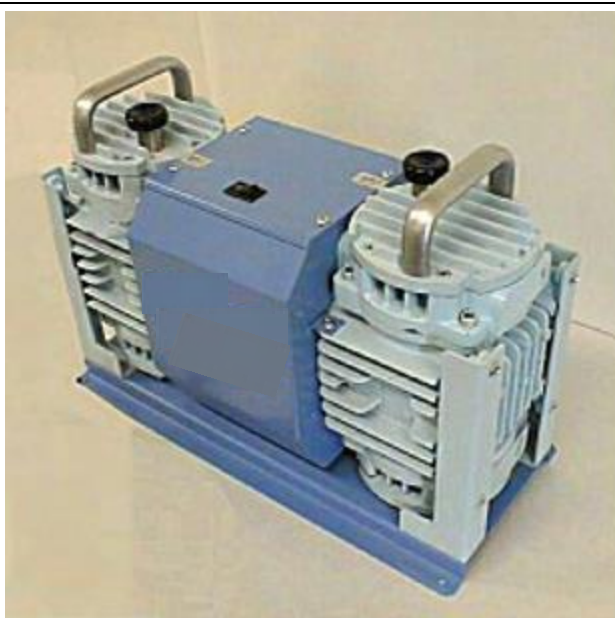


# INSTRUCTION MANUAL

## Diaphragm-type Dry Vacuum Pump

DAU-100



### 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 designed solely for vacuum discharge, and may malfunction or cause accidents if not handled appropriately. Read the manual thoroughly, and pay due attention to inspections, maintenance, and safety.

## Personnel Handling the Equipment

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

## Read the Manual Thoroughly

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

## Keep This Manual in a Safe Place

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

## Copying This Manual Is Prohibited

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

## Statutory Requirements for Disposal

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

## Safety During Repair

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

## Checks When Opening Packaging

Check the following after opening the packaging.

(1) Is the product as you requested?

(2) Are the accessories and necessary parts included?

Standard accessories

- User's manual ..... x 1
- Inlet and outlet caps (fitted to inlet and outlet) ..... x 2
- Power plug adapter (attached to power cord) ..... 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.

## 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.

## Cautions for Safety in Use

### **Danger**

#### Applications

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

### **Warning**

#### Installation

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

#### Power Supply

- \* Always remove the power cord from the wall socket before checking or repairing the pump. Failure to do so may result in electric shock, or the pump suddenly starting and causing injury.
- \* Ensure that the relevant wiring is in accordance with technical standards for electrical equipment and wiring regulations. Incorrect wiring may result in fire.
- \* Always ensure that the pump is correctly earthed. A dedicated earth leakage breaker is recommended. Failure to earth the pump correctly may result in electric shock if a fault or earth leakage occurs.
- \* Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with operation of the overload protection device, and this may result in the motor burning out, or fire.
- \* Do not damage, modify, pull the power cord, or place objects on it. Damage to the cord may result in electric shock or fire.
- \* Always fully insert the power cord into the socket. Partial insertion may result in electric shock.
- \* Remove the cord from the socket while holding the plug. Failure to do so may result in electric shock.
- \* Touching the power cord with wet hands may result in electric shock.
- \* Touching electrical wiring etc while inserting the power plug may result in electric shock.

## **Warning**

### **Operation**

- \* Inserting fingers or objects into the motor inlet may result in electric shock, injury, or fire.
- \* 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 30 kPa (gauge pressure).

### **Maintenance and Repair**

- \* The pump should be dismantled or repaired only by a repair technician trained by the manufacturer.
- \* To prevent ingestion of microscopic particles resulting from wear of components, use a dust mask and gloves when replacing diaphragms, and valves.

## **Caution**

### **Installation**

- \* To prevent back injuries, always use at least two people when lifting and moving the pump.
- \* 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.
- \* The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.
  1. Ambient temperature of 7°C ~40°C and maximum relative humidity of 85% during operation.
  2. Other conditions for storage and operation.
    - a) Level floor of sufficient strength.
    - b) No condensation
    - c) Dust-free environment
    - d) Well ventilated
    - e) Environment free of corrosive or explosive gas.
    - f) Not subject to direct sunlight.
    - g) No danger of fire.
    - h) Maximum ambient temperature of 40°C during assembly of pump.

### **Operation**

- \* Touching rotating components (eg motor, main shaft, axial joints) while the pump is in operation may result in injury.
- \* 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.
- \* Do not insert fingers or objects into, or peer into, the inlet or outlet during operation.

### **Maintenance and Repair**

- \* If the pump ceases operation, turn power OFF (set switch to O) immediately to prevent accidents, remove the power cord from the wall outlet, and contact your dealer or the manufacturer for inspection and repair.



# 1.Product Outline

## 1.1 Purpose of Use and Prohibitions

This product is a dry vacuum pump which employs reciprocating motion of a rubber diaphragm for vacuum discharge.

Observe the following prohibitions to ensure normal operation of the pump.

### Prohibitions

#### **Warning**

- (1) This pump employs only vacuum operation, 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 discharge 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

Model		DAU-100	
Discharge rate	50Hz	100 L/min	
	60Hz	110 L/min	
Pressure achieved		266 Pa	
Motor		AC100V 1 $\phi$ , 300W, 4P, condenser run	AC200V 1 $\phi$ , 300W, 4P, condenser run
Rated current		6.2/5.5 A	3.15/2.90A
Speed		1400/1680 r/min	1410/1700 r/min
Weight		24 kg	
Inlet/outlet piping		NW16	
Air temperature		7°C~ 40°C	
Dimensions		190mm(W) × 437mm(L) × 310mm(H)	

### 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 a pump fault which prevents rotation, or if load becomes excessive.
- 2) It is recommended that additional protective devices (eg. earth leakage breaker) be fitted.

## Warning

- \* Use only at the rated voltage for the motor. Use at other voltages will interfere with normal operation of the overload protection relay, and may result in motor burnout or fire.

## Caution

- \* When the overload protection relay operates the pump will be extremely hot. Touching the pump in this condition may result in burns.

### 1-4 Solenoid Valve (vent valve)

This pump incorporates a solenoid valve (vent valve).

This valve functions to introduce air into the pump chamber, thus eliminating the pressure difference between the pump chamber and atmosphere, and permitting the pump to be restarted smoothly.

Note that low voltage, or the timing with which the pump was stopped, may prevent starting of the pump.

## 2. Dimensions

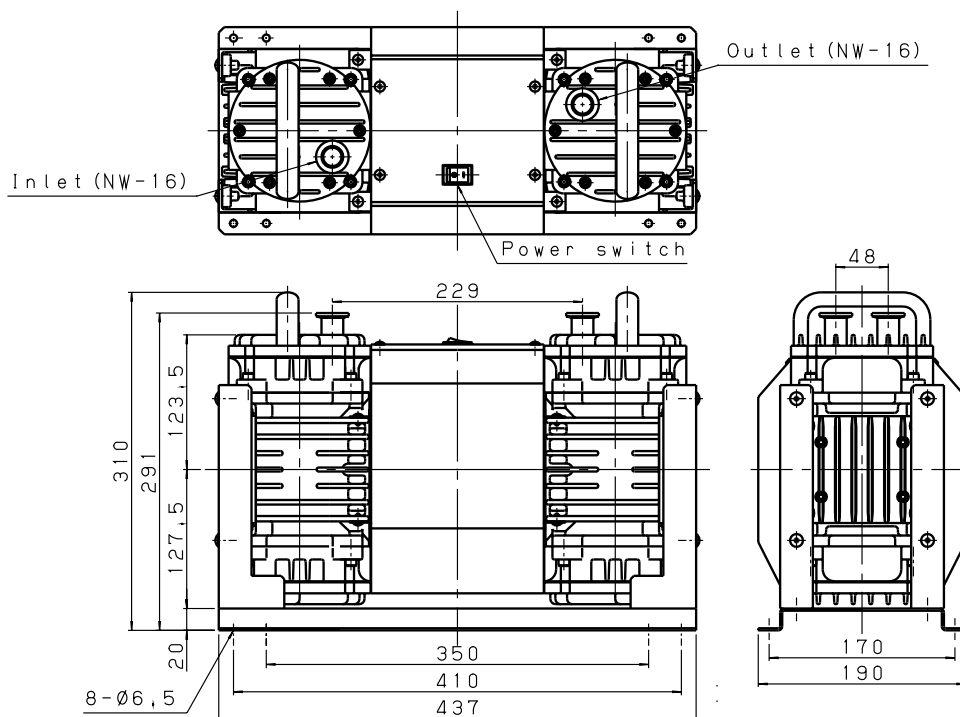


Fig.2-1. DAU-100 External Dimensions

### 3. Installation and Storage

#### 3.1 Cautions for Installation and Storage

#### **Warning**

- \* Do not use the pump in an explosive atmosphere. Such use may result in injury and fire.
- \* Ensure that the vicinity of the motor and pump is completely free of inflammable materials (e.g. inflammable solvents). Use in the presence of such materials may result in fire.
- \* 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 30 kPa (gauge pressure).
- \* Ensure that the vicinity of the pump is free of objects which may obstruct the flow of air in the vicinity of the cooling fan. Such obstructions may result in overheating, causing burns and fire.
- \* Ensure that the relevant wiring is in accordance with technical standards for electrical equipment and wiring regulations. Incorrect wiring may result in fire.
- \* To eliminate the possibility of electric shock, remove the power cord from the outlet before joining electrical wiring. Do not undertake such work on live wires under any circumstances.
- \* Always ensure that the pump is correctly earthed. A dedicated earth leakage breaker is recommended. Failure to earth the pump correctly may result in electric shock if a fault or earth leakage occurs.
- \* Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with operation of the overload protection device, and this may result in the motor burning out, or fire.
- \* Do not damage, modify, pull, or place objects on the power cord. Earth leaks may occur at damaged points on the cord, resulting in electric shock or fire.
- \* Always fully insert the power cord into the socket. Partial insertion may result in electric shock.
- \* Always grip the plug when removing it from the outlet. Pulling on the power cord may result in electric shock.
- \* Inserting or removing the power cord with wet hands may result in electric shock or fire.
- \* Take care not to touch electrical wiring when inserting the plug into the outlet. Any contact with electrical wiring may result in electric shock.

#### **Caution**

- \* To prevent back injuries, always use at least two people when lifting and moving the pump.

#### **Note**

- \* Application of physical shock to, or tipping of, the pump may result in a malfunction.

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

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

1. Ambient temperature of 7°C ~40°C and maximum relative humidity of 85% during operation.
2. Other conditions (during storage and operation).
  - a) Level floor of sufficient strength.
  - b) No condensation
  - c) Dust-free environment
  - d) Well ventilated
  - e) Environment free of corrosive or explosive gas.
  - f) Not subject to direct sunlight.
  - g) No danger of fire.
  - h) Maximum ambient temperature of 40°C during assembly of pump.

### 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 Wiring

- 1) Remove the caps from the inlet and outlet pipes before using the pump
- 2) The wiring is already connected to the pump. Check that the pump switch is set to 'O', and connect the power supply.
- 3) Set the pump switch to 'I' and check for vacuum.
- 4) Set the pump switch to 'O' to stop the pump.
- 5) Attachment of the motor breaker is recommended.

### 3.5 Piping

- 1) Install piping carefully to prevent leaks.
- 2) Use only a very short hose on the inlet. Use of a long hose will reduce exhaust performance. Ensure that the hose has an internal diameter of at least 10mm.
- 3) Ensure that piping connected to the outlet does not cause back pressure. Maximum back pressure is 30 kPa (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.3.1).

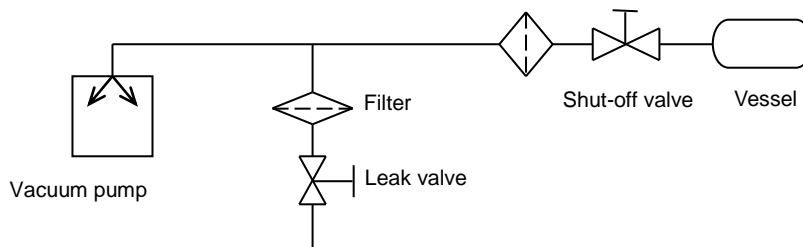


Fig.3-1 Piping Example with Vessel and Vacuum Exhaust

### 3.6 Storage

Set the pump switch to 'O', remove the power cord from the outlet, place the caps over the inlet and outlet, and store the pump in an area of low humidity.

## 4. Cautions for Operation

### 4.1 Cautions for Operation

#### **Danger**

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

#### **Warning**

- \* 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 30 kPa (gauge pressure).
- \* Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with operation of the overload protection device, and this may result in the motor burning out, or fire.
- \* This pump is not designed to be explosion-proof. Ensure that the vicinity of the motor and pump is completely free of inflammable materials (e.g. inflammable solvents). Use in the presence of such materials may result in fire.

#### **Caution**

- \* During operation, or immediately after it has stopped, the pump will be extremely hot. Touching the pump in this condition may result in burns.

#### **Note**

- \* Ensure that the pump is used at an ambient temperature of 7 °C ~40 °C . Operation of the pump at high ambient temperatures will dramatically reduce its operating life.
- \* The pump is not designed to be corrosion-proof. Use only with clean air at normal temperature, or gases of equivalent characteristics.
- \* The pump will not operate normally if damaged. Do not use with corrosive gases, organic solvents, liquids, or condensable gases (eg. steam).
- \* Use of the pump with gases containing particles, dust, water, or corrosive gases will interfere with normal operation.
- \* Application of loads at the inlet and outlet when starting the pump may overload the motor and prevent starting.
- \* This pump is designed solely for vacuum discharge. Operation for long periods at near-atmospheric pressure may result in a malfunction.

Consult the manufacturer for details of use in special applications other than the above.

#### 4.2 Operation of the Thermal Protection Relay

- 1) When the thermal protection relay operates, immediately set the power switch to 'O', remove the power cord from the outlet, and contact the manufacturer. Note that the motor will be very hot and should not be touched.
- 2) Once the cause of the fault has been removed, wait until the motor cools and restart operation.

### **Caution**

When the thermal protection relay operates the pump will be extremely hot. Touching the pump in this condition may result in burns.

#### 4.3 Starting in Cold Weather

Cold weather will increase the viscosity of bearing grease and harden diaphragms, resulting in the pump being difficult to start. Follow the procedure below in such conditions.

- 1) Turn the switch ON/OFF 2~3 times with the inlet open to atmosphere until the pump starts. If the pump still does not start, raise the ambient temperature to beyond 7°C.
- 2) With the inlet open to atmosphere, run the pump for a few minutes to warm it.
- 3) Commence normal operation once the pump has warmed.

## **5. Pump Performance**

#### 5.1 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)”.

The manufacturer measures pump inlet pressure using a Baraton vacuum gauge (Absolute Pressure Transducer 626A).

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 for diaphragm-type dry vacuum pumps varies with the type of gas entering the inlet, and its pressure. The maximum rate of evacuation is reached when air is introduced, and decreases slightly 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  $2.7 \times 10^4$  ~  $4 \times 10^4$  Pa. At pressures below 500Pa, 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

#### **Danger**

When requesting the manufacturer's service division for disassembly and repair, always enter the details of the type of gas used in the pump on the Pump Usage Checksheet. If the pump has been used for discharge of a toxic gas it will be contaminated, and may not be able to be disassembled and repaired in some cases.

#### **Warning**

- \* Ensure that the pump is dismantled and repaired only by qualified repair technicians.  
+ 1 A qualified repair technician has received the appropriate training from the manufacturer.
- \* The customer is able to conduct only the following maintenance and repairs. Do not conduct any other repairs, or modifications other than the manufacturer's standard options.
  - 1) Replacing diaphragms
  - 2) Replacing valves
  - 3) Replacing non-return valves
  - 4) Replacing O-rings
  - 5) Replacing head gaskets
- \* Always remove the power cord before replacing consumables.
- \* When replacing diaphragms and valves, always wear a dust mask and gloves to prevent ingestion of fine particles resulting from wear of the components.

#### **Note**

- \* This pump operates with extremely fine clearances, and therefore requires considerable skill in assembly. If a qualified repair technician is not available, replacement of consumables should be left to the manufacturer's service division.

### 6.2 Maintenance

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

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

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

### 6.3 Regular Inspections

Inspect consumables after the first 4000 hours of operation, and replace in accordance with the Replacement Guide on the following page. Refer to 6.4 Replacing Consumables 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
Diaphragms	4	Synthetic rubber (NBR)	4000~6000 h
A valve	12	Synthetic rubber (NBR)	4000~6000 h
Non-return valves	1	Synthetic rubber (CR)	6000~8000 h
O rings (P-18)	1	Synthetic rubber (NBR)	6000~8000 h
O rings (P-10)	7	Synthetic rubber (NBR)	6000~8000 h
Head gaskets	4	Synthetic rubber (NBR)	6000~8000 h
Bearings	1 Set		Approximately 15000 h

Note that the average life for a component varies with the conditions of use. Bearings are replaced by the manufacturer's service division.

#### <Replacement Guide>

Diaphragms : Replace if cracked, worn, hard, or deformed.

Valves : Replace if deformed, hard, or cracked.

Non-return valves : Replace if deformed, hard, or cracked.

O-rings : Replace if hard, cracked, or stretched.

Head gaskets : Replace if hard, cracked, or stretched.

Bearings : Request manufacturer for repair if abnormal noises or abnormal motor vibration is noted.

#### <Locations for Maintenance and Inspection>

Table 6.2 Locations for Maintenance and Inspection

Period of operation	Inspection item	Inspection details	Method of inspection
4000 hours	Diaphragms	Wear, hard, or cracked	Visual inspection
	Valves	Deformed, hard, or cracked	Visual inspection
	Non-return valves	Deformed, hard, or cracked	Visual inspection
	O rings	Hard, cracked, or stretched	Visual inspection
	Head gaskets	Hard, cracked, or stretched	Visual inspection
	Bearings	Abnormal noises	Listen



#### 6.4 Replacing and Cleaning Consumables

Use the following tools, and refer to the photographs, when replacing cleaning components. Contact the manufacturer's service division for this work if the necessary tools are not available.

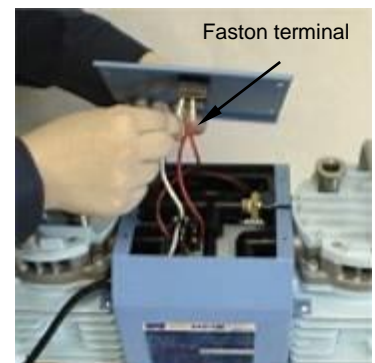
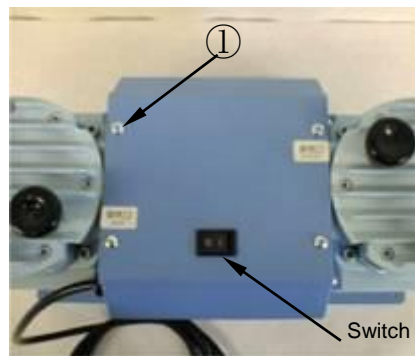
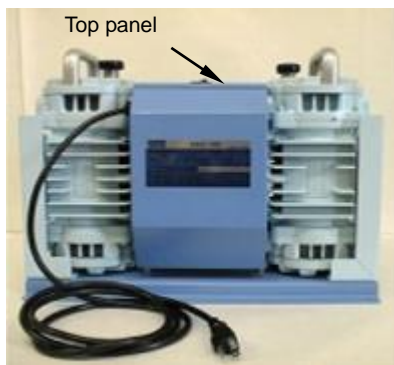
1. Cross head screwdriver : No.2
2. Slotted screwdriver : Minimum blade width 5.5mm, 50mm or longer
3. Spanners : For 4 and 5 mm nuts.
4. Torque wrench : With 4 mm socket. Ensure that it is capable of being set to 3, 4, and 5 N.m torque.
5. Torque wrench : With 5 mm socket. Ensure that it is capable of being set to 16 and 18 N.m torque.
6. Torque driver : Cross head No.2, set to 5Nm torque
7. Spanners : For 14, 26, and 29mm nuts, or equivalent adjustable spanner.
8. Thread lock : Loctite<sup>®</sup>.242
9. Vacuum grease
10. Paper towels, ethyl alcohol

##### 1) Replacing Diaphragms

Use tools 1, 3, 5, 6, 8, 9 and 10 listed above

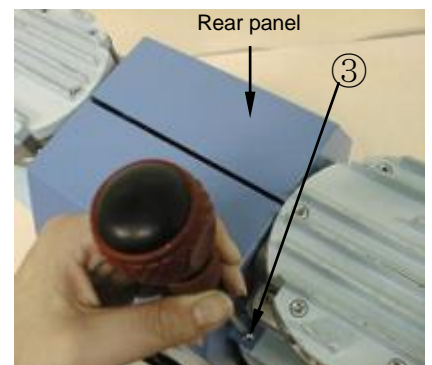
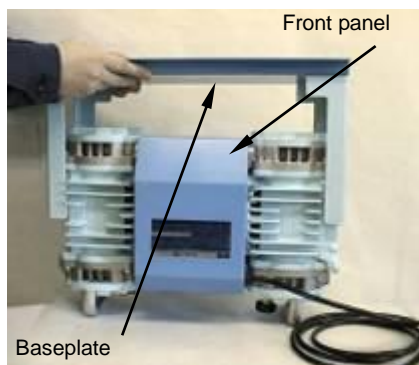
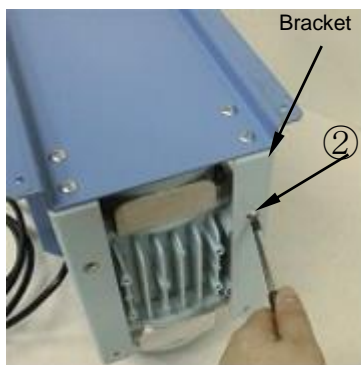
(1) Remove the four truss head screws (M4 x 6L) ① in the top panel, and remove the panel.

(2) Remove the four Faston terminals connected to the rear of the switch.

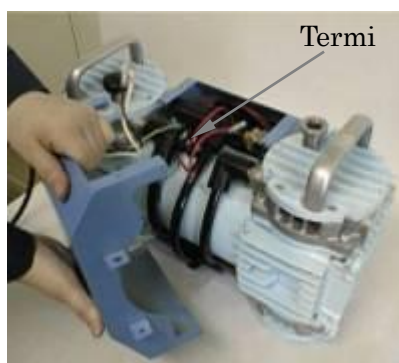
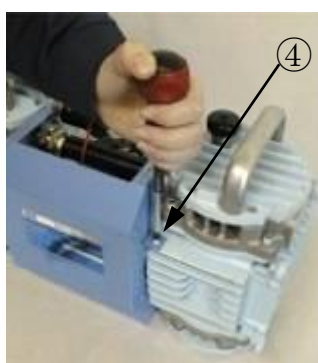
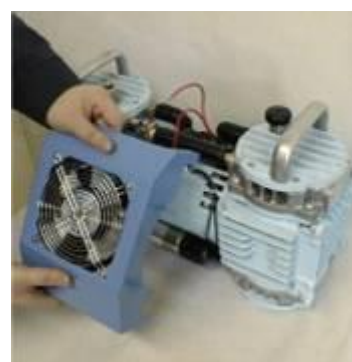
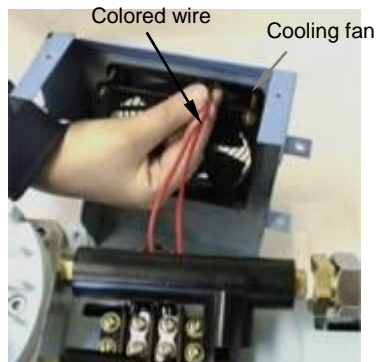
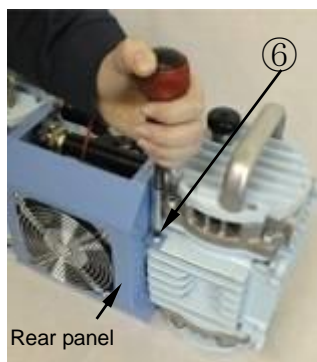


(3) Turn the unit upside-down, remove the eight truss head screws (M4 x 6L) ② in the bracket, and remove the pump from the baseplate.

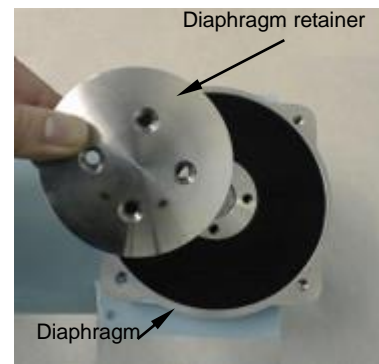
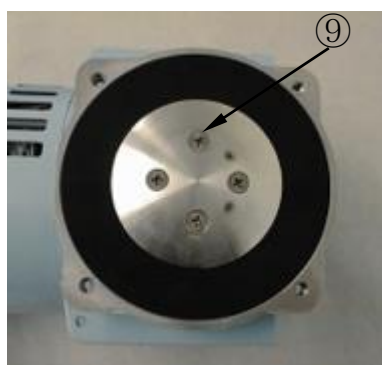
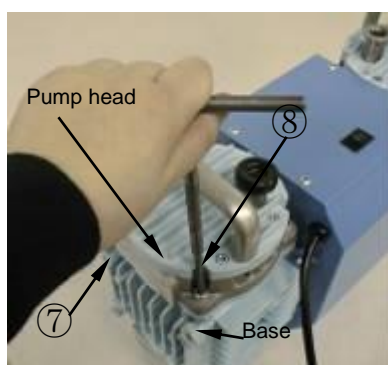
(4) Remove the four truss head screws (M4 x 6L) ③ in the bottom of the front and rear panels, and remove the panels.



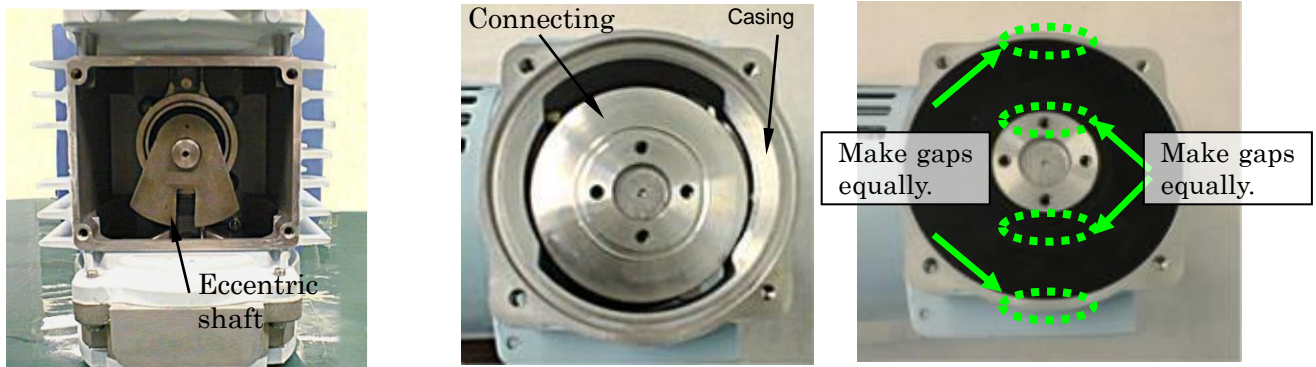
- (5) Turn the unit upright, remove the two truss head screws (M4 x 6L) ④ in the top of the front panel, and remove the front panel.
- (6) Remove the cross pan head screws (M4 x 16L) ⑤ holding the terminal block and power cord earth wire (green), and remove the earth wire.
- (7) Remove the two truss head screws (M4 x 6L) ⑥ in the top of the rear panel, lift as shown in the photo, and remove the Faston terminal on the red wire connected to the cooling fan. Remove the rear panel.



- (8) Remove the four hexagon socket head cap screws (M6 x 22L) ⑧ in the pump head, and remove the pump head.
- (9) Remove the four hexagon socket head cap screws (M5 x 30L) ⑦ holding the base, and remove the base.
- (10) Remove the four countersunk screws (M5 x 12L) ⑨ in the diaphragm retainer, and remove the diaphragm retainer and diaphragm.  
Note: Take care not to damage the cross recess in the top of the countersunk screws.



- (11) Clean the top of the connecting rod, top of the casing, diaphragm retainer, and inside of the pump head by wiping with ethyl alcohol.  
Note: Take care not to leave any scraps of paper towel when wiping these components.
- (12) Set the eccentric shaft as shown in the photo, and fix so that the connecting rod is at the highest position. Place the diaphragm on the connecting rod and adjust so that the gap between the periphery and the inside of the casing is equal in the front-rear and left-right directions.
- (13) Apply a small amount of Loctite® 242 (or equivalent) to the four cross head countersunk screws (M5 x 20L) ⑨, and tighten equally in diagonally opposite pairs to ensure that the diaphragm retainer held firmly in place.  
Note: Tighten three times to 5Nm with a torque driver to prevent damaging the cross recess in the countersunk screws.



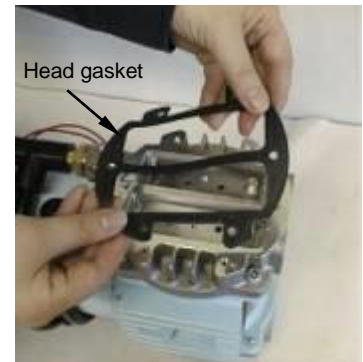
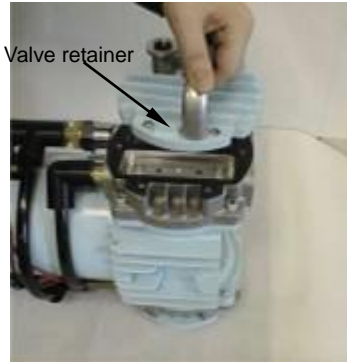
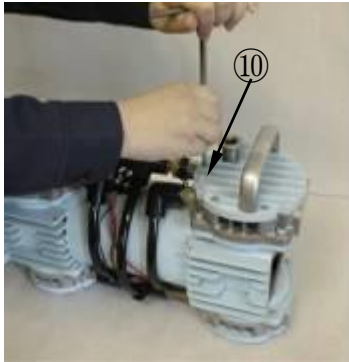
- (14) Place the pump head on the casing, and fix in place in the same position as the connecting rod ⑫. Tighten the four hexagon socket head cap screws (M6 x 22L) ⑧ equally to 16Nm with a torque wrench.
- (15) Place the pump head gasket and pump head cover on the pump head in that order, and tighten the six hexagon socket head cap screws (M5 x 16L) equally in diagonally opposite pairs to 5Nm with a torque wrench.
- (16) Assemble components other than the baseplate in the reverse order to disassembly.  
Note: Apply a small amount of Loctite® 242 (or equivalent) to the screws holding the panel in place.
- (17) Fit the rubber cap to the inlet pipe, run the pump continuously for a period of two hours, and then switch power off.  
Note: If the pump moves due to vibration during continuous operation, transfer it to a stable location.
- (18) Re-tighten the four hexagon socket head cap screws (M6 x 22L) ⑧ in each pump head to 18Nm with a torque wrench.
- (19) Fit the baseplate.  
Note: Apply a small amount of Loctite® 242 (or equivalent) to the screws holding the baseplate in place.



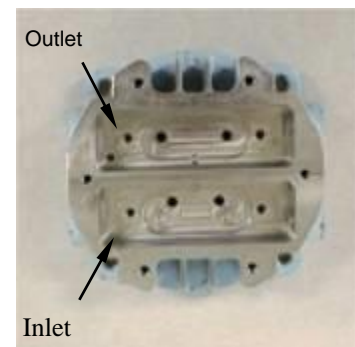
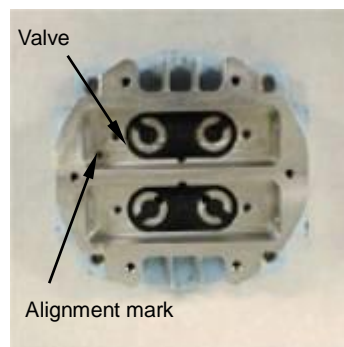
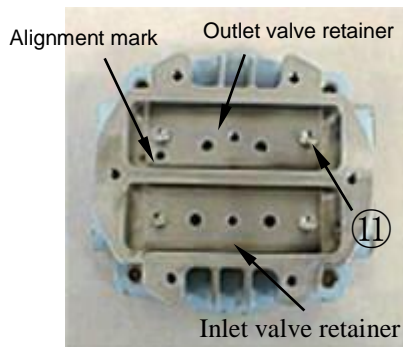
## 2) Replacing Valves

It is recommended that these valves be replaced at the same time as the diaphragms. Use tools 1, 3, 4, 8, and 10 listed above.

- (1) Remove up to the baseplate in accordance with steps (1)~(3) for replacement of the diaphragm.
- (2) Remove the six hexagon socket head cap screws (M5 x 16L) ⑩ in the head cover.
- (3) Remove the head cover and head gasket.

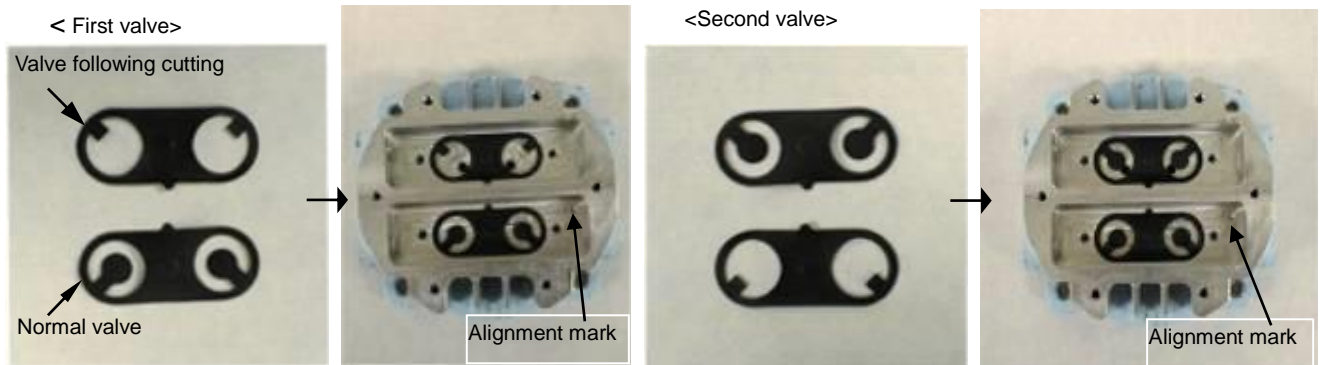
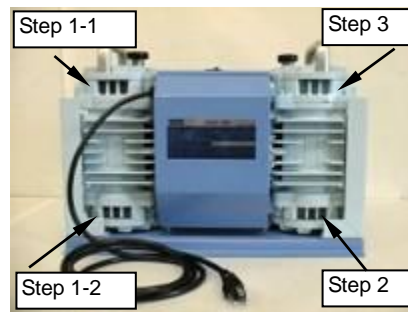


- (4) Remove the two hexagon socket head cap screws (M5 x 16L) ⑪ in each valve retainer (inlet and outlet), fit a hexagon socket head cap screw in the center of the inlet and outlet valve retainers, pull the valve retainers upwards, and remove. Remove the valves as well.
- (5) After disassembly, clean the various components with a paper towel soaked in ethyl alcohol.  
Note: Take care not to leave any scraps of paper towel when wiping these components.



(6) Replacing valves

Note: The normal valve and the cut valve as shown in the photo are used together in steps 1-1 and 1-2. A single normal valve is used in step 2 and step 3.



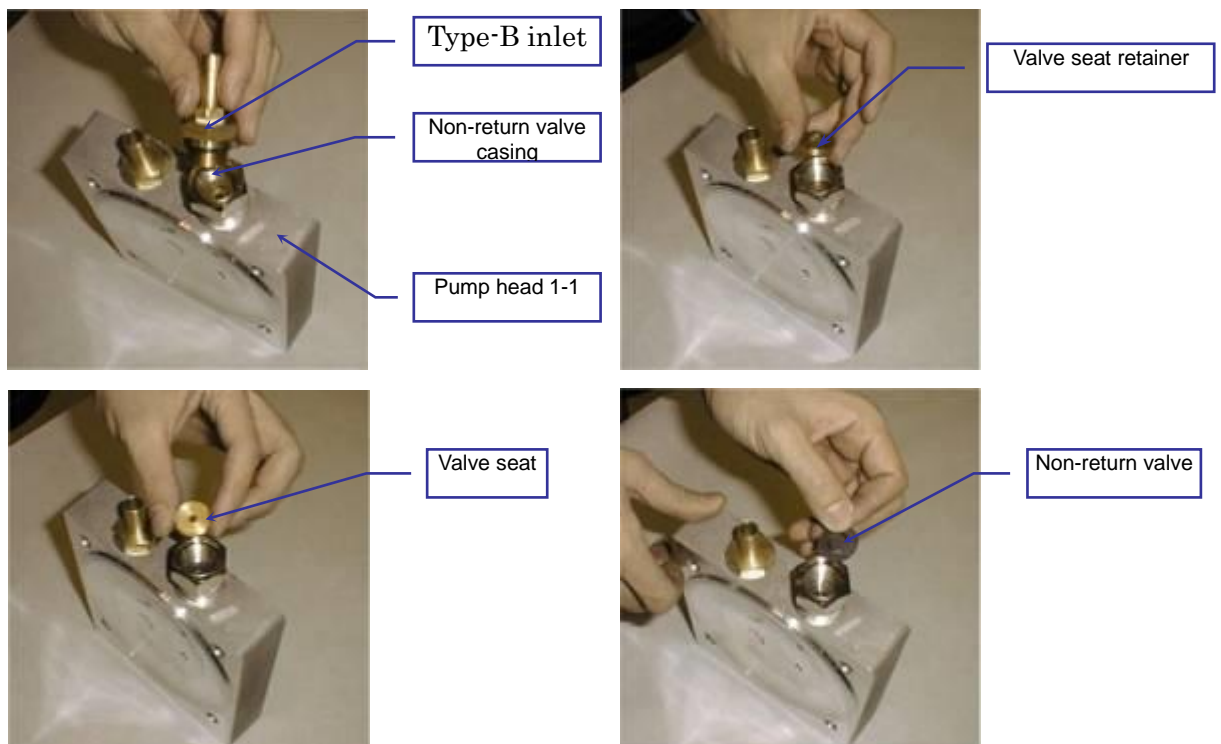
(7) Assemble in the reverse order to disassembly.

- (1) Align the projection on the valve with depression on the pump head and assemble (see photo).
- (2) Fit the outlet valve retainer so its alignment mark is opposite the alignment mark on the pump head outlet.  
Note: Ensure that the valves are not misaligned, and that they are not pinched in the valve retainer.
- (3) Apply a small amount of Loctite® 242 (or equivalent) to the two hexagon socket head cap screws (M5 x 16L) ⑪ in each valve retainer (inlet and outlet), and tighten to 3.5Nm with a torque wrench.  
Note: Tighten to 4Nm in steps 2 and 3.
- (4) Place the pump head gasket and pump head cover on the pump head in that order, and tighten the six hexagon socket head cap screws (M5 x 16L) equally in diagonally opposite pairs to 5Nm with a torque wrench.

3) Replacing non-return valves (simultaneous replacement of diaphragms and non-return valves is recommended)

Use tools No.1, 2, 3, 5, 7, 8, 9, and 10.

- (1) Remove up to the pump head C in accordance with steps (1)~(8) for replacement of the diaphragm.
- (2) Remove the type-B inlet pipe from the non-return valve.
- (3) Remove the valve seat retainer from the non-return valve casing, and remove the valve seat and non-return valve.
- (4) After disassembly, clean the various components with a paper towel soaked in ethyl alcohol.
- (5) Clean the new non-return valve with a paper towel soaked in ethyl alcohol, and place in the non-return valve casing.
- (6) Turn the side of the valve seat with the depression downwards.  
Note: Tap the valve seat gently and check that it is fully in place.
- (7) Apply a small amount of Loctite® 242 to the valve seat retainer, and turn with a slotted screwdriver.
- (8) Apply a uniformly thin covering of vacuum grease to the O-ring in the type-B inlet pipe.
- (9) Screw the type-B inlet pipe into the non-return valve casing.  
Note: Take care not to cut the O-ring when screwing in the inlet pipe.



Non-return valve replacement diagram (photo shows valve for DAU-120)

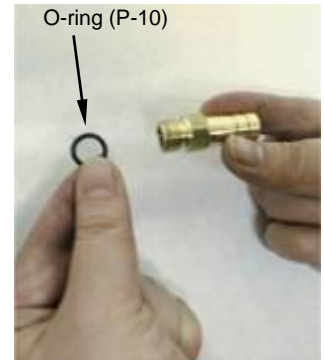
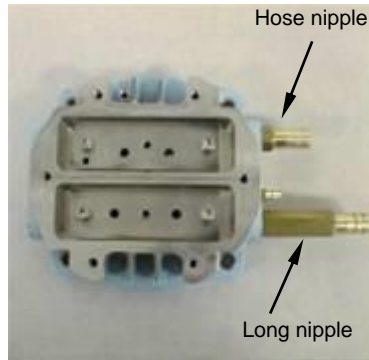
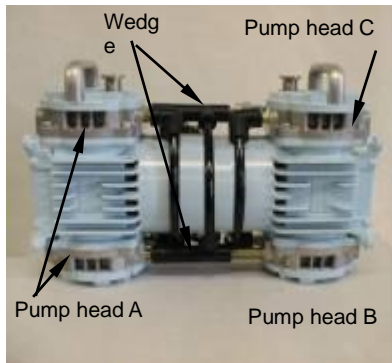
- 4) Replacing O-rings (simultaneous replacement of diaphragms and O-rings is recommended)

Two types of O-ring are used - P-18 (x 1) is used with the type-B inlet pipe, and P-10 (x 7) is used with the hose nipples, and long nipples fitted to the pump head.

<Hose nipples, long nipples>

Use tools No.1, 3, 5, 7, 8, 9, and 10.

- (1) Remove the top or bottom of the pump up to the pump head in accordance with steps (1)~(8) for replacement of the diaphragm and remove the wedge.

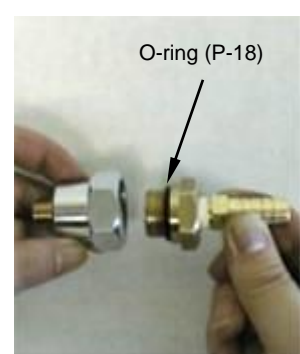
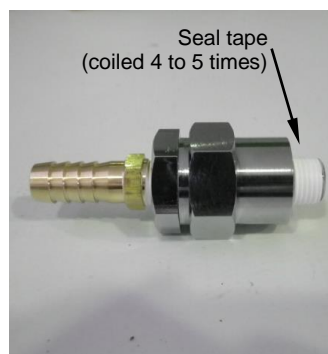
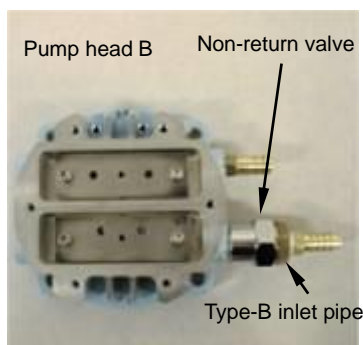


- (2) Remove the hose nipple from pump heads A, B, and C, and remove the long nipple from pump head B.
- (3) After disassembly, clean the various components with a paper towel soaked in ethyl alcohol.
- (4) Apply a uniformly thin covering of vacuum grease to the new O-ring, and replace the old O-ring.
- (5) Assemble in the reverse order to disassembly.

<Non-return valve and type-B inlet pipe>

Use tools No.1, 3, 5, 7, 9, and 10.

- (1) Remove the pump head A or C on the top of the pump in accordance with steps (1)~(8) for replacement of the diaphragm.
- (2) Remove the hose, and remove the non-return valve and type-B inlet pipe.



- (3) After disassembly, clean the various components with a paper towel soaked in ethyl alcohol.

- (4) Apply a uniformly thin covering of vacuum grease to the new O-ring (P-18), and replace the old O-ring used with the type-B inlet pipe.
- (5) Screw the type-B inlet pipe into the non-return valve casing.  
Note: Take care not to cut the O-ring when screwing in the inlet pipe.
- (6) Coil the seal tape four to five times around R1/4 screw of non-return valve.
- (7) Assemble in the reverse order to disassembly.

5) Replacing head gaskets (simultaneous replacement of head gaskets and non-return valves is recommended)

Use tools No.1, 3, 5, 7, 9, and 10.

- (1) Remove up to the head gasket in accordance with steps (1)~(3) for replacement of the valves.
- (2) Replace the head gasket.
- (3) Place the pump head cover on the pump head gasket, and tighten the six hexagon socket head cap screws (M5 x 16L) equally in diagonally opposite pairs to 5Nm with a torque wrench.

6) Replacing bearings

Contact the manufacturer's service division for replacement of bearings.



## 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) Switch is OFF. (3) Problem with power supply voltage. (4) Problem with pump wiring. (5) The breaker has operated. (6) The thermal protection relay has operated. (7) Low ambient temperature. (8) Low voltage. (9) Fault in power supply. (10) Problem with power supply switch. (11) Broken wire in power cord. (12) Problem with motor. (13) Damaged condenser, or connection problem. (14) Locked connecting rod. (15) Problem with bearings. (16) 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. 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 7~40 °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) Replace or repair. (13) Replace or repair. (14) Disassemble pump head and check interior. (15) Replace. (16) 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 diaphragm. (14) Miscellaneous damage to pump components.	(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 7~40 °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 diaphragm etc). (11) Replace and repair. (12) Replace. (13) Replace. (14) Disassemble and repair (replace damaged components).	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.	(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.	

## 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: 7 - 40°C, below 85% RH
  - b) Operation in accordance with the user manual
- (3) Repair fees will incur during the warranty period for the following cases:
    - a) Malfunctions due to a natural disaster or fire.
    - b) Malfunctions caused by special atmospheric conditions, such as salt damage, inflammable gas, corrosive gas, radiation or pollution.
    - c) Malfunctions caused by usage conditions that differ from those stated in the user manual (performance specifications, maintenance and inspection, etc.).
    - d) Malfunctions caused by modifications or repairs carried out by a party other than the manufacturer, or by a service company not approved by the manufacturer.
    - e) Malfunctions caused by noise (electric disturbance).
    - f) Malfunctions that occur when not using a rated power supply.
    - g) Malfunctions that occur when there is an abnormal rise in internal pressure due to the pump exhaust outlet being blocked during operation, etc.
    - h) Malfunctions that occur, when the pump is damaged as a result of being dropped or falling, etc.
    - i) Malfunctions which are determined by the manufacturer's technical personnel to be caused by conditions that do not comply with the usage conditions for this 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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