the volume inside the pump through the diaphragm connected to its Rod, causing the pump to do its pumping action as results of the change of the volume inside the pump and the check ball installed at the head of the pump. The Smoothy metering pump removes pulsation through the flow of fluid having a trapezoid discharge waveform produced by a high-precision constant-velocity cam which is continuously discharged through the two liquid ends having a 180˚ phase difference.





●Discharge waveforms of the pulseless metering pump





The rate of discharge is kept uniform by overlapping the A and B section one anther.

9 Installation

9-1 Installation Place

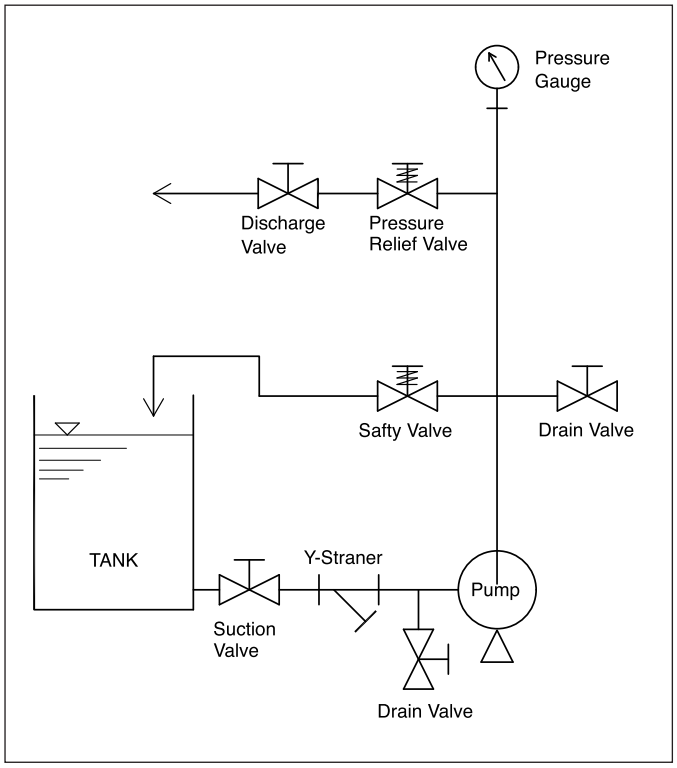
⚠ Caution

- Do not install this pump at the place where ambient temperature is higher than 40°C or lower than freezing point. If the pump is installed at the place, internals of pump may be damaged.
- Do not install pump in place with heavy moisture and dust, or in place with rain, and wind. It may cause electric shock and trouble.

1. If possible, install the pump lower than the minimum level of the tank.
2. Take sufficient space around the pump to facilitate maintenance or repair and also the motor and wiring should be connected safely in consideration of flooding.
3. The pump should be installed at the place where is flat surface and not affected by vibration of other equipments.
4. Pump should be installed on the concrete foundation or on the pedestal can be sufficiently supported. Also, check the level with a leveling instrument so that pump can be installed horizontally.

9-2 Piping (Universal Precautions)

1. Decide the piping system which can sufficiently satisfy suction & discharge condition.
2. Piping should be short and less bending as far as possible and be careful not to make the cavity at which air stay.
3. Install piping support lest piping load fall on the pump. Especially, in case of liquid end material of PVC, be careful about handling.
   Flexible joints are recommended to use to pump Liquid End Part.
4. Be careful that pump is not to be influenced with thermal stress of piping when transferring hot liquid or cold liquid.
5. Don't make U shaped bend in the piping when transferring easily precipitable slurry.
6. Install a flushing pipe line for maintenance and inspection when transferring viscous liquid,
   poisonous liquid, or coagulative liquid.
7. Choose the piping material that has sufficient corrosion resistance to the liquid and can endure the pressure applied in the piping.
8. Connect piping after flushing the inside of piping cleanly and remove the inspection sticker for preventing entrance of foreign substance on the discharge port.
9. Protect the piping with insulating material or keeping warm device, if the liquid may freeze inside of piping. In addition, Install drain valve at the suction & discharge side in order to drain the
   liquid inside piping after operation stopped.



9-3 Suction Piping

1 Suction piping is made with drop method as far as possible. Also, the diameter of the suction piping should be larger than or same with the suction diameter of the pump.
2 Carefully connect the joint of suction piping in order to prevent air inflow into the piping. Discharge rate of pump can be destabilized by air Inflow into the piping.
3 Make piping length of suction side as short as possible. If it is too long, cavitation occurs and regular discharge rate can't be assured.
4 Install a strainer on the suction piping because it make unstable performance that foreign substances flows into pump head.

9-4 Discharge Pipe

1 Safety valve should be installed at a place near to discharge pipe of the pump and do not install any other valves between the pump and the safety valve.
2 Use a discharge pipe of which internal pressure is higher than the set value of the safety valve. Also, carefully fit the joint of the discharge pipe.
3 If discharged at the pressure below than atmospheric pressure, keep the pipe end higher than the water level of the tank or install the back pressure valve to prevent siphon phenomenon. (The pulse rate could be increased after installing the back pressure valve, so consult an expert before installing it.)
4 Install pressure gauge for daily inspection of the discharge pressure.

9-5 Electrical Wiring

⚠ Warning

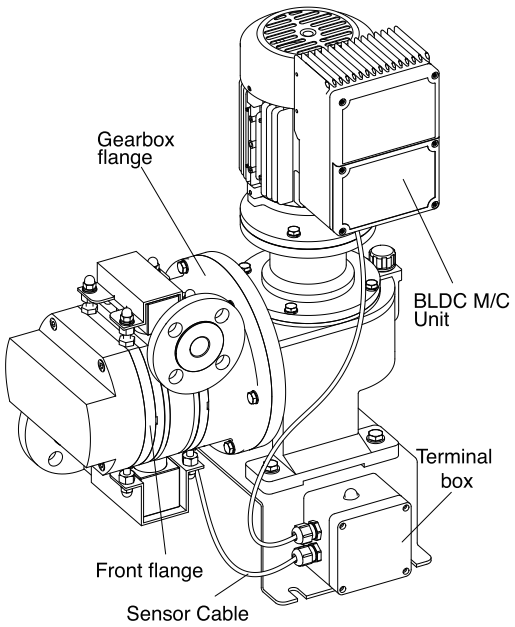
- Do not touch with wet hands. Electric shock may occur.

⚠ Caution

- After checking the power specification of the BLDC M/C UNIT before wiring, connect the pump to the rated power. If not, it may cause trouble and fire.
- Pump should be properly grounded in order to prevent electric shock.
- Entrust the wiring to electrical engineer.
- Install regulated Magnet Switch and Thermal Relay for the adjustment and maintenance of the pump.
- Use standardized parts in wiring and fully pay attention to safety in accordance with the technical standard & wiring regulation of the electrical equipment.
- Reverse rotation of the motor causes trouble, so wire the motor's power so that the motor's rotation direction is clockwise.(This is only for Inverter and general motor.)

9-6 Diaphragm Damage Sensor

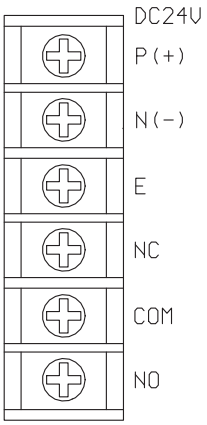
A detector sensing damage to the diaphragm is added to the PDS pump series, which is designed to sense any damage to the diaphragm during pump operation and stop the pump to protect the pump system. A sensor is mounted on the gear box flange and the front flange; when the diaphragm gets damages, it senses fluid leaked at its back and sends a signal. This system is easy to install.
The BLDC M/C UNIT or a separate inverter receives the detection signal and brings the pump to a stop.



1 The diaphragm sensor and the BLDC driver are wired at the factory before the product is shipped.
2 The lamp gets lit when the sensor detects any damage to the diaphragm. The operator can monitor damage to the diaphragm using the trip of the BLDC driver terminal block.
3 When an induction motor is used, the operator can monitor the condition of the diaphragm using the relay of the detector. Do wiring to the terminal block of the detector in reference to the following instruction.

Input Power : DC24V 300mA
Relay Spec. : SPDT 2A DC30V
Cable Standard : AWG18~26
Cable Connector Standard : PF 3/4″

P(+), N(-) : Input Power
E : Ground
NC, COM, NO : Relay



10 Operation

10-1 Preparation

⚠ Caution

- Some water may be remained in the liquid end part of pump after final performance test. In case of use for some liquids reacting radically to water, remove water in the pump and dry the pump necessarily.

When operating pump for the first time after installation, please check the following conditions.

1 Check if there is oil leakage caused by any damaged parts or loosened bolt.
2 Check the oil gauge to see if the driving part of pump is filled with the oil of regulated amount. (The normal position of the oil level is the middle red point of the gauge.)
3 Check if all of accessories, liquid to be transferred, and power supply necessary for pump operation are ready.

10-2 Operation

1 Open the suction and discharge valves.
2 Check the rated power and turn on the pump. Check if the motor fan rotates clockwise. (This is only for inverter or general motor)
3 Open the discharge side up to the atmospheric pressure, and increase the discharge amount slowly up to 50%. Connect to the flange of the discharge side, and then operate test run for 30minutes. Caution) 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 test run, set the discharge capacity to 100% and increase the pressure of the discharge side up to the setting one. Check if the BLDC controller works properly and if every part works properly.

10-3 Control of discharge amount

⚠ Caution

- Do not use the controller (BLDC M/C UNIT) below 10%.

1 The discharge amount can be controlled by the controller (BLDC M/C UNIT).
2 The controller can operate within 10 ~ 100%, but its effective flow rate-controllable range is 20 ~ 100%. (Within 20 ~ 100%, the discharge amount is stable)

10-4 Restart of pump

⚠ Warning

- Do not operate when suction valve and discharge valve are closed or do not close suction valve and discharge valve during operation. Pump and piping may be damaged with excessive pressure rising and liquid may spout when operation under valve closing.

1 In case of stop pump operation for short period(less than 1 week), run the pump at a desired stroke length & prescribed discharge pressure after air bleed operation.
2 In case of stop pump operation for a long period(more than 1 week), the pump should be run at atmospheric pressure of discharge side for several minutes before going into normal operation. Do not start regular operation before above warming up.(Set the controller to 50%)

3 It is concern that pump is damaged by freezing during winter season. Without regard to stop perioed of operation, drain the liquids in the piping and pump by operating dry run after opening the drain valve on the suction piping.
4 In case of stop pump operation for a long period(more than 1 week), the pump should be run at atmospheric pressure of discharge side for several minutes before going into normal operation.
Do not start regular operation before above warming up.(Set the controller to 50%)
5 It is concern that pump is damaged by freezing during winter season. Without regard to stop perioed of operation, drain the liquids in the piping and pump by operating dry run after opening the drain valve on the suction piping.

10-5 Confirmation of discharge amount

If pump has no problem, check the discharge volume under actual running condition with measuring device such as mass cylinder.
1 If discharge volume had no fluctuation after repeated measurements, the pump is judged to be running normally.
2 When the discharge amount increases/decreases by changing the motor speed, measure the discharge amount one minute or more after the change.
Note) If you request the test report, 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 change due to adherence of transferred liquid to the check valve etc., so, always clean 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 life time of parts, so please refer to “14. Consumable Parts”. For other questions, please contact us.

11 Maintenance & Inspection

⚠ Warning

- Turn off the power and stop the pump & other equipments when repairing or disassembling pump, otherwise it may cause electric shock.
- Be careful of big accidents caused by inserting fingers or cloth in rotator.

⚠ Caution

- Wear suitable protective clothing during assembly and disassembly work
- Work after releasing pressure from discharge piping and remove liquid from Liquid End Part prior to repair or maintenance of pump.

11-1 Inspection before operation

1 Check the level of liquid tank and, if it is insufficient, supplement the liquid.
2 Check if the suction & discharge valve are opened.
3 Check if piping is safe and undamaged.
4 Check electrical wiring if there are no electrical short & disconnection.

11-2 Inspection during operation (Daily inspection)

1 Check the level of liquid tank and, if it is insufficient, supplement the liquid. Specially, be careful in the process which handle the chemical solution or required Air-Free circumstance.
2 Check if liquid or air is leaked out the Joint or other parts. If necessary, fasten it again.
If leakage doesn't stop, check O-ring and/or Packing of each parts and replace the damaged O-ring and/or Packing with new one.
3 Check if noise sounds from the motor or pump.
4 Check if the oil in the driving part is sufficient or leaky. If insufficient, refill the oil up to regulated level of the oil level gauge.
5 Check if there is no problem in the setting discharge rate & discharge pressure.
6 Check if the pressure gauge is normal.
7 If there is a standby pump, operate it periodically. Maintain it so that it can work whenever.

11-3 Long-term stop

1 Wash inside Pump Head of suction side and flush water or cleansing solution through Pump Head for about 30 minutes.
2 Put the cover on the pump to protect the pump from dust and/or corrosion.
3 Check foreign substances lay on the Check Valve before restarting the pump.

11-4 Other Maintenance

1 When diluted liquid is used at freezing place in the winter, install heat tracing and humidifier to prevent the pump from freezing because it causes the damage of the pump & other devices with freezing on the liquid end part of pump and inside piping.
2 Clean the inside of tank and joint every 3 months at least.

11-5 Supplement of oil

1 Change of oil in the driving part

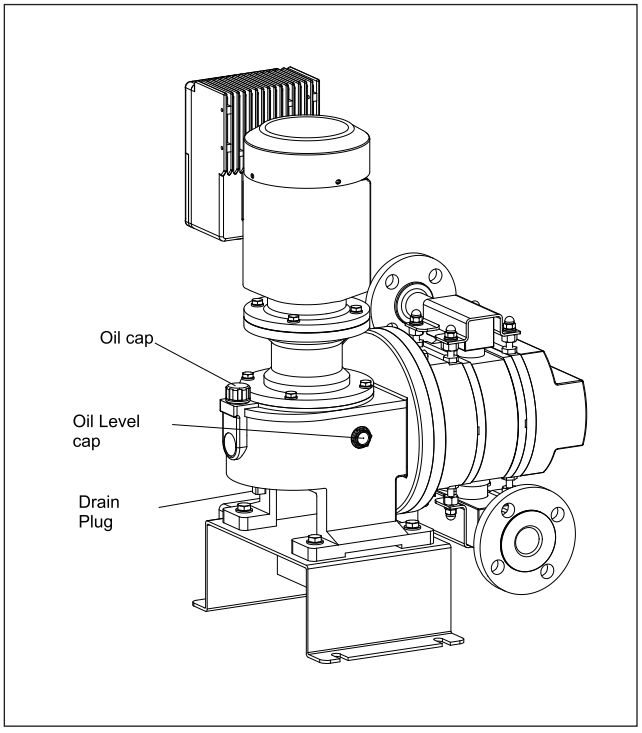
① Changing interval
Change oil after 500 hours when initial operation after buying it, and thereafter, change oil every 4,000 hours of continuous operation. However, when emulsification or deterioration of the oil occurs, change the oil immediately.

② Changing method
- Turn the dial to 0%, loosen the (square) plug with spanner, and drain the used oil. Next, clean the inside with flushing oil.
- After fastening the plug, refill new oil slowly through the oil inlet(Oil Cap) up to the regulated level(Red points) of the oil level cap

MODEL	PDS-1~10
Suitable oil amount	950 mL

③ Recommended oil
- Shell's Omala #220 (※)
- Mobile's Gear oil #630
- Other gear oil with the viscosity grade of ISO VG220, SAE90

Note) (※) means the oil used by us.



12 Cause & Action Probloblem

Problem	Cause	Action
Pump does not work	The circuit breaker opens or the fuse is burnt	Look into the cause and take action
	Cables are broken	Connect or replace
	Wrong wiring	Check the wiring diagram
	Low voltage	Investigate and take action
	Poor insulation	Replace
	The bearing becomes damaged	Check and replace
	The reduction gear gets damaged	Check and replace
Pump work, but does not discharge fluid	The supply tank is empty.	Refill fluid
	Cavitation occurs in the fluid	Check the NPSH and take action
	Air gets in at the suction-side pipe	Inspect and repair piping
	The suction pipe gets clogged	Wash piping and check the condition of the fluid
	The ball seat gets blocked by foreign matter	Wash & check and then install the strainer
	The safety valve leaks	Re-adjust the preset pressure. Inspect and repair
Pump produces insufficient amount of discharge	The motor rotates very slowly	Check the wiring for voltage and frequency
	The amount of discharge was not calibrated correctly	Check the measurement method and measuring instruments
	Insufficient suction pressure	Increase the water level of the supply tank and enlarge the pipe's diameter
	Insufficient discharge pressure	Install a back pressure valve
	The suction pipe gets clogged	Clean the piping and check if the fluid flows properly
	Air comes into the suction pipe	Inspect and repair the piping
	The ball seat and/or check ball become dirty or damaged	Clean or replace
	The piping or pump leaks at joints	Inspect and repair
	The O-ring of the valve gets damaged or defective	Replace
	The constant velocity cam gets worn	Replace
	The diaphragm becomes obsolescent or damaged	Replace
	Cavitation occurs in the fluid	Examine the NPSH and take action
Lubicant leaks	The oil seal gets damaged	Replace
	The lubricant gets contaminated	Check for causes and replace
Fluid leaks a lot	The pressure gauge has broken down	Replace
	The diaphragm gets damaged	Replace
	The valve's O-ring gets impaired and in poor condition	Replace
There is much noise and excessive heat	The atmospheric temperature is high	Improve the installation condition
	The suction pipe is clogged	Wash the pipes
	The bearing is damaged	Check and replace
	The reduction gear is damaged	Check and replace
	Cavitation occurs in the fluid	Examine the NPSH and take action
	Lubricant is insufficient or overflowing	Drain or refill the lubricant to the specified level
	The constant velocity cam gets worn	Check and replace
	The lubricant used is of different specification	Replace it with a specified lubricant
	The motor gets overloaded	Inspect and adjust the discharge pipe system
	The power supplied is improper	Check and repair
	The drive does not work smoothly	Check if it has any driving parts worn out or corroded.

Notes 1. Conduct inspections regularly to keep the pulse rate stable.
2. Refer to the User Manual for any problems relating to the BLDC M/C unit, and contact us if you want to have more information.

13 Replacement of Parts

⚠Warning

• Wear the protective equipment because any liquid which remains inside the pump may come out during disassembly and cause fatal injury to human body.

※Refer to「18. Structure and Name of Check Valve」for assembly and disassembly.

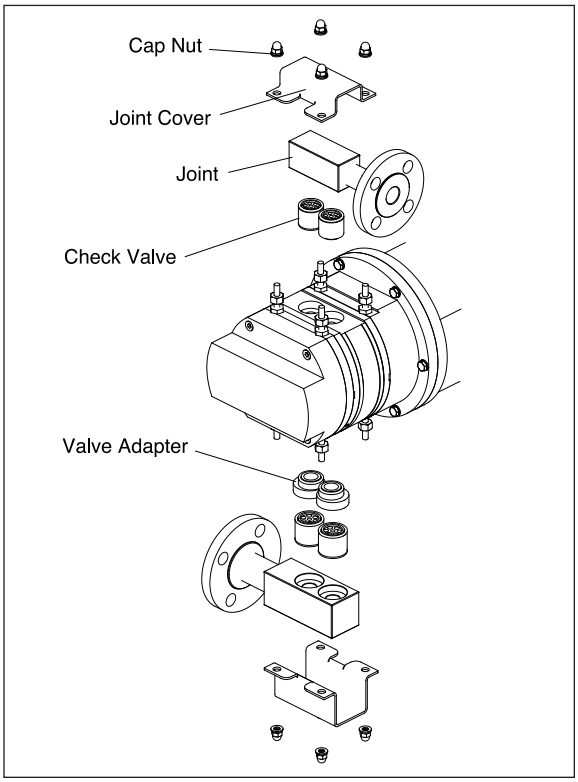
13-1 Replacement of Ball Stopper, Ball Guide, and Check Ball

1 Disassembly

① Unfasten the pipes of the suction and discharge sides.
② Unfasten cap nut of suction and discharge sides, and take out each part. Be careful of any liquid which remains inside the pump may come out.
③ Inspect the each part of Check Valve, and clean or replace.

2 Assembly

① Refer to「18. Structure and Name of Check Valve」for assembly.
② Fasten tightly after connecting to companion piping.



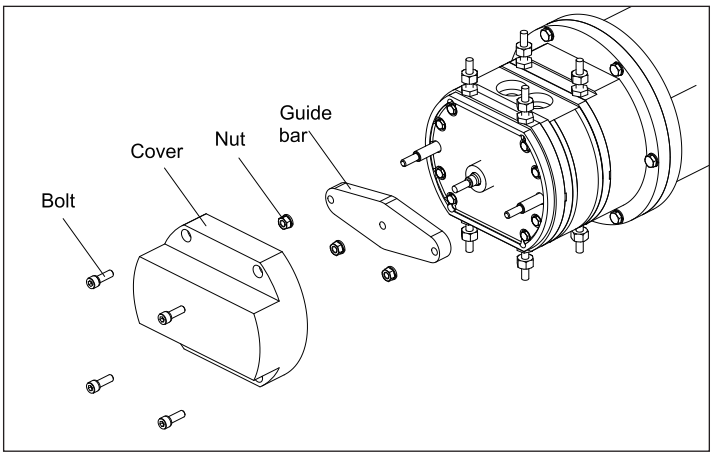
⚠Caution

• Assemble while paying attention to the direction of the value (top: ball stopper). If the order is reversed, the fluid flows reversely, when the pump may get damaged.

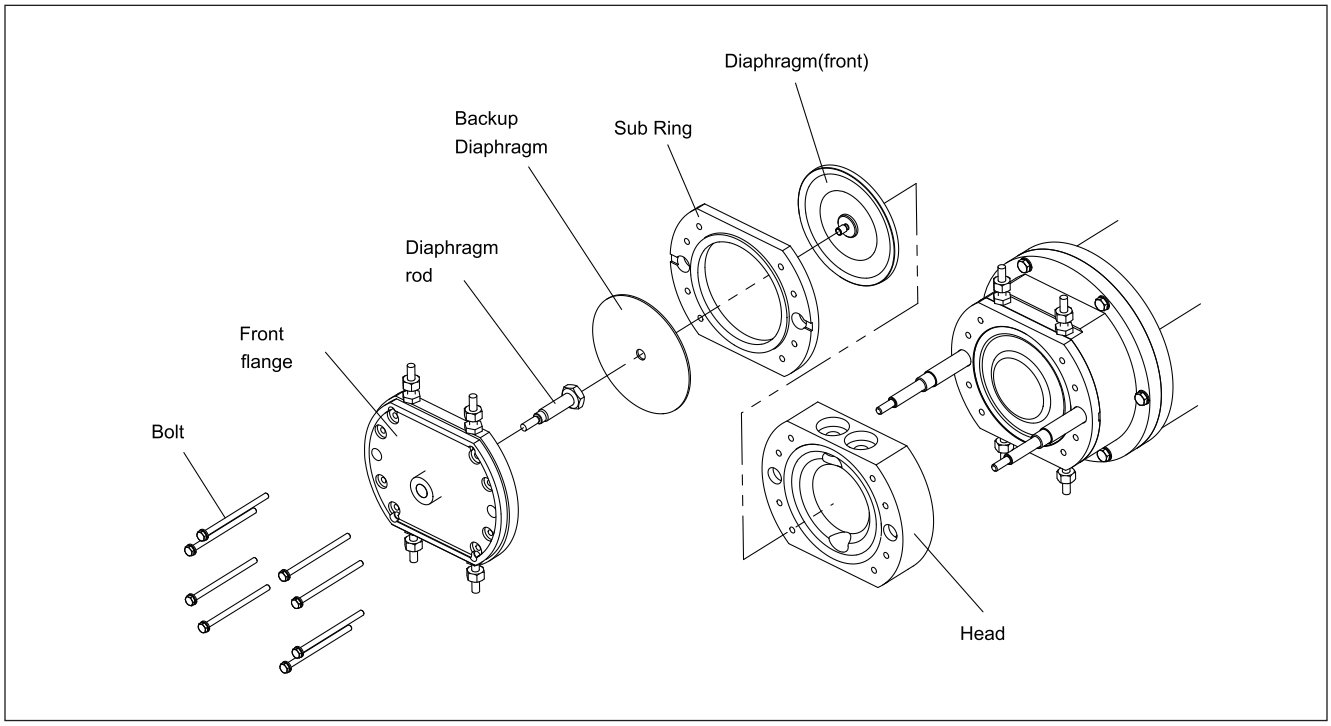
13-2 Replacement of Diaphragm

1 Disassembly

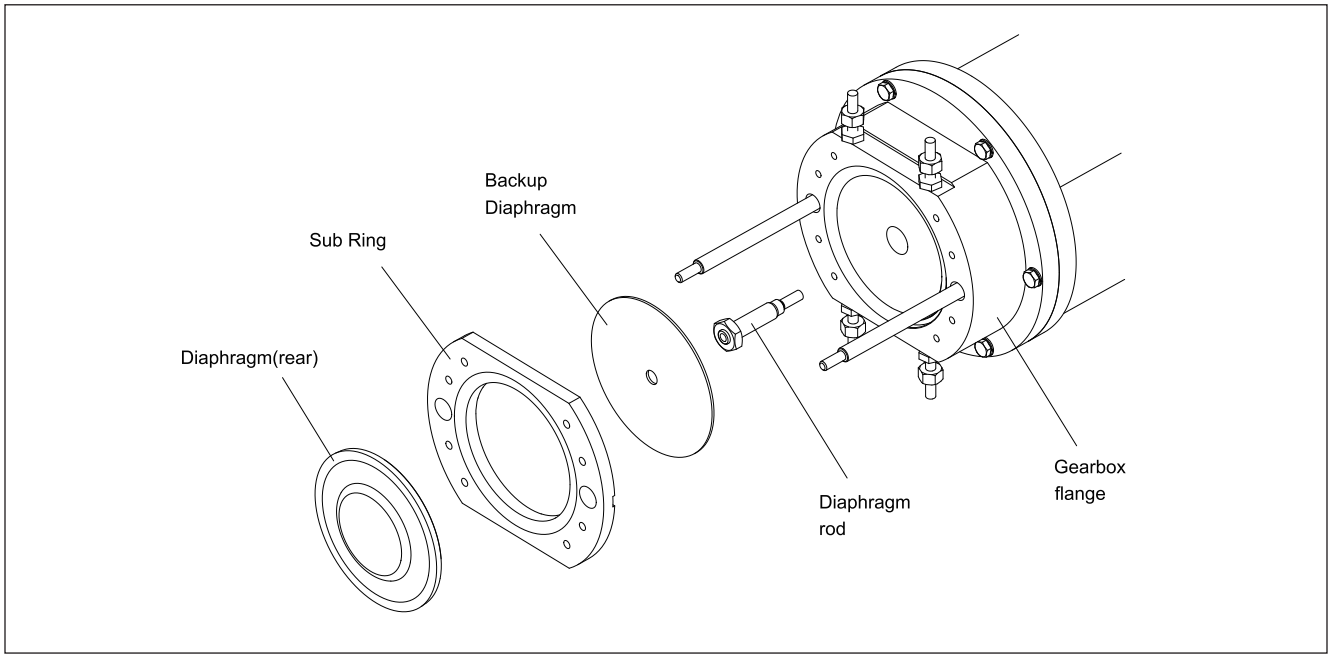
① Unfasten the pipes at the suction-side and discharge-side joints.
② Disassemble the joints in reference to「13-1」.
③ Unscrew the wrench bolts and separate the front cover.
④ Loosen the hexagon nut holding the guide bar using a spanner and disconnect the bar.



⑤ Unscrew the head fixing bolt using a spanner to separate each part such as front flange, sub-ring, and head.



⑥ Unfasten the diaphragm rod with a spanner and then disassemble the front diaphragm.
⑦ Rotate the motor slowly and hold the outer part of the diaphragm when the stroke length of the back diaphragm reaches 100%. At this time, rotate it counter-clockwise to disassemble the diaphragm.



⑧ When the diaphragm displays any sign of abrasion or impairment, replace it with a new one.

2 Assembly

① Assemble it in the reverse order of disassembly.
② When the pump's head bolts are tightened, be sure to give the head fixing bolts uniform force (torque) in the diagonal direction. ※ Recommended torque: 9.8N·m (100kgf·cm)

14 Consumable Parts and Spare Parts

14-1 Consumable part

Part Name	Q'ty	Recommended replacement period
intervalCheck valve	4	1 year
Diaphragm	2	4,000 hours
O-ring (liquid end)	8	1 year
Oil Seal	3	1 year
Reduction gear	1	1 year
Velocity cam	1	1 year

Notes) 1. The each quantity is per a pump.
2. The recommended replacement period is not guaranteed.
It may vary depending on on-site condition.

14-2 Spare Part

• Spare part(s) for 3 years : bearing / Spare part(s) for 3 years or longer: motor

15 Warranty

⚠Warning

• If the pump is reconstructed arbitrarily or the undesignated parts are used into the pump, Cheonsei will not warrant and Cheonsei is not responsible for any expense caused by accident or trouble.

1 Warranty period is one year from purchase date.
2 During warranty period, repair or change of pump is free of charge if trouble or damage of pump due to design or manufacturing of Cheonsei. (※ Consumable parts are excluded.)
3 Repair or change product due to following reasons will be charged regardless the warranty period.
① Trouble or damage of pump expired warranty period.
② Trouble of using by careless handling.
③ Trouble or damage due to using non-designated part & reconstructing the pump arbitrarily.
④ Trouble by fire or natural disaster

16 Repair Service

⚠ Caution

• When the pump is sent to factory for repair service, clean out inside of pump.
• If the pump has been used for harmful & fatal liquid to health, please consult with before sending it.

1 Contact to Cheonsei or local distributor as shown on back of the manual if you have any problem or questions.
2 If you want to repair, please inform the following.
① Model Name & manufacture number written in name plate
② Used period, using condition, state, and transfer liquid
3 If warranty period is over, it may charge according to repair part. Please contact with sales agent for more information.
4 Minimum retention period of parts for repair is 5 years from the date of production.

17 Accesories

1 Back Pressure Valve
According to the conditions of the piping, the discharge rate may be excessive or the pumping liquid may be continuously leaked in spite of stopping the pump which is caused by overfeed or siphon phenomena. The back pressure valve is for preventing such things.

2 Safety Valve(Relief Valve)
When the discharge pressure increases to more than a setting point due to choking the valve with debris or closing the valve, the safety valve will open automatically to relieve the pressure.
Relief valve prevents pump and piping from damages.

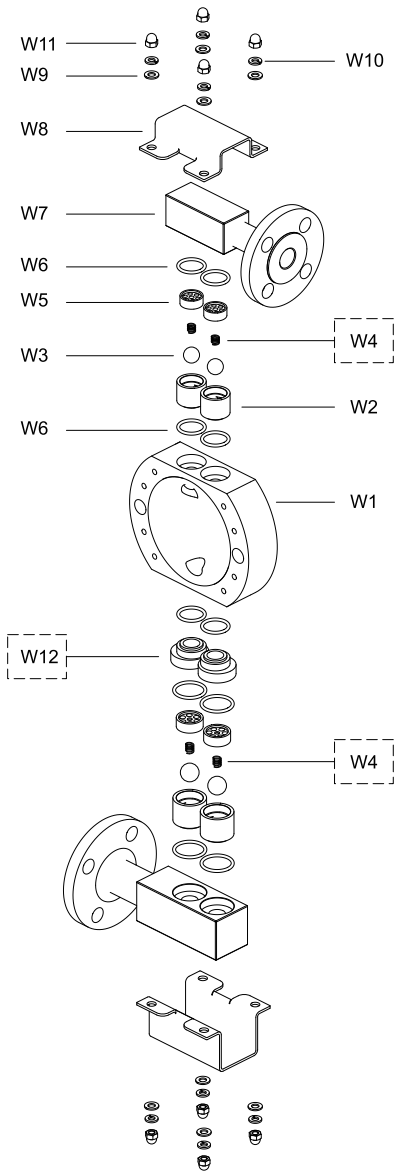
18 Structure & Part Name of Check Valve

18-1 Check Valve

1 Model : PDS-1, 3, 5,10-P□, F□, S□

No.	Part Name	Q'ty
W1	Head	1
W2	Ball Guide	4
W3	Check Ball	4
W4	Spring	4
W5	Ball Stopper	4
W6	O-ring	8(10)
W7	Joint	2
W8	Joint Cover	2
W9	Washer(Flat)	8
W10	Washer(Spring)	8
W11	Cap Nut	8
W12	Valve Adaptor	2

W4 is only for high viscosity type.
W12 is only for PDS-10 type.



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