

# User Manual

## High Vacuum Pumping System

VPT-060

Please read the following before using this product.  
Keep this manual in a safe place ready for use.

The content of this manual is liable to change without prior notice  
due to changes in product specifications, product improvements,  
and revision.

ULVAC KIKO, Inc

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‘\*\*’ indicates a page with safety-related content.

\* For safe use of the product

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## For safe use of the product

Thank you for purchasing this product. This manual presents guidelines for the safe use of this equipment. It contains the necessary basic points for handling, procedures for operation, and procedures for inspection and maintenance. Please read the information provided and make sure you understand correctly so as to prevent a serious accident.




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Read ‘\* For safe use of the product’ thoroughly before using the equipment. The precautions noted here are provided to ensure that the product is used safely, and to avoid danger and injury to users and other personnel.








Ensure that these precautions are always followed.

Meanings of the symbols used in the drawings of this manual are as follows.





|                                                                                             |                                                                                                        |
|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
|  Danger   | Incorrect use is expected to result in circumstances leading to a fatality or serious injury to users. |
|  Warning | Incorrect use may result in circumstances leading to a fatality or serious injury to users.            |
|  Caution | Incorrect use may result in light or moderate injury to users, or physical damage.                     |

|                                                                                     |                                          |
|-------------------------------------------------------------------------------------|------------------------------------------|
|  | The relevant action is always desirable. |
|  | Always connect to earth.                 |
|  | Prohibited.                              |
|  | Do not disassemble.                      |
|  | Do not touch.                            |





## Power Supplies

|                                                                                                   |                                                                                                                     |                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Warning</p> |  <p>Check capacity</p>             | <p>Primary power supply capacity<br/>Prepare a single-phase, 100V power supply of at least 3.0A.</p> <p>If the capacity of the power supply is insufficient, breakers may trip when a current surge occurs in operation.</p>                                                |
|                                                                                                   |  <p>Separate power supply</p>      | <p>Prepare a separate primary power supply. Do not connect other equipment to it.</p> <p>If the capacity of the breaker is insufficient, it may trip when a current surge occurs in operation.</p>                                                                          |
|                                                                                                   |  <p>Connect to earth</p>           | <p>Connect to a Class D earth.<br/>This equipment employs an earthed plug.<br/>When using a plug adapter, connect the earth wire to the nearest earth terminal.</p> <p>An incomplete earth may result in electric shock in the event of a malfunction or short circuit.</p> |
|                                                                                                   |  <p>Check cable capacity</p>     | <p>Avoid using extension cables as much as possible. If an extension cable must be used, use as follows.</p> <p>Use 100V cable with a cross-section of at least 1.25mm<sup>2</sup>.</p> <p>A thin cable may result in overheating, ignition, or fire.</p>                   |
|                                                                                                   |  <p>Prohibited</p>               | <p>Do not place objects on primary cables.</p> <p>Placing objects on cables may result in electric shock or fire.</p>                                                                                                                                                       |
|                                                                                                   |  <p>Caution - electric shock</p> | <p>Do not remove panels and covers. If this cannot be avoided, before work begins, turn all switches OFF, and remove the primary cable plug from the socket.</p> <p>Electric shock.</p>                                                                                     |







## Environment

|                                                                                              |                                                                                                           |                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Warning | <br>Prohibited           | <p>This equipment is not explosion-proof, and therefore cannot be used in environments where there is a danger of explosion.</p> <p>Use in such environments may result in ignition and explosion, with consequent fire and burns.</p> |
| <br>Caution | <br>Ventilation required | <p>The area around the pump may become hot during operation of this equipment.</p> <p>This will increase the room temperature.</p>                                                                                                     |







## Installation

|                                                                                                |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Warning | <br>Check the environment | <p>Install the equipment in a location satisfying the following requirements.</p> <ol style="list-style-type: none"> <li>1) Flat and level.</li> <li>2) Floor with sufficient strength.</li> <li>3) Good ventilation.</li> <li>4) Protected from direct sunlight.</li> <li>5) Room temperature of 8 – 38°C.</li> <li>6) No danger of ignition.</li> <li>7) No chemicals or gases liable to corrode the equipment.</li> <li>8) Not subject to electrical interference (e.g. electrical noise).</li> </ol> <p>Failure to install in accordance with these requirements may cause problems with operation of the equipment, and may reduce its operating life.</p> |
| <br>Caution | <br>Do not work alone     | <p>Use two or more personnel when moving this equipment.</p> <p>Avoid back problems.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



## Operation

|                                                                                                     |                                                                                                                    |                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <br>Do not apply sudden gas loads | <p>Do not apply sudden gas loads (e.g. inflow of atmosphere to the high-vacuum side) during operation of the equipment.</p> <p>Application of a sudden gas load may damage the turbomolecular pump.</p>                                                |
|                                                                                                     | <br>Magnetic field                | <p>Do not operate the pump near or inside a magnetic field.</p> <p>Operating the pump inside a magnetic field may result in equipment failure or malfunction.</p>                                                                                      |
|                                                                                                     | <br>Normal pressure range         | <p>First, run the back pump, and then start the main pump when using this equipment.</p> <p>Normal pressure range: Maximum 260 Pa</p> <p>Application of pressure beyond the normal range will result in overload and stop the turbomolecular pump.</p> |
|                                                                                                     | <br>Suitable gases              | <p>Use only clean gases at normal temperatures (or equivalent).</p> <p>The equipment should not be used to exhaust inflammable, corrosive or harmful gases.</p> <p>The use of unsuitable gases will damage equipment in the exhaust system.</p>        |
|                                                                                                     | <br>Back pressure               | <p>Be careful to avoid back pressure from building up in the equipment.</p> <p>Back pressure will reduce the performance of the equipment.</p> <p>Back pressure: Maximum 10 Pa</p>                                                                     |

## Maintenance, Repair, and Disposal

|                                                                                                     |                                                                                                                       |                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <br>Customer maintenance and repairs | <p>The customer is able to perform the following maintenance and repairs.</p> <ol style="list-style-type: none"> <li>1) Maintenance of the diaphragm vacuum pump.</li> <li>2) Fitting and removing the turbomolecular pump controller.</li> </ol> <p>Contact the manufacturer for repairs other than the above.</p> |
|                                                                                                     | <br>Periodic replacement             | <p>Replace the diaphragm in the diaphragm vacuum pump every 6,000 hours.</p> <p>If the strength of the diaphragm is reduced it may suddenly rupture, and performance of the equipment can then no longer be guaranteed.</p>                                                                                         |
|                                                                                                     | <br>Periodic replacement             | <p>Every 20,000 hours, the turbomolecular pump requires an overhaul to replace the bearings.</p> <p>Failure to replace the bearings will result in abnormal noise and damage to the turbomolecular pump.</p>                                                                                                        |
|                                                                                                     | <br>Prohibited                     | <p>Do not make modifications beyond the manufacturer's standard options.</p> <p>The manufacturer takes no responsibility for modifications.</p>                                                                                                                                                                     |
|                                                                                                     | <br>Legal obligations              | <p>The operator is legally obliged to dispose of the equipment and accessories as industrial waste.</p> <p>Dispose of appropriately in accordance with legislation. Contact the manufacturer if clarification is required.</p>                                                                                      |

## Warning Labels

|                                                                                                       |                                                                                                     |                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br><b>Caution</b> | <br>Check labels | <p>Warning label is applied at the following location.</p> <ol style="list-style-type: none"> <li>1) Controller mount .</li> </ol> <p>Contact the manufacturer if labels become dirty and difficult to read, or if they are peeling off.</p> |
|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## (1) Before Using

### 1. Target Users

Only persons who have used a vacuum exhaust unit or trained based on this manual may operate this equipment.

### 2. Read the Manual Thoroughly

Please read this manual thoroughly in order to use the equipment in a safe and correct manner.

Please pay particular attention when reading the section "To Safely Use This Equipment".

### 3. Keep This Manual in a Safe Place

Keep this manual in a safe place.

After reading this manual, be sure to keep it in a safe place where it is readily accessible to other users.

### 4. 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: 8 - 38°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.

### 5. Statutory Requirements for Disposal

Follow all statutory and local authority regulations when disposing of this equipment. Comply with regulations upon disposal. For details on disposal, contact us.

### 6. Safety during Repair

When requesting repairs to this product, provide a full description of the conditions of use (particularly any use of dangerous materials) for the safety of repair personnel.

In this case, fill in the Use Condition Check Sheet and attach to the product.

If the use conditions are unknown, repair may be refused.

## (2) Product Outline

### 1. Purpose of Use and Prohibitions

This equipment is a turbomolecular pump exhaust unit, with all necessary components mounted on the base. It is comprised of a turbomolecular pump, a controller and a diaphragm, dry vacuum pump.

Follow the prohibitions below to ensure that the equipment is used correctly.



Prohibited

- Use only to exhaust clean air at ambient temperatures, or gases with equivalent characteristics.
- Use only for vacuum exhaust.
- Do not resell, repair or modify without prior approval from the manufacturer.
- Follow the requirements in the manual.

### 2. Safety Equipment and its Purpose and Function

| Item                                      | Purpose                   | Function                                                                                                    | Method of verification |
|-------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------------------------|------------------------|
| Current surge                             | Diaphragm dry vacuum pump | A thermal protector (automatic reset) with an in-built motor that cuts off power.                           | None                   |
| Current surge, high-temperature, overload | Turbomolecular pump       | Stops during free run (no brake operation) using turbomolecular pump controller in-built protection system. | None                   |
| Current surge                             | Controller                | Protects circuit in the controller using fuses (Type: ET 3.15A / SOC Qty. 2).                               | None                   |



Prohibited

Do not operate with the above safety equipment disabled.

### 3. Product Specifications

|                    |                                                     |
|--------------------|-----------------------------------------------------|
| Ultimate pressure  | 10 <sup>-5</sup> Pa                                 |
| Exhaust speed      | 60L/sec.                                            |
| Power requirements | 100V, single phase, 0.3kVA                          |
| Dimensions<br>Mass | 340mm (W) x 340mm (D) x 355mm (H)<br>17kg (approx.) |
| Color              | Baked Finish (6Y 8/0.8)                             |

### 4. Individual Component Specifications

| Component                | Model and specifications                                                                                                           | Quantity |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1) Diaphragm vacuum pump | * Model: DAU-20<br>* Exhaust speed: 20L/min.<br>* Ultimate pressure: 200Pa<br>* Power requirements: 146VA                          | 1        |
| 2) Turbomolecular pump   | * Model: TG70FRAB-20<br>* Exhaust speed: 60L/sec.<br>* Ultimate pressure: 5.0 x 10 <sup>-7</sup> Pa<br>* Power requirements: 160VA | 1        |

### 5. Standard Accessories

|                                      |                                        |   |
|--------------------------------------|----------------------------------------|---|
| 1) Power cable                       | * 100V, single phase plug adapter (2m) | 1 |
| 2) Inlet cap                         | * For ISO63                            | 1 |
| 3) Exhaust cap                       | * For NW16                             | 1 |
| 4) Turbomolecular pump connector cap | * For TG70FRAB-20                      | 1 |
| 5) Remote connector                  | * For Controller TC76                  | 1 |
| 6) User Manual                       | * Plain paper                          | 1 |
| 7) Vacuum Performance Testing Table  | * Plain paper                          | 1 |
| 8) Polycover                         | * 380 x 380 x H400 (0.07mm thick)      | 1 |

## 6. Switch Operation & Description of LED Display

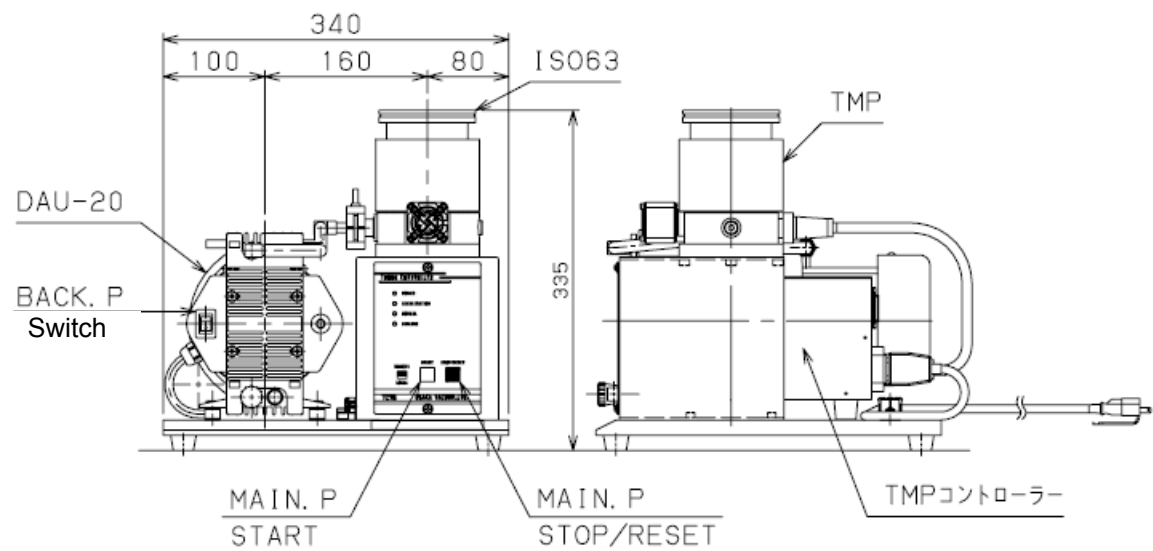


Check

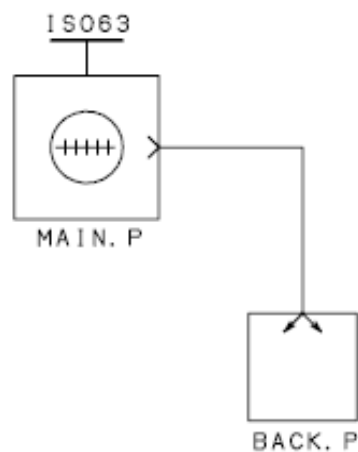
Check safety and status of switches before operation.

| Name                         | Details and operation                                                                                                                                                                                                                          |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LOCAL / REMOTE select switch | <p>TMP: Turbomolecular pump<br/>DAU = Diaphragm dry vacuum pump</p> <p>Select switch: Manual operation and remote control<br/>The select switch can be used on this equipment only when LOCAL is selected. (It cannot be used for REMOTE.)</p> |
| DAU-20<br>BACK P. switch     | <p>Manual ON / OFF<br/>The DAU operates when ON is enabled.</p>                                                                                                                                                                                |
| TMP<br>START button          | <p>The TMP starts operation when ON is manually pressed.</p>                                                                                                                                                                                   |
| STOP / RESET                 | <p>Press OFF or RESET manually to stop (free run) the TMP while it is operating.</p> <p>After the turbomolecular pump has stopped automatically to protect against a malfunction, press it once to reset.</p>                                  |
| LED display                  | <p>The input power has been turned on.</p>                                                                                                                                                                                                     |
| POWER                        | <p>The TMP starts up. Accelerating.</p>                                                                                                                                                                                                        |
| ACCELERATION                 | <p>The TMP is operating normally.<br/>Running at rated speed.</p>                                                                                                                                                                              |
| NORMAL                       |                                                                                                                                                                                                                                                |
| FAILURE                      | <p>An error occurred on the TMP and/or the controller.</p>                                                                                                                                                                                     |

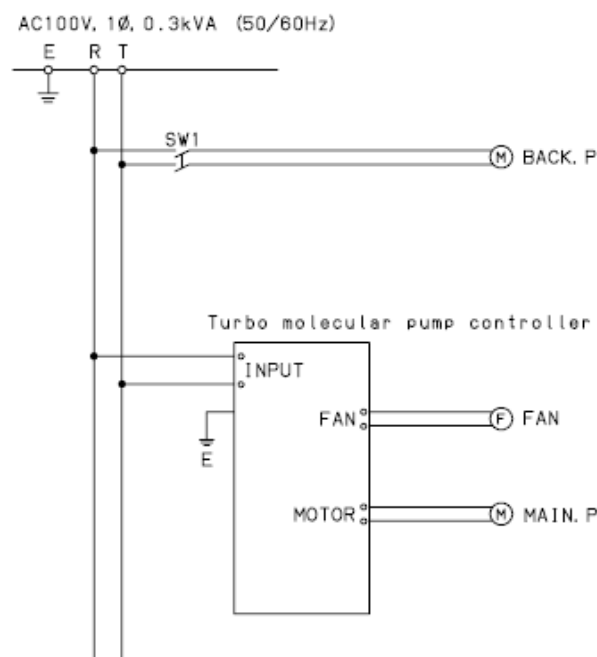
7.Switch Layout



Flow Sheet




Electrical System Diagram



### (3) Opening the Packaging and Installation




#### 1. General Precautions

|                                                                                            |                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Check | <ol style="list-style-type: none"><li>1) Verify that the contents are as requested.</li><li>2) Verify that the accessories are as required.</li><li>3) Clear a space at least 0.1m around the equipment to ensure safety during installation.</li></ol> |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|









#### 2. Packaging at Delivery

|                                                       |
|-------------------------------------------------------|
| The equipment is delivered packed in a cardboard box. |
|-------------------------------------------------------|

#### 3. Location of Installation




|                                                                                                |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Warning | <br>Check the environment | <p>Install the equipment in a location satisfying the following requirements.</p> <ol style="list-style-type: none"><li>1) Flat and level.</li><li>2) Floor with sufficient strength.</li><li>3) Good ventilation.</li><li>4) Protected from direct sunlight.</li><li>5) Room temperature of 8 – 38°C.</li><li>6) No danger of ignition.</li><li>7) No chemicals or gases liable to corrode the equipment.</li><li>8) Not subject to electrical interference (e.g. electrical noise).</li></ol> <p>Failure to install in accordance with these requirements may cause problems with operation of the equipment, and may reduce its operating life.</p> |
| <br>Check   | For safety reasons, following installation, move the equipment at least 0.1m from the wall.                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 4. Power Supply

|                                                                                                                                                            |                                                                                                                 |                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Warning                                                               | <br>Check capacity             | <p><b>Primary power supply capacity</b></p> <p>Prepare a single-phase, 100V power supply of at least 0.3kVA.</p> <p>If the capacity of the power supply is insufficient, breakers may trip when a current surge occurs in operation.</p>                                   |
| <p><b>Primary cable connection specifications</b><br/>(cable supplied with equipment)</p> <p>2m long, 100V cable fitted with 3-pin plug (with adapter)</p> |                                                                                                                 |                                                                                                                                                                                                                                                                            |
| <br>Warning                                                             | <br>Separate power supply      | <p>Prepare a separate primary power supply. Do not connect other equipment to it.</p> <p>If the capacity of the breaker is insufficient, it may trip when a current surge occurs in operation.</p>                                                                         |
|                                                                                                                                                            | <br>Connect to earth          | <p>Connect to a Class D earth.<br/>This equipment employs an earthed plug. When using a plug adapter, connect the earth wire to the nearest earth terminal.</p> <p>An incomplete earth may result in electric shock in the event of a malfunction or short circuit.</p>    |
|                                                                                                                                                            | <br>Check cable capacity     | <p>Avoid using extension cables as much as possible. If an extension cable must be used, make sure it is used as follows.</p> <p>Use 100V cable with a cross-section of at least 1.25mm<sup>2</sup>.</p> <p>A thin cable may result in overheating, ignition, or fire.</p> |
|                                                                                                                                                            | <br>Prohibitions             | <p>Do not place objects on primary cables.</p> <p>Placing objects on cables may result in electric shock or fire.</p>                                                                                                                                                      |
|                                                                                                                                                            | <br>Caution - electric shock | <p>Do not remove panels and covers.<br/>If this cannot be avoided, before work begins, turn all switches OFF, and remove the primary cable plug from the socket.</p> <p>Electric shock.</p>                                                                                |

## (4) Operation

### 1. Risks During Operation, and Associated Safety Measures

|                                                                                              |                                                                                                                    |                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Caution | <br>Do not apply sudden gas loads | <p>Do not apply sudden gas loads (e.g. inflow of atmosphere to the high-vacuum side) during operation of the equipment.</p> <p>Application of a sudden gas load may damage the turbomolecular pump.</p>                                                |
|                                                                                              | <br>Normal pressure range         | <p>First, run the back pump, and then start the main pump when using this equipment.</p> <p>Normal pressure range: Maximum 260 Pa</p> <p>Application of pressure beyond the normal range will result in overload and stop the turbomolecular pump.</p> |

### 2. Exhaust Equipment Operation

#### 2-1 Preparation

(1) Ensure that the turbomolecular pump and the controller plug are securely connected.

MOTOR connector

FAN connector

INPUT connector

\*Refer to the controller manual for further details.

(2) Ensure that LOCAL is enabled for the LOCAL / REMOTE select switch, located on the controller front panel.

(3) Ensure that the primary power cord is securely connected.



## 2-2 Operation

- 1) The exhaust system is connected to the inlet flange:  
VENT V. (option):  
Confirm  
Confirm closure
- 2) Customer breaker:  
Controller LED POWER display:  
TMP cooling fan:  
ON  
ON  
Simultaneous start
- 3) DAU-20 switch:  
ON
- 4) START ■ :  
Press  
  
Turbomolecular pump TMP:  
LED ACCELERATION display during acceleration:  
Start  
ON  
  
TMP operates normally after approximately 2.5 minutes.  
(Rotation speed is between 90 and 100%.)  
LED NORMAL display while at rated speed:  
ON

## 2-3 Stopping

- 1) STOP / RESET ■:  
Press  
  
Controller LED NORMAL display:  
Deceleration → Acceleration  
OFF  
The pump begins to slow down and stop in free run (no brake operation).  
It takes 20 to 25 minutes for the pump to stop completely.
- 2) VENT V. (option):  
Open as necessary  
  
\*The vent valve (option) does not need to be opened when maintaining  
the vacuum in the turbomolecular pump after stopping.
- 3) DAU-20 switch:  
OFF

### 3. Handling Malfunctions

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>3-1 Instantaneous power failure</p> <p>All devices are automatically restored to the status prior to the power failure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>3-2 Long-term power failure</p> <p>Remove the primary cable plug from the socket to restore the status prior to operation.</p> <p>Restoration procedure after power failure<br/>After turning on the power again, press the STOP / RESET ■ on the controller.</p> <p>Refer to section “2-2 Operation” in “2. Exhaust Operation Procedure”.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p>3-3 Overload operation</p> <p>When a leak occurs in the exhaust system, or when a long-term overload occurs due to the large capacity of the exhaust system.</p> <p>Errors that are automatically reset<br/>Name of error / Description</p> <p>Motor overheat<br/>/ When the motor temperature inside the pump rises above 105°C.</p> <p>*Cause</p> <ol style="list-style-type: none"><li>1) The surrounding temperature is hot.</li><li>2) The pump back pressure is high.</li><li>3) The gas flow is too strong.</li><li>4) There is a leak in the system.</li></ol> <p>*Solution</p> <ol style="list-style-type: none"><li>1) Cool the system so that the surrounding temperature is kept under 38°C and the pump surface is less than 50°C.</li><li>2) Keep the pump back pressure below 1200 Pa.</li><li>3) Control the gas flow so that it stays under the permissible value.</li><li>4) Ensure that there is no leak in the system.</li></ol> <p>Input voltage low<br/>/ When the input voltage is less than 90 V for more than 80 msec.</p> <p>*Cause</p> <ol style="list-style-type: none"><li>1) There is a drop in the power voltage.</li></ol> <p>*Solution</p> <ol style="list-style-type: none"><li>1) Check the power voltage.</li></ol> <p>The error will automatically reset when either the motor temperature or the input voltage returns to the normal value.</p> |

### 3. Handling Malfunctions (continued)

#### 3-3 Overload operation (continued)

Errors that can be reset

Controller LED FAILURE display: ON

Name of error / Description

Controller overheat

/ When the temperature inside the controller rises above 80°C.

\*Cause

1) The surrounding temperature is hot.

\*Solution

1) Keep the surrounding temperature below 45°C.

Press STOP / RESET ■ to reset the error.

Acceleration time over

/ When it does not reach the rated operation 6 minutes after startup.

\*Cause

1) The pump back pressure is high.

2) There is a leak in the system.

3) The gas flow is too strong.

\*Solution

1) Keep the back pressure for the pump below 1200 Pa.

2) Ensure that there is no leak in the system.

3) Do not release the flow of gas during startup.

Press STOP / RESET ■ to reset the error.

#### 3-4 Emergency stop

Disconnect the input cable in an emergency stop. After the input power is disconnected, the pump stops free run. It takes approximately 25 minutes for the pump to stop completely.

### 3. Handling Malfunctions (continued)

#### 3-5 Errors that cannot be reset

##### Name of error / Description

Current surge / An abnormal output current surge occurred.

\*Cause / Output short circuit, etc.

System error / Internal controller malfunction or failure.

\*Cause / Malfunction or failure.

Speed over / The rated rotation speed reaches 105%.

\*Cause / Malfunction or failure.

Reset is not possible when the following errors occur: current surge, system error or speed over.

Disconnect the power temporarily, and then turn on the power again after a few minutes.







If the error persists, it is a malfunction or failure.

Return the unit to ULVAC.

Repair is performed at the TMP manufacturer after the equipment is received.

## (5) Maintenance and Repairs

### 1. Risks During Maintenance and Repairs, and Associated Safety Measures

|                                                                                               |                                                                                                                          |                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Warning  | <br>Maintenance and repair prohibitions | <p>The turbomolecular pump and controller employ high-voltages. This has associated dangers, and the possibility of serious accidents.</p> <p>Ensure that only qualified personnel perform inspections and maintenance.</p> <p>Contact the manufacturer for these repairs.</p> |
| <br>Caution | <br>Protective clothing                 | <p>Replace the diaphragm in the diaphragm vacuum pump every 6,000 hours.</p> <p>Wear a dust mask when replacing the diaphragm.</p> <p>Breathing in particles from the diaphragm may be injurious to health.</p>                                                                |
|                                                                                               | <br>Preventing electric shock          | <p>Always remove the primary side cable plug from the socket before removing the turbomolecular pump and controller from the rack.</p> <p>Avoid electric shock.</p>                                                                                                            |
|                                                                                               | <br>Prohibited                        | <p>Do not make modifications beyond the manufacturer's standard options.</p> <p>The manufacturer takes no responsibility for modifications.</p>                                                                                                                                |

### 2. The customer is able to perform the following maintenance and repairs.

- 1) Maintenance of the diaphragm vacuum pump.
- 2) Fitting and removing the turbomolecular pump controller.
- 3) O ring replacement (Option: Vent valve).

Contact the manufacturer for other than the above.

### 3. Removing, Maintaining and Fitting the Device

#### 3-1 Turbomolecular pump controller

1) Tools required: Phillips screwdriver

##### 2) Removal

- (1) Remove the primary power cable plug from the socket.
- (2) Remove the MOTOR, FAN and INPUT connectors
- (3) Remove the two small pan head screws on the front of the controller rack.
- (4) Pull off the controller body from the front of the controller rack to remove.

##### 3) Maintenance and Repairs

Maintenance and repair is performed at the TMP manufacturer after the equipment is received.

When sending the equipment, ensure that the turbomolecular pump is protected from shock, etc., and is handled the same as precision equipment. No particular restrictions apply to fixing the turbomolecular pump in place.

##### 4) Fitting

- 2) Mount the controller following the reverse order of the removal procedure: (4) → (1).

#### 3-2 Turbomolecular pump (TMP)

1) Tools required: Allen wrench (5 mm)

##### 2) Removal

- (1) Remove the primary power cable plug from the socket.
- (2) Remove the inlet flange piping (option) and the inlet protective wire mesh, and fit the protective cap (accessory supplied at delivery) to the inlet.
- (3) Remove the silicon tube.
- (4) Remove the flange with the L-type nipple, the centering O-ring and the NW16 clamp. Fit the protective cap (accessory supplied at delivery).
- (5) Remove the controller. (Controller removal procedure: Steps (2) → (4))
- (6) Use an Allen wrench (5 mm) to remove the hex socket bolts on the controller rack (inside on top).
- (7) Remove the turbomolecular pump.

Keep the removed components in a safe place until reassembly.

##### 3) Maintenance and Repairs

Maintenance and repair is performed at the TMP manufacturer after the equipment is received.

When sending the equipment, ensure that the turbomolecular pump is protected from shock, etc., and is handled the same as precision equipment. No particular restrictions apply to fixing the turbomolecular pump in place.

##### 4) Fitting

- (1) Place the TMP on the controller rack so that the TMP FAN faces forward.
- (2) Mount the TMP following the reverse order of the removal procedure: (6) → (1).

### 3. Removing, Maintaining and Fitting the Device

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>3-3 Diaphragm Dry Vacuum Pump (DAU)</b></p> <p>1) Tools required: Box wrench (7 mm) and Phillips screwdriver</p> <p>2) Removal</p> <ol style="list-style-type: none"> <li>(1) Remove the primary side cable plug from the socket.</li> <li>(2) Remove the DAU-20 power cord from the terminal block.</li> <li>(3) Remove the silicon tube.</li> <li>(4) Remove the four nuts at the rear of the base, and remove the DAU upwards.</li> <li>(5) Remove the four anti-vibration rubber mounts on the DAU.</li> </ol> <p>3) Maintenance and Repairs</p> <p>Refer to the separate manual for the diaphragm dry vacuum pump when replacing the diaphragm.</p> <p>4) Fitting</p> <ol style="list-style-type: none"> <li>2) Mount the pump following the reverse order of the removal procedure: (4) → (1).</li> </ol> |
| <p><b>3-4 Vent Valve (Option)</b></p> <p>1) Tools required: Spanner (13 mm)</p> <p>2) Removal</p> <ol style="list-style-type: none"> <li>(1) Turn the vent valve in a counterclockwise direction to remove.</li> </ol> <p>3) Maintenance and Repairs</p> <ol style="list-style-type: none"> <li>(1) Remove and replace the O-ring.</li> </ol> <p>4) Fitting</p> <ol style="list-style-type: none"> <li>(1) Turn the vent valve in a clockwise direction to mount.</li> </ol>                                                                                                                                                                                                                                                                                                                                          |

### 4. Maintenance and Inspection Locations

| Component                       | Maintenance and inspection details         | Timing                   |
|---------------------------------|--------------------------------------------|--------------------------|
| Turbomolecular pump (TMP)       | Bearing replacement                        | Every 20,000 hrs.        |
| Diaphragm dry vacuum pump (DAU) | Diaphragm<br>Valve<br>Air valve<br>Gas cap | Every 3,000 – 6,000 hrs. |
|                                 | Bearings                                   | Every 15,000 hrs.        |
| Cooling fan                     | Cooling fan rotation                       | Each time used           |
| Vent valve (Option)             | O-ring replacement                         | Every 12 months          |

## 5. Troubleshooting

| Symptoms                                                                                           | Cause                                                                           | Solution                                                                                  |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Ultimate pressure is poor<br>or<br>Ultimate pressure is unstable<br>or<br>Weak exhaust performance | High ambient temperature in area of installation.                               | Use air conditioning to reduce ambient temperature to 25°C or lower.                      |
|                                                                                                    | Short operation time following installation or long-term stoppage of equipment. | Run for 24 – 48hrs and check again.                                                       |
|                                                                                                    | Leaks                                                                           | Check around the parts touched before change occurred when ultimate pressure was reached. |
|                                                                                                    | Problem with measuring equipment.                                               | Replace measuring equipment.                                                              |
| Turbomolecular pump (TMP)<br><br>High current and output.<br>Large temperature increase.           | High gas load.                                                                  | Check for leaks.                                                                          |
|                                                                                                    | Reduced performance of diaphragm dry vacuum pump.                               | Refer to the diaphragm dry vacuum pump manual.<br>Reset thermal relay.                    |
|                                                                                                    | Problem with turbomolecular pump bearings.                                      | Replace every 20,000 hrs.                                                                 |
|                                                                                                    | High ambient temperature.                                                       | Use air conditioning to reduce ambient temperature to 25°C or lower.                      |
| Continuous exhaust noise from exhaust outlet.                                                      | Damage to diaphragm in diaphragm dry vacuum pump.                               | Replace diaphragm.<br>Refer to the diaphragm dry vacuum pump manual.                      |

### Component Manuals

- 1) Diaphragm Dry Vacuum Pump (DAU-20)  
Please note that the diaphragm dry vacuum pump is a built-in type, and may differ in some points.
  - 2) Turbomolecular pump
  - 3) Turbomolecular pump controller
- Refer to these manuals if a problem occurs.



## 6. Storing the Equipment


|                                                                                                                                                                                                                                                            |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Refer to the following instructions when storing the equipment for a long period of time.                                                                                                                                                                  |  |
| 1) Storage location <ul style="list-style-type: none"> <li>• Floor with sufficient strength.</li> <li>• Good ventilation.</li> <li>• Protect from direct sunlight.</li> <li>• Protect from effects of corrosion due to chemicals and gases etc.</li> </ul> |  |
| 2) Steps to be taken prior to, and during storage <ul style="list-style-type: none"> <li>• Evacuate the exhaust system, and fill with nitrogen gas if possible.</li> </ul>                                                                                 |  |

## 7. Consumables



| Location                        | Name             | Part code  | Material                                                      | Qty.  | Replaceable by customer |
|---------------------------------|------------------|------------|---------------------------------------------------------------|-------|-------------------------|
| Base                            | Rubber feet      | GP35L      | NBR                                                           | 4     | ○                       |
| Diaphragm dry vacuum pump (DAU) | Diaphragm        | ----       | Body: Synthetic rubber (EPDM)<br>Connecting gas section: PTFE | 4     | ○                       |
|                                 | Valve            | ----       | FPM                                                           | 6     | ○                       |
|                                 | Air valve        | ----       | FPM                                                           | 2     | ○                       |
|                                 | Gas cap          | ----       | ---                                                           | 1     | ○                       |
|                                 | Bearings         | ----       | ---                                                           | 1 set | ×                       |
| Turbomolecular pump (TMP)       | Silicon tube     | ø 8 × ø 14 | Si                                                            | 1     | ○                       |
|                                 | Centering O-ring | NW16       | FPM                                                           | 1     | ○                       |
|                                 | Bearings         | ----       | ---                                                           | 1 set | ×                       |

## (6) Disposal

### 1. Precautions to be taken for Disposal

|                                                                                                                                                                                                                            |                                                                                                        |                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Caution                                                                                                                               | <br>Legal obligations | <p>The operator is legally obliged to dispose of the equipment and accessories as industrial waste.</p> <p>Please dispose according to the rules or regulations established under law and by the local governing body.</p> |
| Applicable laws: Laws related to the handling and cleanup of waste products.                                                                                                                                               |                                                                                                        |                                                                                                                                                                                                                            |
| <p>Handling:</p> <ul style="list-style-type: none"><li>1) Transport – by industrial waste product collection and transport contractor.</li><li>2) Treatment – by industrial waste product processing contractor.</li></ul> |                                                                                                        |                                                                                                                                                                                                                            |

## (7) Optional Components

|                                                                                                |                                                                                                   |                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Caution | <br>Prohibited | <p>Do not make any modifications beyond the manufacturer's standard options.</p> <p>The manufacturer assumes no responsibility for any modifications undertaken.</p> |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 1. Standard Optional Components

| Optional components              | Application                                                        | Fitting                |
|----------------------------------|--------------------------------------------------------------------|------------------------|
| Various inlet conversion flanges | Inlet connection conversion.                                       | May be fitted on-site. |
| Vent valve                       | Reduces stoppage time.<br>Inside of TMP exposed to the atmosphere. | May be fitted on-site. |