



INSTRUCTION MANUAL

Diaphragm-type Dry Vacuum Pump

Model: DAL-181D, 361S



Request to Users

Please read this manual thoroughly to ensure safe and effective use of the equipment.
Keep this manual in a safe place.
Due to periodic improvements in performance, the equipment described in this manual is subject to changes in dimensions and specifications without prior notice.

ULVAC KIKO, Inc.

Contents

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

Before Using the Equipment.....	0 1
Checks When Opening Packaging	0 2
Using the Pump Safely.....	0 3
• Safety icons.....	0 3
• Cautions for Safety in Use	0 4
1.Product Outline	1
1.1 Purpose of Use and Prohibitions.....	1
1.2 Specifications.....	1
1.3 Thermal Protection Relay	1
2.Overall View	2
3.Installation and Storage.....	2
3.1 Cautions for Installation and Storage	2
3.2 Environmental Conditions for Installation, Storage, and Operation	3
3.3 Location	3
3.4 Fluctuations in the power voltage and frequency	3
3.5 Electric Wiring	4
3.6 Fitting Piping	5
3.7 Piping.....	5
3.8 Storage.....	5
4.Cautions for Operation.....	6
4.1 Cautions for Operation.....	6
4.2 Operation of the Thermal Protection Relay.....	6
4.3 Precautions when starting	6
5.Pump Performance	7
5.1 Pressure Achieved.....	7
5.2 Evacuation Rate.....	7
5.3 Power Requirements	7
6.Maintenance, Inspection, and Repair	8
6.1 Cautions for Maintenance, Inspection, and Repair.....	8
6.2 Maintenance.....	8
6.3 Regular Inspections.....	8
6.4 Replacing and Cleaning Consumables	1 0
1) Cleaning Inlet Filters.....	1 1
2) Replacing Diaphragms	1 1
3) Replacing DAL-181D Unit Valves	1 5
4) Replacing DAL-361S Unit Valves	1 7
5) Replacing O-rings	1 8
6) Replacing Piping	1 9
7) Replacing Exhaust Filters	2 1
8) Replacing Bearings	2 1
6.5 Troubleshooting List	2 2
7.In Conclusion.....	2 3
• Warranty	2 3
• Usage Status Check Sheet	
• Product information, service bases, and contact information	

Figures and Tables

Fig.2.1 DAL-181D and DAL 361S Dimensions.....	2
Fig.3.1 Change region of the voltage and frequency	4
Fig.3.2 Wiring Diagram.....	4
Fig.3.3 Fitting Piping	5
Fig.3.4 Example of Piping Used When Evacuating a Vessel	5
Table 1.1 Product Specifications	1
Table 6.1 Consumables List	8
Table 6.2 Locations for Maintenance and Inspection.....	9
Table 6.3 Troubleshooting List	2 2

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	-----	×	1
• Piping protector cap (supplied with piping)	-----	×	2
• Piping (long hose nipple : L - 1)	-----	×	1
• Piping (long hose nipple : L - 2)	-----	×	1

Note: Piping is not fitted.

Fit after opening the package (see 3-6. Fitting Piping on P5).

- (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.

The top and bottom surfaces of the pump are covered with a blue film to protect against dust, contamination, and damage, during assembly and transport.

Remove this film after opening the box.

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

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

Maintenance and Repair

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

Warning

Installation

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

Power Supply

- (4) Always 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.
- (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) Remove the power cord from the wall socket before connecting any wiring. Connecting wiring with the power on may result in electric shock.
- (7) Always ensure that the pump is correctly earthed. A dedicated earth leakage breaker is recommended. Failure to earth the pump correctly may result in electric shock if a fault or earth leakage occurs.
- (8) Use the pump only at the rated voltage. Use at other than the rated voltage will interfere with operation of the overload protection device, and this may result in the motor burning out, or fire.
- (9) Do not damage, modify, pull the power cord, or place objects on it. Damage to the cord may result in electric shock or fire.
- (10) Always fully insert the power cord into the socket. Partial insertion may result in electric shock.
- (11) Remove the cord from the socket while holding the plug. 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.

Warning

Operation

- (14) This pump is not designed to be explosion-proof. When using the pump, ensure that there are no inflammable materials such as solvents, or explosive gases, in the vicinity. Use under such conditions may result in injury or fire.
- (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 diaphragms, valves, and O rings.

Caution

Installation

- (1) To prevent back injuries, always use at least two people when lifting and moving the pump.
- (2) Microscopic particles resulting from wear of components are discharged from the outlet and contaminate the room. If necessary, connect a pipe from the discharge outlet to the outside of the building.
- (3) The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.
 - 1. Ambient temperature of 7~40°C and maximum relative humidity of 85% during operation.
 - 2. Other conditions for storage and operation.
 - a) Level floor of sufficient strength.
 - b) No condensation
 - c) Dust-free environment
 - d) Well ventilated
 - e) Environment free of corrosive or explosive gas.
 - f) Not subject to direct sunlight.
 - g) No danger of fire.
 - h) Maximum ambient temperature of 40°C during assembly of pump.

Caution

Operation

- (4) Touching rotating components (eg motor, main shaft, axial joints, cooling fan) while the pump is in operation may result in injury.
- (5) The overload protector operates when the pump becomes excessively hot. Touching it in this condition may result in burns.
- (6) Touching the motor while the pump is in operation or while it is still hot immediately after having been switched off may result in burns.
- (7) Do not insert fingers or objects into, or peer into, the inlet or outlet during operation.

Maintenance and Repair

- (8) 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.
- (9) Leave the pump for at least 30 minutes until it has cooled, and begin operation again. Touching the pump immediately after it has stopped may result in burns.

Note

Installation

- (1) The pump may malfunction if it is subjected to shocks or tipped over on its side.

Applications

- (2) This pump is not designed to be corrosion-proof. Use it only with clean air at normal temperature, or with gases of equivalent characteristics.
- (3) This pump is designed solely for vacuum extraction. Operation for long periods at near-atmospheric pressures may result in a malfunction.
- (4) 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.
- (5) Entry of corrosive gases, organic solvents, fluids, or gases able to be condensed (eg. steam) may result in damage to the pump and prevent normal operation.
- (6) Entry of gases containing dust and particles may prevent normal operation of the pump.

Operation

- (7) Use the pump within an ambient temperature range of 7~40°C. Use at high ambient temperatures will dramatically reduce the life of the pump.
- (8) Back pressure at the outlet while the pump is starting may overload the motor.
- (9) The thermal protection relay operates when the pump reaches a very high temperature. Touching the pump in this condition may result in burns.

Maintenance and Repair

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

1. Product Outline

1.1 Purpose of Use and Prohibitions

This product is a 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		DAL-181D	DAL-361S
Voltage		200	
Exhaust rate	50Hz	180 L/min	360 L/min
	60Hz	210 L/min	390 L/min
Operating pressure		3.33kPa	17.3kPa
Motor		3 Φ , 200V, 500W, 4P	
Rated current		2.4/2.9A (50/60Hz)	
Rotational speed		1410/1700rpm	
Outlet piping		O.D. Φ 21 \times I.D. Φ 15 (G 1/2)	
Weight		39.0kg	
Ambient temperature during use		7 ~ 40°C	
Dimensions		388mm (W) \times 523.6mm (L) \times 274mm (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, motor breaker) be fitted.

 Warning	See Warning (8), P04
 Caution	See Caution (5), P06

2. Overall View

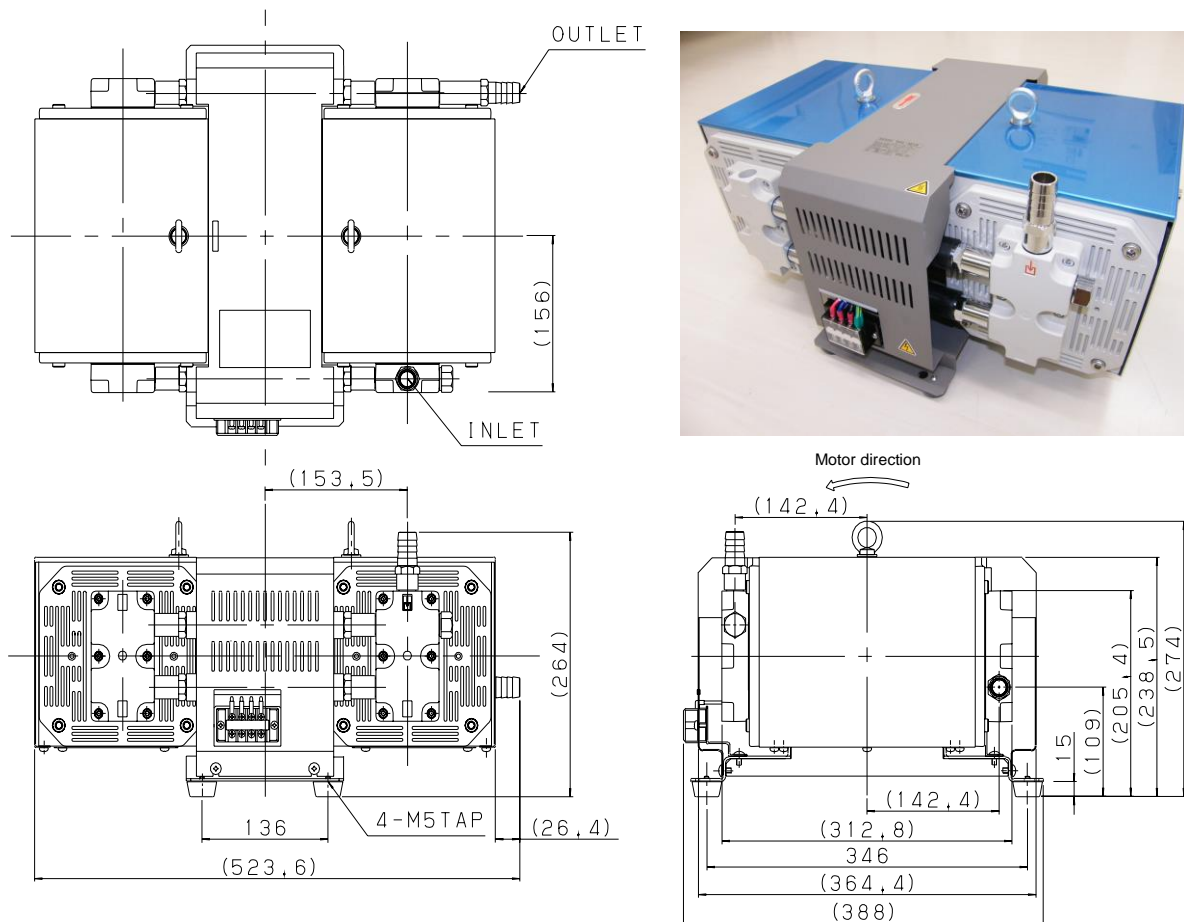





Fig.2.1 DAL-181D and 361S Dimensions

3. Installation and Storage

3.1 Cautions for Installation and Storage

 Warning	See Warning (1)(2)(3)(5)(6)(7)(8)(9)(10)(11)(12)(13), P04
 Caution	See Caution (1)(2)(3), P05
 Note	See Note (1), P07

3.2 Environmental Conditions for Installation, Storage, and Operation

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

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

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 Fluctuations in the power voltage and frequency

Standard: Rotation electricity machine general rules

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

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

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

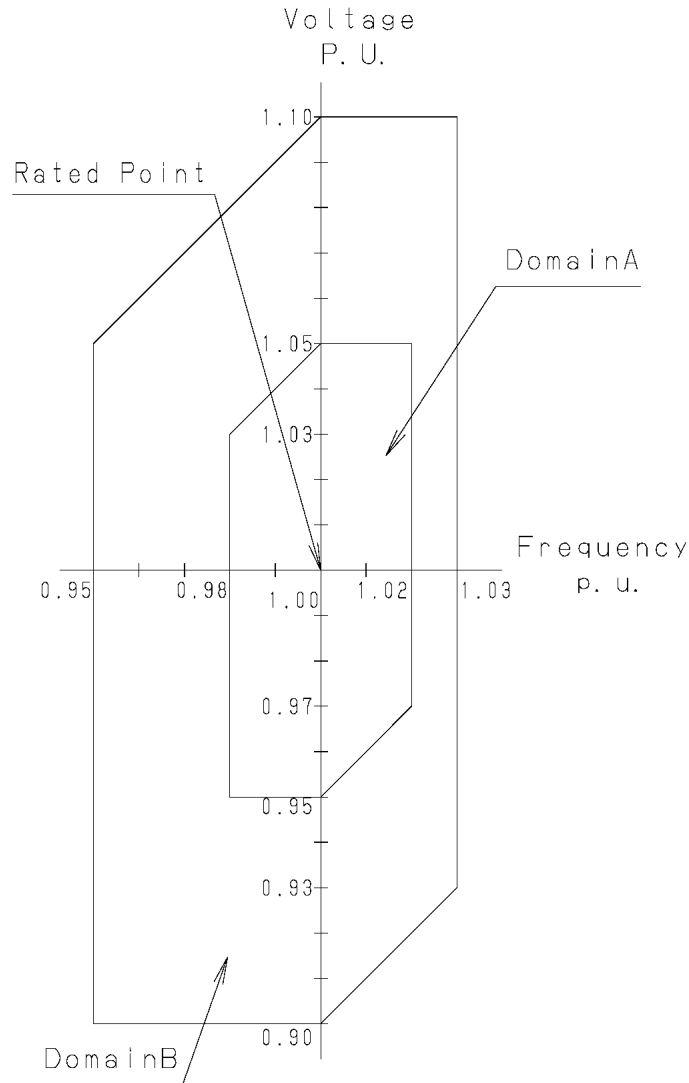


Fig. 3.1 Change region of the voltage and frequency

3.5 Electric Wiring

- 1) Fit the piping and inlet filter before use.
 - 2) Ensure that a switch with internal breaker is installed between the pump terminal block and the power supply.
 - 3) Modification to pump wiring is required. Connect the power cable to the pump terminal block, install the switch between the terminal block and the power supply, and insert the power cable plug into regulation voltage socket (see Fig.3.2 Wiring Diagram).
- Note: Use power supply cable with a cross-section of 1.25 mm².

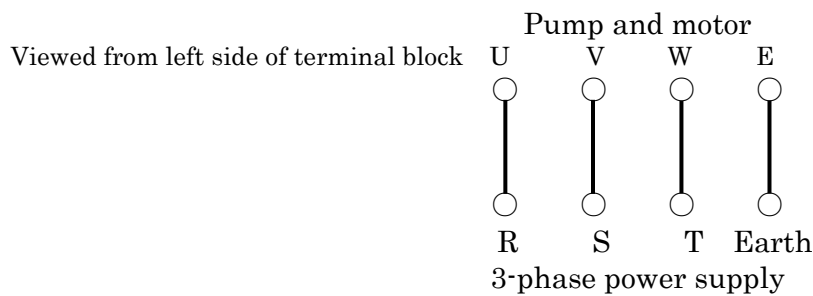


Fig.3.2 Wiring Diagram

- 4) Turn the switch ON and check for suction.
- 5) When suction is confirmed, switch power OFF to stop the pump.

3.6 Fitting Piping

The piping (long hose nipple (L-1,L-2)) is not fitted. After opening the packing fit it as shown in to Fig.3-3.

- 1) Select Inlet piping(long hose nipple (L-1))attachment point ① or ②.

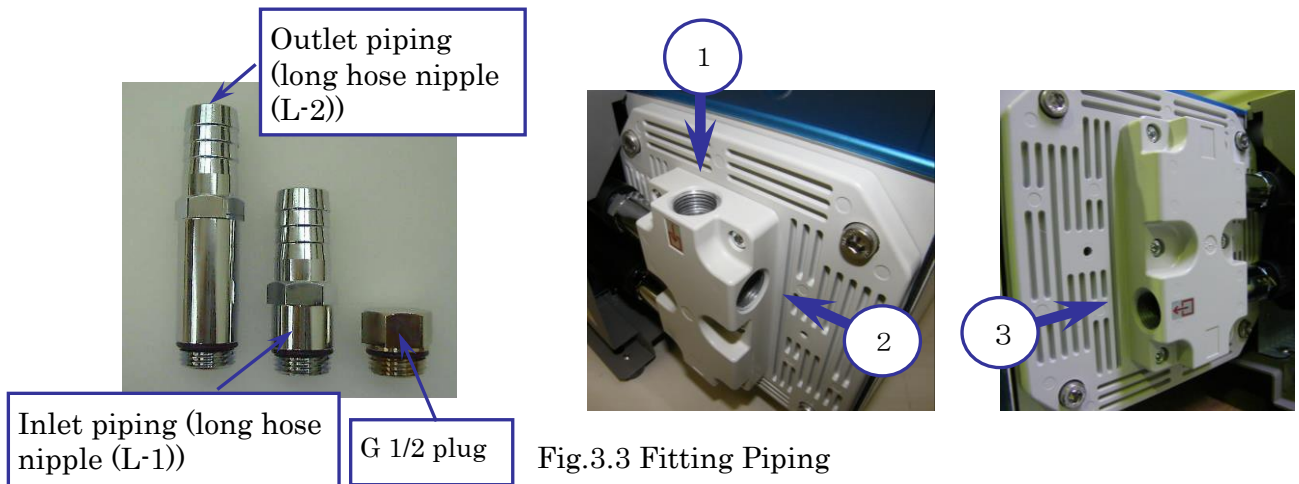
Note: At the time of shipment, a G 1/2 plug is attached to ②.

- 2) Attach the G 1/2 plug to the unused hole of ① or ②.

- 3) Put outlet piping(long hose nipple (L-2)) into ③.

- 4) Tighten the piping (or G 1/2 plugs) to 1.0 ± 0.2 Nm torque. Bed the piping, and G 1/2 plugs on O-rings.

Note: Over-tightening the piping may damage the O-rings.



3.7 Piping

- 1) Install piping carefully to prevent leaks.
- 2) Piping connected to the inlet should be at least 15 mm inside diameter.
- 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 outlet pipe that are not from our products, please select the outlet 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.3.4).
- 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 inlet 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.

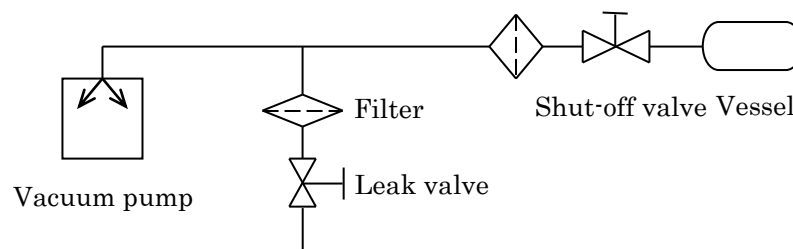






Fig.3.4 Example of Piping Used When Evacuating a Vessel

3.8 Storage

Turn the switch OFF (set to O), remove the power plug from the outlet, place the rubber 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	See Danger (1)(2), P04
 Warning	See Warning (8)(14)(15)(16), P04-P05
 Caution	See Caution (4)(6)(7), P06
 Note	See Note (2)(3)(4)(5)(6)(7)(8)(9), P07

4.2 Operation of the Thermal Protection Relay

- 1) When the thermal protection relay operates, switch the pump power supply OFF (set 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	See Caution (5), P06
---	----------------------

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 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.

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.3.4 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 (ie the no-load condition)”.

Note that the indicator values for pressure may differ between types of vacuum gauges. Pressure achieved in practice, occasionally becomes 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 the pump 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 $2.7 \times 10^4 \sim 4 \times 10^4$ Pa. At pressures below this range the 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	See Danger (3), P04
 Warning	See Warning (4)(17)(18), P04, 05
 Caution	See Caution (8)(9), P06
 Note	See Note (10), P07

Maintenance and repair by the customer's repair technician is limited to the following procedures. Do not undertake other repairs, or make modifications other than the standard options supplied by the manufacturer.

- 1) Replacing Diaphragms
- 2) Replacing Valves
- 3) Replacing O rings
- 4) Replacing Piping
- 5) Replacing Filters

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

After commencement of use, inspect consumables after every 4,000 hrs of operation, and replace and clean in accordance with the Replacement and Cleaning Guide on the following page. Refer to 6.4 Replacing and Cleaning Consumables for the replacement 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
	181D	361S		
Inlet filters	2	2	SUS	————
Exhaust filters	4	4	Urethane foam	6000h
Diaphragms	4	4	Synthetic rubber (EPDM)	6000h
Valves A	6	4	PTFE	6000h
Valves C	2	4	PTFE	6000h
Valve clamps B	4	4	SUS	6000h
Valve clamps A	4	4	PTFE	6000h

Components	Quantity		Material	Average life
	181D	361S		
O-rings (P-18)	11	11	Synthetic rubber (FPM)	10,000h-12,000h
O-rings (P-48)	8	8	Synthetic rubber (FPM)	10,000h-12,000h
T-joints	2	3	Synthetic rubber (EPDM)	10,000h-12,000h
Elbows	—	2	Synthetic rubber (EPDM)	10,000h-12,000h
Straight pipes	2	—	Synthetic rubber (EPDM)	10,000h-12,000h
Synflex tubes	2	4	Nylon	10,000h-12,000h
Connecting tubes	2	2	Silicon	10,000h-12,000h
Bearings	1 set	1 set	—	About 15000h

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

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

Bearings are replaced by the manufacturer's service division

<Replacement and Cleaning Guide>

Replace or clean components if performance is reduced or the following symptoms become apparent.

Inlet filters : Clean if filter is dirty or has rubbish on it.

Exhaust filters : Replace if filter is dirty, clogged or hard.

Diaphragms : Replace if worn, hard or deformed; or if surface has fine cracks.

Valves : Replace if deformed, hard or cracked.

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

T-joints : Replace if deformed, hard or cracked.

Elbows : Replace if deformed, hard or cracked.

Straight pipes : Replace if deformed, hard or cracked.

Synplex tubes : Replace if deformed, hard or cracked.

Connecting tubes : Replace if deformed, hard or cracked.

Bearings : Contact manufacturer for repair if abnormal noise or abnormal motor vibration (vibrating noise) 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
Every 4.000 hrs	Inlet filters	Dirty or presence of rubbish	Visual inspection
	Exhaust filters	Dirty, clogged or hard	Visual inspection
	Diaphragms	Deformed, hard, or cracked	Visual inspection
	Valves	Deformed, hard or cracked	Visual inspection

Period of operation	Inspection item	Inspection details	Method of inspection
Every 4.000 hrs	O-rings	Damage or leakage	Visual inspection
	T-joints	Deformed, hard or cracked	Visual inspection
	Elbows	Deformed, hard or cracked	Visual inspection
	Straight pipes	Deformed, hard or cracked	Visual inspection
	Synflex tubes	Deformed, hard or cracked	Visual inspection
	Connecting tubes	Deformed, hard or cracked	Visual inspection
	Bearings	Abnormal noises	Listen

6.4 Replacing and Cleaning Consumables



※ The pump becomes very hot after operation. After stopping the pump, leave it for 30 minutes to cool, and replace and clean components only after it has cooled to a safe temperature.

※ Always put on dust mask and gloves before replacing diaphragms and valves. Any fine particles produced by mechanical wearing may become airborne causing a health risk if inhaled.

Prepare the following tools and replace as shown in the diagram. Contact the manufacturer's service division if the necessary tools are not available.

1. Phillips screwdriver : No.2
2. Hexagonal wrenches : 4 and 6mm
3. Torque wrench : 4 and 6mm hexagonal sockets
It must be possible to set the tightening torque to 6N·m and 18N·m.
4. Spanner : 23 mm or equivalent adjustable spanner.
5. Vacuum grease : Used on O-rings.
6. Solvent : Must not affect rubber components (eg. ethyl alcohol).
7. Paper towels : Paper towels etc. used to wipe away dirt.
8. Dust mask and gloves
9. Thin rod : Used to remove the inlet filters of the valve retainer.

※ When replacing components, use tools 6 and 7 to remove dirty spots.

1) Cleaning Inlet Filters

It is recommended that inlet filters be cleaned at the same time diaphragms, valves and O-rings are replaced.

Use tools 4, 6 and 7.

- (1) Use spanner to remove inlet pipe. Use a thin rod to remove the inlet filter behind the valve retainer hole.
- (2) Remove any rubbish from the removed inlet filter and wipe clean with solvent.
- (3) Fasten the cleaned inlet filter behind the valve retainer hole.
- (4) Use spanner to fasten inlet pipe.

Note: Do not over tighten. Over tightening may damage the O-ring.

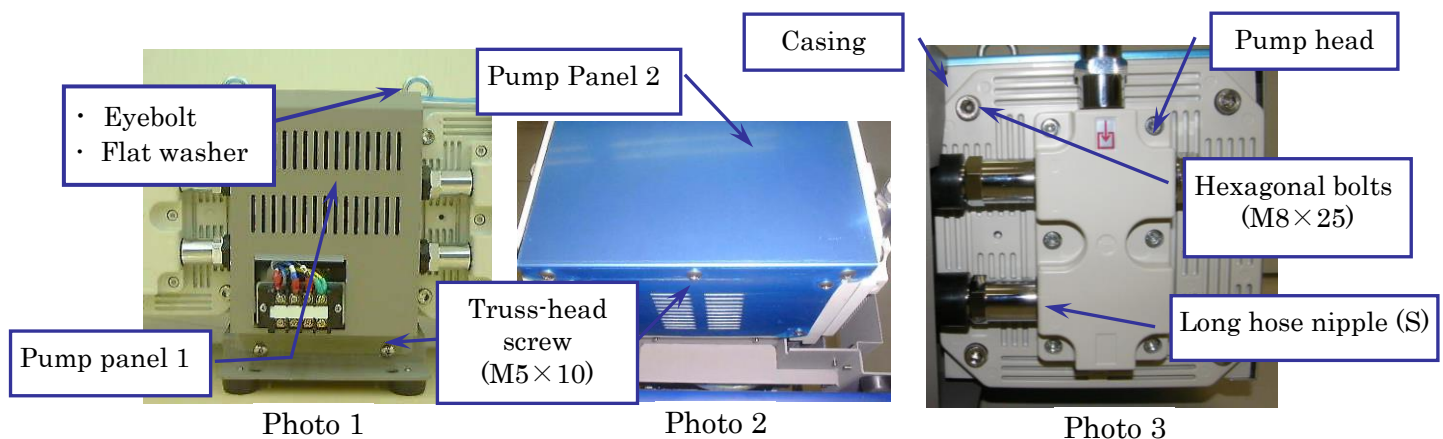
2) Replacing Diaphragms

It is recommended to replace all four diaphragms at the same time.

Use tools 1, 2, 3, 5, 6, 7 and 8.

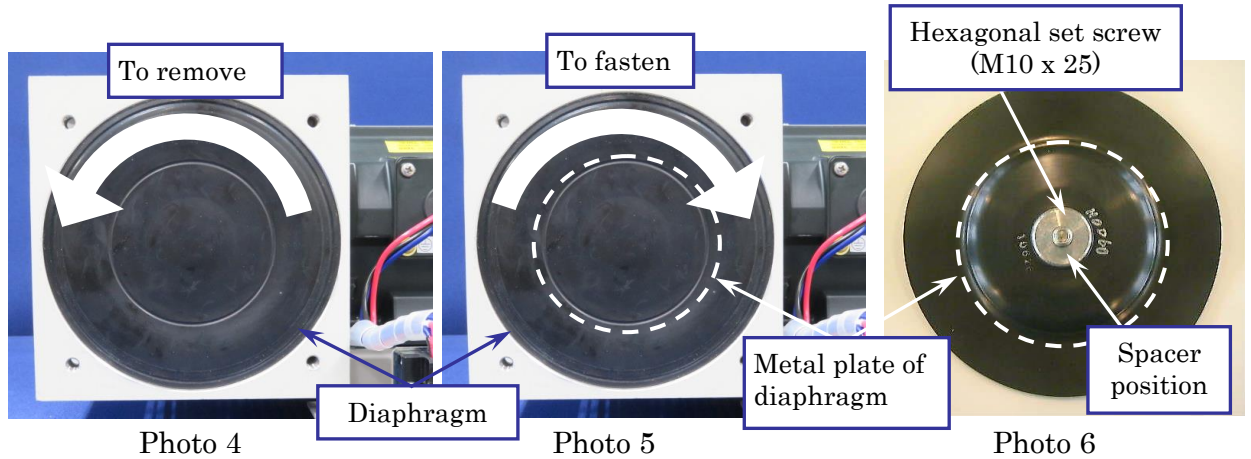
2)-1 Removing Pump Heads

- (1) Remove the eyebolt (M8), flat washer (M10), truss-head screws (M5×10) and remove the pump panels 1 and 2. (Photo 1,2)
- (2) The piping (black) is visible when the panels are removed. Remove the pump head as described below, and then remove the piping from the long hose nipple (S).
- (3) Remove the four hexagonal bolts (M8×25) from the pump head and remove the pump head. (Photo 3.) The four pump heads may be removed in any order.



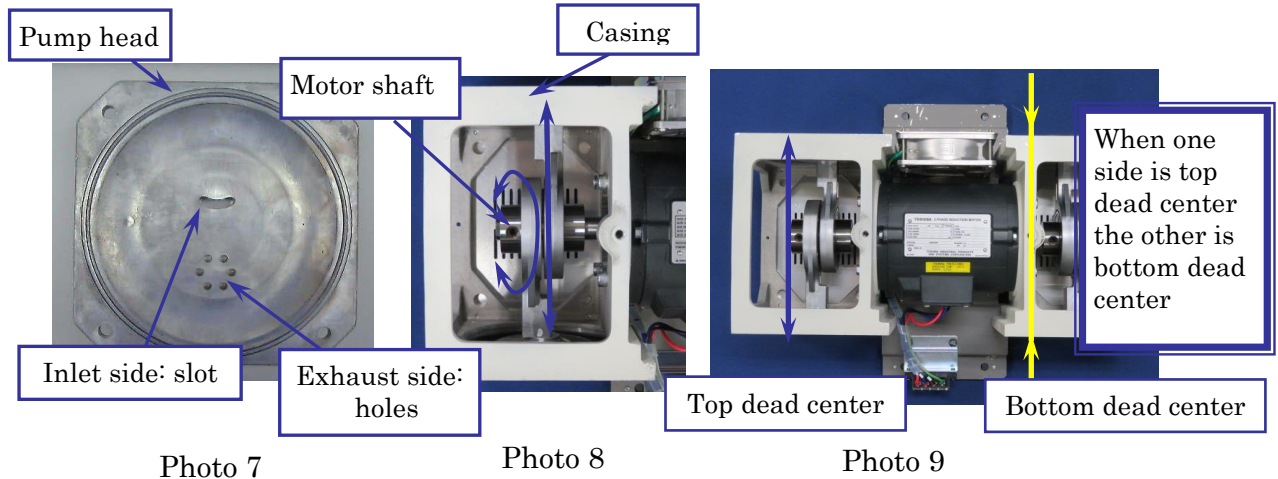
- (4) When removing the pump head from the casing, gently remove the rubber piping (black) from the long hose nipple (S).
Note: Take care not to damage the inside of the pump head.
- (5) Remove the rubber piping (black) from the long hose nipple (S) on the other pump head and remove it.
- (6) Remove the other pump heads in the same manner.

2)-2 Removing Diaphragms



- (1) Grasp the rim of the diaphragm and rotate it in an anti-clockwise direction to remove it. Remove the spacer attached to the rear of the diaphragm. (Photo 4.)
Note: Always wear gloves to perform this task. Do not lose the spacer.
Note: Diaphragm removal is easier performed with two people.
- (2) Apply a small amount of vacuum grease to the hexagonal set screw (M10×25) on the rear side of the new diaphragm and on the spacer removed in step (1). Fasten the spacer to the rear side of the diaphragm. (Photo 6) Grease will prevent the screw from galling.
- (3) Rotate the new diaphragm in a clockwise direction until it stops. Tighten a further 5°-10° from that position. (Photo 5.)
Note: Take care not to over tighten.

2)-3 Fitting Pump Heads



- (1) Place the pump head on the casing so that the inlet side (slot) is positioned on top (Photo 7) and tighten temporarily in place with the four hexagonal bolts (M8×25).
- (2) Turn the motor shaft by hand until the connecting rod reaches top dead center. (Photo 8,9.)
Note: The diaphragm is closest to the pump head at top dead center.

- (3) Tighten the four hexagonal bolts ($M8 \times 25$) that were temporarily fastened.
Note: Tighten diagonally opposite pairs of hexagonal bolts to $18N \cdot m$ with the torque wrench a number of times.
- (4) Fit the piping to the pump head. (Photo 10-17.)
- (5) Insert the long hose nipple (S) of the other pump head into the piping and fix it to the casing.
Note: Temporarily fasten the pump head to the casing like before and tighten it to $18N \cdot m$ at top dead center.
- (6) Fix the other pump heads in place in the same manner. Turn the motor shaft by hand to check that the pump head and the diaphragm are not in contact.
Note: If contact between pump head and diaphragm occurs, it will make a noise and cause the pump head to vibrate. Switch off the machine and contact the manufacturer's service division.
- (7) Temporarily fix the pump panel 1 in place with the four truss-head screws ($M5 \times 10$).
- (8) Pass an eyebolt (M8) with a flat washer (M10) through pump panel 2 and fix it in place with the three truss-head screws ($M5 \times 10$)
Note: Fix the other pump panel 2 in place in the same manner.
- (9) Tighten the four truss-head screws ($M5 \times 10$) to fix the temporarily fastened pump panel 1 in place.
Note: Hook pump panel 2 onto the pump panel 1.
Note: Ensure that pump panels 1 and 2 are not loose.

DAL-181D

*The unit is as follows when the pump head and piping have been fitted.

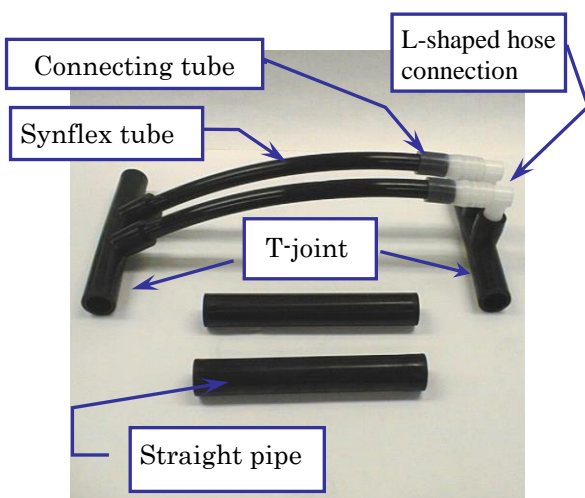


Photo 10 Piping

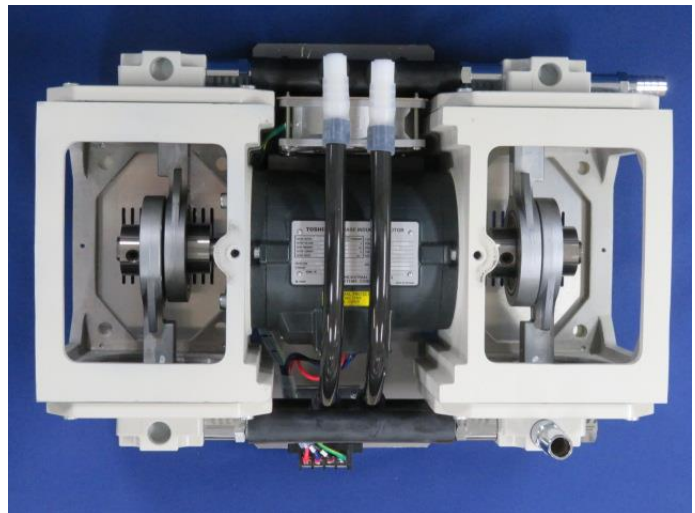


Photo 11 Top View

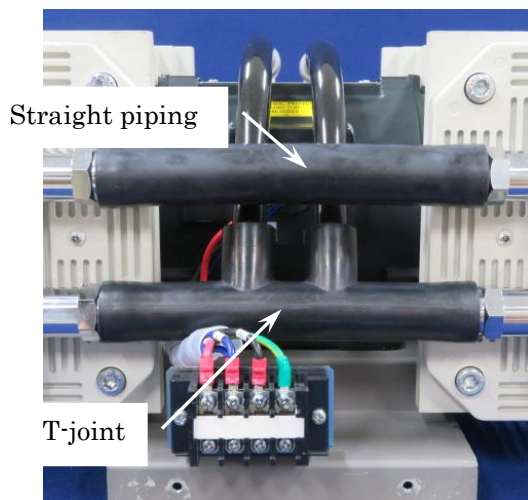


Photo 12 Terminal Block side

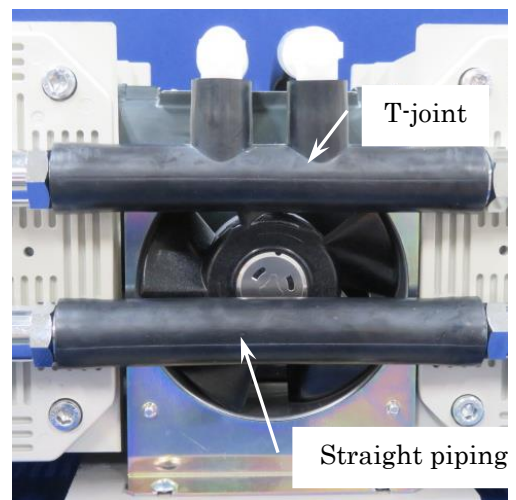


Photo 13 Fan side

DAL-361S *The unit is as follows when the pump head and piping have been fitted.

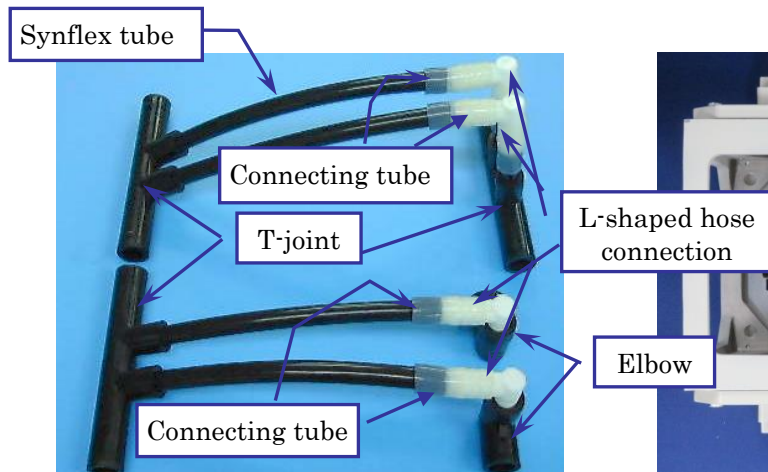


Photo 14 Piping

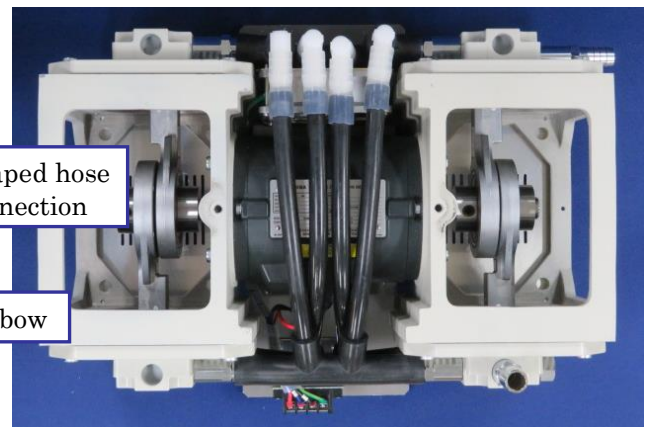


Photo 15 Top View

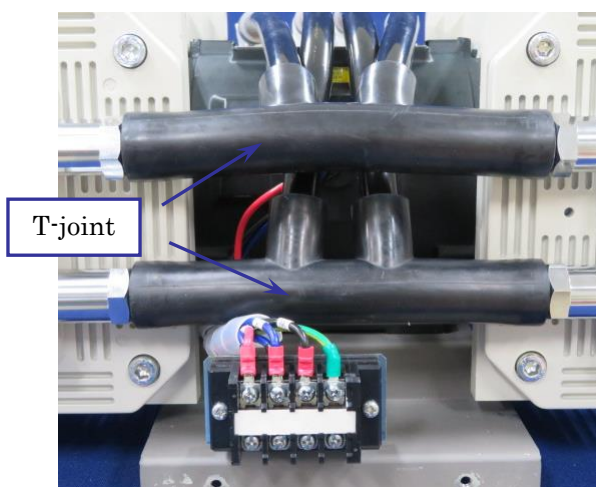


Photo 16 Terminal Block side

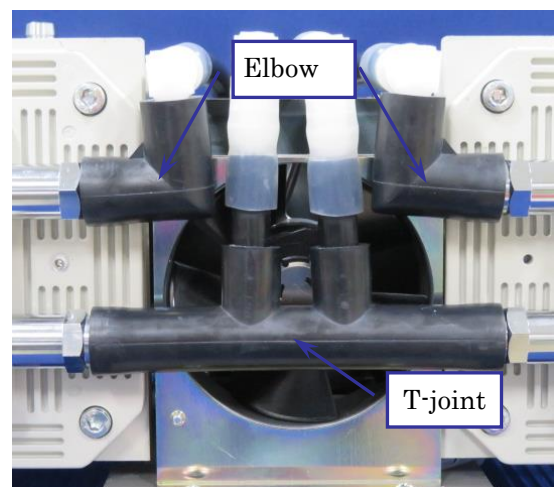


Photo 17 Fan side

3) Replacing DAL-181D Unit Valves

It is recommended to replace valves at the same time as replacing diaphragms.
Use tools 1, 2, 3, 6, 7 and 8

- (1) Remove pump panels 1 and 2, piping and pump heads. Use the same procedure as 2)-1 Removing Pump Heads in 2) Replacing Diaphragms.
- (2) Reduce the risk of damaging the pump head by choosing a firm work surface and covering it with a soft sheet. Position the removed pump head so that the valve retainer is upwards.

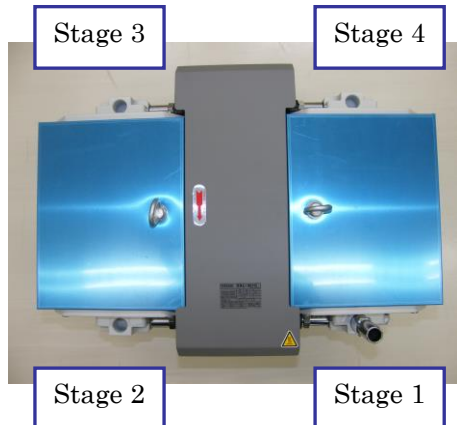


Photo 18

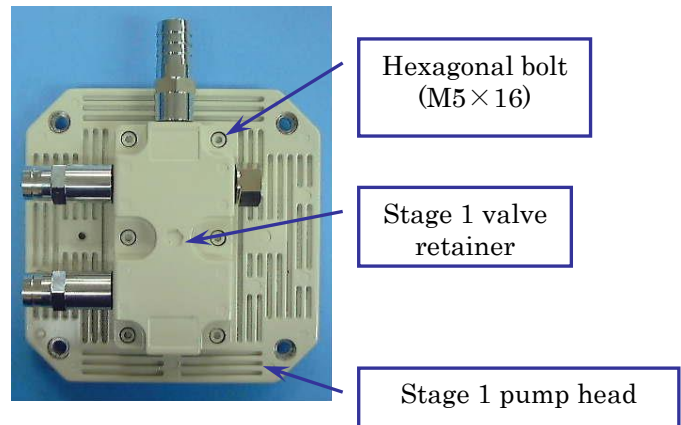


Photo 19

- (3) Remove the valve retainer by removing the six hexagonal bolts (M5 x 16) that are fastening it in place. (Photo 19)

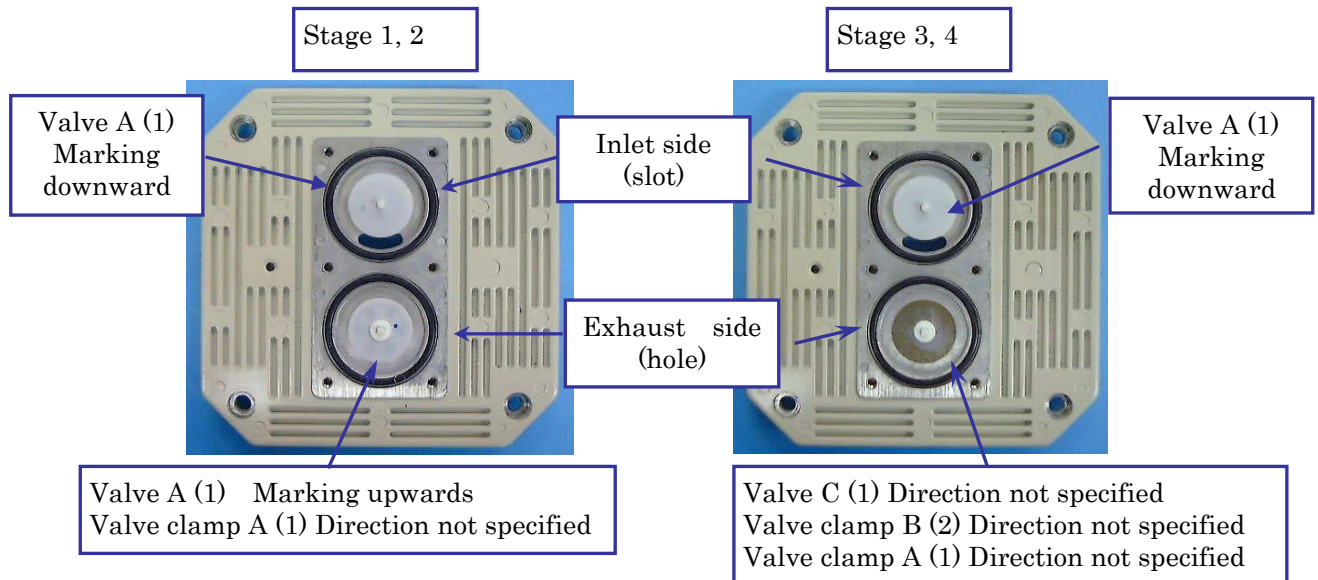


Photo 20

Photo 21

- (4) Remove valve A, valve C, valve clamp A and valve clamp B. Use solvent to clean the valve retainer and the area on the pump head where the valve was fastened.
- (5) Fasten one valve A (marking downwards) to the inlet (slot) of side 1 and side 2, and then fasten one valve A (marking upwards) and one valve clamp A in that order to the exhaust (hole). (Photo 20)
- (6) Fasten one valve A (marking downwards) to the inlet (slot) of side 3 and side 4, and then fasten one valve C, two valve clamp Bs and one valve clamp A in that order to the exhaust (holes). (Photo 21)

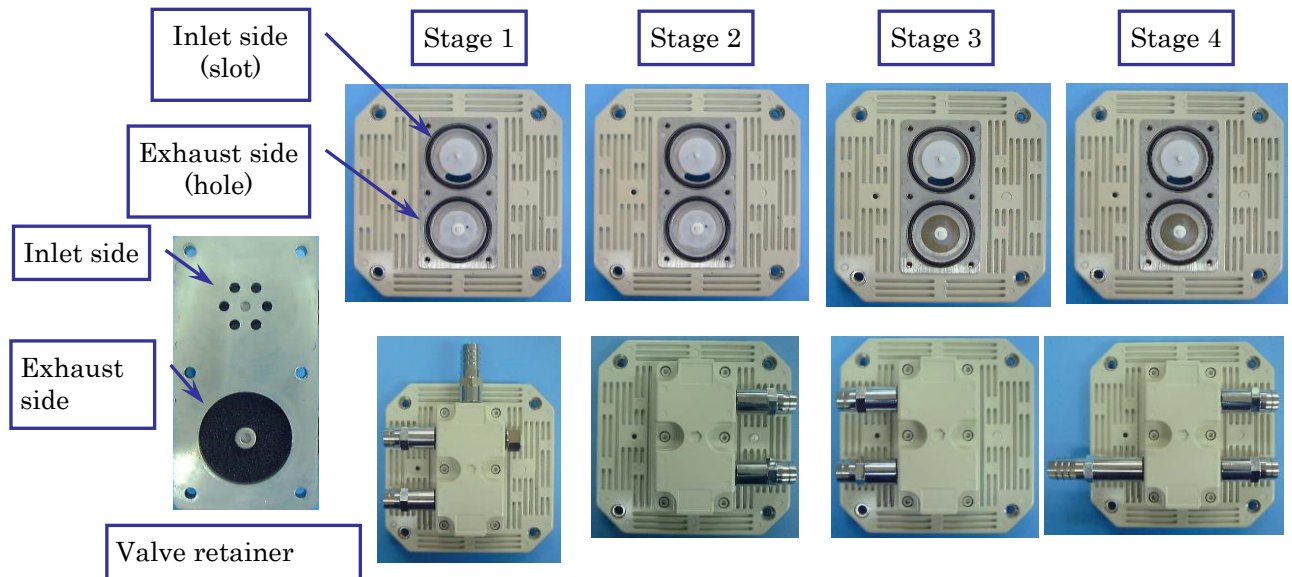


Photo 22

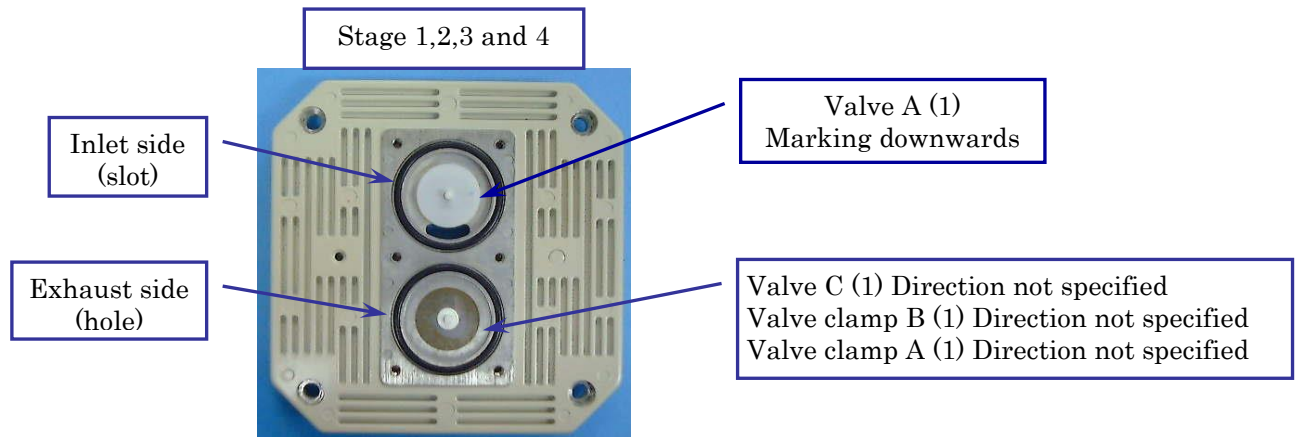
- (7) Position the valve retainer on the pump head as shown in Photo 22 and fix it in place with hexagonal bolts ($M5 \times 16$). (Photo 22.)
 - Note: Fasten so that the inlet side of the valve retainer connects to the inlet side (slot) of the pump head.
 - Note: Tighten diagonally opposite pairs of hexagonal bolts to $6N \cdot m$ with the torque wrench a number of times.
 - Note: When viewed from side-on, the O-ring should be hidden from view.
- (8) Fix the pump head in place, fit the piping and fix panels 1 and 2 in place. Use the same procedure as 2)-3 Fitting Pump Heads in 2) Replacing Diaphragms.

4) Replacing DAL-361S Unit Valves

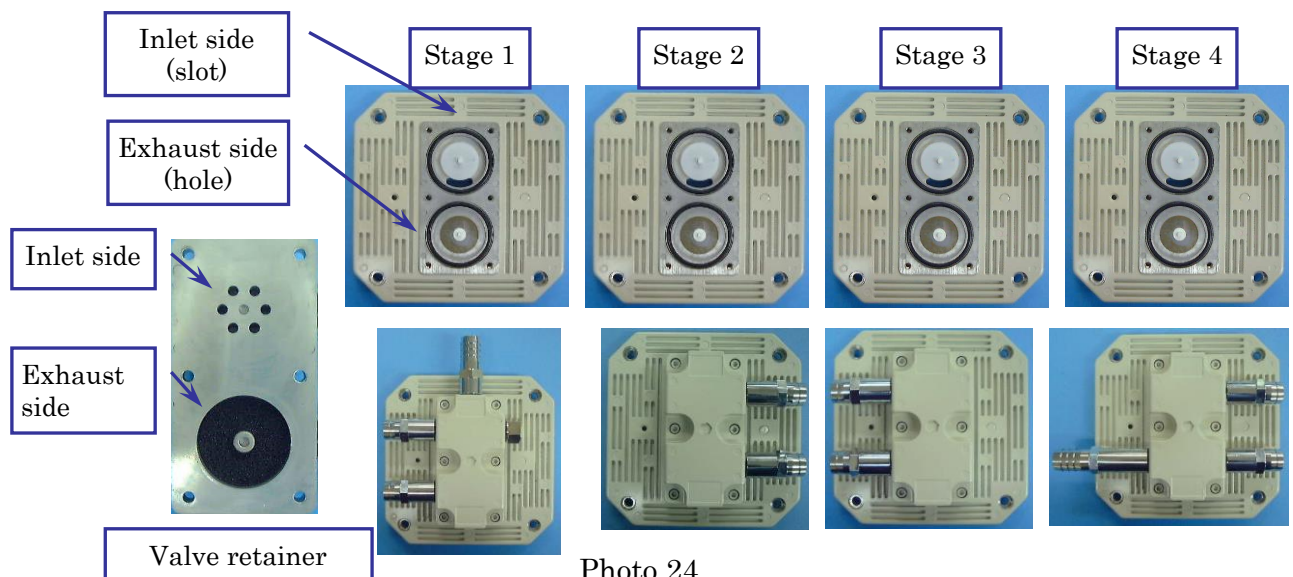
It is recommended to replace valves at the same time as replacing diaphragms.

Use tools 1, 2, 3, 6, 7 and 8.

- (1) Use the same procedure as steps (1)-(4) in 3) Replacing DAL-181 Unit Valves and remove the pump heads and valve retainers. Use solvent to clean the valve retainer and the area on the pump head where the valve is fitted. (Photo 18,19.)



- (2) Fasten one valve A (marking downward) to all pump head inlets (slot) and then one valve C, one valve clamp B and one valve clamp A in that order to the outlets (holes). (Photo 23.)



- (3) Position the valve retainer on the pump head as shown in Photo 24 and fix it in place with the hexagonal bolts ($M5 \times 16$). (Photo 24.)
Note: Fasten so that the inlet side of the valve retainer connects to the inlet side (slot) of the pump head.
Note: Tighten diagonally opposite pairs of hexagonal bolts to $6N \cdot m$ with the torque wrench a number of times.
Note: When viewed from side-on, the O-ring should be hidden from view.
- (4) Fix the pump head in place, fit the piping and fix panels 1 and 2 in place. Use the same procedure as 2)-3 Fitting Pump Heads in 2) Replacing Diaphragms.

5) Replacing O-rings

It is recommended that O-rings be replaced at the same time as replacing diaphragms. Use tools 1, 2, 3, 4, 5, 6, 7 and 8.

- (1) Remove pump panels 1 and 2, piping, pump heads and valve retainers. The procedure is the same as steps (1)-(3) of 3) Replacing DAL-181D Unit Valves.
- (2) Remove the O-rings (P-18) by first removing the long hose nipples (L-1), (L-2), (S) and G 1/2 plug with a spanner.

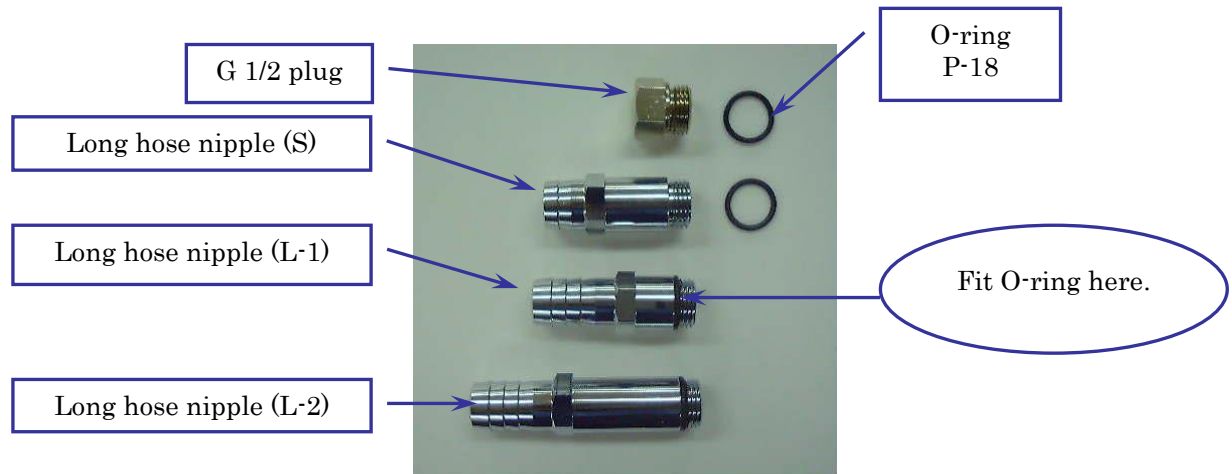


Photo 25

- (3) Evenly cover the entire surface of the new O-rings (P-18) with a light coating of vacuum grease. Fit them to the long hose nipples (L-1), (L-2), (S) and the G 1/2 plug. (Photo 25.)
- (4) Use solvent to remove any vacuum grease on the fastener parts. Fix the long hose nipples (L-1), (L-2), (S) and the G 1/2 plug with a spanner. Note: Do not over tighten. Over tightening can damage the O-rings.
- (5) Remove the Pump Head's O-rings (P-48) and use solvent to clean the O-ring grooves and valve retainers. (Photo 26.)

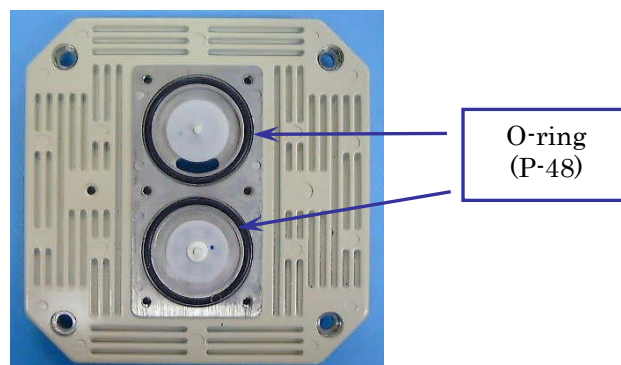


Photo 26

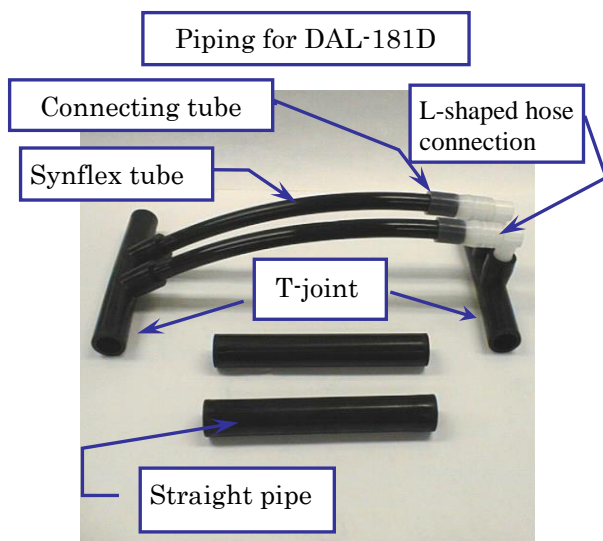
- (6) Cover the new O-ring (P-48) all over with an even light coating of vacuum grease. Fit it into the O-ring groove.
- (7) Fit and fix in place, the valve retainers, pump heads, piping and panels 1 and 2. For 181D, this procedure is the same as steps (7)-(8) of 3) Replacing DAL-181D Unit Valves. For 361S, this procedure is the same as steps (3)-(4) of 4) Replacing DAL-361S Unit Valves.

6) Replacing Piping (T-joints, elbows, straight pipes, synflex tubes, and connecting tubes)

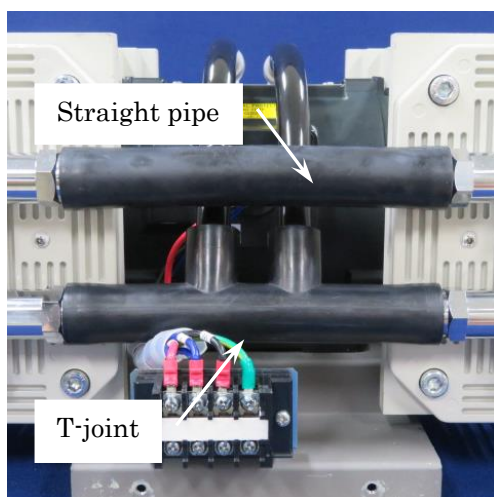
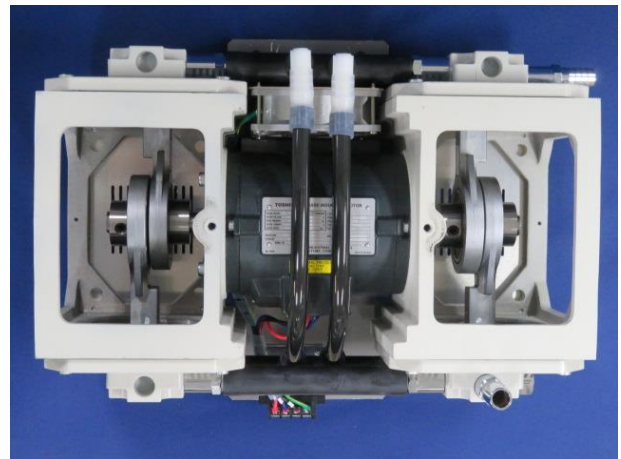
It is recommended that you replace piping at the same time as replacing diaphragms. Use tools 1, 2, 3, 5, 6, 7 and 8

- (1) Remove pump panels 1 and 2, piping, pump heads and valve retainers. This procedure is the same as steps (1)-(4) of 2)-1 Removing Pump Heads in 2) Replacing Diaphragms.
- (2) Replace the piping (T-joints, elbows, straight pipes, synflex tubes, and connecting tubes) with new parts.
Note: When replacing piping, lightly apply vacuum grease to the connecting areas of the piping and then connect the piping.
- (3) After replacing piping, use the same procedure as 2)-3 Fitting Pump Heads in 2) Replacing Diaphragms to reassemble the unit.

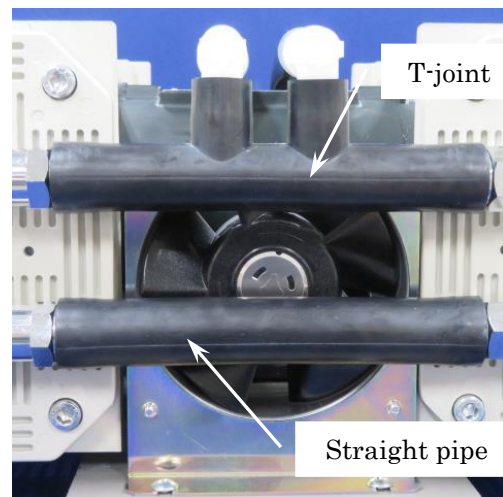
DAL-181D Piping to be Replaced



Unit with pump heads and piping fitted

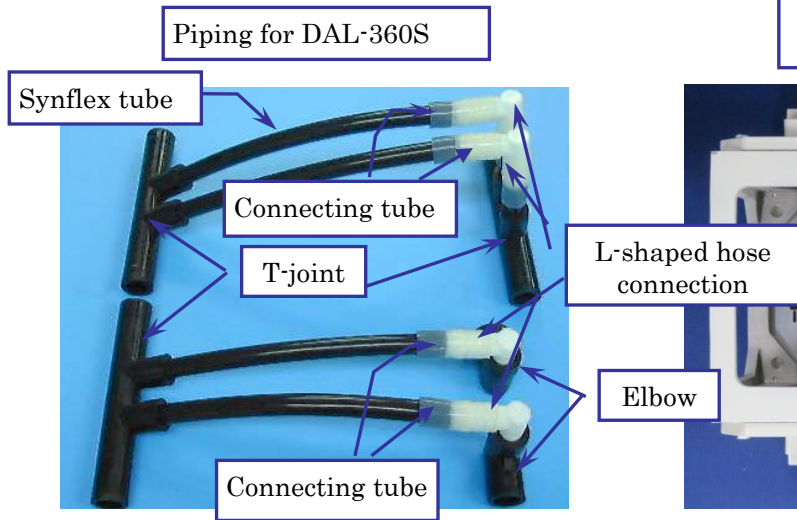


Terminal Block side

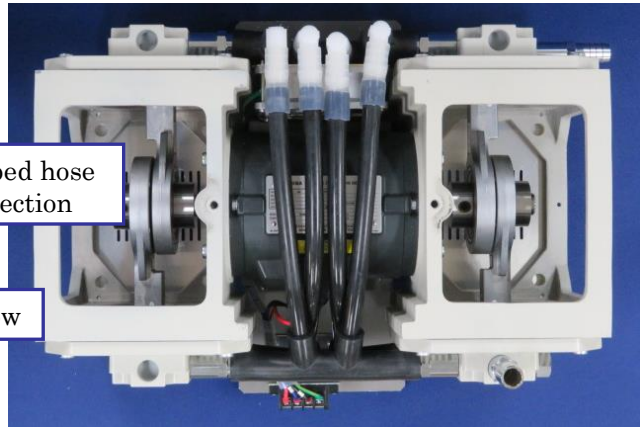


Fan side

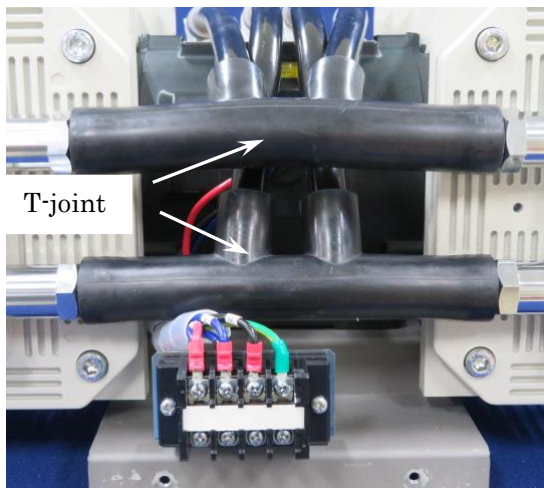
DAL-361S Piping to be Replaced



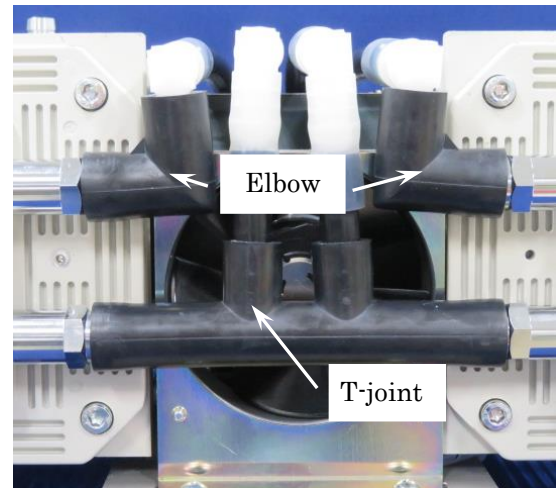
Unit with pump heads and piping fitted.



Top View



Terminal Block side



Fan side

7) Replacing Exhaust Filters

It is recommended to replace exhaust filters at the same time as replacing diaphragms. Use tools 1, 2, 3, 6, 7 and 8.

- (1) Remove pump panels 1 and 2, piping, pump heads and valve retainers. The procedure is the same as steps (1)-(3) in 3) Replacing DAL-181D Unit Valves.
- (2) Remove the urethane exhaust filters from the exhaust side of all the valve retainers.
- (3) Use solvent to clean the fastening area of the exhaust filter. (Photo 27.)
- (4) Fit the new exhaust filter taking care to prevent it from collapsing in. Then check to make sure the exhaust filter is not deformed.
- (5) Fit and fix in place the valve retainers, pump heads, piping and panels 1 and 2. For 181D, this procedure is the same as steps (7)-(8) in 3) Replacing DAL-181D Unit Valves. For 361S, this procedure is the same as steps (3)-(4) in 4) Replacing DAL-361S Unit Valves.

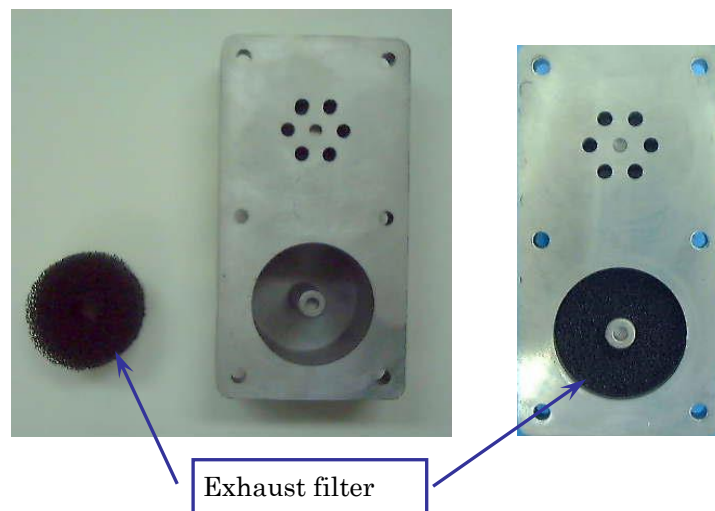


Photo 27

8) Replacing Bearings

Contact the manufacturer's service division for bearing replacement.

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 $\pm 10\%$. (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 $7\sim 40\text{ }^{\circ}\text{C}$. (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 or repair. (16) Disassemble and repair (replace damaged components).	3-5. 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 valves. (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, or 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 $7\sim 40\text{ }^{\circ}\text{C}$. (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 + $30\text{ }^{\circ}\text{C}$)	(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 $\pm 10\%$. (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 (this equipment) extends for a period of one year from the date of shipment.

(2) Any malfunctions or defects which occur under normal usage conditions during the warranty period will be repaired free of charge.

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

Normal usage conditions refer to the following:

a) Ambient temperature and humidity during operation: 7 - 40°C, below 85% RH

b) Operation in accordance with the user manual

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

a) Malfunctions due to a natural disaster or fire.

b) Malfunctions caused by special atmospheric conditions, such as salt damage, inflammable gas, corrosive gas, radiation or pollution.

c) Malfunctions caused by usage conditions that differ from those stated in the user manual (performance specifications, maintenance and inspection, etc.).

d) Malfunctions caused by modifications or repairs carried out by a party other than the manufacturer, or by a service company not approved by the manufacturer.

e) Malfunctions caused by noise (electric disturbance).

f) Malfunctions that occur when not using a rated power supply.

g) Malfunctions that occur when there is an abnormal rise in internal pressure due to the pump exhaust outlet being blocked during operation, etc.

h) Malfunctions that occur, when the pump is damaged as a result of being dropped or falling, etc.

i) Malfunctions which are determined by the manufacturer's technical personnel to be caused by conditions that do not comply with the usage conditions for this 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/>

株式会社アルバック
規格品事業部 東日本営業部
〒253-8543
神奈川県茅ヶ崎市萩園2500
TEL:0467-89-2416

株式会社アルバック
規格品事業部 西日本営業部
〒532-0003
大阪府大阪市淀川区宮原3-3-31 上村ニッセイビル5F
TEL:06-6397-2286

ULVAC KIKO,Inc.

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

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



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

ULVAC,Inc.
Components Division
2500 Hagisono, Chigasaki, Kanagawa, 253-8543, Japan
TEL:+81-467-89-2261