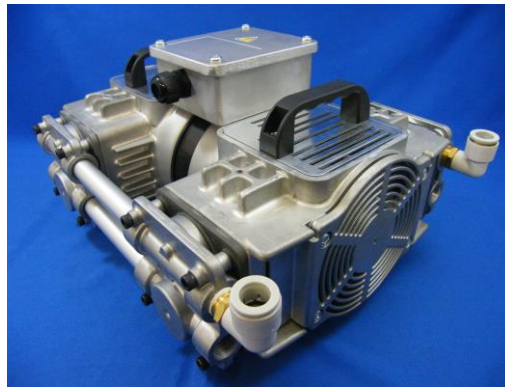




# INSTRUCTION MANUAL

## Oscillating Piston Dry Vacuum Pump

DOP-400SB



### 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.



## Declaration of Conformity



We, Company:ULVAC KIKO,Inc.

of Address:291-7 Chausubaru Saito-city,Miyazaki (ZIP Cord:881-0037) Japan.

This declaration is issued under the sole responsibility of the manufacturer.  
In accordance with the following Directive:

2006/42/EC	Machinery Directive
2011/65/EU+(EU)2015/863	RoHS Directive

declare under our sole responsibility that the product,

<b>Type of Product</b>	<b>: <u>Oscillating Piston Type Dry Vacuum Pump</u></b>
<b>Model Name</b>	<b>: <u>DOP-400SB</u></b>

to which this declaration related is in conformity with the following standards:

EN 1012-2:1996+A1:2009  
Compressors and vacuum pumps – Safety requirements, Part2. Vacuum pumps  
IEC EN 61010-1:2010+A1:2019  
Safety requirement for electrical equipment for measurement, control and laboratory use  
Part1.General requirement

following the provisions of

The person stated below will keep the following technical documentation:

- operating and maintenance instructions
- technical drawings
- description of measures designed to ensure conformity
- other technical documentation, e.g. quality assurance measures for design and production

### **Person authorized to compile the technical file:**

( Name and address) Chris Goebel  
ULVAC GmbH  
Klausnerring 4 85551 Kirchheim b. München, Germany

**31.Mar, 2023**  
**Miyazaki , Japan**  
(date & place)

**Makoto Uchimura**  
**Development manager** *Makoto Uchimura*  
(name, function, signature)

We, Company:ULVAC KIKO,Inc.

of Address:291-7 Chausubaru Saito-city,Miyazaki (ZIP Cord:881-0037) Japan.

This declaration is issued under the sole responsibility of the manufacturer.  
In accordance with the following Directive:

Supply of Machinery (Safety) Regulations 2008  
(S.I. 2008 No. 1597, as amended by S.I. 2019 No. 696)

The Restriction of the Use of Certain Hazardous Substances in Electrical and  
Electronic Equipment Regulations 2012 (S.I. 2012 No. 3032)

declare under our sole responsibility that the product,

**Type of Product** : **Oscillating Piston Type Dry Vacuum Pump**  
**Model Name** : **DOP-400SB**

to which this declaration related is in conformity with the following standards:

BS EN 1012-2:1996+A1:2009

Compressors and vacuum pumps – Safety requirements, Part2. Vacuum pumps

BS IEC EN 61010-1:2010+A1:2019

Safety requirement for electrical equipment for measurement, control and laboratory use  
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**Makoto Uchimura**  
**Development manager** *Makoto Uchimura*  
(name, function, signature)

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## 0 . Before Using the Equipment

Thank you for purchasing this product. Your custom is very much appreciated.

This pump is only for vacuum pumping, 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 may be refused if these circumstances are unclear.

## 0. 1 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?

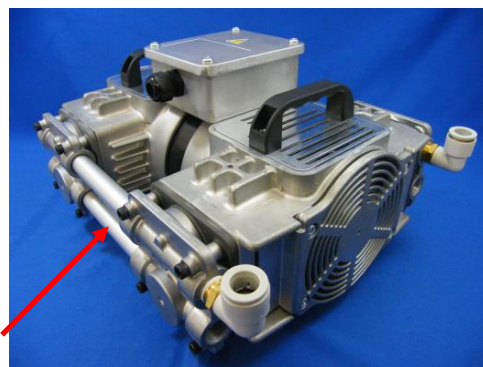
Standard accessories

- Instruction manual ----- x 1
- Silencer ----- 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 tube on the side of the pump is not gripped or bent when removing the pump from the packaging. Holding the pump by this tube may damage it, thus reducing pump performance.
2. Always remove the vent plug before using the pump.
3. Fit an inlet filter if there is a possibility of foreign matter or dust particles entering the pump.
4. 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.



DOP-400SB

## 0. 2 Using the Pump Safety

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 symbols

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 temperature Caution**

Some parts of the pump may reach temperatures of 60°C or more during operation.  
Touching such components may result in burns.

### **Electric Shock Caution**

Always switch off the main power supply before installing electrical wiring or performing any electrical work on the pump. Failure to do so may result in electric shock.



The Inlet pipe of the pump



The Outlet pipe of the pump



## Cautions for Safety in Use



### **Danger**

#### Applications

- (1) This pump is not designed to be explosion-proof, and should therefore not be used to evacuate explosive gases.
- (2) In addition to discharge of gas via the pump outlet, gas may leak from the pump itself. Use it only with clean air at normal temperature, or gases of equivalent characteristics.

#### Maintenance and Repair

- (3) When sending the pump to the manufacturer's service division for dismantling and repair, always note the type of gas that has been used on the 'Pump Usage Check Sheet'.



### **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. Such use may result in fire.
- (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 malfunction 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 relay, and this may result in the motor burning out, or fire.
- (9) Do not damage/ modify/pull the power cord. Do not place objects on it. Damage to the cord may result in electric shock or fire.

[Continued on next page]

## Warning

### Power Supply

(10) When attaching the main power cord to the pump, please use the power cord which meets the rated voltage and current, pursuant to the provision.

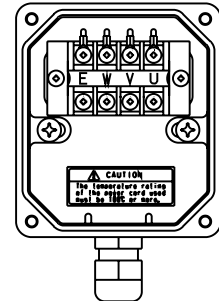
4-Core-cable (Size of the wire lead: 1.0mm<sup>2</sup> or larger, 300V or more, 10A or more, 100°C or higher, one earth cable included)

Ensure that one of the core wires is used as an earth wire.

Firmly attach the 6 - 12mm diameter Cable gland compatible cable fitted with the appropriate terminals (M4 terminal block screws) to a terminal block. Failure to follow these requirements may result in electric shock.

Wiring and ground construction should be done subject to your local law and the safety requirements.

The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.



(11) Switch off the main power supply, and remove the power cord from the terminal block, 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) After connection, please confirm that the rotatory direction of the pump is a prescribed direction.

### Operation

(15) This pump is not designed to be explosion-proof, and should therefore not be used in the vicinity of inflammable substances (eg inflammable solvents) or in explosive atmospheres. Failure to follow these requirements may result in injury or fire.

(16) Inserting fingers or objects into the motor inlet may result in electric shock, injury, or fire.

(17) Operating the pump with the discharge outlet blocked, or with a device which prevents passage of gas to the discharge outlet, may result in rupture of the pump. The internal pressure of the pump rises and the pump body may rupture and the motor become overloaded. This pump is not designed to be pressure-resistant. The internal pressure of the pump is limited to 0.03 MPa (gauge pressure).

### 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) To prevent back injuries, always use at least two people when lifting and moving the pump.
- (2) 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.
- (3) The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.
  1. Ambient temperature of 0-40°C and relative humidity of 85% or less 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 when connecting the pump.
- (4) 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.

### Operation

- (5) Touching rotating components (eg motor, main shaft, axial joints, cooling fan) while the pump is in operation may result in injury.
- (6) When the thermal protector operates, the pump will become extremely hot. Please do not touch the pump. Touching the pump in that condition will cause burn injury. Turning off the main power supply of the system, please contact us.
- (7) Touching the motor while the pump is in operation or while it is still hot immediately after having been switched off may result in burns.
- (8) Inserting fingers or objects, or peering, into, the inlet or outlet during operation may result in injury or malfunction.

[Continued on next page]

## **Caution**

### **Maintenance and Repair**

- (9) If the pump ceases operation, switch off the main power supply immediately to prevent accidents, remove the power cord from the wall outlet, and contact your dealer or the manufacturer for inspection and repair.
- (10) After stopping the pump, leave it for 30 minutes or more and begin work on it only after checking that it has cooled sufficiently. The interior of the pump is extremely hot immediately after it has been switched OFF, and burns may result if it is touched in this condition.

## **Note**

### **Installation**

- (1) Application of shock to the pump, or allowing it to fall over, may result in a malfunction.
- (2) Do not grip or bend the tube on the side of the pump. Any damage to this tube may reduce the performance of the pump.
- (3) Fit an inlet filter if there is a possibility of foreign matter or dust particles entering the pump.

### **Application**

- (4) 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.
- (5) This pump is only for vacuum pumping. Use at near-atmospheric pressures for long periods of time may result in a malfunction.

### **Operation**

- (6) Use the pump at an ambient temperature of 0 – 40°C. The life of the pump will be severely reduced if it is operated at high temperatures.
- (7) Application of back pressure at the pump outlet will overload the motor and may prevent the pump starting.

### **Maintenance and Repair**

- (8) This pump operates with precision clearances and therefore requires particular skill for assembly. If a repair technician is not available, contact the manufacturer's service division for replacement of consumables.

## 1. Product Outline

### 1.1 Purpose of Use and Prohibitions

This product is a piston dry vacuum pump 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 vacuum pumping, and must not be pressurized.
- (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 evacuate gases containing particles, dust, water, or corrosive gases.
- (5) Do not operate the pump for long periods at near-atmospheric pressure.

### 1.2 Specifications

Table 1.1 Product Specifications (50Hz/60Hz)

Model	DOP-400SB		
Evacuate rate (L/min)	400/440		
Pressure achieved (kPa)	12		
Motor	3 $\phi$ 200V 400W 4P 50/60Hz 3 $\phi$ 220V 400W 4P 60Hz Fitted with thermal protection relay (automatic reset type)		
Voltage, frequency	200V·50Hz	200V·60Hz	220V·60Hz
Rated current (A)	2.4	2.8	2.7
Speed (r.p.m.)	1470	1750	1760
Noise(dB(A) at 1m)	70 or less (with Silencer)		
Inlet pipe	Application tube outer diameter $\phi$ 16		
Weight (kg)	23		
Air temperature (°C)	0-40		
Dimensions (mm)	316W×434L×231H		
Over voltage category	II		
Pollution degree	2		
Insulation Category	Class 1		

### 1.3 Thermal Protector



- 1) This pump is fitted with an automatic reset thermal protector 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.

Characteristics of the thermal protector

Automatic reset thermal protector

Operation temperature	120±10°C
Reset temperature	80±10°C

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

 <b>Warning</b>	See "Warning" (8) on p.04.
 <b>Caution</b>	See "Caution" (6) on p.06.

## 2. Dimensions

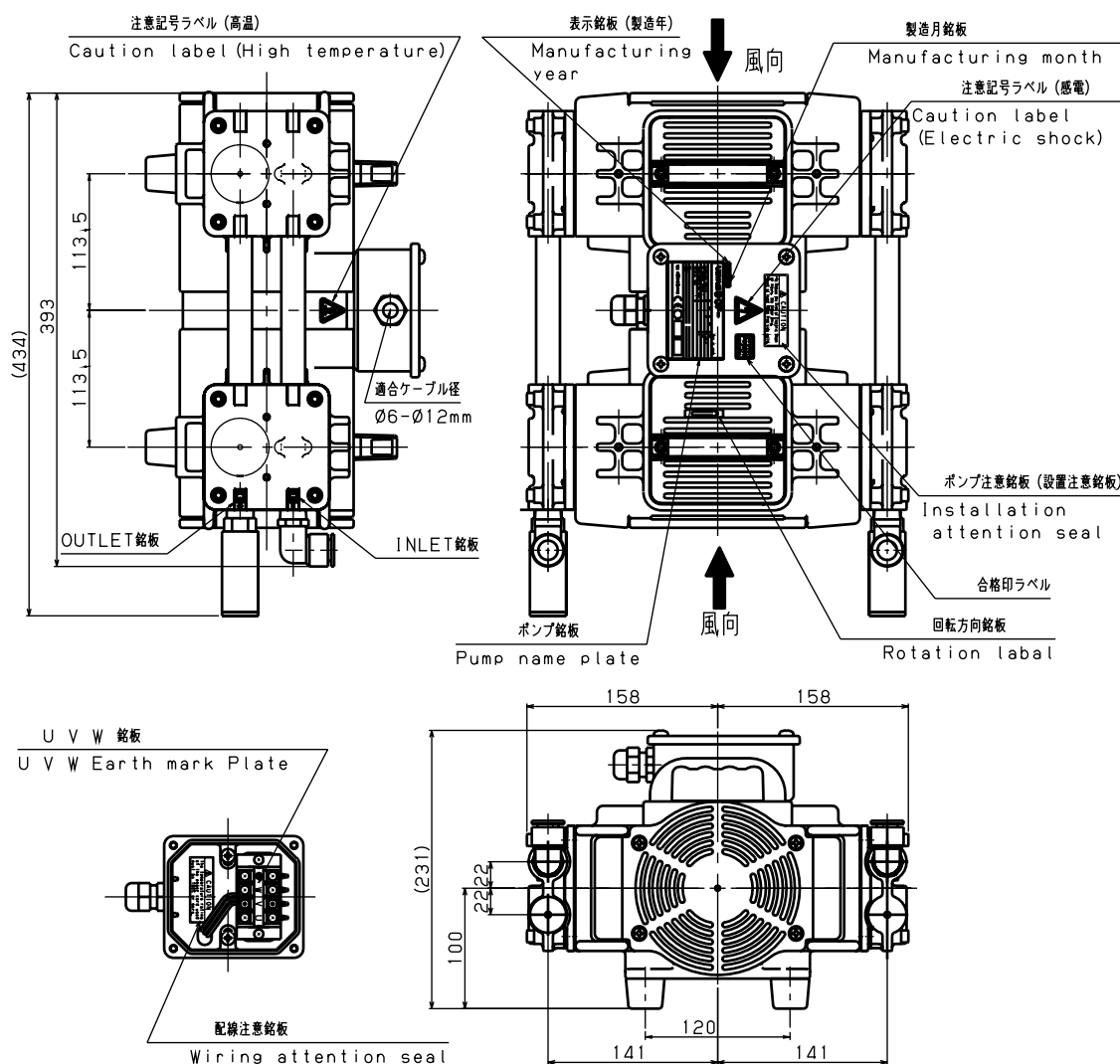





Fig. 2-1 DOP-400SB

### 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) and(14)on p.04 and 05.
 <b>Caution</b>	See "Caution" (1), (2) (3) and (4) on p.06.
 <b>Note</b>	See "Note" (1), (2), and (3) on p.07.

#### 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 0-40°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 when connecting the pump.
  - i) Sufficient space is available on all sides of the pump, and the pump cooling fan inlet is not blocked.

#### 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 Operational Checks Following Installation

- 1) Remove the rubber cap and vent plug on the inlet pipe.
- 2) Remove the four screws in the terminal box cover, pass the power cord through the cable gland, and connect to the terminal block. Fit the appropriate crimped connectors to the end of the cord.

Caution: Use the power cord which meets the rated voltage and current, pursuant to the provision.

Caution: 4-Core-cable(Size of the wire lead:  $1.0\text{mm}^2$  or larger, 300V or more, 10A or more,  $100^\circ\text{C}$  or higher, one earth cable included)

 <b>Caution</b>	The temperature rating of the power cord used must be $100^\circ\text{C}$ or more.
--	--

Caution: Use M4 terminal block screws with cable gland compatible cable of 6 - 12 mm diameter.

- 3) Switch power ON, check the direction of rotation, and check for suction.
- 4) When checks are complete, switch off the main power supply and stop the pump. Check that the pump has stopped.

### 3.5 Fluctuations in the power voltage and frequency

Standard: Rotation electricity machine general rules  
IEC60034-1:2004

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 ( $\text{N}\cdot\text{m}$ ).

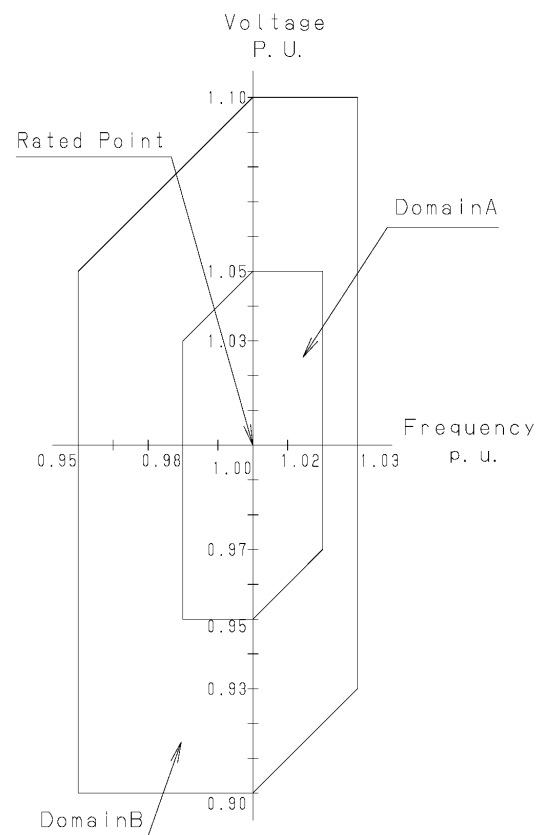


Fig.3-1 Fluctuations in the power voltage and frequency

### 3.6 Piping

- 1) Ensure that all piping is installed without leaks, and fit a filter on the pump inlet.

Two inlet, ensure in one pipe.

- 2) Use inlet piping with an internal diameter of 12 mm or more.
- 3) Ensure that piping connected to the outlet does not cause back pressure. Maximum back pressure is 0.03 MPa (gauge pressure).



- 4) When evacuating a vessel, ensure that a shut-off valve is placed between the pump inlet pipe and the vessel (see Fig. 3-2).

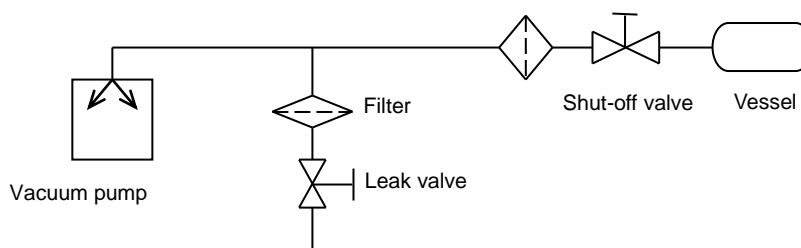


Fig. 3-2 Example of Piping Used When Evacuating a Vessel

### 3.7 Storage

Switch off the main power supply and check that the pump has stopped.

Remove the power cord connected to the pump, place the rubber cap on the inlet pipe, remove the silencer from the outlet and fit the vent plug, and store in a location with low humidity

## 4. Cautions for Operation

### 4.1 Cautions for Operation

<b>Danger</b>	See "Danger" (1) and (2) on p.04.
<b>Warning</b>	See "Warning"(8), (14), (15) ,(16)and (17) on p.04 and p.05.
<b>Caution</b>	See "Caution" (4), (5), (6) ,(7)and (8) on p.06.
<b>Note</b>	See "Note" (3), (4), (5), (6) and (7) on p.07.

### 4.2 Operation of the Thermal Protector

- 1) If the thermal protector 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.

Characteristics of the thermal protector

Automatic reset thermal protector

Operation temperature	120±10°C
Reset temperature	80±10°C



## Caution

See "Caution" (6) on p.06.

Immediately switch off the main power and contact to the manufacturer, when thermal protector is activated.

### 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 0°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 Pressure Achieved

The term "pressure achieved" as employed in the catalogue and in this manual is defined as "the minimum pressure obtained by the pump without introduction of gas from the pump inlet (i.e. the no-load condition)".

Note that the indicator values for pressure may differ between types of vacuum gauges.

The pressure achieved in practice is higher than that noted in the catalogue for the following reasons.

- (1) The fact that the vacuum gauge is mounted a distance from the pump, the steam generated by water droplets and rust etc on the inside walls of the pump and piping, and a variety of gases present in the system result in increased pressure.
- (2) Leaks into the vacuum system introduce other gases, resulting in increased pressure.

### 5.2 Evacuation Rate

The rate of evacuation varies with the type of gas used, and its pressure. The maximum rate of evacuation is reached when air is introduced, and slowly decreases as pressure is reduced. The resistance of the piping system increases with small bore piping which extends over long distances, and this reduces the rate of evacuation.





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

### 5.3 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  $2.7 \times 10^{-4} \sim 6 \times 10^{-4}$  Pa. If pressure drops below this level, compression work is considerably reduced and power is expended in mechanical work.

## 6. Maintenance, Inspection, and Repair

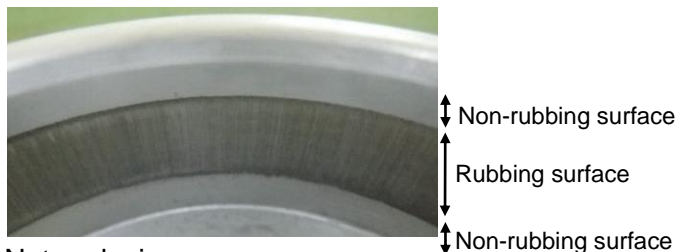
### 6.1 Cautions for Maintenance, Inspection, and Repair

 <b>Danger</b>	See "Danger" (3) on p.04.
 <b>Warning</b>	See "Warning" (4), (17) and (18) on p.04 and p.05.
 <b>Caution</b>	See "Caution" (9) and (10) on p.07.
 <b>Note</b>	See "Note" (8) on p.07.

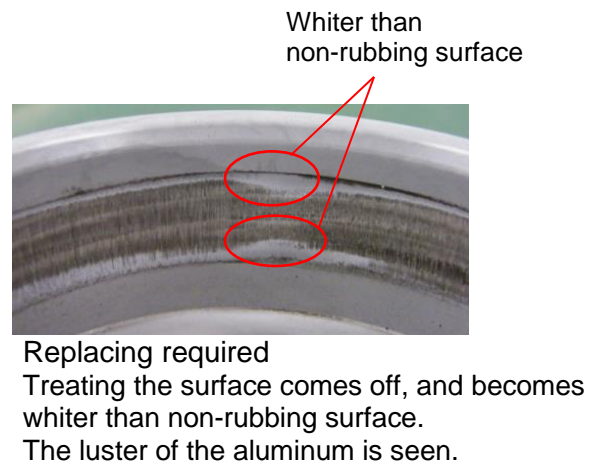
Customer repair technicians are able to perform the following maintenance and repairs. Other repairs and modifications (except for the standard options available from the manufacturer) should not be performed by the customer.

- 1) Replacing cup packing
- 2) Replacing valve A type
- 3) Replacing valve D type
- 4) Replacing valve holder plate A type
- 5) Replacing gaskets
- 6) Replacing O ring
- 7) Replacing Cylinder ※1

※1 Replacing it by the state of the rubbing surface.



Not replacing  
The material changes into a rubbing surface and it becomes black.



### 6.2 Maintenance

Ensure that the following checks are conducted at least once every three days while the pump is in operation.

- 1) Does the pump emit abnormal noises?
- 2) Is the pump abnormally hot?
- 3) Is gas evacuated normally?
- 4) Is the silencer blocked?

Resolve any problems in accordance with "6-5.Troubleshooting List."

### 6.3 Regular Inspections

Inspect consumables after the first 3000 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 Consumables and Cleaning for procedures.

In addition, change it in our Service Section when there is not a repair engineer.

# <Consumables List>

Table 6-1 Consumables List (DOP-400SB)

Components	Quantity	Material	Average life
Cup packing	4	PTFE	6000 Hr
valve A type	4	PTFE	6000 Hr
valve D type	4	PTFE	6000 Hr
valve holder plate A type	4	PTFE	6000 Hr
Gaskets	4	EPDM	6000 Hr
O ring	8	EPDM	6000 Hr
Cylinder	4	Aluminum	6000 Hr
Bearings	1 set	———	15000 Hr

Life of these components tends to be extended when the requirements in "4.1 Cautions for Operation" are followed, and the pump is operated under a light load. The term 'light load' refers to operation at achieved pressure (inlet closed).

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.

Cup packing: Replace in the event of abnormal wear, hardening, or cracking.

Valve A type: Replace in the event of deformation, hardening, or chipping.

Valve D type: Replace in the event of deformation, hardening, or chipping.

Valve holder plate A type:

Replace in the event of abnormal wear, hardening, or cracking.

Gaskets: Replace in the event of deformation, hardening, or cracking.

O ring: Replace in the event of deformation, hardening, or chipping.

Cylinder: Replace in the event of Treating the surface comes off. Refer to※1 P9.

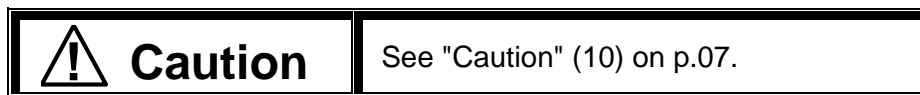
Bearings: Contact the manufacturer for repair in the event of abnormal noises or abnormal motor vibration (chattering).

## <Locations for Maintenance and Inspection>

Table 6-2 Locations for Maintenance and Inspection

Period of operation	Inspection item	Inspection details	Method of inspection
Every 3000 hours	Cup packing	Abnormal wear, hardening, cracking.	Visual inspection
	Valve A type	Deformation, wear, hardening, cracking.	Visual inspection
	Valve D type	Deformation, wear, hardening, cracking.	Visual inspection
	Valve holder plate A type	Deformation, wear, hardening, cracking.	Visual inspection
	Gaskets	Deformation, hardening, cracking.	Visual inspection
	O ring	Deformation, hardening, cracking.	Visual inspection
	Cylinder	Treating the surface comes off	Visual inspection
	Bearings	Abnormal noises.	Listen
	Silencer	Blocking	Visual inspection

## 6.4 Replacing Consumables and Cleaning



- (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.

Prepare the following tools, and refer to photographs, before replacing components and cleaning. Contact the manufacturer's service division if the required tools are not available.

### \* Tools

1. Hex wrenches: 5 mm across flats
  2. Torque wrench: Hexagon socket, 5 mm across flats (A torque wrench prepares the thing which 10N·m and 12N·m can set.)
  3. Philips screwdriver: No. 2, No. 3
  4. Cleaning solvent: Solvent which does not affect rubber components (eg ethyl alcohol)  
※When using, please read carefully the instruction for solvent.
  5. Paper: Soft cloth or paper to remove contamination
  6. Dust mask, gloves, oil-based pen, and air compressor
  7. Roctite 242
- ※ Wipe components which is contaminated during replacement with 4. And 5. Above.

### Procedure for Replacing Consumables in DOP-400SB

This product is comprised of four head pump chambers. This description includes the procedure for replacing consumables for a single head. It is recommended that the consumables for the remaining three heads are also replaced using this procedure.

### \* Replaceable Consumables

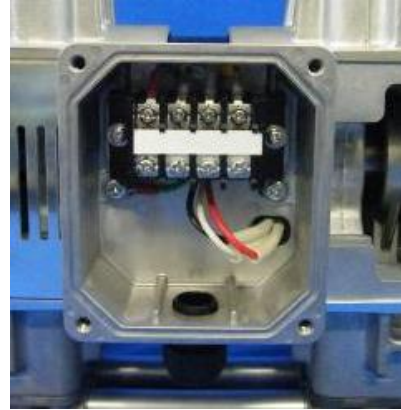
- |                             |                |                |
|-----------------------------|----------------|----------------|
| · Cup packing               | · Valve A type | · Valve D type |
| · Valve holder plate A type | · Gaskets      |                |
| · O ring                    | · Cylinder     |                |

## 1) Preparations for Replacing Pump Parts

- (1) Switch off the pump primary power supply, and remove the piping connected to the inlet pipe.
- (2) Open the terminal box, and remove the wiring connected to the terminal block.
- (3) Remove the pump from the equipment.

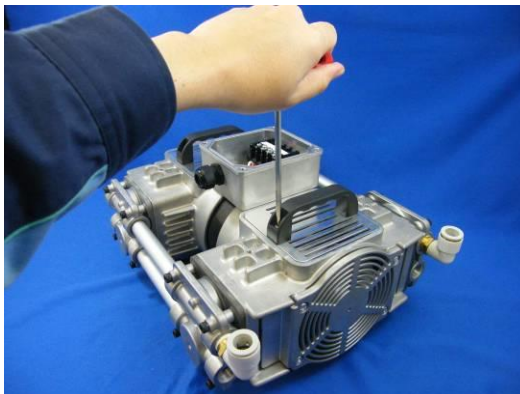


(1) Remove from the equipment.



(2) (3) Remove wiring

- (4) Using the 5 mm hex wrench, loosen the M6X20 hex-headed bolt holding the handle.
- (5) Remove the handle and panel.
- (6) Stand the pump up so that the head may be removed vertically.



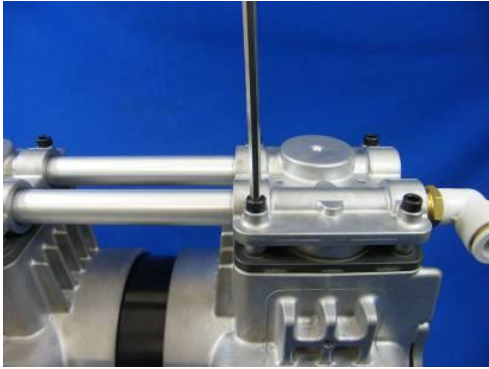
( 4), (5) Loosen the bolt.



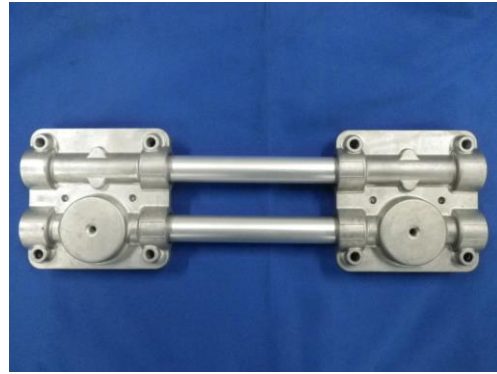
(6) Stand the pump up so that the head may be removed vertically.

## 2) Removing the Head Cover

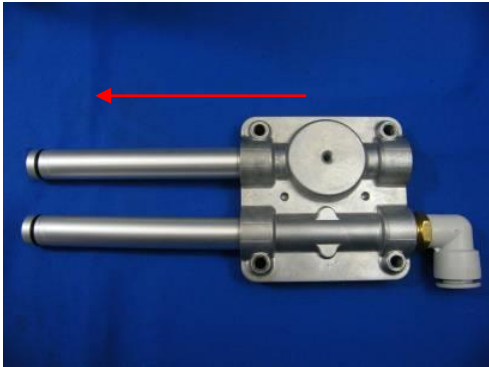
- (1) Using the hex wrench, loosen the four M6xL45 hex-headed bolts holding the head cover, and remove them.
- (2) Remove a connection pipe and a head cover.
- (3) Pull out a connection pipe from a head cover.
- (4) Remove an O-ring attached to a connection pipe.



(1) Loosen the screws



(2) Remove a connection pipe and a head cover.



(3) Remove a connection pipe and a head cover.

(4) Remove an O-ring attached to a connection pipe.



### 3) Removing the Cylinder

- (1) Mark the casing and cylinder with a permanent marker before removing the cylinder.
- (2) While wearing the gloves, turn the fan slowly upwards. Always ensure that gloves are worn.
- (3) Remove the cylinder upwards.



(1) Mark the casing and cylinder.



(2) Turn the fan upwards.



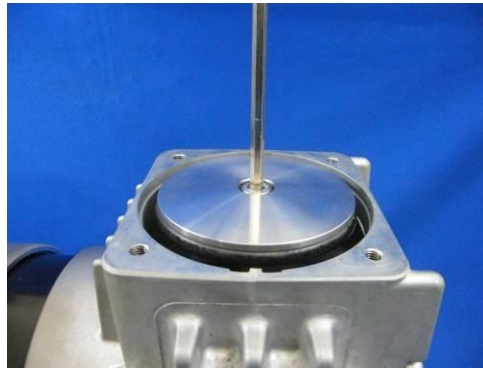
(3) Remove upwards.

**Caution:**  
 When the attachment direction of a cylinder is mistaken, a pump breaks down.  
 Please mark and enable it to certainly attach in the appointed direction, before removing.

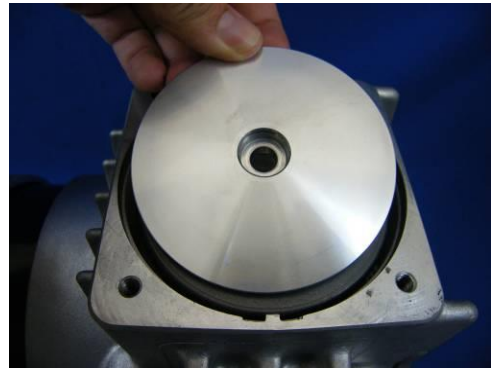


#### 4) Removing the Holder Plate and Cup Packing.

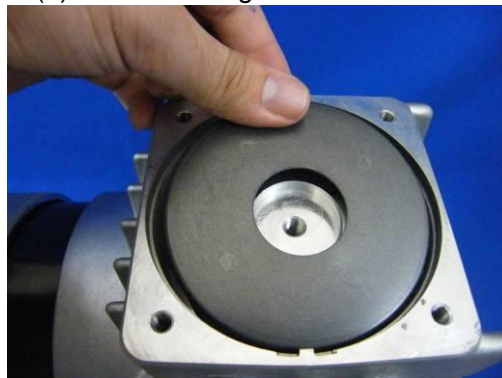
- (1) Loosen M8 X L16 belonging to hexagon hole in the holder plate. While wearing gloves, hold the loosened connecting rod and loosen the hexagon whole screws.
- (2) Remove the holder plate.
- (3) Remove the cup packing.
- (4) Removal is now complete.



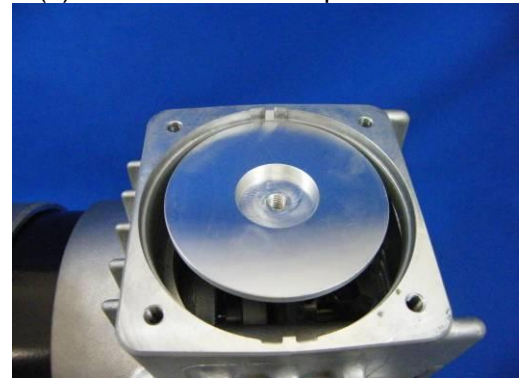
(1) Loosen hexagon screw



(2) Remove the holder plate



(3) Remove the cup packing.

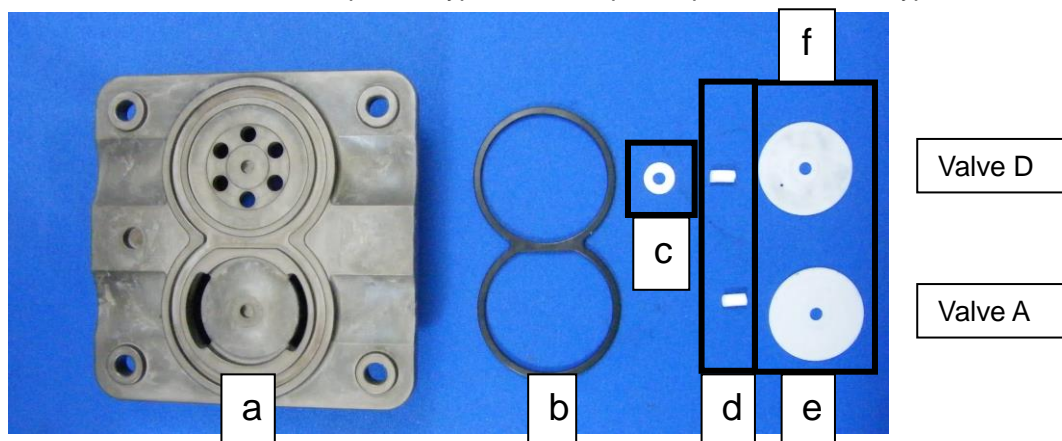


(4) Removal is now complete.

#### 5) Removing Small Cylinder Components

##### (1) Cylinder list

a : Cylinder    b : Gaskets    c : Valve holder plate A type    d : Pump headpin    e : Valve A type    f : Valve D type



- (2) Remove valve A, valve weight A, a gasket, a pump headpin.

(The pump headpin is not expendable supplies; please do not be lost.)

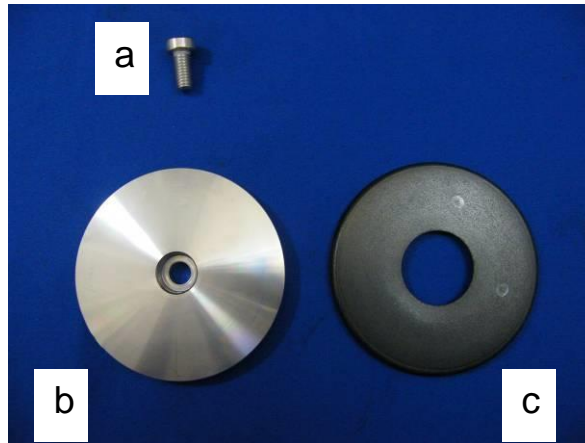
- (3) Take the washings to a waste and remove fat in the whole cylinder neatly.  
Particularly, the mount of the valve, the cylinder inner wall part clean it.



## 6) Cup Packing Holder Plate Details Parts, Cleaning

### (1) Holder plate and cup packing components list

a ; Hexagon hole bolt    b ; Cup packing holder plate    c ; Cup packing



(2) Take the washings to a waste and remove fat neatly Cup packing holder plate particularly Contact department Cup packing.

## 7) Connection Pipe Cleaning

(1) Take the washings to a waste and remove fat neatly in the whole connection pipe particularly a groove.

## 8) Replacing and Assembling Consumables

(1) Replace the cup packing. Place the cup packing on the connecting rod to ensure that the canopy is downwards.

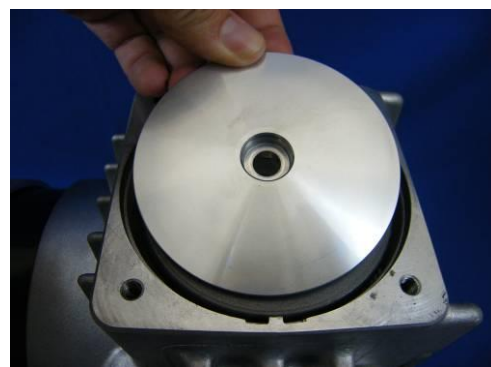
(2) Fitting holder plate.

(3) Roctite 242 is applied to M8×L16 Hexagon hole bolt screw part 3-4 piles.

The holder plate is installed in a bolt by 12 N·m.

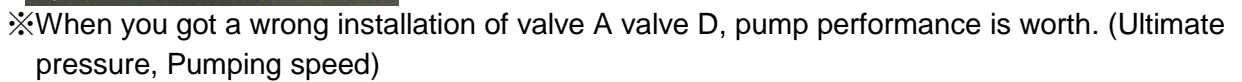


(1) Replacing cup packing.

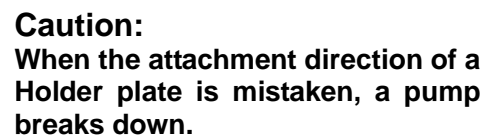


(2) Fitting holder plate.

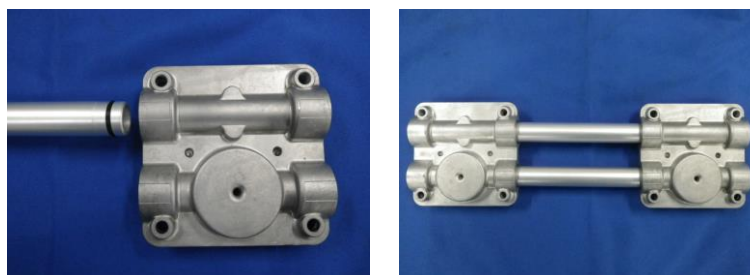
(Only A of the lower photograph follows a valve relief pitcher. As for the valve of the A side, a sunspot comes to the top.)



(Put it on so that a marking matches)



ring.)



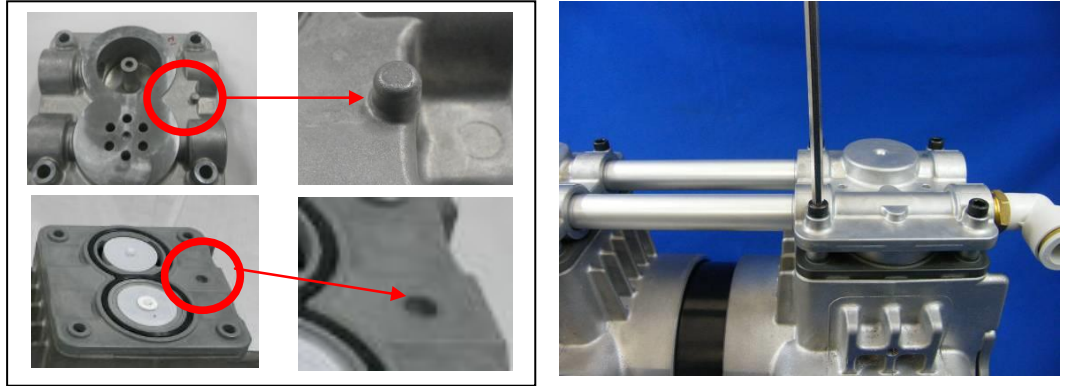
(7) Installation of the pump head.

Pile up a pole of the pump head and hole of the Cylinder.

Note) Tighten bolt M6 X L45 belonging to hexagon hole with a torque wrench. Please tighten the clamping torque in the opposite angle, equality in  $10\text{N}\cdot\text{m}$ .

Note) Confirm that it does not seem that a gasket is destroyed seeing from the side.

Pump head pole and Cylinder hole



(8) Installation of the steering wheel panel

- Install it in order of a panel steering wheel.
- Fix bolt M6 X L20 with the steering wheel hexagon hole in a hexagon wrench of opposite side 5mm.



(9)Consumption part exchange completion.

## 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. (2) The main power supply switch is not ON. (3) Problem with power supply voltage. (4) Problem with pump wiring. (5) The breaker has operated. (6) The thermal protector has operated. (7) Low ambient temperature. (8) Low voltage. (9) Fault in power supply. (10) Broken wire in power cord. (11) Problem with motor. (12) Locked connecting rod. (13) Problem with bearings. (14) Miscellaneous damage to pump components.	(1) Connect power supply. (2) Set switch to I. (3) Ensure that voltage variation is within +/-10%. (4) Rewire the pump and contact the manufacturer. (5) Investigate the reasons for operation. (6) Switch power OFF, and eliminate the cause of operation of the relay. Contact the manufacturer. (7) Ensure that ambient temperature is 0~40 °C. (8) Adjust the power supply voltage, and check the power supply cable. (9) Replace or repair. (10) Replace or repair. (11) Replace or repair. (12) Dismantle the head cover and cylinder, and check the interior. (13) Replace. (14) Disassemble and repair (replace damaged components).	3-4. 4-2. 4-3. 6-4. 6-4.
Pressure does not diminish.	(1) Pump is too small for capacity of vacuum vessel. (2) Pressure measurement is incorrect. (3) Vacuum gauge is unsuitable. (4) The inlet piping is too small in diameter, or too long. (5) Low voltage. (6) Ambient temperature unsuitable. (7) Leaks in inlet piping. (8) Leaks from piping or connections. (9) Foreign matter inside pump. (10) Water or solvent etc has been sucked into pump causing problems. (11) Damage to motor. (12) Damage to inlet/outlet valve. (13) Damage to cup packing. (14) Miscellaneous damage to pump components. (15) The silencer is blocked.	(1) Select another pump. (2) Measure the pressure correctly. (3) Measure with a calibrated vacuum gauge suitable for the pressure range. (4) Connect piping of an inside diameter greater than the inlet diameter, and reduce the distance between the pump and vacuum vessel. (5) Adjust the voltage, and check the power supply cable. (6) Ensure that ambient temperature is 0-40 °C. (7) Clean and replace. (8) Check for leaks in piping, check diameter and length of piping, and repair. (9) Remove foreign matter, disassemble and clean, and replace components. (10) Disassemble and repair (replace valves and cup packing etc). (11) Replace and repair. (12) Replace. (13) Replace. (14) Disassemble and repair (replace damaged components). (15) Clean and replace.	5-1. 5-1. 5-1. 6-4. 6-4. 6-4.
Pump surfaces are abnormally hot (more than room temperature + 30 °C)	(1) Continuous operation with high pressure gas. (2) High temperature gas. (3) Problem with power supply voltage. (4) Motor has seized. (5) The silencer is blocked.	(1) Do not run the pump continuously at near-atmospheric pressure. (2) Fit cooling equipment (eg. gas cooler) to the inlet. (3) Ensure that voltage variation is within +/-10%. (4) See the section on problems with pump rotation. (5) Clean and replace.	1-1 3-5 6-3

## 7. In Conclusion

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

### Warranty

- (1) The warranty for this pump 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: 0 - 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 vacuum 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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<https://ulvac-kiko.com/en>

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



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