

ULVAC

User's Manual

Diaphragm-type Dry Vacuum Pump

DTC-22A, DTC-22B, DTC-22C**DTC-22※**

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.

※ : It wishes attention because I will assume A,B,C to be DTC-22 generically for the sign that indicates the specification of the voltage.

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

- (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.

High Temperatures

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

Electric

To prevent electric shock, always shut-off the primary power supply before working on electrical wiring, or engaging in any electrical work.

Cautions for Safety in Use



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.**

Suck gas

- (4) The pump is not designed to prevent leakage of harmful/poisonous/toxic gas.
- (5) In case it is used with toxic/corrosive gases proper safety measures shall be implemented by the end user of which adequacy needs to be evaluated upon installation. These measures may include employment of safety ducting system, leakage detection system etc. depending on a comprehensive risk assessment
- (6) The vacuum vessel that enters the gas that influences the harmful gas or the human body like the noxious fume and the environment is exhausted in the vacuum with this pump. There is causing the poisoning accident and the fatal accident at that time when the vehicle exhaust emission of the pump is indoors opened. Please do the following countermeasure and use the pump safely.

Suck gas [corrosive gases]

- (7) It is necessary to connect the vehicle exhaust emission of the pump with a special ventilation duct or exclusion device. And, do not discharge the vehicle exhaust emission indoors.
- (8) Please confirm the thing that doesn't leak to the piping of the pump inhalation side and the exhalation side.
- (9) It is necessary to install the gas leakage detector for the suck gas on the device. When the leakage is detected, it is necessary to do the setting that intercepts the gas inflow to the pump.
- (10) Please exchange the consumable parts to prevent the leakage from the pump every 5000 hours. (The bearing is excluded.)
- (11) Please take shelter at once when the gas leaks by any chance due to the breakdown of the pump. And, please ventilate the air in the room enough. Moreover, please enter the room of the device after wearing the hazard mask when you confirm the device. Do not detach the hazard mask until safety is confirmed.

Suck gas [flammable gases]

- (12) The mixed gas within the range of the explosion prohibits exhausting.
- (13) It is necessary to connect the vehicle exhaust emission of the pump with a special ventilation duct or combustion device. And, do not discharge the vehicle exhaust emission indoors.
- (14) Please confirm the thing that doesn't leak to the piping of the pump inhalation side and the exhalation side.
- (15) It is necessary to install the gas leakage detector for the suck gas on the device. When the leakage is detected, it is necessary to do the setting that intercepts the gas inflow to the pump.

- (16) Please exchange the consumable parts to prevent the leakage from the pump every 5000 hours. (The bearing is excluded.)
- (17) Please take shelter at once when the gas leaks by any chance due to the breakdown of the pump. And, please ventilate the air in the room enough. Moreover, please enter the room of the device after wearing the hazard mask when you confirm the device. Do not detach the hazard mask until safety is confirmed.

Suck gas [explosive gases]

- (18) No explosive gases in side the pump.

Suck gas [Poisonous gases]

- (19) It is necessary to connect the vehicle exhaust emission of the pump with a special ventilation duct or exclusion device. And, do not discharge the vehicle exhaust emission indoors.
- (20) Please confirm the thing that doesn't leak to the piping of the pump inhalation side and the exhalation side.
- (21) It is necessary to install the gas leakage detector for the suck gas on the device. When the leakage is detected, it is necessary to do the setting that intercepts the gas inflow to the pump.
- (22) Please exchange the consumable parts to prevent the leakage from the pump every 5000 hours. (The bearing is excluded.)
- (23) Please take shelter at once when the gas leaks by any chance due to the breakdown of the pump. And, please ventilate the air in the room enough. Moreover, please enter the room of the device after wearing the hazard mask when you confirm the device. Do not detach the hazard mask until safety is confirmed.

Grounding Instructions [Plug]

- (24) This product must be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. If the product is equipped with a cord having a grounding wire with an appropriate grounding plug, the plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.
- (25) Improper installation of the grounding plug can result in a risk of electric shock. If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to either flat blade terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.
- (26) Check with a qualified electrician or serviceman when the grounding instructions are not completely understood, or when in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it does not fit the outlet, have the proper outlet installed by a qualified electrician.

Grounding Instructions [Field Wiring]

- (27) This product must be connected to a grounded, metallic, permanent wiring system, or an equipment-grounding terminal or lead on the product.

 **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.
Open the distance from the shield to the ventilation entrance part for the fan by 3.5cm or more when you set it up.

Power Supply

- (4) Turn off the main disconnection device 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) Turn off the main disconnection device 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) Touching the power cord with wet hands may result in electric shock.
- (11) Touching electrical wiring etc while inserting the power plug may result in electric shock.

Warning

Operation

- (12) 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.
- (13) Inserting fingers or objects into the motor inlet may result in electric shock, injury, or fire.
- (14) Operating the pump with the discharge outlet blocked, or with a device which prevents passage of gas to the discharge outlet. The internal pressure of the pump rises 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

- (15) The pump should be dismantled or repaired only by a repair technician trained by the manufacturer. ※ 1
- ※ 1 Person who receives our technical training
- (16) To prevent ingestion of microscopic particles resulting from wear of components, use a dust mask and gloves during repair work.

Caution

Installation

- (1) The fine clearances used in this pump require that the following conditions be satisfied during storage, installation, and operation.
 - 1. Ambient temperature of 0~40°C and maximum relative humidity of 85% during operation.
 - 2. Other conditions 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.
- (2) To prevent back injury, always use both hands to lift pumps.
- (3) 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.

Operation

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



Caution

Maintenance and Repair

- (9) Dispose in accordance with legislation for disposal and cleaning of waste products, handle as industrial waste, and do not incinerate.
Toxic fluorine gas is generated by incineration of fluorine-based plastics.
- (10) If the pump ceases operation, turn power OFF (set switch to O) immediately to prevent accidents, turn off the main disconnection device, and contact your dealer or the manufacturer for inspection and repair.
- (11) Leave the pump for at least 30 minutes until it has cooled, and begin operation again. Touching the pump immediately after it has stopped may result in burns.



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 for general corrosion resistance, however it is not resistant to molten alkali metals such as molten sodium, to fluorine at high temperatures, and to some oxides of fluorine.
- (4) Corrosion-resistant plastic is used in the external covering of the DTC-22, however it is not resistant to all chemicals.

Ensure that the following chemicals do not come in contact with the pump. Any chemical, including the following, which comes into contact with the pump should be wiped off immediately.

- Acetone
- Ethyl ether
- Ethyl acetate
- Animal fats

 **Note****Installation**

- (5) Ingestion of liquids or compressed and gases into the pump will result in damage and prevent proper operation.
- (6) Ingestion of rubbish and dust in the air entering the pump will interfere with its proper function. If the air is likely to contain rubbish or dust, a filter should be fitted to the inlet to protect the pump.
- (7) Ducting should always be fitted to the pump outlet if toxic corrosive gases, or steam, enters the pump.

Operation

- (8) Use the pump within an ambient temperature range of 40°C. Use at high ambient temperatures will dramatically reduce the life of the pump.
- (9) Back pressure at the outlet while the pump is starting may overload the motor.
- (10) The thermal protector operates when the pump reaches a very high temperature. Touching the pump in this condition may result in burns.
- (11) To maintain the performance of the pump, always ensure that it is cleaned internally after use. Clean by ingesting clean air for 3~5 minutes under no-load conditions.

Maintenance and Repair

- (12) 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.

PTFE is a highly corrosion-resistant plastic and is used in components which come in contact with gas.

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 designed for general corrosion resistance, however it is not resistant to molten alkali metals such as molten sodium, to fluorine at high temperatures, and to some oxides of fluorine. (4) Corrosion-resistant plastic is used in the external covering of the DTC-22 however it is not resistant to all chemicals. Ensure that the following chemicals do not come in contact with the pump. Any chemical, including the following, which comes into contact with the pump should be wiped off immediately. • Acetone • Ethyl ether • Ethyl acetate • Animal fats (5) Ensure that the gas entering the pump does not contain rubbish, dust, or water (except steam). (6) Do not operate the pump for long periods at near-atmospheric pressure.



1.2 Specifications

Table 1.1 Product Specifications

Model		DTC-22A	DTC-22B	DTC-22C
Discharge rate	50Hz	20L/min		
	60Hz	24L/min		
Pressure achieved		1.0×10 ³ Pa		
Motor		Single phase		
		AC 115 (±10%)	AC 220 (±10%)	AC 230 (±10%)
		50 W, 4P, with condenser-run thermal protection relay (automatic reset)		
Rated current		1.20/1.32A (50/60Hz)	0.60/0.72A (50/60Hz)	0.60A (50Hz)
Speed		1260/1580rpm	1275/1570rpm	1270rpm
Inlet and outlet piping		O.D.Φ10X I.D.Φ6(G1/4)		
Weight		7.1kg		
Air temperature		0~40°C		
Dimensions (W refers to the distance to the tip of the intake or exhaust pipe)		142mm(W)X272mm(L)X202mm(H)		
Over Voltage Category		II		
Pollution Degree		2		

1.3 Thermal Protector

- 1) This pump is fitted with an automatic reset thermal protector for overload protection. This device shuts off the motor power supply circuit automatically to prevent burn-out if the motor temperature rises due to 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), P06
 Caution	See Caution (6), P07

2. Dimensions



Top (width 142mm)



Front (length 272mm)






Front (length 202mm)

Fig.2.1 DTC-22

3. Installation and Storage

3.1 Cautions for Installation and Storage

 Warning	See Warning (1)(2)(3)(5)(6)(7)(8)(9)(10)(11), P06
 Caution	See Caution (1)(2)(3), P07
 Note	See Note (1), P08 (5)(6)(7)(8), P09

3.2 Environmental Conditions for Installation, Storage, and Operation

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

- 1) Ambient temperature of 0~40°C and maximum relative humidity of 85% during operation.
- 2) Other conditions (during storage and operation).
 - a) Level floor of sufficient strength.
 - b) No condensation
 - c) Dust-free environment
 - d) Well ventilated
 - e) Environment free of corrosive or explosive gas.
 - f) Not subject to direct sunlight.
 - g) No danger of fire.

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 Checking Operation After Installation

- 1) Remove the rubber caps from the inlet and outlet.
- 2) Check that the pump switch is OFF (set to O), and insert the plug into the wall socket.
 Note: Ensure that the power plug is sufficient for the rated voltage and current.
 Note: Extension cords should be 3-wire, with lead wires having a cross-sectional area of at least 0.75 mm².
- 3) Please intercept the power supply and connect it, except when the power strip is a plug.
- 4) Turn the switch ON (set to I) and check that gas is being drawn into the inlet.
- 5) When this check is complete, turn the power switch OFF (set to O) to stop the pump.

3.5 Piping

- 1) Install piping carefully to prevent leaks.
- 2) Piping connected to the inlet should be at least 5 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 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).

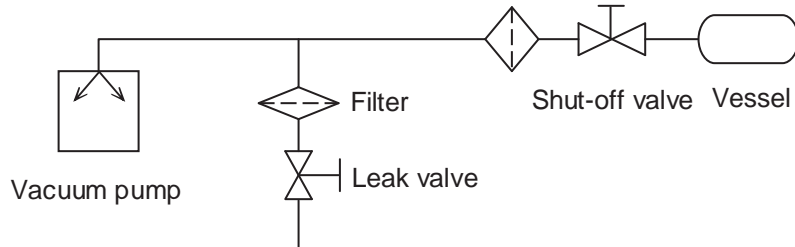






Fig.3.1 Example of Piping Used When Evacuating a Vessel

3.6 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),P06 (12)(13)(14), P07
 Caution	See Caution (4)(5)(6)(7)(8), P07
 Note	See Note (2)(3)(4),P08 (5)(6)(7)(8)(9)(10)(11), P09

- 1) To maintain the performance of the pump, always ensure that it is cleaned internally after use. Clean by ingesting clean air for 3~5 minutes under no-load conditions.
- 2) Consult the manufacturer if the pump is to be used in a special application.

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 pump will be very hot and should not be touched.
- 2) The pump operates automatically when temperature drops. Shut-off the power supply, and determine the cause of operation of the thermal protection relay.
- 3) Once the cause of the fault has been removed, wait until the motor cools and restart operation.

 Caution	See Caution (6), P07
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4.3 Starting in Cold weather (In door Use only)

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 0°C.
- 2) With the inlet open to atmosphere, run the pump for a few minutes to warm it.
- 3) Commence normal operation once the pump has warmed.

5. Pump Performance

5.1 Pressure Achieved

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

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

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

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

5.2 Evacuation Rate

The 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) , P06 (15)(16),P07
 Caution	See Caution (9)(10)(11), P08
 Note	See Note (12), P09

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 inlet and outlet valves
- 3) Replacing O rings

6.2 Maintenance

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

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

If a problem is found, take the measures described in 6.6 Troubleshooting List.

6.3 Regular Inspections

Inspect consumables after the first 3000 hours of operation, and replace and clean in accordance with the Replacement and Cleaning Guide on the following page. Refer to 6.5 Replacing and Cleaning Consumables for procedures.

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

Table 6.1 Consumables List

Components	Quantity	Material	Average life
Diaphragms	2	Synthetic rubber (EPDM) In contact with gas: PTFE	6,000hr
Inlet and outlet valves A	2	Perfluoroelastomer	6,000hr
Inlet and outlet valves B	2	Perfluoroelastomer	6,000hr
Valves holder	2	PTFE	6,000hr
O rings (P-10A)	2	Fluorine rubber (FPM)	6,000hr
O rings (S-24)	4	Fluorine rubber (FPM)	6,000hr
O rings (AS568-110)	4	Fluorine rubber (FPM)	6,000hr
Bearings	1 set	—	15,000hr

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 Guide>

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

Table 6.2 Locations for Maintenance and Inspection

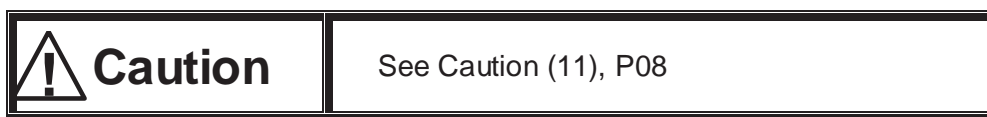
Period of operation	Inspection item	Replacement guidelines	Method of inspection
3000 hours	Diaphragms	Wear of PTFE components, deformation, hardening, or cracking of rubber components	Visual inspection
	Inlet and outlet valves valve holder	Deformed, hard, or cracked	Visual inspection
	O rings	Hard, cracked, or stretched	Visual inspection
	Bearings	Abnormal noises	Listen

6.4 Content of contact to our service section

- 1) Model : Model of the name plate
- 2) Serial No. : Serial No of the name plate
- 3) Gases used with pump : Information required for safety purposes
- 4) Condition : Duration of use, Abnormal noises, Pressure problems, etc.
- 5) Other : Noticed content

The above-mentioned content was brought together as " Pump Usage Check Sheet ".
The seat is attached to page 15.

6.5 Replacing and Cleaning Consumables



Always use a mask and gloves when replacing components to prevent ingestion of microscopic particles resulting from wear of components.

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) Phillips screwdriver : No.2
- 2) Hex socket wrench : (1) 3mm (2) 5mm
- 3) Torque wrench : 5mm hexagonal socket, set to 11 N.m torque
- 4) Phillips Torque screwdriver : Set to 0-4 N.m torque.
- 5) Spanners : 14mm or equivalent adjustable spanner
- 6) Vacuum grease : For replacing O rings.
- 7) Solvent : Use a solvent such as ethylalcohol which has no effect on rubber components.
- 8) Paper towels etc

1) Replacing Diaphragms

(It is recommended that both diaphragms be replaced simultaneously.)

Caution! Where gloves when attaching or removing the diaphragms.
There is a danger of injuries.

Use tools No.1,2,3,4,5,6, 7 and 8 listed above

1) -1. DTC-22

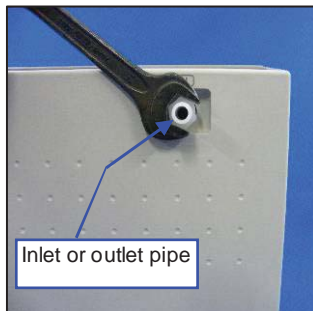


Photo 1

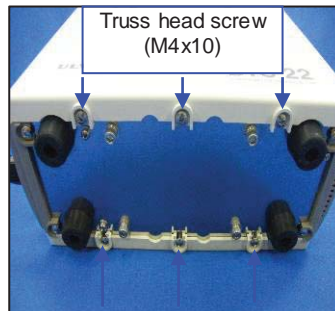


Photo 2

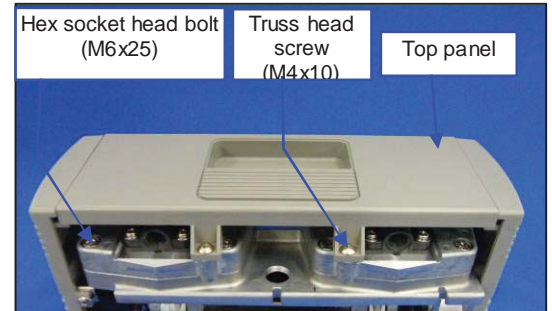


Photo 3

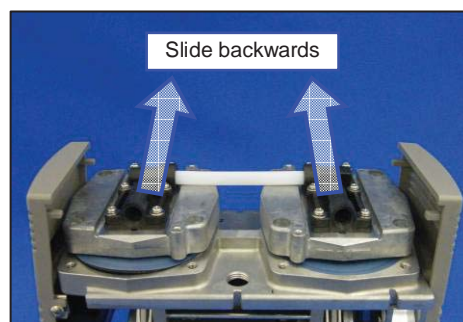


Photo 4

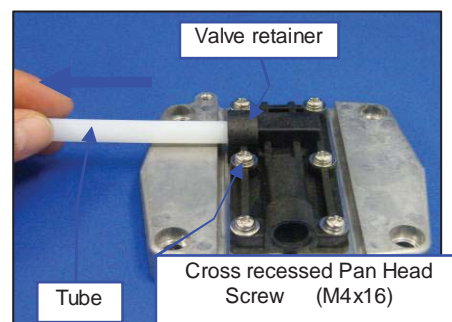


Photo 5

- (1) Remove the inlet and outlet pipes, and lay the pump on a soft cloth. See Photo 1.
- (2) Remove the six truss screws (M4x10) in the base of the pump, and remove the front panel (white). See Photo 2.
- (3) Stand the pump up, remove the four truss screws (M4x10), and remove the top panel. See Photo 3.
- (4) Remove the eight hex socket head bolts (M6x25), and remove the pump head as shown in Photo 4.

Note: Gripping or bending the connecting tube will damage it and reduce performance of the pump.

Note: After removing the pump head, lay it on a soft cloth.

Note: There is a thing that the pump head spacer has been inserted under the pump head. (Photo 6 and 7) After Diaphragms is exchanged, the pump head spacer is installed in the same part. Identify it so as not to confuse it.

Note: It marks the pump head spacer. Marking is used to identify the thickness, and there are each red, blue, and a black. Note that it influences the performance when making a mistake as former position.



Photo 6

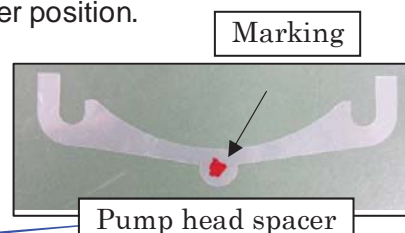


Photo 7

- (5) Withdraw the connecting tube from the valve retainer, and disassemble the left and right pump heads. See Photo 5.

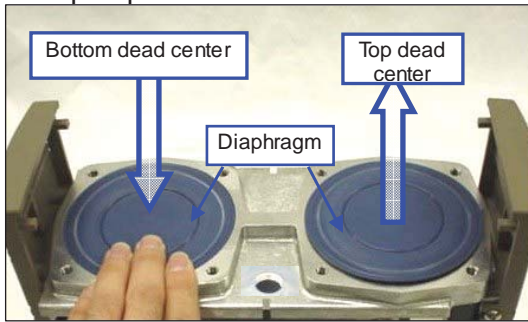


Photo 8

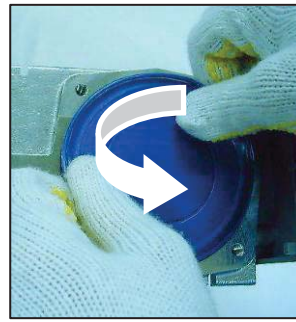


Photo 9

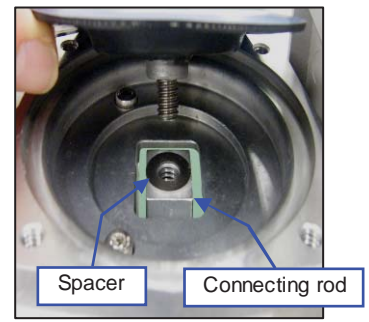


Photo 10

- (6) When one diaphragm is pushed downwards (to bottom dead center), the other diaphragm rises (to top dead center). It is then possible to grip the edge of the diaphragm. See Photo 8.

- (7) While holding the edge of the diaphragm, turn it in the anti-clockwise direction and remove it. See Photo 9. Remove the other diaphragm in the same way.

Note: Use two persons to grip the diaphragm if it is difficult to remove.

Note: A spacer (washer) is inserted between the diaphragm and connecting rod. Ensure that this spacer does not fall into the pump. See Photo 10.

Note: The connecting rod may drop into the pump.

After removing the diaphragm, insert a hex head bolt (M6x25) into the tapped portion of the connecting rod to hold the pump head cover in place.

- (8) Clean the tapped portion of the connecting rod by wiping with a cloth impregnated with solvent.

- (9) Apply a small amount of vacuum grease to the threads on the new diaphragm, and to the spacer, and screw it onto the connecting rod clockwise. See Photo 11.

Note: Check that the spacer (see Photo 10) removed in (7) is returned to its original position.

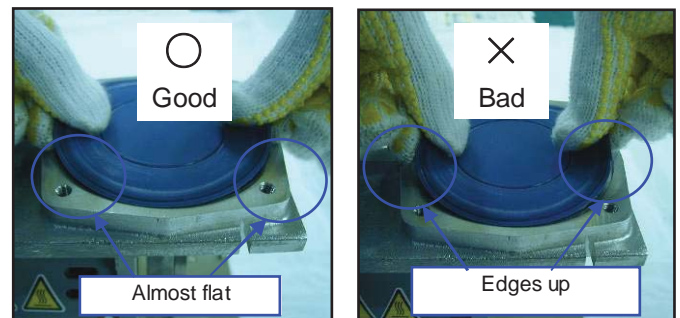


Photo 11

Note: To prevent wrinkles in the PTFE sheet, hold the diaphragm and fit it firmly as shown in Photo 11.

- (10) Fit the other diaphragm in the same way.

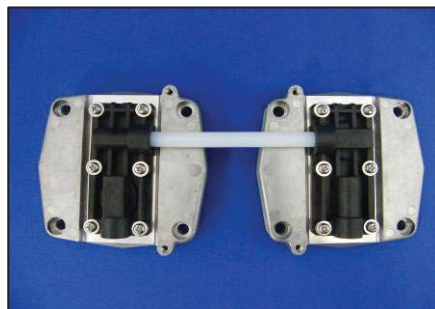


Photo 12

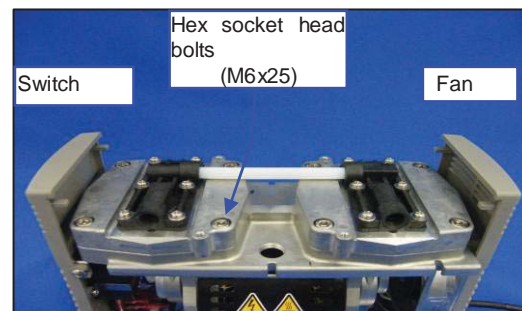


Photo 13

- (11) Apply a small amount of vacuum grease over a distance of 5mm at both ends of the connecting tube, and place the tube fully over the nipples to connect the two pump head covers. See Photo 12.
- (12) Place the connected pump heads over the casing, and bolt in place with hex socket head bolts (M6x25).

Note: Ensure that the pump heads are in the correct orientation. See Photo 13.

- (13) The pump head spacer is inserted between the pump head and the casing as shown in

Photo 14.

Note: Insert the pump head spacer in the same place as the place that has adhered.

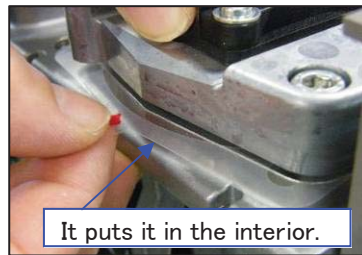


Photo14

(14) The pump head is fixed with hex socket head bolts (M6X25).

Note: Ensure that the hex socket head bolts (M6x25) are tightened in diagonally opposite pairs to a torque of 11Nm.

Note: Confirm the thing that the pump head spacer has been inserted in the interior.
(Photo 15 and 16)

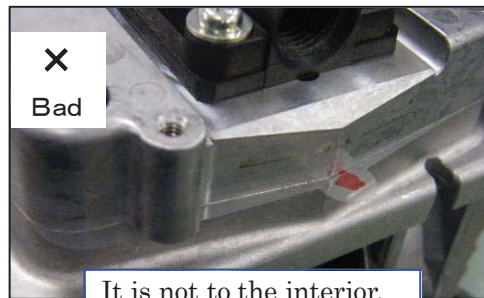


Photo 15



Photo 16

(15) Position the top panel, and fix it in place with the truss head screws (M4x10).

(16) Lay in the pump on its side, and fix the front panel in place with the truss head screws (M4x10).

(17) Stand the pump upright, and fit the inlet and outlet pipes.

2) Replacing Inlet and Outlet Valves

(it is recommended that valves be replaced simultaneously with diaphragms)

Use tools No.1, 2, 3, 4, 6, 7 and 8.

2)-1. DTC-22

- (1) Remove the front panel, top panel, and pump head cover. Remove in the sequence described in 1) Removing Diaphragms (1)~(5).
- (2) Remove the cross recessed Pan Head Screw (M4x16), separate the pump head and valve retainer, and remove the inlet and outlet valves. See Photo 17.
- (3) Disassemble the other pump ahead in the same manner, and remove the inlet and outlet valves.
- (4) Clean the pump ahead and valve retainers with solvent.

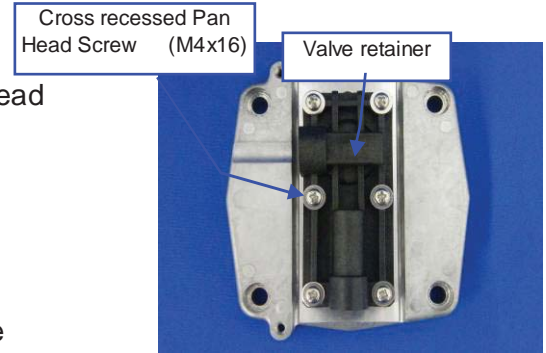


Photo 17

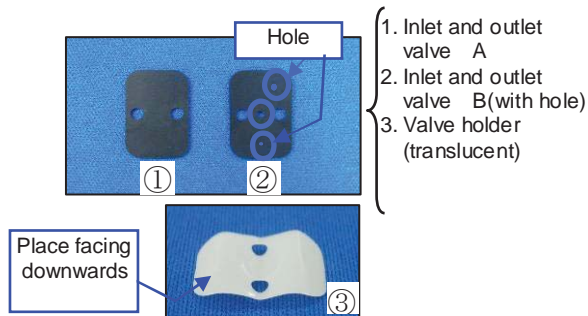


Photo 18

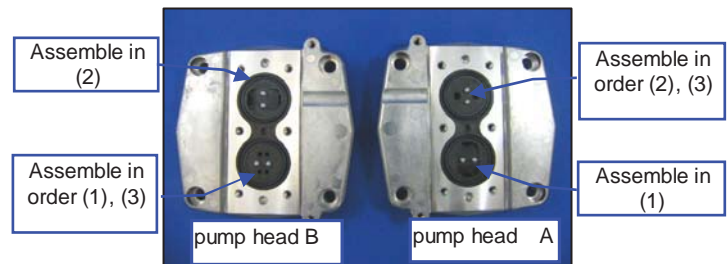


Photo 19

- (5) Fit the new inlet and outlet valves.

Note: Ensure that the valves are fitted correctly as shown in Photos 18 and 19.
- (6) Fit the valve retainers to the pump heads.

Note: Ensure that the inlet and outlet valve O rings are not crushed.

Note: Repeatedly tighten bolts in diagonal pairs to 0.4Nm.
- (7) Connect the two pump heads and fit to the casing. Fit in the sequence described in 1) Replacing Diaphragms, (11)~(17).

3) **Replacing O Rings** (it is recommended that O rings be replaced simultaneously with diaphragms)

Use tools No.1, 2, 3, 4, 5, 6, 7 and 8.

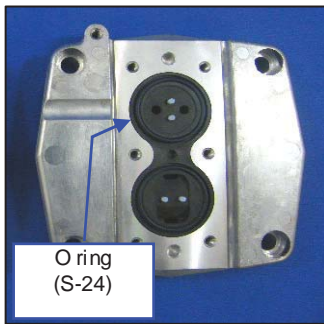


Photo 20

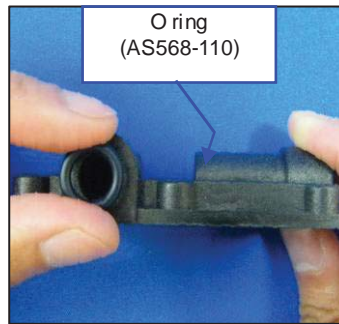


Photo 21

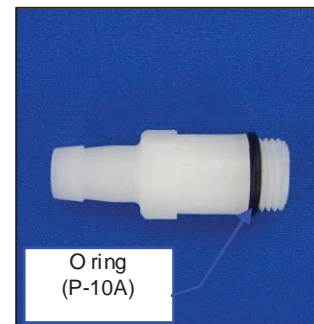


Photo 22

- (1) Remove the pump head from the casing, and remove the valve retainer. Use the procedure described in 2) Replacing Inlet and Outlet Valves, (1)~(2).
 - (2) Remove the O rings. See Photos 20, 21, 22.
 - (3) Clean the inlet and outlet pipes, pump heads, and valve retainers with solvent.
 - (4) Lubricate the entire surface of each O ring with a light coating of vacuum grease, and fit each in the appropriate location.
- Note: AS568-110 requires two O rings in each location (total of four).
- (5) Fit all components. Use the procedure described in 2) Replacing Inlet and Outlet Valves, (6)~(7).

4) **Replacing Bearings**

Contact the manufacturer's Service Section.

6.6 Troubleshooting List

Table 6.3 Troubleshooting List

Problem	Causes	Solutions	Reference	
Problems with starting and rotation of pump	(1) Not connected to power supply.	(1) Connect power supply.	3-4.	
	(2) Switch is OFF.	(2) Set switch to I.		
	(3) Problem with power supply voltage.	(3) Ensure that voltage variation is within +/-10%.		
	(4) Problem with pump wiring.	(4) Rewire the pump. Contact the manufacturer.		
	(5) The breaker has operated.	(5) Investigate the reasons for operation.		
	(6) The thermal protection relay has operated.	(6) Switch power OFF, and eliminate the cause of operation of the relay. Contact the manufacturer.		4-2.
	(7) Low ambient temperature.	(7) Ensure that ambient temperature is 0~40 °C.		4-3.
	(8) Low voltage.	(8) Adjust the power supply voltage, and check the power supply cable.		
	(9) Fault in power supply.	(9) Replace or repair.		
	(10) Problem with power supply switch.	(10) Replace or repair.		
	(11) Broken wire in power cord.	(11) Replace or repair.		
	(12) Problem with motor.	(12) Replace or repair.		
	(13) Damaged condenser, or connection problem.	(13) Replace or repair.		
	(14) Locked connecting rod.	(14) Disassemble pump head and check interior.		
	(15) Problem with bearings.	(15) Replace or repair.		6-5.
	(16) Miscellaneous damage to pump components.	(16) Disassemble and repair (replace damaged components).		6-5.
Pressure does not diminish	(1) Pump is too small for capacity of vacuum vessel.	(1) Select another pump.	5-1.	
	(2) Pressure measurement is incorrect.	(2) Measure the pressure correctly.		
	(3) Vacuum gauge is unsuitable.	(3) Measure with a calibrated vacuum gauge suitable for the pressure range.		5-1.
	(4) The inlet piping is too small in diameter, or too long.	(4) Connect piping of an inside diameter greater than the inlet diameter, or reduce the distance between the pump and vacuum vessel.		5-1.
	(5) Ambient temperature unsuitable.	(5) Ensure that ambient temperature is 0~40 °C.		
	(6) Leaks in inlet piping.	(6) Clean and replace.		
	(7) Leaks from piping or connections.	(7) Check for leaks in piping, check diameter and length of piping, and repair.		
	(8) Foreign matter inside pump.	(8) Remove foreign matter, disassemble and clean, and replace components.		
	(9) Problem due to ingestion of liquid or compressed gas into the pump.	(9) Disassemble and repair (replace valves and diaphragm etc).		6-5.
	(10) Damage to inlet valve.	(10) Replace.		6-5.
	(11) Damage to diaphragm.	(11) Replace.		6-5.
	(12) Miscellaneous damage to pump components.	(12) Disassemble and repair (replace damaged components).		
Pump surfaces are abnormally hot (more than room temperature + 30 °C)	(1) Continuous operation with high pressure gas.	(1) Do not run the pump continuously at near-atmospheric pressure.		
	(2) High temperature gas.	(2) Fit cooling equipment (eg. gas cooler) to the inlet.		
	(3) Problem with power supply voltage.	(3) Ensure that voltage variation is within +/-10%.		
	(4) Motor has seized.	(4) See the section on problems with pump rotation.		

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: 0 - 40°C, below 85% RH
- b) Operation in accordance with the user manual

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

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

- (4) Disclaimer

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

Usage Status Check Sheet (for use in Operation 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 Operatio

Usage: _____ 1 3

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: _____

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

* You are requested to ship the package to our Service Division (CS Center). (See the attached list of addresses.)