

# INSTRUCTION Manual

Oscillating Piston Dry Compressor  
(For device installation)

DOP-81SP

## Request to Users

Please read this manual thoroughly to ensure safe and effective use of the equipment.

Keep this manual in a safe place.

Due to periodic improvements in performance, the equipment described in this manual is subject to changes in dimensions and specifications without prior notice.

ULVAC KIKO, Inc.

# Contents

Pages with a shaded background are those which contain items related to safety.

Before Using the Equipment .....	01
Checks When Opening Packaging .....	02
Using the Pump Safely.....	03
• Safety icons .....	03
• Cautions for Safety in Use .....	04
1. Product Outline .....	1
1.1 Purpose of Use and Prohibitions .....	1
1.2 Specifications .....	1
1.3 Thermal Protection Relay .....	2
2. Dimensions, Product Safety Signs and Labels .....	3
3. Installation and Storage .....	5
3.1 Cautions for Installation and Storage .....	5
3.2 Environmental Conditions for Installation, Storage, and Operation .....	5
3.3 Location .....	5
3.4 Electric Wiring .....	5
3.5 Fluctuations in the power voltage and frequency .....	6
3.6 Checking Operation After Installation .....	6
3.7 Piping .....	7
3.8 Storage.....	7
4. Cautions for Operation .....	7
4.1 Cautions for Operation .....	7
4.2 Operation of the Thermal Protection Relay .....	7
4.3 Starting in Cold Weather .....	8
5. Pump Performance .....	8
5.1 Discharge Rate(Flow Rate) .....	8
5.2 Power Requirements .....	8
6. Maintenance, Inspection, and Repair .....	9
6.1 Cautions for Maintenance, Inspection, and Repair .....	9
6.2 Maintenance .....	9
6.3 Regular Inspections .....	9
6.4 Replacing and Cleaning Consumables .....	10
6.5 Troubleshooting List .....	16
7. In Conclusion .....	17
• Warranty .....	17
• Usage Status Check Sheet (used with requests for disassembly and repair)	
• Product information, service bases, and contact information	

## Figures and Tables

Fig.2.1 DOP-81SP Dimensions.....	3
Fig.2.2 DOP-81SP Labels Locations.....	4
Fig.3.1 Instillation Method of Earth Screw.....	5
Fig.3.2 Change region of the voltage and frequency .....	6
Fig.3.3 Example of Piping Used When Evacuating a Vessel .....	7
Fig.5.1 Discharge rate(Flow rate) characteristic diagram 【Reference】 .....	8
Table 1.1 Product Specifications.....	1
Table 1.2 Current rating (recommended value) of protective devices.....	2
Table 2.1 Product Safety Signs and Labels .....	4
Table 6.1 Consumables List.....	9
Table 6.2 Locations for Maintenance and Inspection.....	10
Table 6.3 Troubleshooting List.....	16

## **Before Using the Equipment**

Thank you for purchasing this product. Your custom is very much appreciated. This pump is designed for pressurization only and may malfunction or cause accidents if not handled appropriately. Read the manual thoroughly, and pay due attention to inspections, maintenance, and safety.

### **Personnel Handling the Equipment**

Only persons who have read this manual thoroughly, and have sufficient understanding of safety, pump specifications, and method of operation, may operate this pump.

### **Read the Manual Thoroughly**

Read the manual thoroughly in order to use the equipment correctly. Read the section on Safe Use particularly closely.

### **Keep This Manual in a Safe Place**

After reading this manual, be sure to keep it in a safe place which is readily accessible to others needing to use it.

### **Copying This Manual Is Prohibited**

No part of this manual may be copied for use by a third party without the express permission of the manufacturer.

### **Statutory Requirements for Disposal**

Follow all statutory and local authority regulations when disposing of this pump.

### **Safety During Repair**

Please provide a full description of the circumstances of use (particularly the use of dangerous materials) for the safety of repair personnel when requesting the manufacturer for repairs to the pump. Your request for repair of may be refused if these circumstances are unclear.

## Checks When Opening Packaging

Check the following after opening the packaging.

- (1) Is the product as you requested?
- (2) Are the accessories and necessary parts included?

Standard accessories

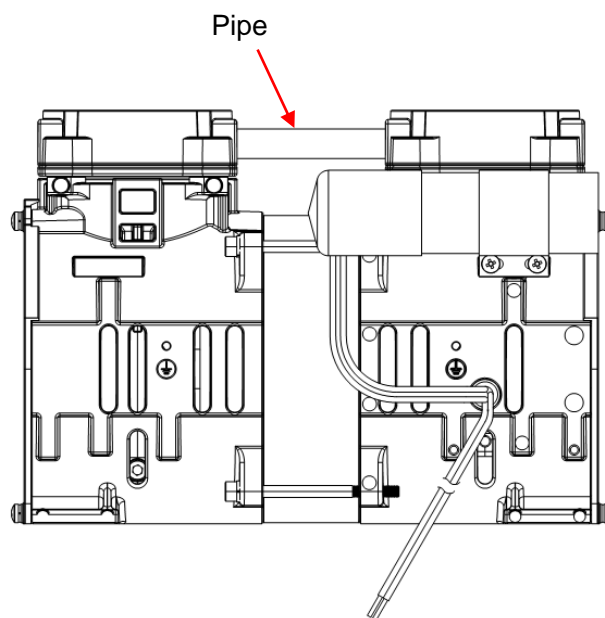
- Instruction manual ----- x 1
- Inlet and outlet caps (fitted to inlet and outlet) ----- x 2

- (3) Is the pump damaged in any way?
- (4) Are any external screws or inlet and outlet pipes loose? Are any components missing?

Contact your agent or the sales division of the manufacturer if there are any problems with the pump.

### Note

1. Ensure that the pipe on the side of the pump is not gripped or bent when removing the pump from the packaging. Holding the pump by this pipe may damage it, thus reducing pump performance.
2. Always remove the outlet cap before using the pump.
3. Fit an inlet filter if there is a possibility of foreign matter or dust particles entering the pump.



## Using the Pump Safely

To ensure that the pump is handled correctly, read this section thoroughly before use.

This manual and the warning labels on the pump include safety icons as an aid to understanding safety requirements.

These safety icons warn the operator and others of possible dangers and damage and should always be followed.

- **Safety icons**

The meanings of the safety icons are as follows.



### **Danger**

Incorrect handling of the equipment is very likely to result in death or serious injury to the operator.



### **Warning**

Incorrect handling of the equipment may result in death or serious injury to the operator.



### **Caution**

Incorrect handling of the equipment may result in light or medium injuries to the operator or damage to the equipment.



### **Note**

Incorrect handling of the equipment may result in damage to the equipment and hinder its correct operation.



### **High Temperatures**

Some components reach surface temperatures in excess of 60°C during pump operation. Burns may result if these components are touched during operation.



### **Electric Shock**

Turn off the main power supply before performing electrical work or wiring. It may lead to electric shocks.

## • Cautions for Safety in Use

### **Danger**

#### Applications

- (1) This pump is not designed to be explosion-proof, and should therefore not be used to discharge explosive gases.
- (2) In addition to discharge of gas via the outlet, gas may also leak from other parts of the pump, and it should therefore not be used with toxic gases. If toxic gas is discharged for any reason it is important to note that the interior of the pump will be contaminated by the gas, requiring appropriate caution during maintenance.

#### Maintenance and Repair

- (3) When requesting the manufacturer's service division to dismantle and repair the pump, always note the gas which the pump has been used with on the Usage Check Sheet. Note that if it has been used to discharge toxic gas for any reason it will be contaminated. **Please be aware that use with some gases will preclude dismantling and repair.**

### **Warning**

#### Installation

- (1) Do not use the pump in an explosive atmosphere. Such use may result in injury and fire.
- (2) Ensure that there are no inflammable materials such as solvents in the vicinity when using the pump.
- (3) Ensure that the motor is freely ventilated to prevent overheating which may result in fire or burns.

#### Power Supply

- (4) Always switch off the main power supply, and make sure that the pump has stopped, before carrying out inspection and repair.
- (5) Ensure that the relevant wiring is in accordance with technical standards for electrical equipment and wiring regulations. Incorrect wiring may result in fire.
- (6) Always switch off the main power supply before installing electrical wiring. Carrying out work on the pump while the power is connected may result in electric shock.
- (7) Always ensure that the pump is correctly earthed. A dedicated earth leakage breaker is recommended. Failure to earth the pump correctly may result in electric shock if a fault or earth leakage occurs.
- (8) Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with operation of the overload protection device, and this may result in the motor burning out, or fire.
- (9) Do not damage, modify, pull the power cord, or place objects on it. Damage to the cord may result in electric shock or fire.
- (10) Ensure that the power cord used for the pump is appropriate for the rated voltage and current. With each core wire having a cross-section area of 0.75mm<sup>2</sup> or more.
- (11) Switch off the main power supply, before disconnecting the power cord from the pump. Failure to do so may result in electric shock.
- (12) Touching the power cord with wet hands may result in electric shock.
- (13) Touching electrical wiring etc while inserting the power cord may result in electric shock.
- (14) The electric motor fitted to this pump incorporates a thermal protector. However for safety reasons therefore, it is necessary to fit an overload (over current), protection device and an earth leakage breaker.

## **Warning**

### Operation

- (15) This pump is not designed to be explosion-proof. When using the pump, ensure that there are no inflammable materials such as solvents, or explosive gases, in the vicinity. Use under such conditions may result in injury or fire.
- (16) Inserting fingers or objects into the motor inlet may result in electric shock, injury, or fire.
- (17) There is fear of the explosion. Please do not drive the pump with the exhaust side shut. Pressure in the pump rises, and the main body of the pump might explode, and the motor become an overload. The limit value of pump internal pressure is 0.50MPa (gage pressure). Please install the protection instrument such as safety valves.

### Maintenance and Repair

- (18) The pump should be dismantled or repaired only by a repair technician trained by the manufacturer.
- (19) To prevent ingestion of microscopic particles resulting from wear of components, use a dust mask and gloves when replacing cup packing, inlet and outlet valves, and gaskets.

## **Caution**

### Installation

- (1) Microscopic particles resulting from wear of components are discharged from the outlet and contaminate the room. If necessary, connect a pipe from the discharge outlet to the outside of the building.
- (2) The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.
  - 1. Ambient temperature of 7~40°C and maximum relative humidity of 85% during operation.
  - 2. Other conditions for storage and operation.
    - a) Level floor of sufficient strength.
    - b) No condensation
    - c) Dust-free environment
    - d) Well ventilated
    - e) Environment free of corrosive or explosive gas.
    - f) Not subject to direct sunlight.
    - g) No danger of fire.
    - h) Maximum ambient temperature of 40°C during assembly of pump.
    - i) Free of soot and oil.
    - j) Free of splashing or flooding.
    - k) Keep it indoor ventilated.
    - l) When installing the pump, avoid mounting a pump directly on the base. Employ anti-vibration rubber between the base and the pump.

### Operation

- (3) Do not use in applications involving organ transplants, or contact with body fluids or living tissue.
- (4) Touching rotating components (e.g. motor, main shaft, axial joints, cooling fan) while the pump is in operation may result in injury.
- (5) The overload protector operates when the pump becomes excessively hot. Touching it in this condition may result in burns.
- (6) Touching the pump while the pump is in operation or while it is still hot immediately after having been switched off may result in burns.
- (7) Do not insert fingers or objects into, or peer into, the inlet or outlet during operation.
- (8) Ensure that the customer installs a trap if steam is generated. Ensure that condensate does not enter the pump. A malfunction may result if condensate enters the pump.



## **Caution**

### **Maintenance and Repair**

- (9) Dispose in accordance with legislation for disposal and cleaning of waste products, handle as industrial waste, and do not incinerate.
- (10) If the pump ceases operation, turn power OFF immediately to prevent accidents, remove the power cord from the wall outlet, and contact your dealer or the manufacturer for inspection and repair.
- (11) Leave the pump for at least 30 minutes until it has cooled, and begin operation again. Touching the pump immediately after it has stopped may result in burns.
- (12) As the pump is not protected against entry of water, it is not guaranteed against splashing or flooding.

## **Note**

### **Installation**

- (1) The pump may malfunction if it is subjected to shocks or tipped over on its side.
- (2) Do not grip or bend the pipe on the side of the pump. Any damage to this pipe may reduce the performance of the pump.
- (3) By removing the fixed rubber legs, do not install the pump directly to the system. There would be a case that the pump casing is deformed and a load occurs to the motor bearing.
- (4) Fit an inlet filter if there is a possibility of foreign matter or dust particles entering the pump.
- (5) Use ventilation holes, and fit a cooling fan, to reduce the temperature in the vicinity of the pump. Ensure that the pump cooling fan inlet is not blocked. Ensure that a space of at least 100mm is available on all sides of the pump.

### **Application**

- (6) This pump is not designed to be corrosion-resistant. It should only be used with clean air at normal temperatures, or gases with equivalent characteristics.
- (7) This pump is only for pressure pumping, and must not be vacuumed.
- (8) In addition to discharge of gas via the pump outlet, gas may leak from the pump itself. Do not use the pump to evacuate toxic gases. If the pump is used to evacuate toxic gas, appropriate care is required during maintenance.
- (9) The pump will not often operate normally if it is used with corrosive gases, organic solvents, liquids, or condensed gases (e.g. steam).
- (10) The pump will not often operate normally if it is used with gases containing particles or dust etc. Always fit a filter to the inlet.

### **Operation**

- (11) Use the pump at an ambient temperature of 7 – 40°C. The life of the pump will be severely reduced if it is operated at high temperatures.
- (12) Application of back pressure at the pump outlet will overload the motor and may prevent the pump starting.
- (13) When the thermal protection relay operates the pump will be extremely hot. Touching the pump in this condition may result in burns.

### **Maintenance and Repair**

- (14) The fine clearances used in this pump require skill in its assembly. If a repair technician is unavailable, replacement of all consumables should be left to the manufacturer's service division.

# 1. Product Outline

## 1.1 Purpose of Use and Prohibitions

This product is a piston dry pump(compressor) employing reciprocating motion of cup packing.  
Observe the following prohibitions to ensure normal operation of the pump.

### Prohibitions

#### **Warning**

- (1) This pump is only for pressure pumping, and must not be vacuumed.
- (2) Do not re-sell, repair, or modify this pump without the approval of the manufacturer.

#### **Note**

- (3) This pump is not designed to be corrosion-proof. Use it only with clean air at normal temperature, or gases of equivalent characteristics.
- (4) Do not attempt to discharge gases containing particles, dust, water, or corrosive gases.  
If moisture is aspirated, aspirate the atmosphere for about 10 minutes before pump stop to dry the interior of the pump.

## 1.2 Specifications

Table 1.1 Product Specifications

Model		DOP-81SP
Discharge rate (Flow rate) [L/min]	50[Hz]	85
	60[Hz]	100
Max Pressure [MPa(G)]		0.50
Motor		1 $\phi$ , 450W, 4P , capacitor run
Rated Voltage [V]		100
Rated current [A]	50[Hz]	6.2
	60[Hz]	7.0
Speed [r/min]	50[Hz]	1380
	60[Hz]	1630
Dimensions [mm]		165.5(W) $\times$ 259(L) $\times$ 179(H)
Weight [kg]		9
Inlet and outlet		Rc1/4
Air temperature [°C]		7~40
Over Voltage Category		II
Pollution Degree		2
Protection class		Class 1
Installation location		Indoor use only and device built-in use only
Sound pressure level		65[dB(A)](Uncertainty : 3[dB(A)])

NOTE: Noise emission value determined according to noise test code given in ISO 3744 and according described to ISO 4871.

The sum of a measured noise emission value and its associated uncertainty represents an upper boundary of the range of values which is likely to occur in measurements.

### 1.3 Thermal Protection Relay



1) This pump is fitted with an automatic reset thermal protection relay for overload protection. This device shuts off the motor power supply circuit automatically to prevent burn-out if the motor temperature rises due to overloading, or there is a pump fault which prevents rotation.

2) Always fit other protective devices (e.g. earth leakage breaker, motor breaker) in addition to the overload protection relay.

Refer to Table 1.2 for the current rating (recommended value) of the additional protective devices. Please contact the manufacturer's sales division if you have any questions.

Table 1.2 Current rating (recommended value) of protective devices

Model	Current[A]
DOP-81SP	9.0

 <b>Warning</b>	See Warning (8), P04
 <b>Caution</b>	See Caution (5), P05

2. Dimensions,Product Safety Sign and Labels

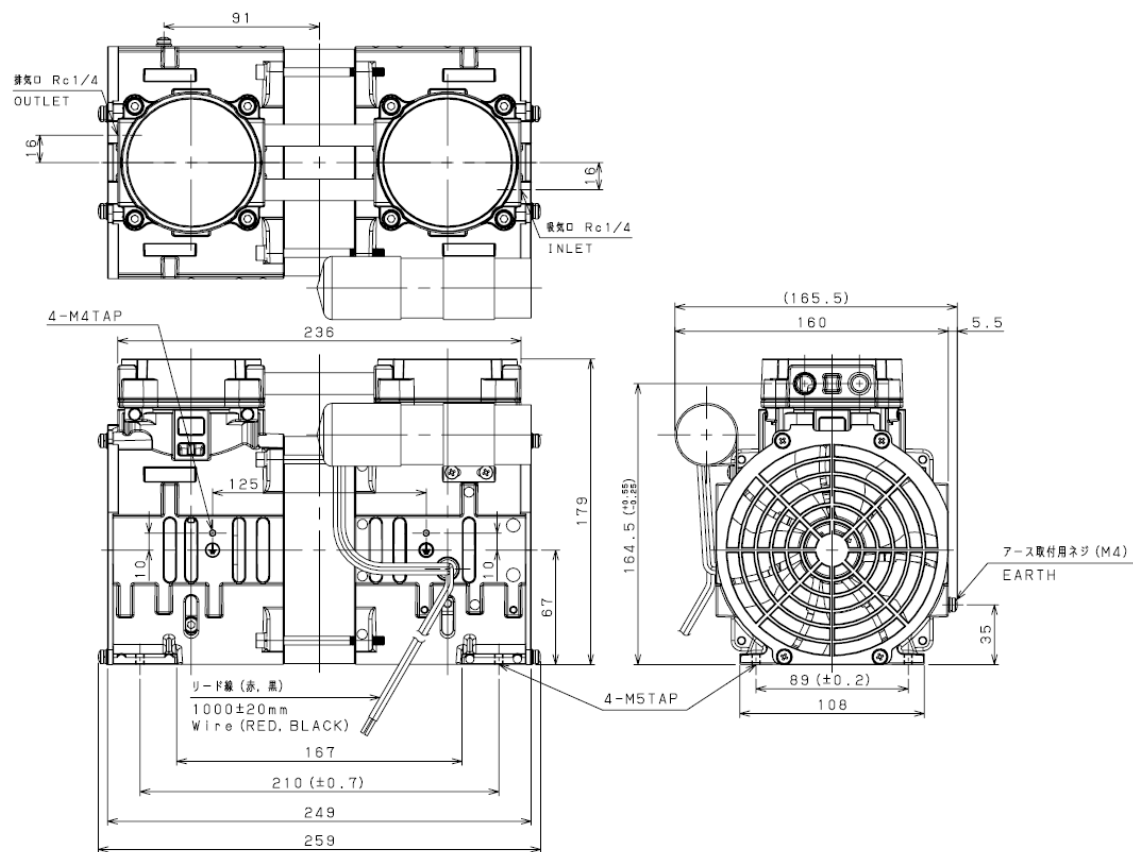


Fig.2.1 DOP-81SP Dimensions

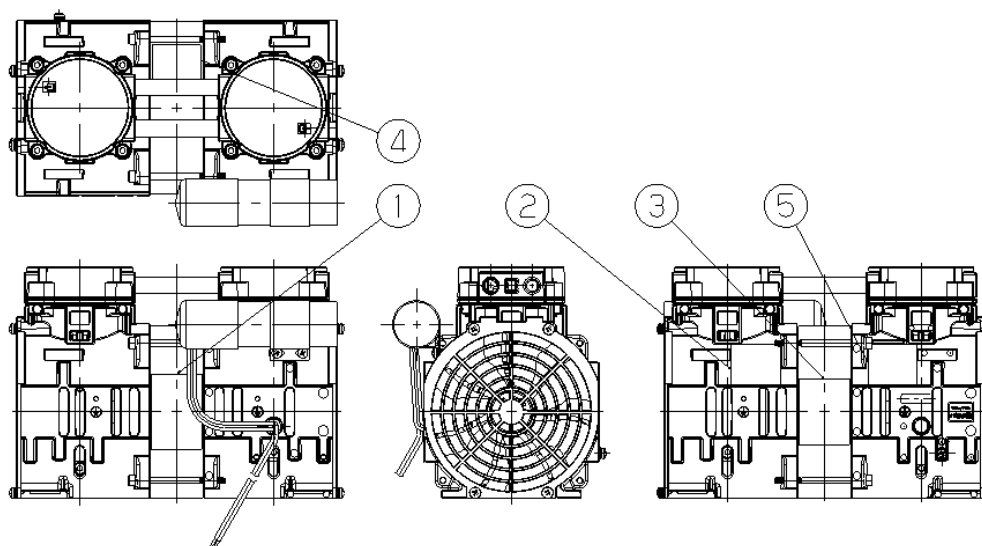








Fig.2.2 DOP-81SP Labels Locations

Table 2.1 Product Safety Signs and Labels

<p>①Maintenance warning label</p> <div><p><b>WARNING</b></p><p>•To prevent the risk of electric shock or injury, disconnect the power cord from the power supply before starting maintenance.</p><p><b>AVERTISSEMENT</b></p><p>•Pour éviter les chocs électriques et les blessures, débranchez le cordon d'alimentation de l'alimentation avant de commencer l'entretien</p></div>	<p>②Installation warning label</p> <div><p><b>CAUTION</b></p><p>•To Reduce the Risk of Electric Shock or Injury, Use Indoors Only. •Mount at least 100mm from side walls.</p><p><b>ATTENTION</b></p><p>•Utiliser cet appareil uniquement à l'intérieur pour éviter les risques de décharge électrique ou de blessures. •Le monter à au moins 100 mm des murs latéraux.</p></div>	<p>③Hot surface label</p> <div><p><b>CAUTION</b></p><p>•Hot surface •To reduce the risk of burn, do not touch</p><p><b>ATTENTION</b></p><p>•Surface chaude •Pour réduire les risques de brûlures, ne pas toucher</p></div>																																												
<p>④Connection tube label</p> <div><p><b>NOTICE</b></p><p>•Do not hold or push this tube as it may break the parts.</p><p><b>AVIS</b></p><p>•Ne tenez pas et ne poussez pas ce tube car il pourrait casser les pièces.</p></div>	<p>⑤Name plate</p> <div><table border="1"><tr><td colspan="4"><b>ULVAC DOP-81SP</b></td></tr><tr><td colspan="2">ULVAC KIKO, Inc.</td><td colspan="2">MADE IN JAPAN</td></tr><tr><td></td><td>50</td><td>60</td><td>Hz</td></tr><tr><td>PUMPING SPEED</td><td>85</td><td>100</td><td>L/min</td></tr><tr><td>MAX. PRESSURE</td><td colspan="3">0.5 MPa(G)</td></tr><tr><td>AMBIENT OPERATION TEMP. RANGE</td><td colspan="3">7~40 °C</td></tr><tr><td>SERIAL NO.</td><td colspan="3">1900001</td></tr><tr><td colspan="4">SINGLE PHASE 450W 4POLE CAPACITOR RUN</td></tr><tr><td>Hz</td><td>50</td><td>60</td><td>RATING CONT.</td></tr><tr><td>VOLT</td><td>100</td><td>100</td><td>INS. CLASS B</td></tr><tr><td>AMP</td><td>6.2</td><td>7.0</td><td></td></tr></table></div>	<b>ULVAC DOP-81SP</b>				ULVAC KIKO, Inc.		MADE IN JAPAN			50	60	Hz	PUMPING SPEED	85	100	L/min	MAX. PRESSURE	0.5 MPa(G)			AMBIENT OPERATION TEMP. RANGE	7~40 °C			SERIAL NO.	1900001			SINGLE PHASE 450W 4POLE CAPACITOR RUN				Hz	50	60	RATING CONT.	VOLT	100	100	INS. CLASS B	AMP	6.2	7.0		
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### 3. Installation and Storage

#### 3.1 Cautions for Installation and Storage

 <b>Warning</b>	See Warning (1)(2)(3)(5)(6)(7)(8)(9)(10)(11)(12)(13)(14), P04
 <b>Caution</b>	See Caution (1)(2), P05
 <b>Note</b>	See Note (1)(2)(3)(4)(5), P06

#### 3.2 Environmental Conditions for Installation, Storage, and Operation

The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.

1. Ambient temperature of 7~40°C and maximum relative humidity of 85% during operation.
2. Other conditions (during storage and operation).
  - a) Level floor of sufficient strength.
  - b) No condensation
  - c) Dust-free environment
  - d) Well ventilated
  - e) Environment free of corrosive or explosive gas.
  - f) Not subject to direct sunlight.
  - g) No danger of fire.
  - h) Maximum ambient temperature of 40°C during assembly of pump.
  - i) Free of soot and oil.
  - j) Free of splashing or flooding.
  - k) Keep it indoor ventilated.
  - l) When installing the pump, avoid mounting a pump directly on the base. Employ anti-vibration rubber between the base and the pump.

#### 3.3 Location

The pump should be installed level in a location with minimal dust and humidity. This location should be selected in consideration of ease of installation and removal, inspection, and cleaning.

Particular attention should be paid to ambient temperature when fitting the pump to equipment. Use anti-vibration rubbers to isolate the pump from vibrations in the equipment. See 3.2 Environmental Conditions for Installation, Storage, and Operation for details.

#### 3-4 Electric Wiring

- (1) The wire diameter of power cord must be 0.75 mm<sup>2</sup> or more.
  - (2) We recommend end-user to equip protection device such as earth leakage breaker motor breaker on electric wiring to prevent from motor burnout which may occur by overcurrent.
  - (3) Be sure to ground to the screw next to the earth mark.  
Please attach earth terminal as shown in Fig.3-1.
  - (4) The electric wire which will be connected to the earth must be green / yellow striped or green colored insulating coating wire. Its wire diameter must be 0.75 mm<sup>2</sup> or more.
- Notice: Before operating wire connection, be sure to unplug the power plug.

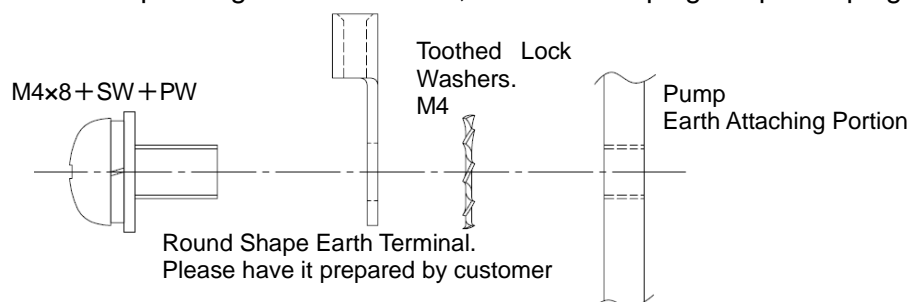


Fig.3.1 Installation Method of Earth Screw

### 3.5 Fluctuations in the power voltage and frequency

Standard: Rotation electricity machine general rules

JIS C 4034-1:1999, JEC-2137-2000

To the voltage change and frequency change in Domain A, in main rated values, it operates continuously, and can be used practically convenient, and to the voltage change and frequency change in Domain B, it shall operate with main rated values and shall be used practically convenient.

However, operation with "it is convenient and safe is maintained on "practical use, it means not resulting in the grade which shortens a life remarkably, and the characteristic, a temperature rise, etc. do not apply correspondingly in the state of rating. Moreover, main rating shows rated torque (N·m).

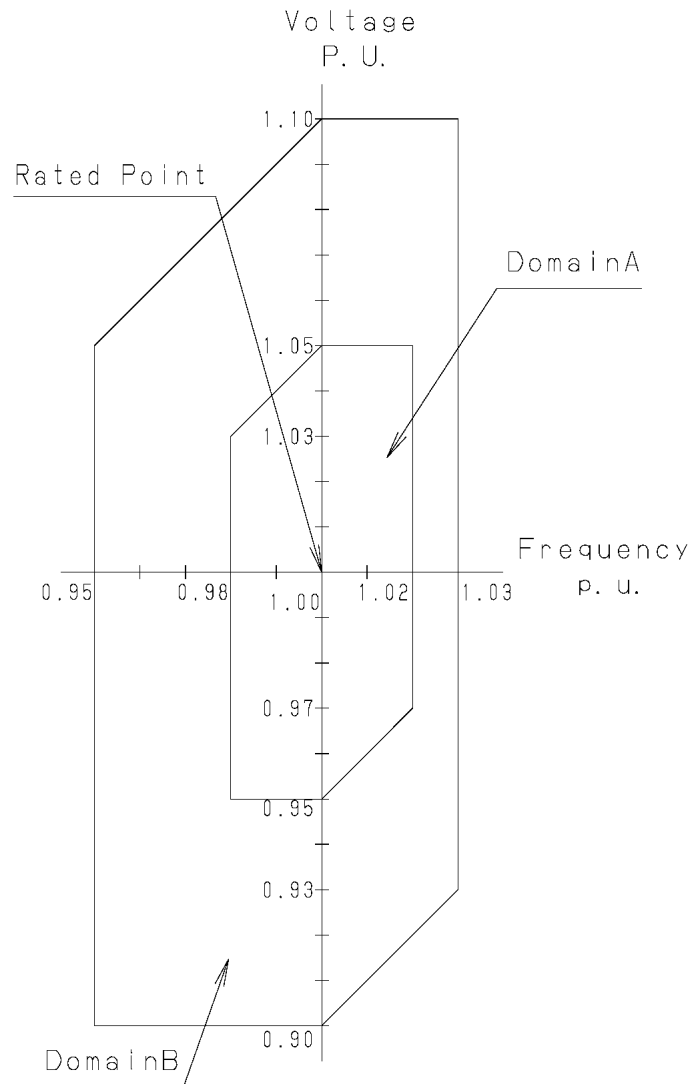


Fig. 3.2 Change region of the voltage and frequency

### 3.6 Checking Operation After Installation

- 1) Remove the cap on the inlet and outlet pipe.
- 2) Switch power ON, check the direction of rotation, and check for suction.
- 3) When checks are complete, switch off the main power supply and stop the pump. Check that the pump has stopped.

Caution: Use cable, with each core wire having a cross-section area of 0.75 mm<sup>2</sup> or more.

### 3.7 Piping

- 1) Ensure that all piping is installed without leaks, and fit a filter on the pump inlet.
- 2) Use inlet piping with an internal diameter of 5 mm or more.
- 3) The limit value of pump internal pressure is 0.50MPa (gage pressure).
- 4) In case of selecting the inlet pipe and exhaust pipe that are not from our products, please select the exhaust pipe that has same or larger inner diameter length with the inlet pipe.
- 5) Install the protection instrument such as safety valves about piping like Figure 3.3 between the exhaust tube and the container of the pump.

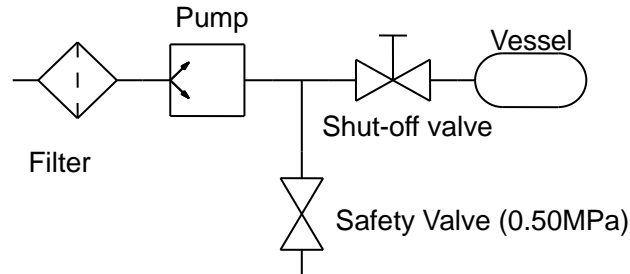






Fig.3.3 Example of Piping Used When Pressurizing a Vessel

### 3.8 Storage

Switch off the main power supply and check that the pump has stopped.  
Remove the power cord connected to the pump, place the caps over the inlet and outlet, and store in a location with low humidity.



## 4. Cautions for Operation

### 4.1 Cautions for Operation

 <b>Danger</b>	See Danger (1)(2), P04
 <b>Warning</b>	See Warning (8)(15)(16)(17), P04,P05
 <b>Caution</b>	See Caution (3)(4)(6)(7)(8), P05
 <b>Note</b>	See Note (3)(4)(5)(6)(7)(8)(9)(10)(11)(12), P06

### 4.2 Operation of the Thermal Protection Relay

- 1) If the thermal protection relay operates, switch off the main power supply immediately and contact the manufacturer. The motor will be extremely hot and should not be touched under any circumstances.
- 2) When the cause of the problem has been eliminated, check that the motor has cooled, switch on the main power supply, and check that the pump is operating.

 <b>Caution</b>	See Caution (5), P05
 <b>Note</b>	See Note (13),P06



#### 4.3 Starting in Cold Weather

The bearing grease and cup packing may harden under cold conditions, and the pump may be difficult to start. Use the following procedure in this case.

- 1) Open the inlet to atmosphere, and switch power ON-OFF two or three times until the pump starts. If the pump still does not start, raise the ambient temperature above 7°C.
- 2) With the inlet open to atmosphere, run the pump for a few minutes to warm it.
- 3) Commence normal operation once the pump has warmed.

### 5. Pump Performance

#### 5.1 Discharge Rate(Flow Rate)

The rate of discharge varies with the type of gas used, and its pressure. The maximum rate of discharge is reached when air is introduced, and slowly decreases as pressure is increases.

The resistance of the piping system increases with small bore piping which extends over long distances, and this reduces the rate of discharge.

The declared rate of discharge for this pump is the maximum value achieved with dry air.

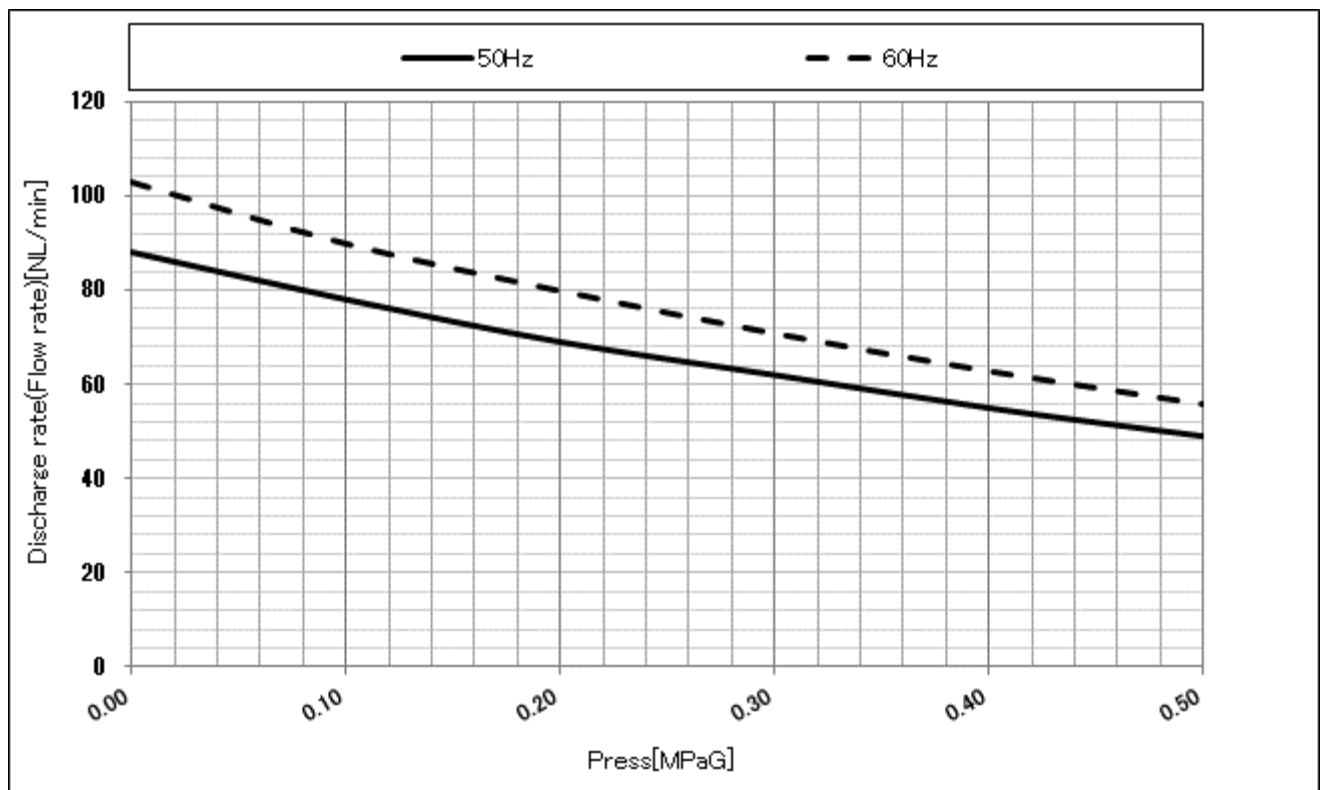






Fig.5.1 Discharge rate(Flow rate) characteristic diagram 【Reference】

#### 5.2 Power Requirements

The power required to drive the pump is the total of the work required to overcome the rotational resistance of the pump (mechanical work), and the work required to compress the air (compression work), and is at a maximum at an inlet pressure of 0.50MPaG.

## 6. Maintenance, Inspection, and Repair

### 6.1. Cautions for Maintenance, Inspection, and Repair

 <b>Danger</b>	See Danger (3), P04
 <b>Warning</b>	See Warning (4)(18)(19), P04,P05
 <b>Caution</b>	See Caution (10)(11), P06
 <b>Note</b>	See Note (14), P06

Customer repair technicians are able to perform the following maintenance and repairs. Other repairs and modifications (except for the standard options available from the manufacturer) should not be performed by the customer.

- 1) Replacing cup packing
- 2) Replacing suction and exhaust valves
- 3) Replacing cylinder
- 4) Replacing gaskets
- 5) Replacing O rings

### 6.2 Maintenance

The following checks are required at least once every three days during operation.

- (1) Check for abnormal noises.
- (2) Check for abnormal heating of the pump.
- (3) Check that gas is discharged normally.

If a problem is found, take the measures described in 6.5 Troubleshooting List.

### 6.3 Regular Inspections

Inspect consumables after the first 4000 hours of operation, and replace and clean in accordance with the " Guidelines for Replacement and Cleaning "on the following page. Refer to 6.4 Replacing and Cleaning Consumables for procedures.

Request replacement by the manufacturer's service division if a repair technician is not available.

Table 6.1 Consumables List

No.	Components	Quantity	Material	Average life
①	Cup packing	2	PTFE	4,000 Hr
②	Suction valves	2	SUS	4,000 Hr
③	Exhaust valves	2	SUS	4,000 Hr
④	Cylinder	2	A5056	4,000 Hr
⑤	Gaskets	2	FPM	4,000 Hr
⑥	O rings(P 10)	4	FPM	4,000 Hr
⑦	O rings(S 63)	2	FPM	4,000 Hr
⑧	Bearing	4	-	12,000 Hr

Note that the average life for a component varies with the conditions of use.

Always follow 4.1 Cautions for Operation, and remember that life is extended by running the pump at minimal load (running the pump at minimal load is operation at near-atmospheric pressure).

Bearings are replaced by the manufacturer's service division.




< Guidelines for Replacement and Cleaning >

Replace or clean components if performance is reduced and/or the following symptoms appear.

Table 6.2 Locations for Maintenance and Inspection

Period of operation	Inspection item	Inspection details	Method of inspection
Every 4000 hours	Cup packing	Abnormal wear, hardening, cracking.	Visual inspection
	Suction and exhaust valves	Deformation, chipping.	Visual inspection
	Cylinder	Abnormal wear.	Visual inspection
	O rings	Deformation, hardening, cracking.	Visual inspection
	Gaskets	Deformation, hardening, cracking.	Visual inspection
	Bearings	Abnormal noises.	Listen
	Power cords	Cracking	Visual inspection
		Loosening of terminals	Tighten a screw

#### 6.4 Replacing and Cleaning Consumables

 <b>Warning</b>	See Warning (18),(19),P05
 <b>Caution</b>	See Caution (11),P06
 <b>Note</b>	See Note (14),P06

- (1) The interior of the pump is extremely hot immediately after operation. After stopping the pump, leave it for 30 minutes or more and begin replacing consumables and cleaning only after checking that it has cooled sufficiently.
- (2) To prevent ingestion of microscopic particles in the air, use a dust mask and gloves when replacing components and cleaning.
- (3) To prevent injury, wear gloves when replacing consumables.

#### Tools Required for Setup

Have the following tools on hand and perform the replacement while referring to the diagram.

**If there is no repair technician available**, or if you do not have access to the required tools, please make the appropriate request to our repair services department.

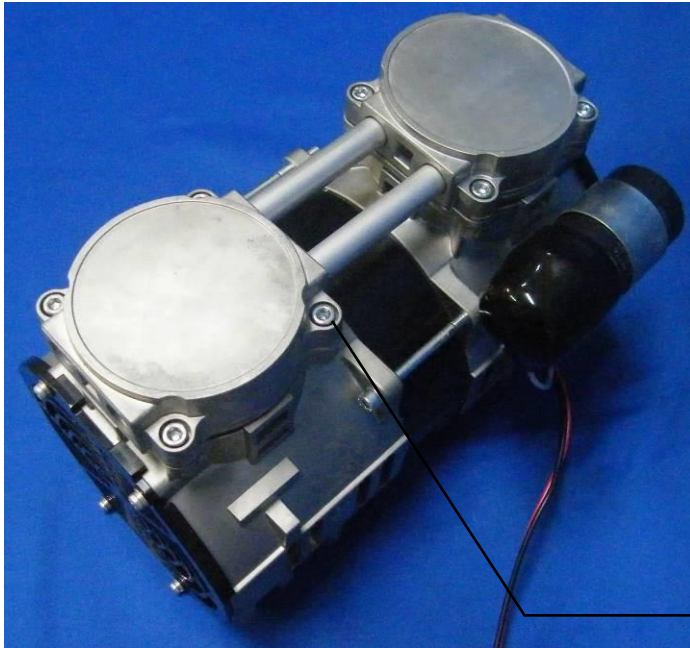
• Required Tools

1. Torque wrench - bit size 4 mm (3.0 Nm)
2. Phillips head (+) screwdriver- No.2
3. Torque screwdriver- No.2 (0.8 Nm, 3.0 Nm)
4. Rag
5. Solvent for wiping (something that has no effect on rubber, such as ethanol)
6. vacuum grease
7. Loctite 242 or Loctite 243

\*Use items No.4 and 5 to wipe down any dirty area when replacing the part.

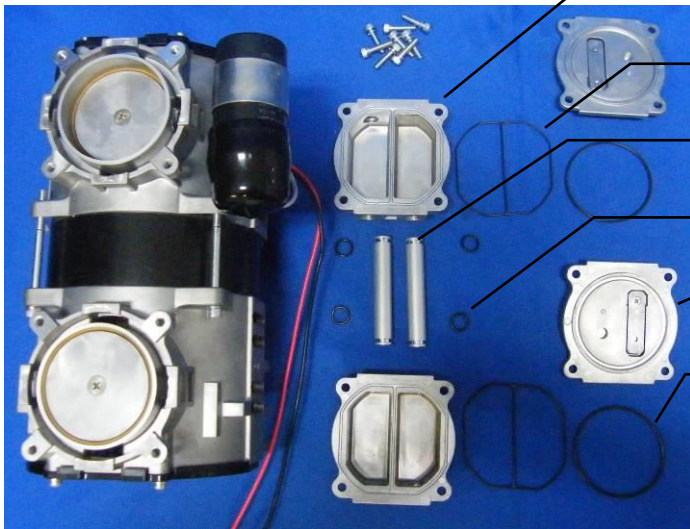
## Installing the Replacement Parts

### i. Unit Disassembly



\* Disengage power before beginning procedure.

Step 1: Remove the eight hex socket screws (M5×20) as shown at (①), then remove the head covers (②), head gaskets (③), head plates (④), and large O-rings (⑤). Note that the head gaskets and O-rings may be firmly fixed in place and difficult to remove. The head covers (②) are joined by way of two connector pipes (⑥). Pull out the pipes and remove the four small O-rings (⑦) attached to their ends.



①

②

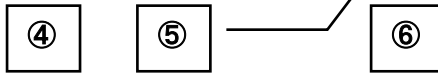
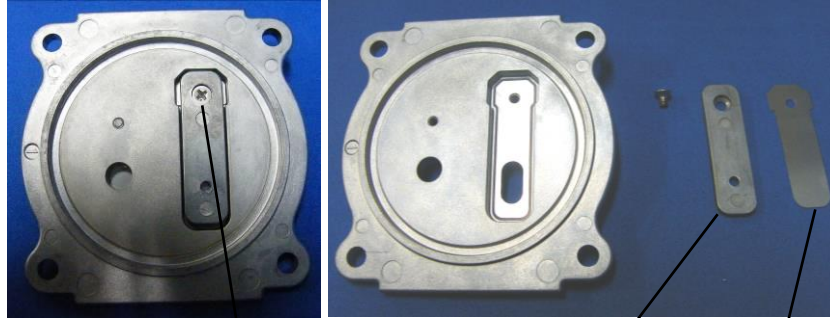
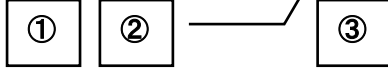
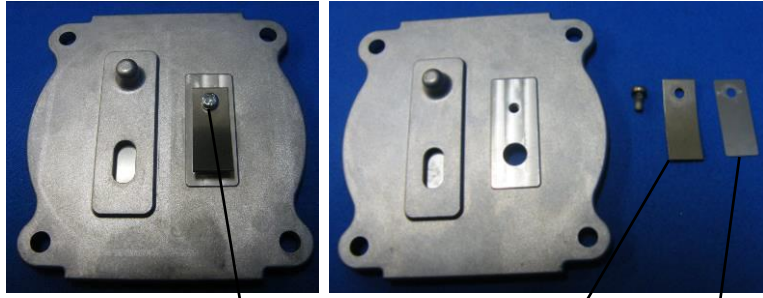
③

⑥

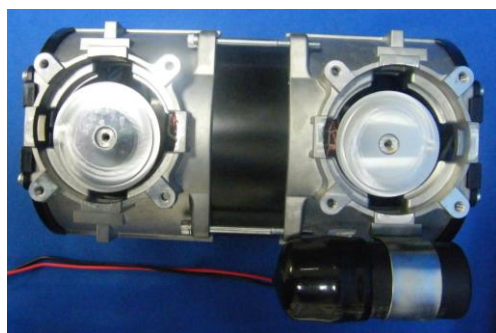
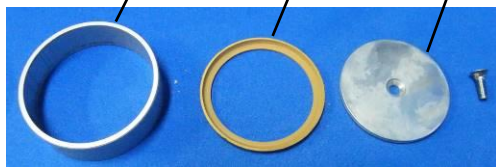
⑦

④

⑤



Step 2: Find and remove the panhead screws (M3×6) (①), exhaust valve covers (②), and exhaust valves (③) from the head plates removed in Step 1. On the reverse side of the head plates, find and remove the countersunk screws (M3×5) (④), intake valve covers (⑤), and intake valves (⑥).



Step 3: With the base unit disassembled as in Step 1, find and remove the countersunk screws (M5×15) (①), the cylinders (②), the cup packings (③), and the follower plates (④).

This concludes the disassembly process. Proceed to the next section of the guide for replacement and reassembly instructions.



## ii. Replacement and Reassembly



①

②

Step 4: Locate the grooves on each end of the connector pipes (①). Attach the small O-rings (②) such that they align with the grooves. Each pipe requires two rings, for a total of four small O-rings. Apply vacuum grease to all four O-rings before proceeding with Step 5.

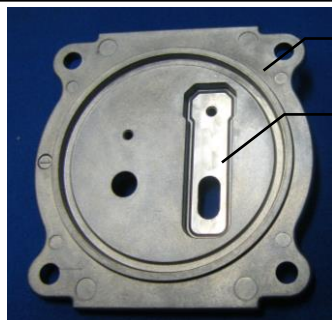


②

①

③

Step 5: Taking care not to allow the greased O-rings to tear, insert one end of each pipe (①) into one head cover (②), then align the other head cover with the opposing ends of the pipes and insert. Next, insert a head gasket (③) into the gasket groove on each head cover. Pressing the gaskets into the grooves may be somewhat difficult. Be certain they are snugly inserted as far back as possible all along the grooves.

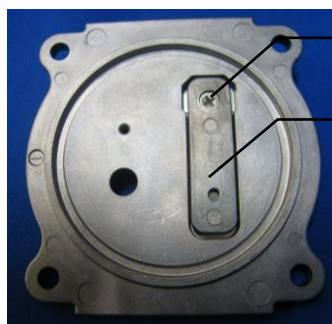


①

**Intake Surface**



②



④

③

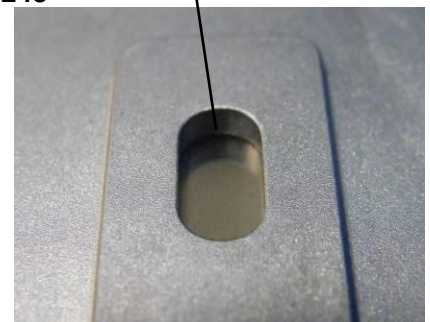
Step 6: With the intake surface of each head plate (①) facing upward, locate the recessed areas for the intake valves. For each plate, insert an intake valve (②) followed by an intake valve cover (③). Apply Loctite 242 or Loctite 243 to the 2 or 3 bottommost threads of the countersunk screws (M3x5) (④), then use a torque screwdriver (0.8 Nm) to secure the valves and covers.

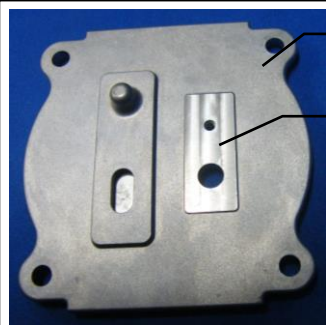
\* Correct torque is critical when tightening the screws.

\* Flip the head plate over and check that the valve is flush against the inside surface. If a gap is observed, repeat Step 6.

**Valve is flush with inside surface**

**Area to apply Loctite 242 or 243**



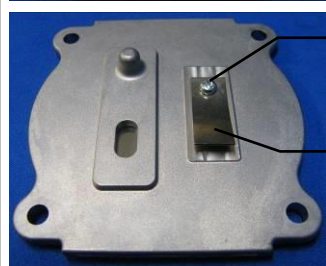


①

**Exhaust Surface**



②



④

③

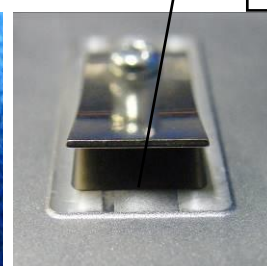
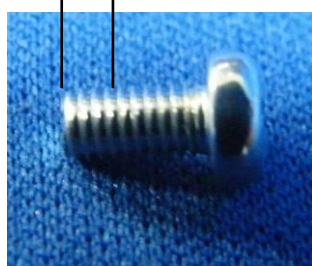
Step 7: With the exhaust surface of each head plate (①) facing upward, locate the raised areas for the exhaust valves. To each head plate, attach an exhaust valve (②) followed by an exhaust valve cover (③). Apply Loctite 242 or Loctite 243 to the 2 or 3 bottommost threads of the panhead screws (M3×6) (④), then use a torque screwdriver (0.8 Nm) to secure the valves and covers.

\* Correct torque is critical when tightening the screws.

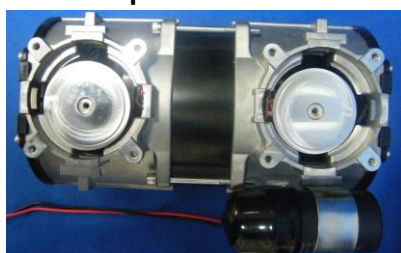
\* Check that the exhaust valve is flush with the surrounding surface. If a gap is observed, repeat Step 7.

Area to apply Loctite 242 or 243

Valve is flush with surrounding surface

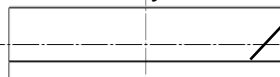


As in Step 3



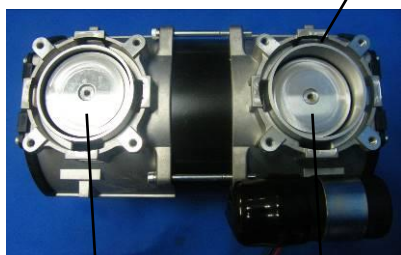
Step 8: With the base unit disassembled as in Step 3, reinsert the cylinders (①), ensuring the peripheral grooves are oriented downward.

Side view of cylinder



Peripheral groove oriented downward

① This side toward base unit



Topmost

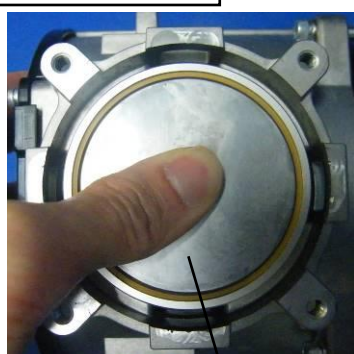
Bottommost

Press down on one connecting rod until the depressed rod is at its bottommost position and the other rod at its topmost position. Place the cup packing (②) into the cylinder on the depressed side, cover with the follower plate (③), then press firmly on the plate until the packing is secure. Repeat for the other side. Lift each plate off to check the packing.

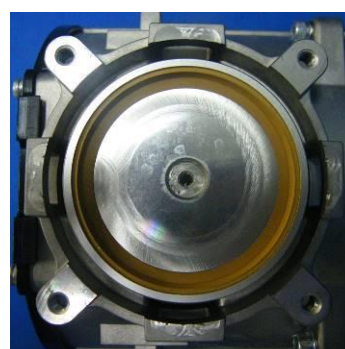
\* The inner lip of the packing must be flush with the upper surface of the connecting rod.



②

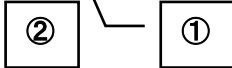
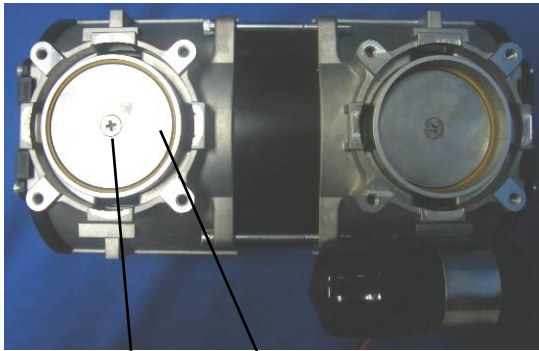


③



Inspecting the cup packing to ensure that it is securely in place

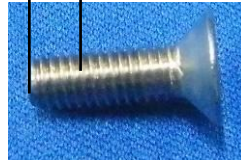




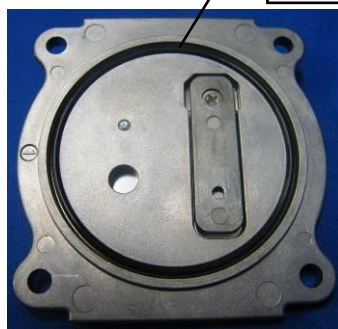
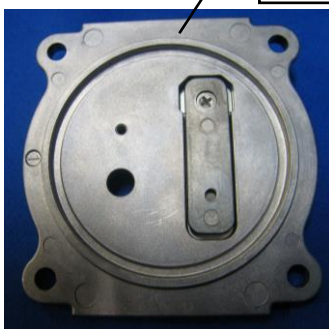
Step 9: Place each follower plate (①) back on top of its respective cup packing. Apply Loctite 242 or Loctite 243 to the 5 to 7 bottommost threads of a countersunk screw (M5×15) (②) and use a torque screwdriver (3.0 Nm) to secure the plate and packing. Repeat for the other side.

\* Correct torque is critical when tightening the screws.

←→ Area to apply Loctite 242 or 243

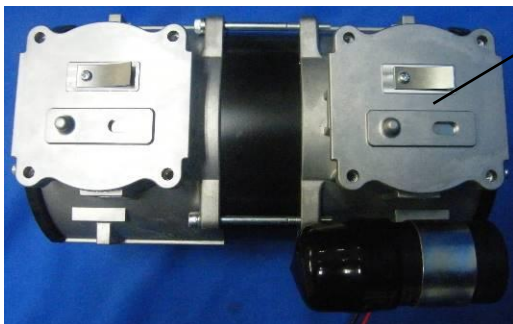


As in Step 6

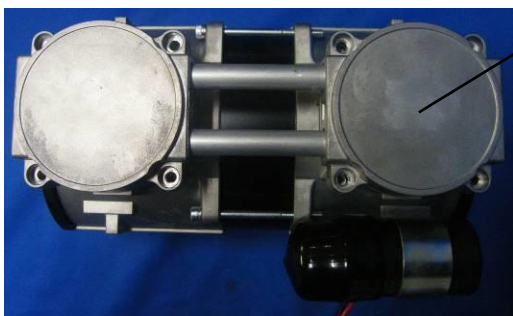


Step 10: Place a large O-ring (②) into the groove on each head plate (①) as assembled in Step 6.

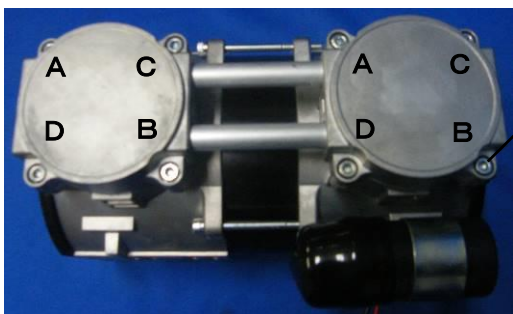
Load the head plates (③) onto the base unit as assembled in Step 9, using the image at left to ensure correct orientation. Incorrectly oriented head plates may result in unit failure or damage.



Next, load the head covers (④) as assembled in Step 5 onto the head plates, ensuring that the head gaskets do not fall off when the head covers are inverted. A small quantity of vacuum grease may be applied to the gaskets to prevent them from falling during placement. The grease should be applied to the portion of the gaskets in contact with the head covers when pressed into the grooves as in Step 5.



Finally, use a 4mm hex head torque wrench (3.0 Nm) to replace the eight hex socket screws (M5×20) (⑤), securing the head covers in place. Tighten each screw incrementally, moving in order from A to D as shown in the image at left and taking about three full passes to fully secure the screws.



\* Correct torque is critical when tightening the screws.

The device is now fully reassembled.



## 6.5 Troubleshooting List

Table 6.3 Troubleshooting List

Problem	Causes	Solutions	Reference
Problems with starting and rotation of pump	(1) Not connected to power supply.	(1) Connect power supply.	3-4
	(2) Switch is OFF.	(2) Set switch to on.	
	(3) Problem with power supply voltage.	(3) Ensure that voltage variation is within +/-10%.	
	(4) Problem with pump wiring.	(4) Rewire the pump. Contact the manufacturer.	
	(5) The breaker has operated.	(5) Investigate the reasons for operation.	
	(6) The thermal protection relay has operated.	(6) Switch power OFF, and eliminate the cause of operation of the relay. Contact the manufacturer.	4-2
	(7) Low ambient temperature.	(7) Ensure that ambient temperature is 7~40 °C.	4-3
	(8) Low voltage.	(8) Adjust the power supply voltage, and check the power supply cable.	3-5
	(9) Fault in power supply.	(9) Replace or repair.	6-4
	(10) Problem with power supply switch.	(10) Replace or repair.	
	(11) Broken wire in power cord.	(11) Replace or repair.	
	(12) Problem with motor.	(12) Replace or repair.	
	(13) Locked connecting rod.	(13) Disassemble pump head cover, and cylinder; and check interior.	
	(14) Problem with bearings.	(14) Replace or repair.	
	(15) Miscellaneous damage to pump components.	(15) Disassemble and repair (replace damaged components).	6-4
Pressure does not diminish	(1) Pump is too small for capacity of pressurizing vessel.	(1) Select another pump.	5-1.
	(2) Pressure measurement is incorrect.	(2) Measure the pressure correctly.	
	(3) Pressurizing gauge is unsuitable.	(3) Measure with a calibrated Pressurizing gauge suitable for the pressure range.	
	(4) The inlet piping is too small in diameter, or too long.	(4) Connect piping of an inside diameter greater than the inlet diameter, or reduce the distance between the pump and Pressurizing vessel.	3-7
	(5) Low voltage.	(5) Adjust the voltage, and check the power supply cable.	3-5
	(6) Ambient temperature unsuitable.	(6) Ensure that ambient temperature is 7~40 °C.	4-3
	(7) Leaks in outlet piping.	(7) Clean and replace.	6-4
	(8) Leaks from piping or connections.	(8) Check for leaks in piping, check diameter and length of piping, and repair.	
	(9) Foreign matter inside pump.	(9) Remove foreign matter, disassemble and clean, and replace components.	
	(10) Water or solvent etc has been soaked into pump causing problems.	(10) Disassemble and repair (replace valves and diaphragm etc).	
	(11) Damage to motor.	(11) Replace and repair.	
	(12) Damage to suction / exhaust valve	(12) Replace.	6-4
	(13) Damage to cup packing.	(13) Replace.	6-4
	(14) Miscellaneous damage to pump components.	(14) Disassemble and repair (replace damaged components).	
Pump surfaces are abnormally hot	(1) The pressurizing pressure exceeds the specification value.	(1) It sets it in the specification value.	3-5
	(2) High temperature gas.	(2) Fit cooling equipment (eg. gas cooler) to the inlet.	
	(3) Problem with power supply voltage.	(3) Ensure that voltage variation is within +/-10%.	
	(4) Motor has seized.	(4) See the section on problems with pump rotation.	

## 7. In Conclusion

Please contact the manufacturer's sales division if you have any questions.

### Warranty

- (1) The warranty for this pump (this equipment) extends for a period of one year from the date of shipment.
- (2) Any malfunctions or defects which occur under normal usage conditions during the warranty period will be repaired free of charge.

Note, the warranty stated here is an individual warranty covering the pump. In addition, the scope of the warranty coverage concerning repairs is limited to the repair and/or replacement of parts.

Normal usage conditions refer to the following:

- a) Ambient temperature and humidity during operation: 7 - 40°C, below 85% RH
- b) Operation in accordance with the user manual

- (3) Repair fees will incur during the warranty period for the following cases:

- a) Malfunctions due to a natural disaster or fire.
- b) Malfunctions caused by special atmospheric conditions, such as salt damage, inflammable gas, corrosive gas, radiation or pollution.
- c) Malfunctions caused by usage conditions that differ from those stated in the user manual (performance specifications, maintenance and inspection, etc.).
- d) Malfunctions caused by modifications or repairs carried out by a party other than the manufacturer, or by a service company not approved by the manufacturer.
- e) Malfunctions caused by noise (electric disturbance).
- f) Malfunctions that occur when not using a rated power supply.
- g) Malfunctions that occur when there is an abnormal rise in internal pressure due to the pump exhaust outlet being blocked during operation, etc.
- h) Malfunctions that occur, when the pump is damaged as a result of being dropped or falling, etc.
- i) Malfunctions which are determined by the manufacturer's technical personnel to be caused by conditions that do not comply with the usage conditions for this pump.
- j) Malfunctions due to the replacement of consumables.

- (4) Disclaimer

- a) We shall not be liable for any malfunctions of our products caused by the customer, regardless if the malfunction does not fall within the warranty period, nor shall we be liable for any loss of opportunity for the customer's clients or for compensation for any damages to other products, labor costs, production loss, transportation expenses and other related work.
- b) We shall not be liable for any claims and patent infringements, including secondary damages, filed a claim by a third party against the customer.

## Usage Status Check Sheet (for use in Instruction Manual)

- \* For the purpose of safety control of repair personnel, fill in within the heavy line frame and attach the sheet to the item of which repair is requested.
- \* In case this sheet were not attached or filled in, your request of repair and service may not be accepted.
- \* In accordance with the Private Information Protection Law, the provided information will be used only for determining the cause of failure and whether detoxifying washing should be conducted. It will never be provided to any third person.

Model Name: \_\_\_\_\_ Manufacturer's Serial No.: \_\_\_\_\_

1. Inhaled Gas \* Please be sure to fill in.

(1) Whether there is harmful effect on human bodies Yes No (Sing your name below.)

(2) Whether there is unusual smell Yes No

(3) Type and Name of Gas: \_\_\_\_\_

\* Industrial Safety and Health Law designates particular substances as the materials to be notified.

2. Usage Status

Operation Method: Approx. ( ) hours per day, ( ) years and ( ) months

☐ Continuous Operation ☐ Intermittent Operation

Usage: \_\_\_\_\_

3. Failure Status ☐ Unusual Noise ☐ Abnormal Pressure ☐ Abnormal Actuation ☐ Oil Leakage

Other Symptoms: \_\_\_\_\_

4. Detail of Request ☐ Repair (Overhaul) ☐ Regular Checks

5. Others: \_\_\_\_\_

Company Name: \_\_\_\_\_ Personnel in charge: \_\_\_\_\_

Address: \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

Agent Name: \_\_\_\_\_ Personnel in charge: \_\_\_\_\_

Address: \_\_\_\_\_

Tel: \_\_\_\_\_ Fax: \_\_\_\_\_

\* In case you do not have any direct transaction with us, please be sure to fill in the agent name.

6. Confirmation

The gas and substance used in this pump or unit is harmless to human bodies, or it is not contaminated by any substance harmful to human bodies.

Signed \_\_\_\_\_ (seal) Date: \_\_\_\_\_

\* Please send the parcel to our Service Division. (See attached contact information.)

\* In order to avoid a trouble during transportation, please evacuate oil from any oil pump before shipping.

アルバック機工株式会社

<https://ulvac-kiko.com>

製品情報・サービス拠点・お問い合わせはこちらから



<https://showcase.ulvac.co.jp/ja/>

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ULVAC KIKO,Inc.

<https://ulvac-kiko.com/en>

Please contact us for products, Service Base or other Inquiries from here.



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