

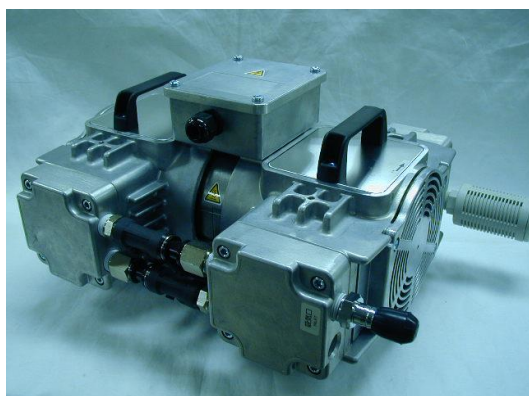
# INSTRUCTION MANUAL

## Oscillating Piston Dry Vacuum Pump

DOP-200S, 100T, 50F, 100ST, 50DT, 50S4, 50S4 II

DOP-200SV, 100TV, 50FV, 100STV, 50DTV, 50S4V, 50S4V II

DOP-300S, 150T, 300SV, 150TV



DOP-300S



DOP-300SV

### 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.

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

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## 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.

## 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

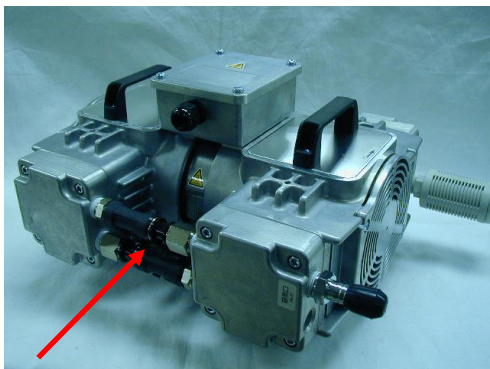
- Instruction manual ----- x 1
- Inlet pipe protective cap and vent plug ----- x 1 each
- Silencer ----- x 1

- (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.

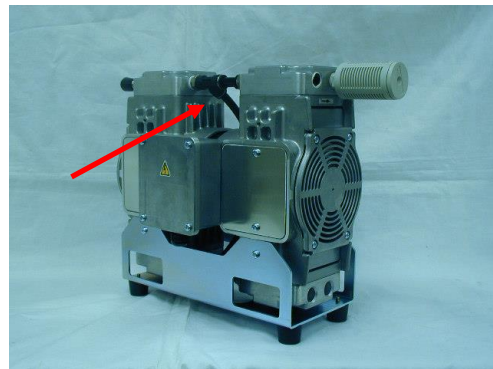


### Note

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-300S



DOP-300SV

## 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 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.

- 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. Do not use the pump to evacuate toxic gases. If toxic gas is evacuated 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 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'. Note that if the pump has been used to evacuate toxic gas, it may be contaminated and dismantling and repair may not be possible.

## **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, or pull the power cord, or place objects on it. Damage to the cord may result in electric shock or fire.

[Continued on next page]

## **Warning**

### **Power Supply**

- (10) Ensure that the power cord used for the pump is appropriate for the rated voltage and current. Use a 4-core cable, with each core wire having a cross-section area of 1.0mm<sup>2</sup> or more. Ensure that one of the core wires is used as an earth wire. Firmly attach the 6 - 12mm diameter SKINTOP 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.
- (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 plug may result in electric shock.



### **Operation**

- (14) 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.
- (15) Inserting fingers or objects into the motor inlet may result in electric shock, injury, or fire.
- (16) 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**

- (17) The pump should be dismantled or repaired only by a repair technician trained by the manufacturer.
- (18) 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. Use two persons to lift the upright vertical type of pump from its base.
- (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.

[Continued on next page]



## **Caution**

### Installation

(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.



Use two persons  
to hold here with  
both hands.

### Operation

- (4) Touching rotating components (eg motor, main shaft, axial joints, cooling fan) while the pump is in operation may result in injury.
- (5) When the overload protection relay operates the pump will be extremely hot. Touching the pump in this condition may result in burns.
- (6) 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.
- (7) Inserting fingers or objects, or peering, into, the inlet or outlet during operation may result in injury or malfunction.

### Maintenance and Repair

- (8) 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.
- (9) 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.
- (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.

### **Application**

- (5) 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.
- (6) This pump is only for vacuum pumping. Use at near-atmospheric pressures for long periods of time may result in a malfunction.
- (7) 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.
- (8) The pump will not often operate normally if it is used with corrosive gases, organic solvents, liquids, or condensed gases (eg steam).
- (9) 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**

- (10) 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.
- (11) Application of back pressure at the pump outlet will overload the motor and may prevent the pump starting.
- (12) 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**

- (13) 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

(Product specification of each model is put on P.18-21.)

### 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-200S		DOP-200SV	DOP-300S		DOP-300SV
Evacuate rate (L/min)	200/220			300/330		
Pressure achieved (kPa)	8			8		
Motor	3φ200V280W4P 50/60Hz 3φ220V280W4P 60Hz Fitted with thermal protection relay (automatic reset type)			3φ200V400W4P 50/60Hz 3φ220V400W4P 60Hz Fitted with thermal protection relay (automatic reset type)		
Voltage, frequency	200V·50Hz	200V·60Hz	220V·60Hz	200V·50Hz	200V·60Hz	220V·60Hz
Rated current (A)	1.8	1.7	1.6	2.5	2.3	2.2
Speed (r.p.m)	1382	1651	1692	1401	1672	1701
Inlet pipe	O.D.φ16×I.D.φ12 (R1/2)					
Weight (kg)	20		22	20		22
Air temperature (°C)	0-40					
Dimensions (mm)	315W×434L×231H		216W×460.5L×353H	315W×443L×231H		225W×469.5L×353H
Over voltage category	Ⅱ			Ⅱ		
Pollution degree	2			2		
Insulation Category	Class 1			Class 1		

### 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 (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" (5) on p.06.

## 2. Dimensions

(Product specification of each model is put on P.18-21.)

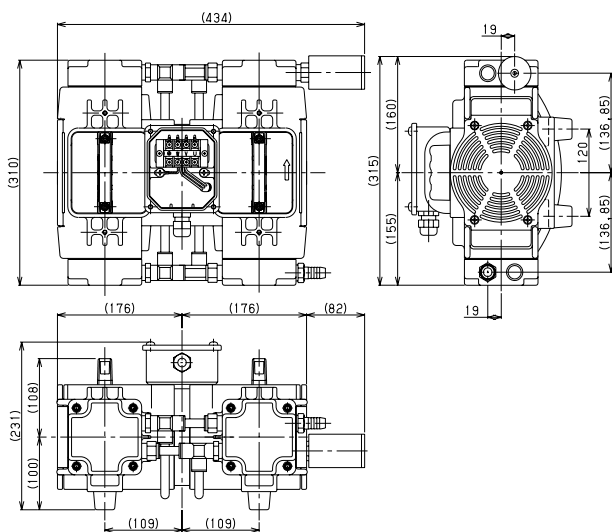


Fig.2.1 DOP-200S

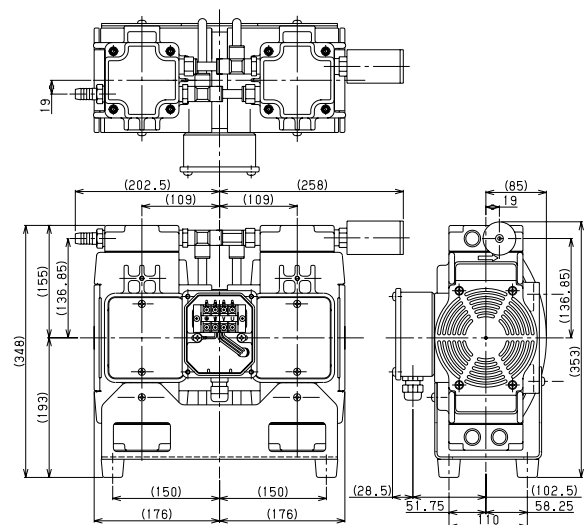


Fig.2.2 DOP-200SV

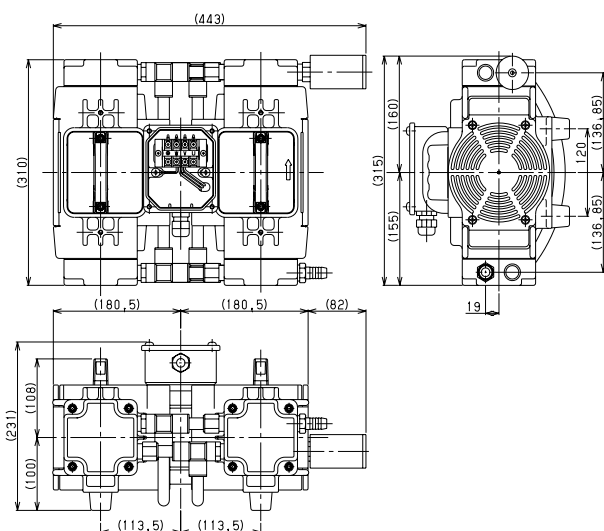


Fig.2.3 DOP-300S

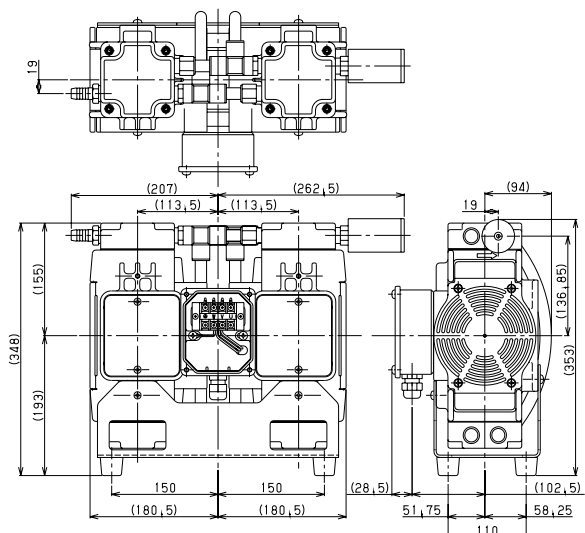





Fig.2.4 DOP-300SV

### 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) and (13) on p.04 and p.05.
 <b>Caution</b>	See "Caution" (1), (2) and (3) on p.05 and p.06.
 <b>Note</b>	See "Note" (1), (2), (3) and (4) 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 SKINTOP, and connect to the terminal block. Fit the appropriate crimped connectors to the end of the cord.

Caution: Ensure that the power cord is appropriate for the rated voltage and current.

Caution: Use a 4-core cable, with each core wire having a cross-section area of 1.0 mm<sup>2</sup> or more. Use one of the core wires as an earth wire.

Caution: Use M4 terminal block screws with SKINTOP 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: Rotating electric machine general rules IEC 60034-1:2004.

There is no problem to main parts when operated continuously under the voltage and frequency fluctuations in area A, and no problem to main parts when operated under the voltage and frequency fluctuations in area B.

Here, “no problem” means that the pump can be operated safely

and without the life of the parts being shortened, and does not refer to the pump characteristics or the rated conditions such as a rise in temperature.

The ratings are the rated torque (N.m).

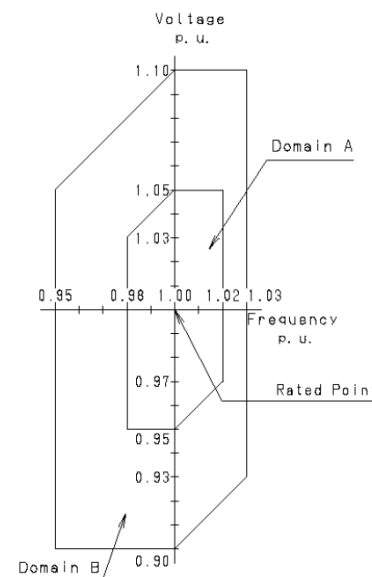


Fig.3.1 Change region of the voltage and frequency

### 3.6 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 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) 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) When evacuating a vessel, ensure that a shut-off valve is placed between the pump inlet pipe and the vessel (see Fig. 3.2).

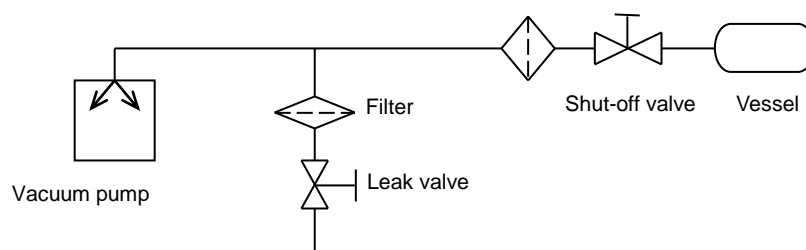


Fig. 3.2 Example of Piping Used When Evacuating a Vessel

- 6) When starting the pump, it may not start if the intake-side pressure is lower than the atmospheric pressure.  
Attach an atmospheric release leak valve between the pump intake pipe and vessel, and set the intake-side pressure to atmospheric pressure when starting the pump.  
After starting the pump, always close the leak valve.





### 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) and (16) on p.04 and p.05.
 <b>Caution</b>	See "Caution" (4), (6) and (7) on p.06.
 <b>Note</b>	See "Note" (3), (4), (5), (6), (7), (8), (9), (10), and (11) on p.07.

### 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) on p.06.
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### 4.3 Precautions when starting

#### 1) 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.

#### 2) Precautions regarding the intake-side pressure

Set the intake-side pressure to atmospheric pressure when starting the pump.

If the pressure is lower than atmospheric pressure, it will apply a load on the motor and may prevent the pump from starting.

If it is necessary to maintain a vacuum, attach a shut-off valve or three-way valve between the pump and vessel. Refer to fig.3.2 for a piping example using a shut-off valve.

## 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  $2.7 \times 10^4$  -  $6 \times 10^4$  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" (8) and (9) on p.06.
 <b>Note</b>	See "Note" (13) 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 inlet and outlet valves
- 3) Replacing gaskets
- 4) Replacing inlet valve rubber separator
- 5) Replacing backup inlet and outlet valves
- 6) Replacing connecting tubes

### 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.

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

<Consumables List>

Table 6.1 Consumables List

Components		Quantity		Material	Average life
		200(※1)	300(※2)		
Inlet and outlet valves (Other than ※3)		12	12	SUS	———
DOP-50S4,50S4V, 50S4 II ,50S4V II (※3)	Inlet valves(t=0.2)	4		SUS	———
	outlet valves	4			
Backup inlet and outlet valves		8	8	PTFE	6000 h
Cup packing		4	4	PTFE	6000 h
Inlet valve rubber separator		4	4	Silicon	6000 h
Gaskets		4	4	NBR	6000 h
Connecting tubes		1 set	1 set	Nylon	6000 h
Bearings		1 set	1 set	———	15000 h

※1 DOP-200S,200SV,100T,100TV,50F,50FV,100ST,100STV,50DT,50DTV,50S4,50S4V,50S4 II ,50S4V II

※2 DOP-300S,300SV,150T,150TV

※3 DOP-50S4,50S4V,50S4 II ,50S4V II : Quantity 4

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.

Backup inlet and outlet valves:

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

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

Inlet and outlet valves:

Replace in the event of deformation, hardening, or chipping.

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

Inlet valve rubber separator:

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

Connecting tubes: Replace in the event of deformation, wear, hardening, or cracking.

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

<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	Backup inlet and outlet valves	Abnormal wear, hardening, cracking.	Visual inspection
	Cup packing	Abnormal wear, hardening, cracking.	Visual inspection
	Inlet and outlet valves	Deformation, hardening, chipping.	Visual inspection
	Inlet valve rubber separator	Deformation, wear, hardening, cracking.	Visual inspection
	Gaskets	Deformation, hardening, cracking.	Visual inspection
	Connecting tubes	Deformation, hardening, cracking.	Visual inspection
	Bearings	Abnormal noises.	Listen

## 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 and 3 mm across flats
  2. Torque wrench: Hexagon socket, 5 mm across flats (torque settable to 8Nm)
  3. Philips screwdriver: No. 2
  4. Cleaning solvent: Solvent which does not affect rubber components (eg ethyl alcohol)
  5. Paper: Soft cloth or paper to remove contamination
  6. Dust mask, gloves, oil-based pen, air compressor
- ※ Wipe components which is contaminated during replacement with 4. and 5. above.

Procedure for exchanging the article of consumption of this product..

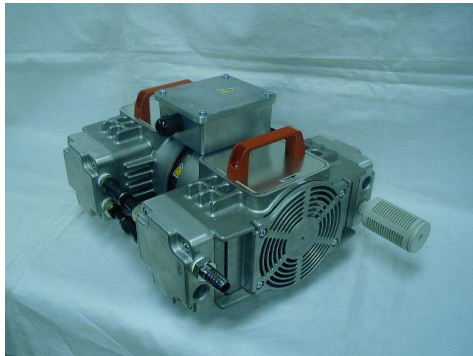
This product is comprised of four head pump chambers. This description includes the procedure for replacing consumables for a single head. It is recommended that the consumables for the remaining three heads are also replaced using this procedure. The replacement procedure is described using the DOP-200S. Remove the angle when replacing consumables in the vertical type of pump.

### \* Replaceable Consumables

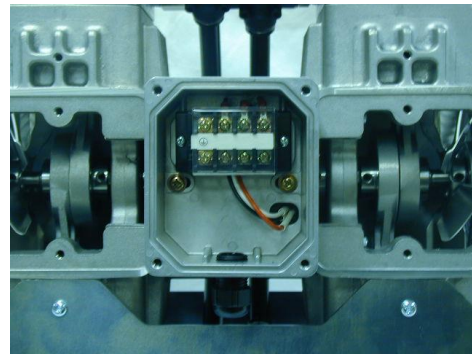
- |                                  |                                |
|----------------------------------|--------------------------------|
| · Backup inlet and outlet valves | · Inlet valve rubber separator |
| · Inlet and outlet valves        | · Cup packing                  |
| · Gaskets                        | · Connecting tubes             |

## 1) Preparations for Replacing the Pump

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

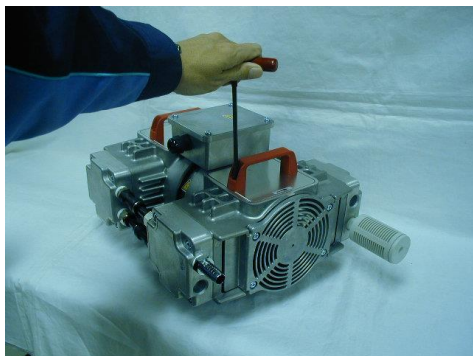


(1),(2) Remove from the equipment.



(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.



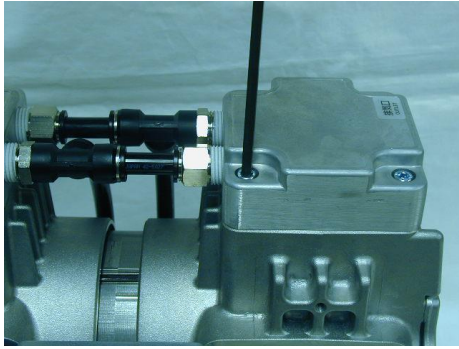
(4),(5) Loosen the bolt.



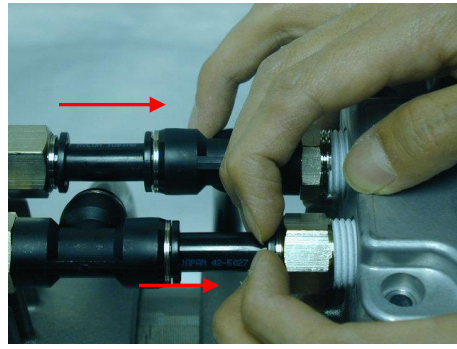
(6) Stand the pump up so that the head may be removed vertically.

## 2) Removing the Head Cover

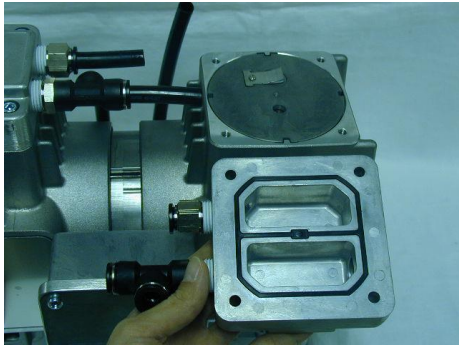
- (1) Using the hex wrench, loosen the four M6xL30 hex-headed bolts holding the head cover, and remove them.
- (2) Pull the fitting joint forwards with both hands and remove from the connecting tube. Pull the left and right fitting joints alternately until they are removed.
- (3) Remove the connecting tube, and remove the head cover.



(1) Loosen the screws.



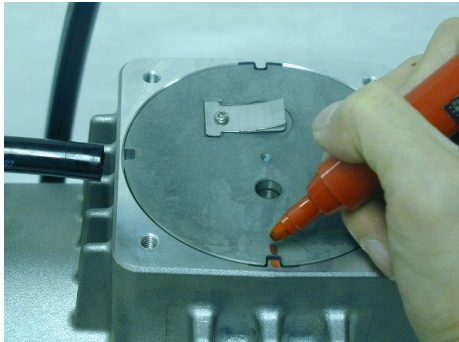
(2) Pull the joint forward.



(3) Remove the head cover.

### 3) Removing the Cylinder

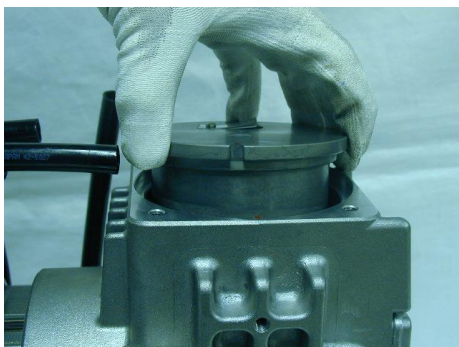
- (1) Mark the casing and cylinder with a permanent marker before removing the cylinder.
- (2) While wearing the gloves, turn the fan slowly upwards. Always ensure that gloves are worn.
- (3) Remove the cylinder upwards.



(1) Mark the casing and cylinder.



(2) Turn the fan upwards.



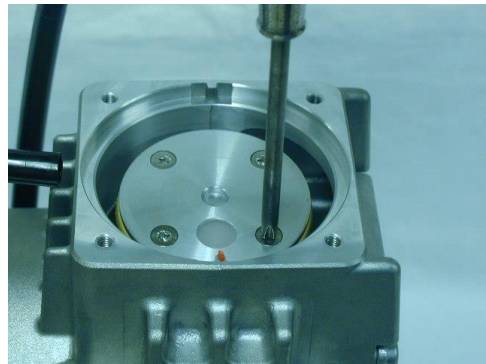
(3) Remove upwards.



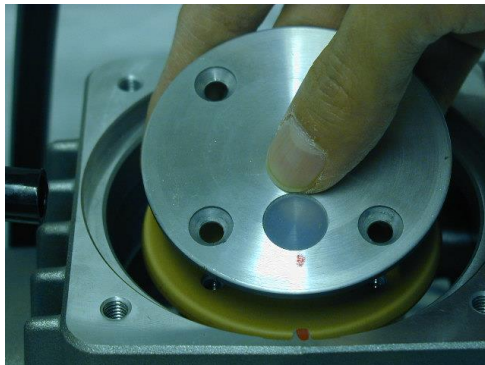
- 4) Removing the Holder Plate, Cup Packing, and Inlet Valve Rubber Separator
- (1) Mark the holder plate at the mark on the casing.
  - (2) Loosen the four countersunk M5xL12 screws in the holder plate. While wearing gloves, hold the loosened connecting rod and loosen the four countersunk screws.
  - (3) Remove the holder plate.
  - (4) Remove the cup packing.
  - (5) Removal is now complete.



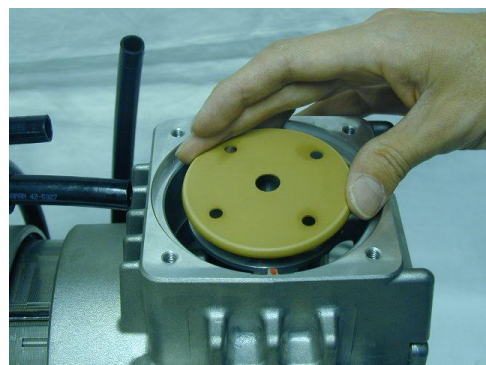
(1) Mark the holder plate.



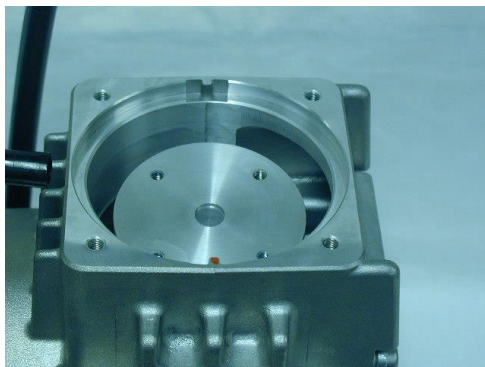
(2) Loosen countersunk screws.



(3) Remove the holder plate.



(4) Remove cup packing.



(5) Removal complete.

## 5) Removing Small Cylinder Components

- (1) Loosen the outlet valve holder plate M3xL5 roundhead screw.
- (2) Remove the outlet valve holder plate, backup outlet valve, and outlet valve.
- (3) Loosen the inlet valve holder plate M3xL5 roundhead screw.
- (4) Remove the inlet valve holder plate and inlet valve.
- (5) Place a small amount of cleaning fluid on a soft cloth or paper and wipe the entire cylinder to remove oil and grease. It is particularly important to clean the inlet and outlet valve mountings, and the inside surface of the cylinder.

**Caution: Take care to ensure that the mark is not lost.**

- (6) Cylinder list



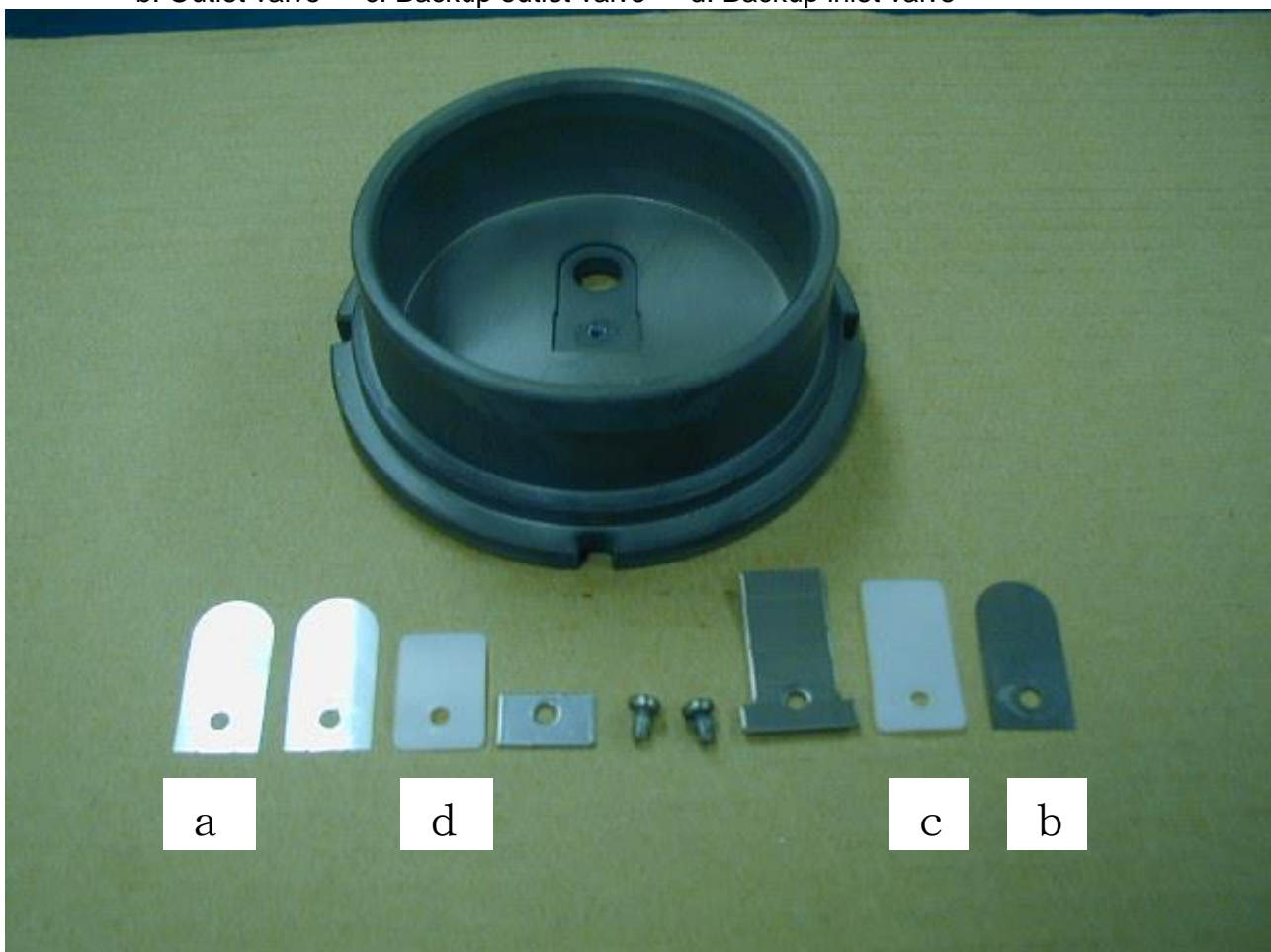
(1), (2) Loosen and remove screw.



(3), (4) Loosen and remove screw.

a: Inlet valve (DOP-50S4,50S4V,50S4 II ,50S4V II : One piece t=0.2 )

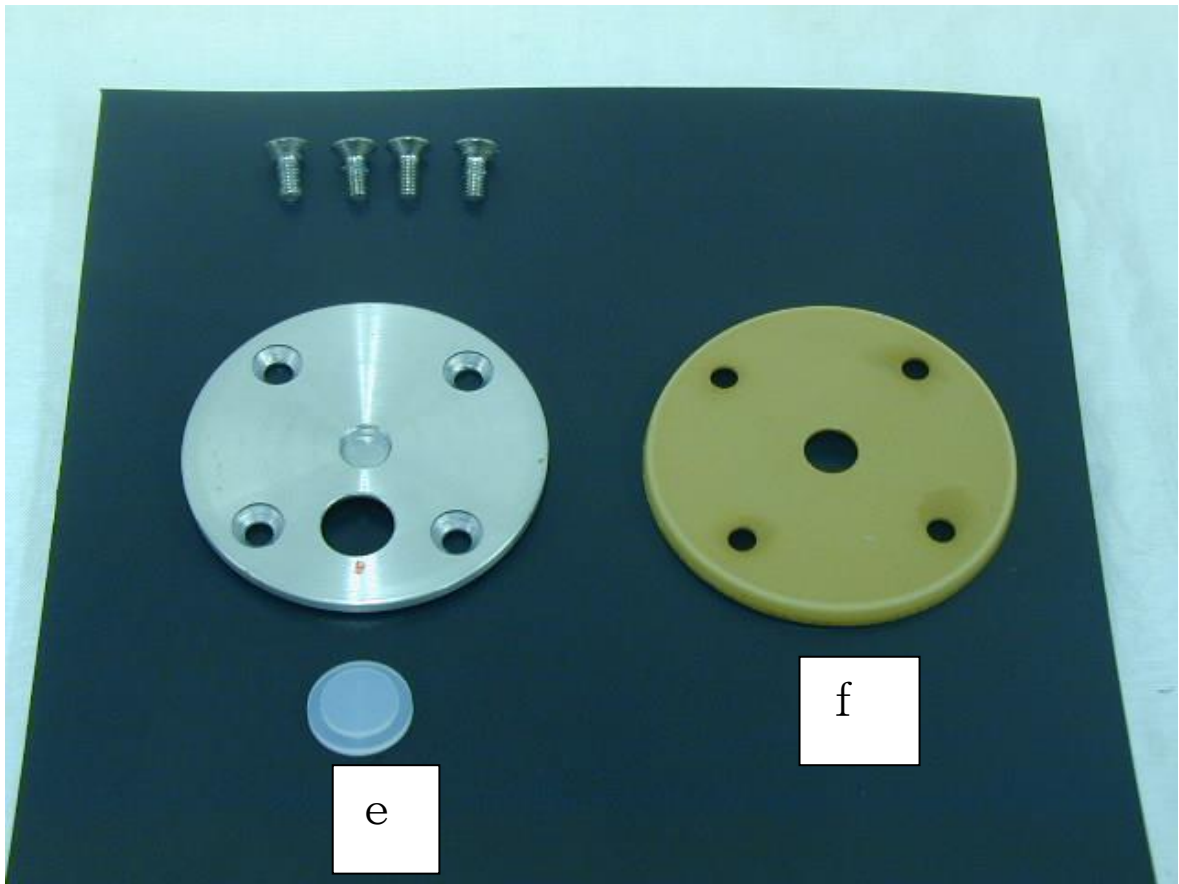
b: Outlet valve c: Backup outlet valve d: Backup inlet valve



## 6) Detailed Holder Plate Components

(1) Holder plate and cup packing components list

e: Inlet valve rubber separator      f: Cup packing

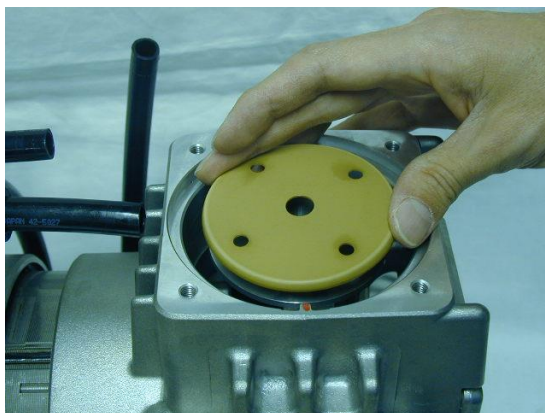


## 7) Replacing and Assembling Consumables

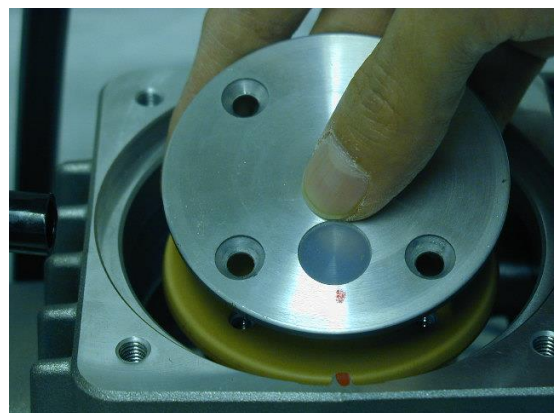
(1) Replace the cup packing. Place the cup packing on the connecting rod to ensure that the canopy is downwards.

(2) Insert the new inlet valve rubber separator into the groove on the rear of the cleaned holder plate.

(3) Align the mark on the holder plate, and tighten the four M5xL12 countersunk screws.



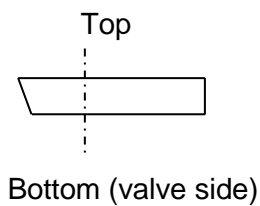
(1) Replacing cup packing.



(3) Fitting holder plate.



- (4) Place two inlet valves on the washed cylinder and place the backup inlet valve, inlet valve holder plate on top. Ensure that the inlet valve holder plate is mounted in the correct orientation. The top of the inlet valve holder plate is set facing up so that the shorter direction (distance from the center of the hole to the edge face) is pointing towards the right-hand side of the inlet valve. When set in place, tighten the M3xL5 roundhead screw to prevent the inlet valve contacting the groove on the periphery.
- (5) Place the outlet valve on the cylinder, and place the backup outlet valve on the outlet valve.
- (6) Place the outlet valve holder plate on the backup outlet valve and tighten the M3xL5 roundhead screw. Tighten the screw while ensuring that the valve does not contact the groove on the periphery.



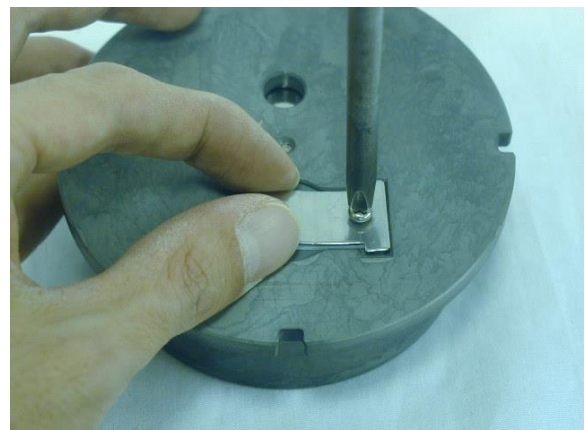
(4) Fitting the inlet valve



(4) Fitting the outlet valve

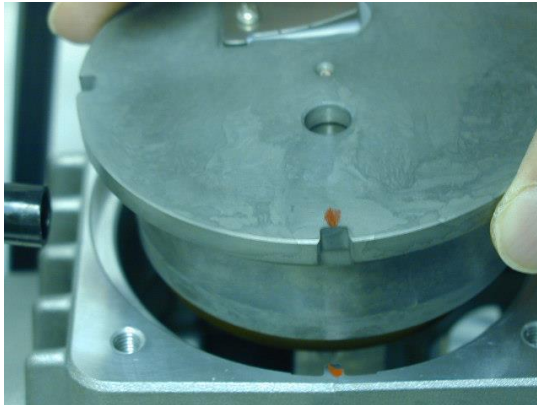


(5) Fitting the outlet valve holder plate



(6) Tightening the screw

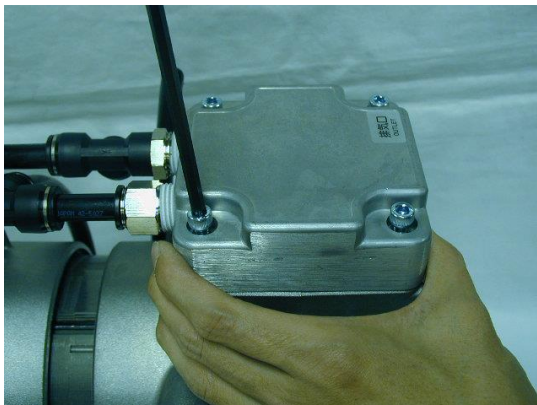
- (7) Align the cylinder with the mark, and insert in the cup packing.
- (8) Remove the head cover gasket and wash the head cover. After washing, blow with compressed air, and fit the new gasket.
- (9) Insert the head cover joint in the connecting tube and align the screw holes in the casing and head cover. Tighten the four M6xL30 hex-headed bolts to a torque 8Nm. When replacing the connecting tube, ensure that the replacement tube is cut to the same pump length.
- (10) Fit the connecting tube. (When replacing the connecting tube, ensure that the replacement tube is cut to the same pump length.)
- (11) Lay the pump on its side and fit the panel and handle.
- (12) Replacement of consumables is now complete (fit the angle to complete replacing consumables in the vertical type pump).



(7) Inserting the cylinder.



(8) Replacing the gasket.



(9) Fitting the head cover.



(10) Fitting the connecting tube.



(11) Fitting the panel and handle.



(12) Replacement of consumables complete.

## 6.5 Troubleshooting List

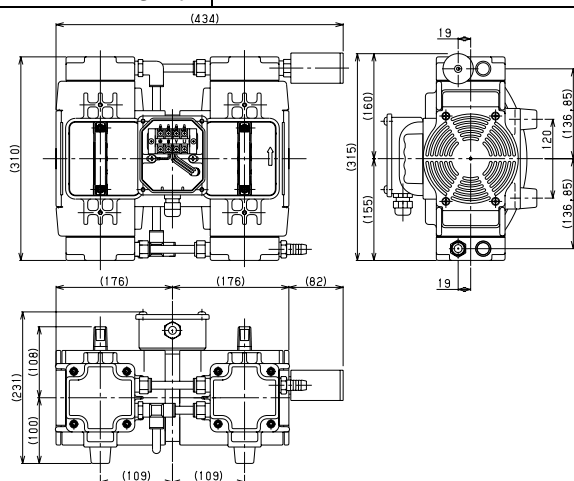
Table 6.3 Troubleshooting List

Problem	Causes	Solutions	Reference
Problems with starting and rotation of pump	(1) Not connected to power supply.	(1) Connect power supply.	3-4.
	(2) The main power supply switch is not ON.	(2) Set switch to I.	
	(3) Problem with power supply voltage.	(3) Ensure that voltage variation is within +/-10%.	
	(4) Problem with pump wiring.	(4) Rewire the pump and contact the manufacturer.	4-2.
	(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.	
	(7) Low ambient temperature.	(7) Ensure that ambient temperature is 0-40 °C.	4-3.
	(8) Low voltage.	(8) Adjust the power supply voltage, and check the power supply cable.	
	(9) Fault in power supply.	(9) Replace or repair.	
	(10) Problem with power supply switch.	(10) Replace or repair.	6-4.
	(11) Broken wire in power cord.	(11) Replace or repair.	
	(12) Problem with motor.	(12) Replace or repair.	
	(13) Locked connecting rod.	(13) Dismantle the head cover and cylinder, and check the interior.	6-4.
	(14) Problem with bearings.	(14) Replace.	
	(15) Miscellaneous damage to pump components.	(15) Disassemble and repair (replace damaged components).	
Pressure does not diminish.	(1) Pump is too small for capacity of vacuum vessel.	(1) Select another pump.	5-1.
	(2) Pressure measurement is incorrect.	(2) Measure the pressure correctly.	
	(3) Vacuum gauge is unsuitable.	(3) Measure with a calibrated vacuum 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, and reduce the distance between the pump and vacuum vessel.	5-1.
	(5) Low voltage.	(5) Adjust the voltage, and check the power supply cable.	
	(6) Ambient temperature unsuitable.	(6) Ensure that ambient temperature is 0-40 °C.	
	(7) Leaks in inlet 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 sucked into pump causing problems.	(10) Disassemble and repair (replace valves and cup packing etc).	6-4.
	(11) Damage to motor.	(11) Replace and repair.	
	(12) Damage to inlet/outlet valve.	(12) Replace.	
	(13) Damage to cup packing.	(13) Replace.	6-4.
	(14) Miscellaneous damage to pump components.	(14) Disassemble and repair (replace damaged components).	
	(15) The silencer is blocked.	(15) Clean and replace.	
Pump surfaces are abnormally hot (more than room temperature + 30 °C)	(1) Continuous operation with high pressure gas.	(1) Do not run the pump continuously at near-atmospheric pressure.	
	(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.	
	(5) The silencer is blocked.	(5) Clean and replace.	

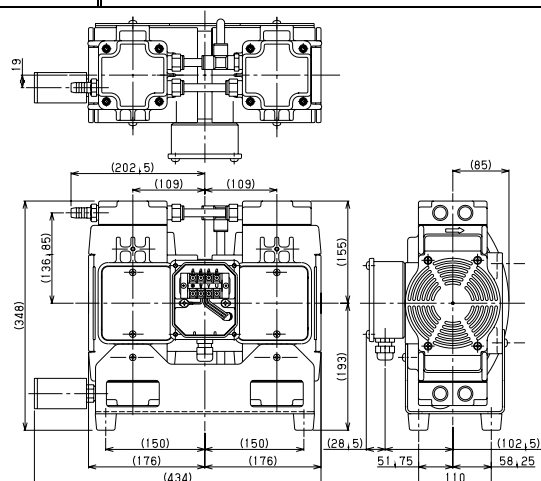
## 7. Product specification of each model

(50/60Hz)

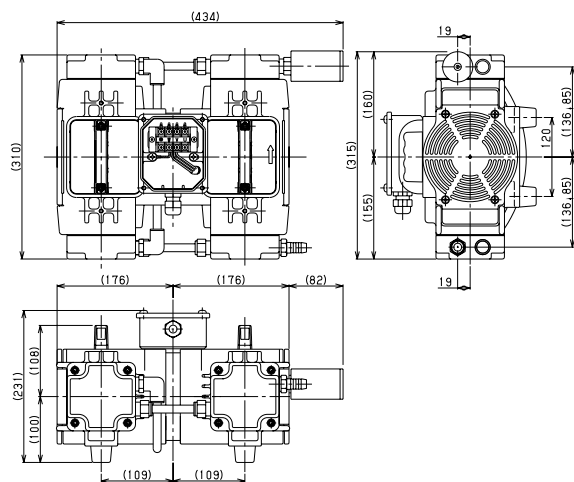
Model	DOP-100T		DOP-100TV	DOP-50F		DOP-50FV
Evacuate rate (L/min)	100/110			50/55		
Pressure achieved (kPa)	0.4			0.27		
Motor	3φ200V280W4P 50/60Hz 3φ220V280W4P 60Hz Fitted with thermal protection relay (automatic reset type)			3φ200V280W4P 50/60Hz 3φ220V280W4P 60Hz Fitted with thermal protection relay (automatic reset type)		
Voltage, frequency	200V·50Hz	200V·60Hz	220V·60Hz	200V·50Hz	200V·60Hz	220V·60Hz
Rated current (A)	1.8	1.7	1.6	1.8	1.7	1.6
Speed (r.p.m)	1382	1651	1692	1382	1651	1692
Inlet pipe	O.D.φ16×I.D.φ12 (R1/2)					
Weight (kg)	20		22	20		22
Air temperature (°C)	0-40					
Dimensions (mm)	315W×434L×231H		216W×434L×348H	315W×434L×231H		216W×434L×348H
Over voltage category	II			II		
Pollution degree	2			2		
Insulation Category	Class 1			Class 1		



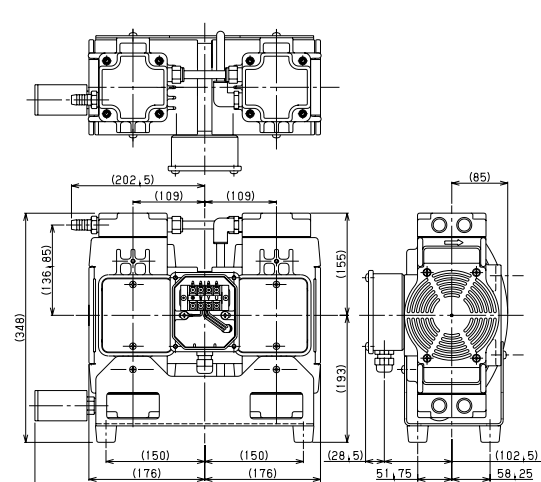
DOP-100T



DOP-100TV



DOP-50F

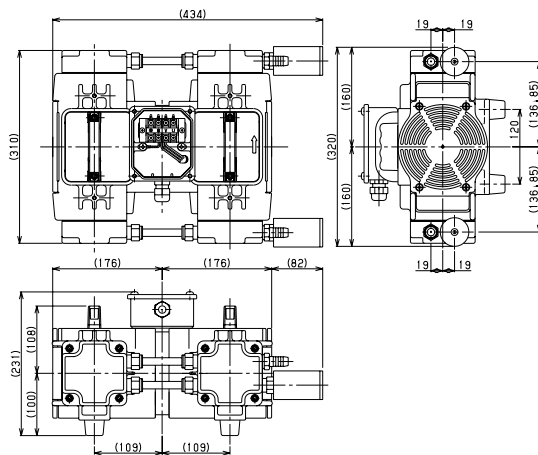


DOP-50FV

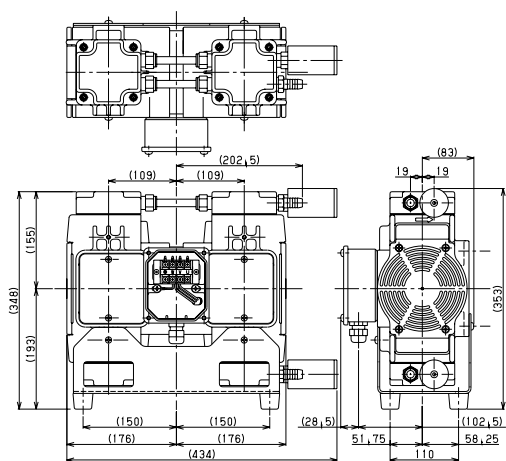
# Product specification of each model

(50/60Hz)

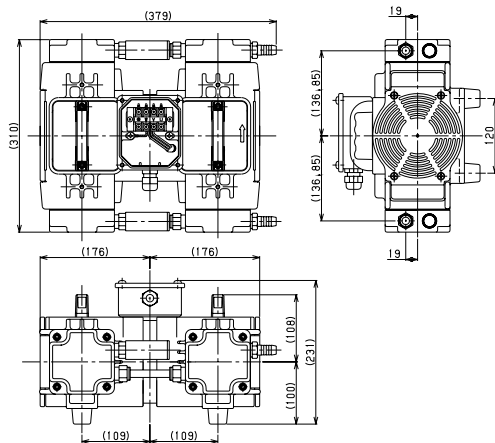
Model	DOP-100ST		DOP-100STV	DOP-50DT		DOP-50DTV
Evacuate rate (L/min)	100/110			50/55		
Pressure achieved (kPa)	8			1.2		
Motor	3φ200V280W4P 50/60Hz 3φ220V280W4P 60Hz Fitted with thermal protection relay (automatic reset type)			3φ200V280W4P 50/60Hz 3φ220V280W4P 60Hz Fitted with thermal protection relay (automatic reset type)		
Voltage, frequency	200V·50Hz	200V·60Hz	220V·60Hz	200V·50Hz	200V·60Hz	220V·60Hz
Rated current (A)	1.8	1.7	1.6	1.8	1.7	1.6
Speed (r.p.m)	1382	1651	1692	1382	1651	1692
Inlet pipe	O.D.φ16×I.D.φ12 (R1/2)					
Weight (kg)	20		22	20		22
Air temperature (°C)	0-40					
Dimensions (mm)	320W×434L×231H		214W×434L×353H	310W×379L×231H		214W×379L×348H
Over voltage category	II			II		
Pollution degree	2			2		
Insulation Category	Class 1			Class 1		



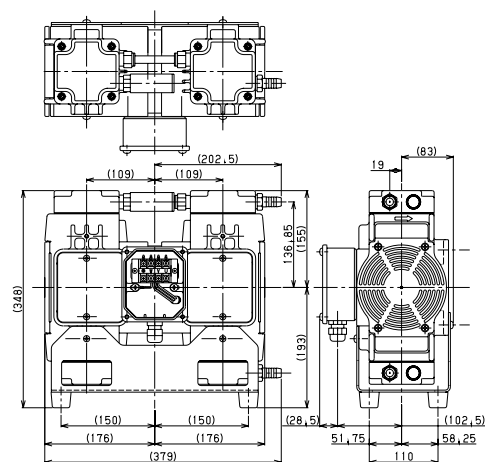
DOP-100ST



DOP-100STV



DOP-50DT

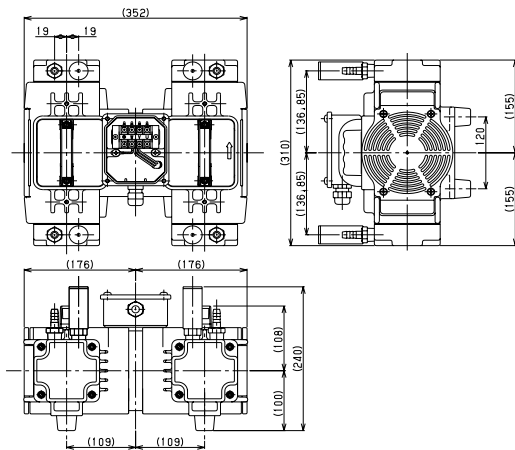


DOP-50DTV

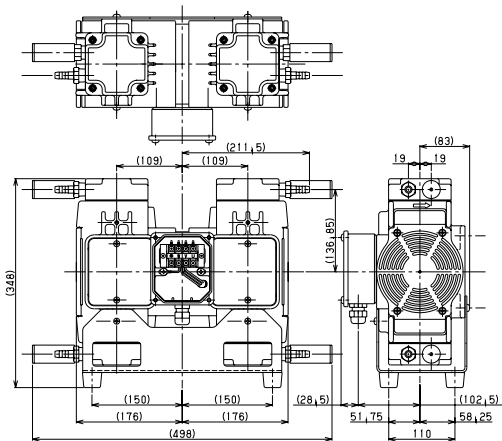
# Product specification of each model

(50/60Hz)

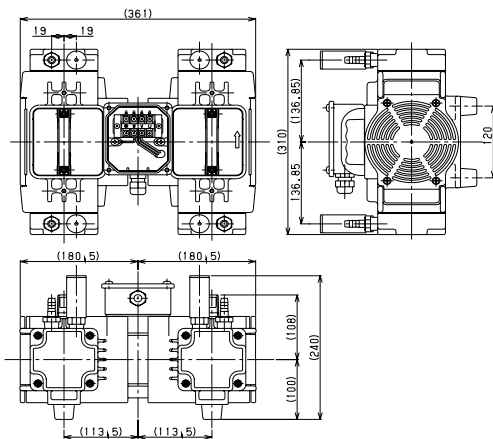
Model	DOP-50S4		DOP-50S4V		DOP-50S4 II		DOP-50S4V II	
Evacuate rate (L/min)	50/55				55			
Pressure achieved (kPa)	12 (Single head)				12 (Sigle head)			
Motor	3φ200V280W4P 50/60Hz Fitted with thermal protection relay (automatic reset type)				3φ200V400W4P 60Hz Fitted with thermal protection relay (automatic reset type)			
Voltage, frequency	200V·50Hz	200V·60Hz	—		—	200V·60Hz	—	
Rated current (A)	1.8	1.7	—		—	1.7	—	
Speed (r.p.m)	1382	1651	—		—	1651	—	
Inlet pipe	O.D.φ12×I.D.φ8 (R1/2)							
Weight (kg)	20		22		20		22	
Air temperature (°C)	0-40							
Dimensions (mm)	310W×4352L×240H		214W×498L×348H		310W×361L×240H		214W×507L×348H	
Over voltage category	II				II			
Pollution degree	2				2			
Insulation Category	Class 1				Class 1			



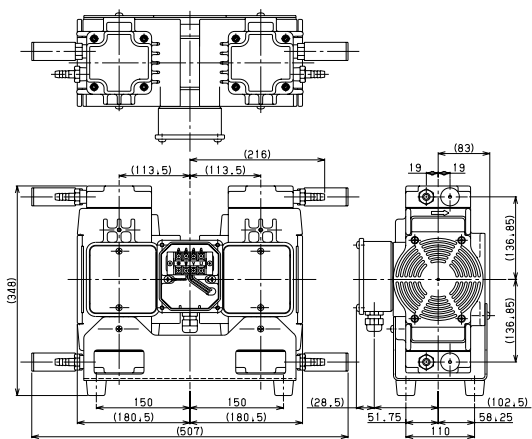
DOP-50S4



DOP-50S4V



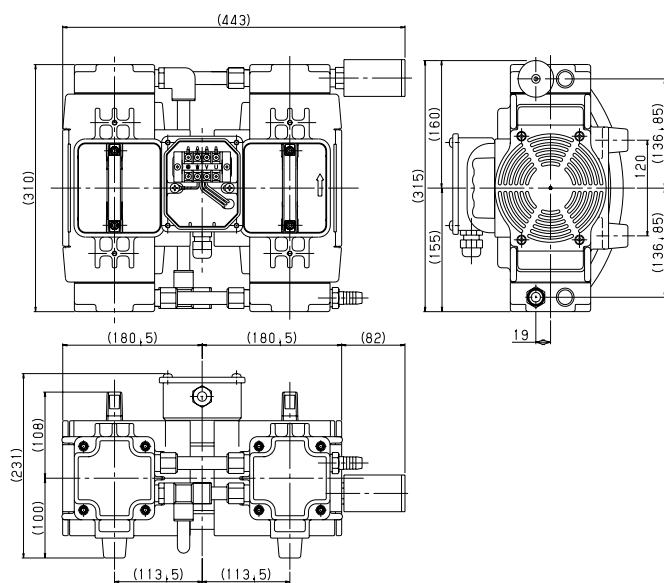
DOP-50S4 II



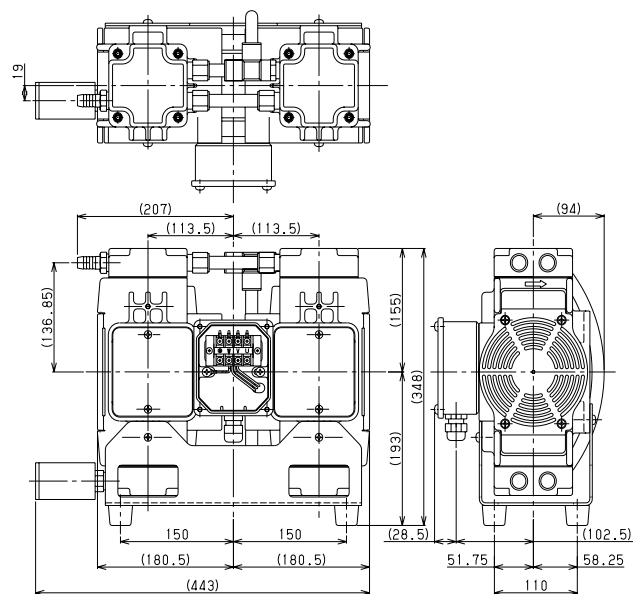
DOP-50S4V II

Product specification of each model (50/60Hz)

Model	DOP-150T		DOP-150TV
Evacuate rate (L/min)	140/160		
Pressure achieved (kPa)	0.4		
Motor	3φ200V400W4P 50/60Hz 3φ220V400W4P 60Hz Fitted with thermal protection relay (automatic reset type)		
Voltage, frequency	200V·50Hz	200V·60Hz	220V·60Hz
Rated current (A)	2.5	2.3	2.2
Speed (r.p.m)	1401	1672	1701
Inlet pipe	O.D.φ16×I.D.φ12 (R1/2)		
Weight (kg)	20	22	
Air temperature (°C)	0-40		
Dimensions (mm)	351W×443L×231H		225W×443L×348H
Over voltage category	Ⅱ		
Pollution degree	2		
Insulation Category	Class 1		



DOP-150T



DOP-150TV



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



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