

User Manual

Small Vacuum Deposition System

V T R - 0 6 0 M / E R H

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 revisions.

ULVAC KIKO, Inc.

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indicates a page with safety-related content.

For safe use of this product

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For safe use of this product

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




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Read the section “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.

A description of the symbols used in this manual is provided below.








 Danger	Incorrect use poses an imminent threat and can result in a fatality or a serious injury for the users.
 Warning	Incorrect use poses a serious threat and can result in a fatality or a serious injury for the users.
 Caution	Incorrect use poses a risk and can result in light or moderate injury to users, or physical damage.

	Always perform this task or step.
	Always connect to a ground.
	Prohibited.
	Do not disassemble.
	Do not touch.







Warning Labels

 Caution	 Check labels	<p>A warning label is affixed at the following location.</p> <ol style="list-style-type: none"> 1) Left back of the rack. (PL018) 2) Right front of the rack. (PL019)(PL020) <p>Contact the manufacturer if the labels become dirty and difficult to read, or if they are peeling off.</p>
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Power Supplies

 Warning	 Check capacity	<p>Primary power supply capacity Prepare a single phase 100 V power supply with a minimum of 6.0 A and a single phase 100 V power supply with a minimum of 8.0 A.</p> <p>When the capacity of the power supply is insufficient, breakers may trip if there is an overcurrent during operation.</p>
	 Separate power supply	<p>Prepare a separate primary power supply. Do not connect other equipment to it.</p> <p>When the capacity of the breaker is insufficient, the breakers may trip if there is an overcurrent during operation.</p>
	 Connect to ground	<p>Connect to a Class D ground. This equipment uses a grounded plug. When using a plug adapter, connect the ground wire to the nearest ground terminal.</p> <p>An incomplete ground may result in electric shock in the event of a malfunction or short circuit.</p>
	 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 a 100 V cable with a minimum cross-section of 2.0 mm².</p> <p>A thin cable may result in overheating, ignition, or fire.</p>
	 Prohibited	<p>Do not place objects on the primary cables.</p> <p>Placing objects on the cables may result in electric shock or fire.</p>
	 Caution – electric shock	<p>Do not touch the terminal block when inserting the primary cable into the socket.</p> <p>Electric shock.</p>








Environment

 Warning	 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 causing a fire and burn injury.</p>
	 Do not touch	<p>The sealed rotary vacuum pump becomes hot during operation. Therefore, do not touch the pump with your hands during operation or for 30 minutes after stopping operation.</p> <p>Touching the pump causes burn injury.</p>
 Caution	 Use oil mist trap	<p>Oil mist is discharged from the exhaust outlet on the sealed rotary vacuum pump during roughing operation. Use an oil mist trap .</p> <p>Oil mist contaminates the room and affects personnel.</p>
	 Ventilation required	<p>The area around the pump may become hot during the operation of this equipment.</p> <p>This will increase the room temperature.</p>









Installation

 Warning	 Check the environment	<p>Install the equipment in a location that satisfies the following requirements.</p> <ol style="list-style-type: none"> 1) Flat and level. 2) Floor with sufficient strength. 3) Good ventilation. 4) Protected from direct sunlight. 5) Room temperature: 8 – 30°C. 6) No danger of ignition. 7) No chemicals or gases liable to corrode the equipment. 8) Not subject to electrical interference (e.g. electrical noise). <p>Failure to install in accordance with these requirements may cause problems with the operation of the equipment and may reduce its operating life.</p>
 Caution	 Do not work alone	<p>Use two or more personnel when lifting and moving this equipment.</p> <p>Take the necessary precautions to avoid hurting your back or other body parts.</p>
	 Secure equipment	<p>Measuring device rack use the adjuster to secure the equipment after installation is complete.</p> <p>This helps prevent the equipment from moving and/or damage during an earthquake, etc.</p>

Operation

 Warning	 Prohibited	Do not expose the glass chamber to shock or heat that is 50°C or higher. Broken pieces or shards may shoot out if the inside is damaged when a vacuum is created. This can cause equipment damage.
 Caution	 Do not apply sudden gas loads	Do not apply sudden gas loads (e.g. inflow of atmosphere to the high-vacuum side) during operation of the equipment. Application of a sudden gas load may damage the turbomolecular pump.
	 Check top lid	When opening the chamber to remove the vapor source or deposition materials, etc., remove the top lid before opening the chamber. If opened without removing the top lid, the top lid may fall down and become damaged when the chamber is opened.
	 Pressurize to atmospheric pressure	When pressurizing the vacuum tank to atmospheric pressure, stop the turbomolecular pump and turn the back pump switch OFF. Then, open the vent valve on the turbomolecular pump to pressurize the inside of the equipment to atmospheric pressure. When equipped with a solenoid valve (option), first, turn OFF the back pump switch to automatically pressurize to atmospheric pressure. To prevent the reverse flow of oil.
	 Close completely	When equipped with a main valve (option), make sure it is completely closed before pressurizing the inside of the vacuum tank to atmospheric pressure. If air from the atmosphere enters the turbomolecular pump during operation, it will damage the pump.

Maintenance, Repair and Disposal

 Warning	 Protective clothing	<p>Put on a dust mask and gloves when cleaning the thin film that builds up and adheres to the inside of the vacuum tank.</p> <p>The thin film turns into fine particles dispersing into the air and can enter your body through inhalation.</p>
	 Protective clothing	<p>Put on a dust mask and gloves when changed the oil on the sealed rotary vacuum pump.</p> <p>Exposure can harm your physical condition.</p>
	 Inspection check	<p>Inspect the equipment every day and make sure that the screws that secure the protective cover to the glass chamber and the hinges are not loose.</p> <p>If loose, the glass chamber can fall down and cause an accident.</p>
 Caution	 Periodic replacement	<p>As a general rule, replace the oil mist trap element every 6 months to a year.</p> <p>If the element is clogged, the exhaust resistance increases and can cause an oil leak from the axis seal or damage the oil level gauge.</p>
	 Legal compliance	<p>The owner and/or operator are legally obliged to dispose of the equipment and pump, etc., as industrial waste.</p> <p>Please dispose according to the rules or regulations established under law and by the local governing body.</p>
	 Prohibited	<p>Do not modify without prior approval from the manufacturer.</p> <p>The manufacturer assumes no responsibility for modifications undertaken.</p>

(1) Introduction

1. Users

This equipment is to be operated by personnel with experience using vacuum deposition systems, or by personnel that have received training that is based on this manual.

2. Reading and Understanding the Manual

Read the manual thoroughly before use, and ensure that the equipment is used correctly. It is particularly important to read the section entitled "For safe use of this product."

3. Storing the User Manual

Keep the user manual in a safe place.
After reading the manual, store it in a safe place where it is readily available to users.

4. Warranty

(1) The warranty for 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 this equipment. In addition, the scope of the warranty coverage concerning repairs is limited to the repair and/or replacement of parts.
Normal usage conditions refers to the following:
a) Ambient temperature and humidity during operation: 8 - 30°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, terrestrial upheaval 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 noted in the user manual (performance specifications, maintenance and inspection, etc.).
d) Malfunctions caused by modification or repair that is 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 determined by the manufacturer's technical personnel to be caused by conditions that do not comply with the usage conditions for this vacuum pump (this equipment).
j) Consumables.
(4) Disclaimer
a) We shall not be liable for any malfunctions of our products caused by the customer, regardless if the malfunction falls within the warranty period, nor be liable for any loss of opportunity for the customer's clients or for compensation of any damages to other products, labor costs, production loss, transportation expenses and other related work.
b) We shall not be liable for any secondary damages that occur for the customer due to filed claims and patent infringements of a third party.

5. Legal Compliance

When disposing the equipment, and specifically, when disposing used oil, there are legal obligations.
Dispose appropriately in accordance with the law. Contact the manufacturer for further clarification.

6. Safety During Repairs

To ensure the safety of repair personnel, please note the usage conditions, particularly the presence of any dangerous substances, when making a repair request to the manufacturer.
Fill out the usage conditions check sheet and attach it to the equipment.
The repair request may be refused if the usage conditions are unclear.

(2) Product Outline

1. Purpose of Use and Prohibited Items

This equipment is a vacuum deposition system that creates and deposits a thin film by evaporating substances from a vapor source using resistance heating evaporation in a vacuum.

Observe the prohibited items below to ensure that the equipment is used correctly.



Prohibited

Using this equipment only as vacuum chamber.

Putting objects other than evaporation source materials or samples in the vacuum tank.

Reselling, repairing or modifying without prior approval from the manufacturer.

2. Safety Equipment and its Purpose and Function

Item	Purpose	Function	Method of verification
Error in internal wiring circuit	System protection	Circuit protector causes power to turn off. Provides protection for an internal wiring short circuit and a burnout in the wiring.	None
Overcurrent, high-temperature, overload	Turbomolecular pump	Stops during free run (no brake operation) using the protection system built into the turbomolecular pump controller.	None
Overcurrent	Turbomolecular pump controller	Protects circuit in the controller using fuses (Type: ET 3.15 A / SOC Qty. 2).	None



Prohibited

Operating while the above safety equipment is disabled.

3. Product Specification

Ultimate pressure	10^{-4} Pa unit (When there is no load and it is clean inside the vacuum) Option specification : 1.5×10^{-3} Pa
Exhaust time	Under 20 minutes and up to 4.0×10^{-3} Pa (When there is no load and it is clean inside the vacuum)
Power requirements (Unit) (Power supply)	100 V, single phase, 0.6 kVA 100 V, single phase, 0.8 kVA
External dimensions (Unit) (Power supply)	428 mm (W) × 438 mm (D) × 713 mm (H) 480 mm (W) × 435.3 mm (D) × 149 mm (H) (excluding protrusions)
Weight (Unit) (Power supply)	Approximately 50 kg Approximately 24 kg
Exterior paint (Unit)	JIS S5-462 Baked finish (Munsell 5GY8/0.5)

For special use, refer to the specifications sheet.

4. Individual Component Specifications

Component	Model and specifications	Qty.
1) Glass chamber	<ul style="list-style-type: none"> • Dimensions: Inner diameter ϕ 236 mm × 250 mm (H) • Material: Borosilicate glass 	1
2) Base plate	<ul style="list-style-type: none"> • Number of ports: 7 ports • Dimensions: Outer diameter ϕ 270 mm • Material: Made from iron with nickel plating • Accessories: Electrodes Shutter Sealing flange for service port Sealing flange for base plate 	1 2 set 1 set 2 set 2 set
3) Evaporation power supply	<ul style="list-style-type: none"> • Model: PSE-150C • Input: Single phase 100 V • Output: Max. 80 A (Min. 25 A) • Control input method: Thyristor AC phase control method • Output control: Constant power, constant current and constant voltage • Output change: Load output change – Output control 1 position • Rating: 30 min. • Accessories: Input cable (with plug) Output cable (with crimped terminal) 	1

Component	Model and specifications	Qty.
4) Turbomolecular pump (TMP)	<ul style="list-style-type: none"> • Model: TG70F • Exhaust flow rate: 60 L/sec. • Ultimate pressure: 5×10^{-7} Pa • Exhaust outlet: ISO-R63, KF16 • Controller model: TC76 • Power requirements: 160 VA 	1
5) Sealed rotary vacuum pump (RP)	<ul style="list-style-type: none"> • Model: G-20DA • Exhaust flow rate: 20 L/min. • Ultimate pressure: 1.3 Pa • Power requirements: 370 VA • Hydraulic oil: SMR-100 180 mL 	1

For special use, refer to the specifications sheet.

5. Standard Accessories

1) Power cable	<ul style="list-style-type: none"> • For equipment unit: 100 V single phase with plug, 4 m • For evaporation power supply: 100 V single phase with plug, 4 m 	1 1
2) User manual	• Plain paper	1
3) Vacuum performance testing table	• Plain paper	1
4) Allen wrench	• 3 mm	1
5) TMP intake cap	• Intake cap for transporting the turbomolecular pump	1

For special use, refer to the specifications sheet.

6. Using Switches, Handles and Operation Levers



Check

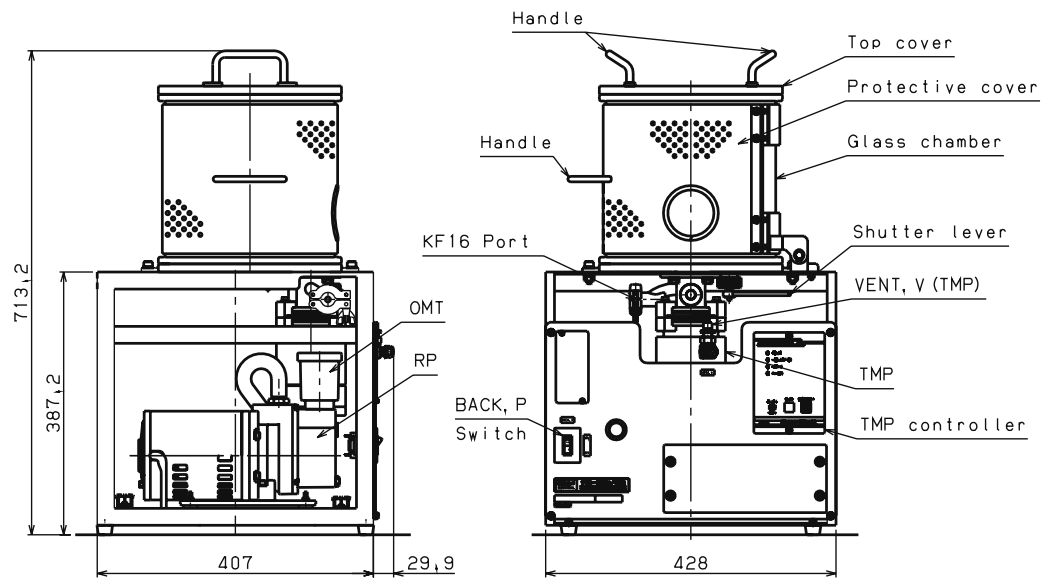
Check the safety and status of the switches, handles and operation levers before operating the equipment.

Name	Operation
BACK.P switch	Manual ON/OFF ON: Lamp lights up
VENT.V	Straight type Needle and value Open: Handle is vertical Close: Handle is horizontal
TMP controller START button STOP / RESET button POWER ACCELERATION NORMAL FAILURE	Manual ON ON: TMP operates Manual OFF OFF: TMP stops (free run) Manual RESET RESET: TMP resets (When it stops automatically to protect when TMP malfunctions) LED lights up: Input power has been turned ON LED lights up: TMP starts up / accelerates LED lights up: TMP operates normally / running at rated speed LED lights up: TMP controller error
Main valve handle (Option)	Counterclockwise: OPEN Clockwise: CLOSE Open completely: Turn handle counterclockwise 90 degrees Close completely: Turn handle clockwise 90 degrees
3 way valve (Option)	Turn lever in the direction FORE / CLOSE / ROUGH to operate.
VENT.V (Option)	Screw type leak port (Valve for pressurizing vacuum to atmospheric pressure) Open: Counterclockwise Close: Clockwise

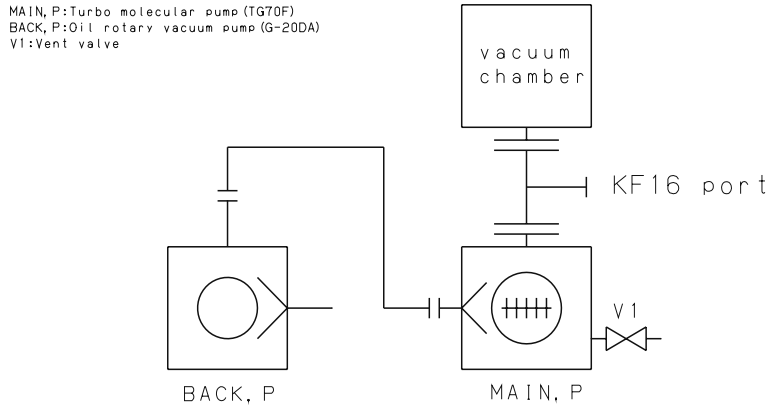
*Refer to each user manual for details on the device switches.

7. Layout of Switches, Handles and Operation Levers

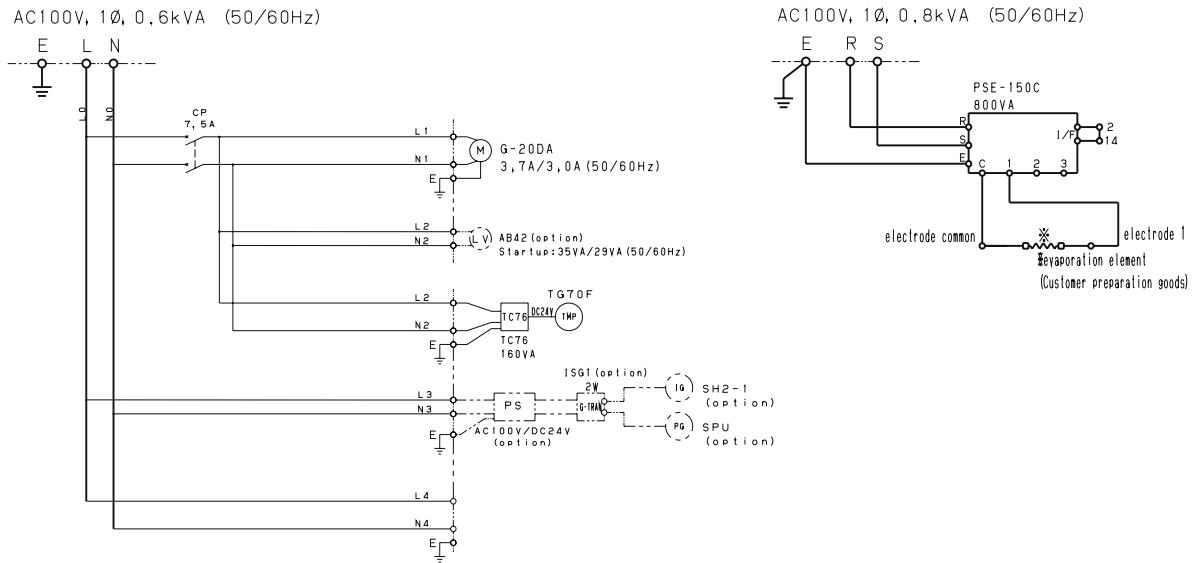
Standard specification



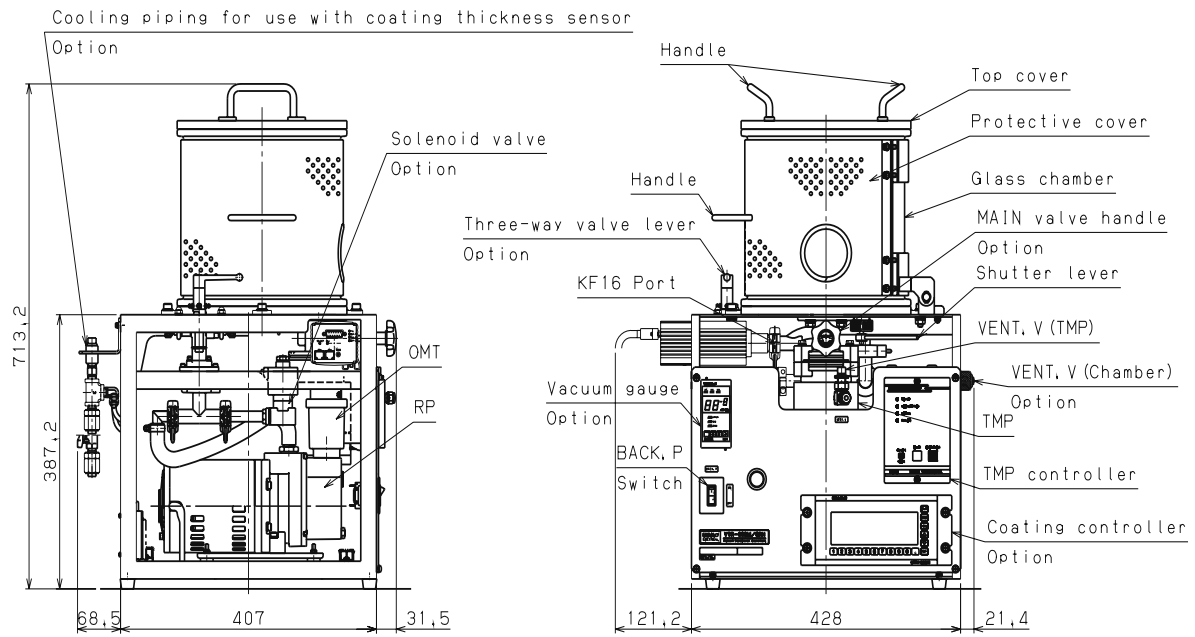
Exhaust system diagram



Electrical system diagram

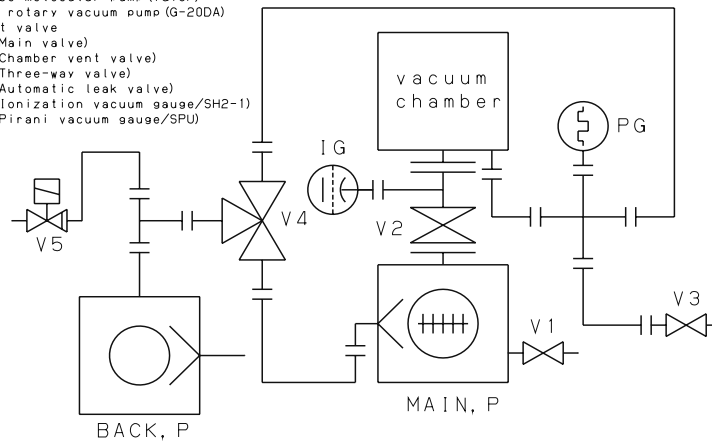


Option specification



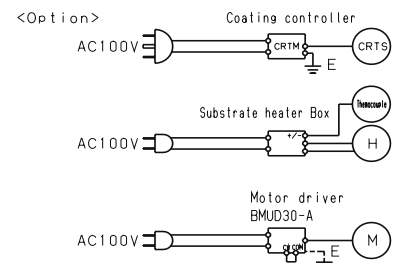
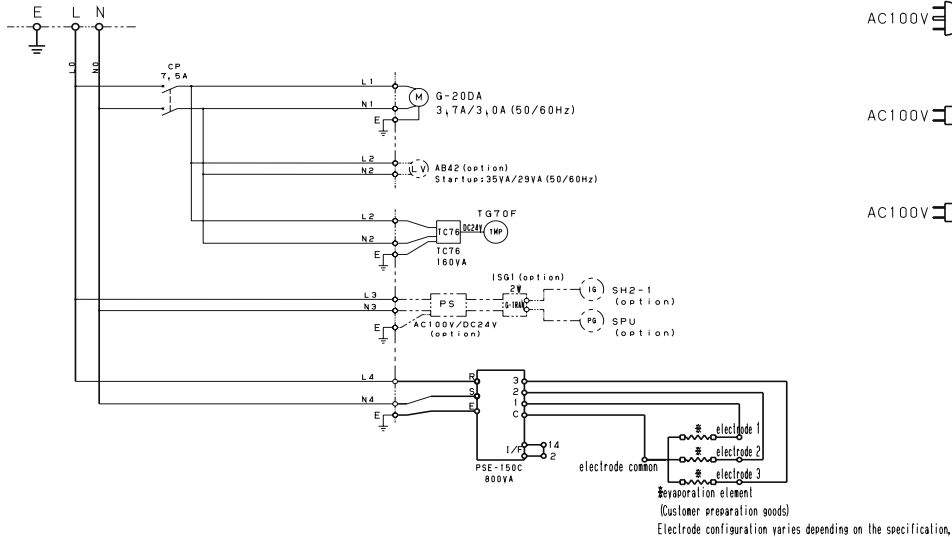
Exhaust system diagram

MAIN, P: Turbo molecular pump (TG70F)
 BACK, P: Oil rotary vacuum pump (G-20DA)
 V1: TMP vent valve
 V2: Option (Main valve)
 V3: Option (Chamber vent valve)
 V4: Option (Three-way valve)
 V5: Option (Automatic leak valve)
 IG: Option (Ionization vacuum gauge/SH2-1)
 PG: Option (Pirani vacuum gauge/SPU)




Electrical system diagram

AC100V, 1 ϕ , 1.4kVA (50/60Hz)



(3) Opening the Packaging and Installation




1. General Precautions

 Check	<ol style="list-style-type: none">1) Verify that the contents match the product that was ordered.2) Verify that the specified accessories are included.3) Clear a space at least 1 m around the equipment to ensure safety during installation.
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2. Packaging at Delivery

This product is delivered with the equipment packed in a crate and the accessories in a cardboard box, etc.

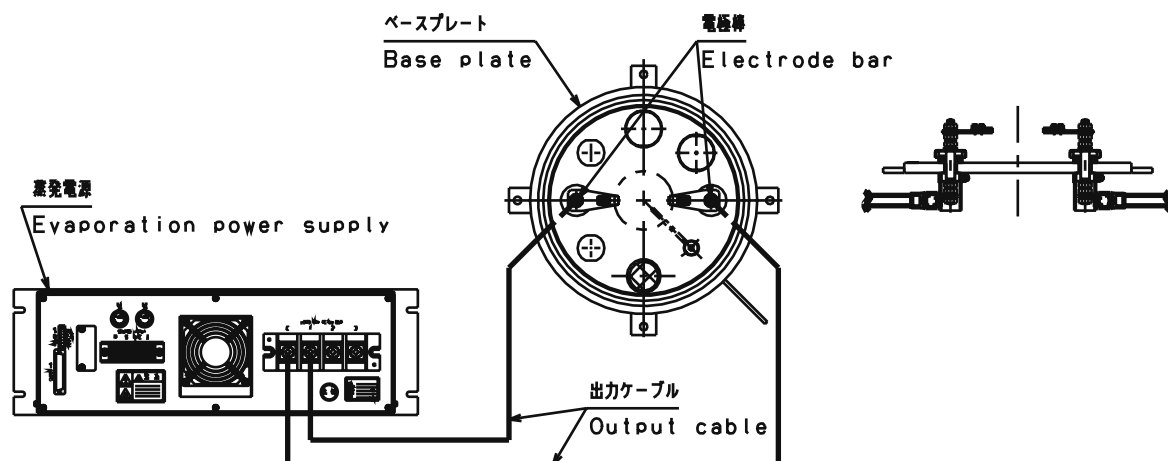
3. Location of Installation

 Warning	 Check the environment	<p>Install the equipment in a location that satisfies the following requirements.</p> <ol style="list-style-type: none">1) Flat and level.2) Floor with sufficient strength.3) Good ventilation.4) Protected from direct sunlight.5) Room temperature: 8 – 30°C.6) No danger of ignition.7) No chemicals or gases liable to corrode the equipment.8) Not subject to electrical interference (e.g. electrical noise). <p>Failure to install in accordance with these requirements may cause problems with the operation of the equipment and may reduce its operating life.</p>
 Check	For safety reasons, move the equipment at least 0.5 m from the wall after installation so that all obstructions are cleared away to have space for opening and closing the chamber and for maintenance and repair.	

4. Power Supply

 Warning	 Check capacity	<p>Primary power supply capacity Prepare a single phase 100 V power supply with a minimum of 6.0 A and a single phase 100 V power supply with a minimum of 8.0 A.</p> <p>When the capacity of the power supply is insufficient, breakers may trip if there is an overcurrent during operation.</p>
<p>Primary cable connection specifications Equipment: 4 m cable and 3 P plug with ground for 100 V single phase Evaporation power supply: 4 m cable and 3 P plug with ground for 100 V single phase</p>		
 Warning	 Separate power supply	<p>Prepare a separate primary power supply. Do not connect other equipment to it.</p> <p>When the capacity of the breaker is insufficient, the breakers may trip if there is an overcurrent during operation.</p>
	 Connect to ground	<p>This equipment uses a grounded plug. When using a plug adapter, connect the ground wire to the nearest ground terminal.</p> <p>An incomplete ground may result in electric shock in the event of a malfunction or short circuit.</p>
	 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 a 100 V cable with a minimum cross-section of 2.0 mm².</p> <p>A thin cable may result in overheating, ignition, or fire.</p>
	 Prohibited	<p>Do not place objects on the primary cables.</p> <p>Placing objects on the cables may result in electric shock or fire.</p>
	 Caution – electric shock	<p>Do not touch the terminal block when inserting the primary cable into the socket.</p> <p>Electric shock.</p>

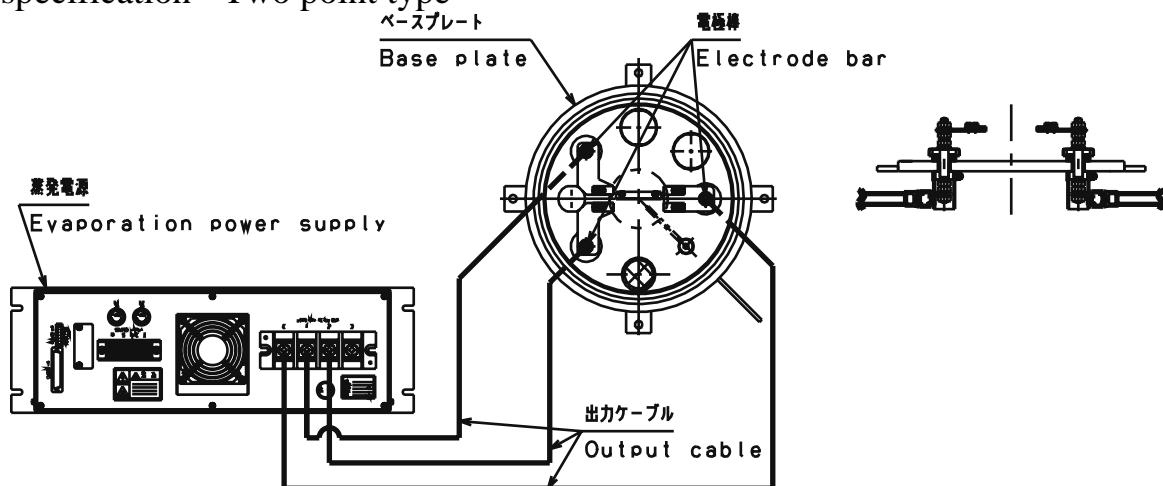
Wiring Diagram of Evaporation Power Supply Output Standard specification - One point type



※蒸発電源に接続する出力ケーブルは、締めトルク：12N・mで締め付けてください。

※The output cable connected with the evaporation power supply is a tightening torque: Please tighten by 12N・m,

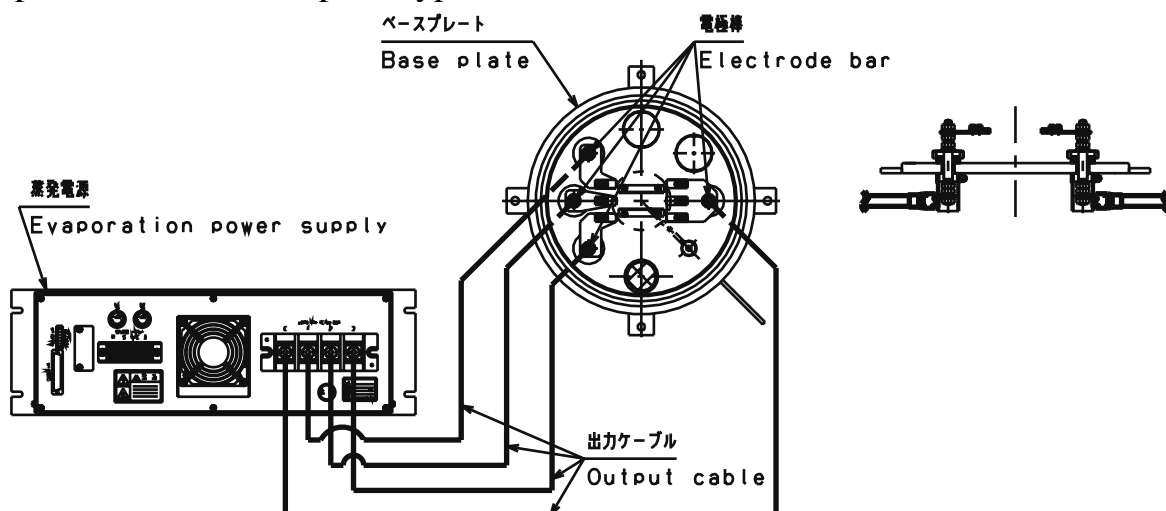
Option specification - Two point type



※蒸発電源に接続する出力ケーブルは、締めトルク：12N・mで締め付けてください。

※The output cable connected with the evaporation power supply is a tightening torque: Please tighten by 12N・m,

Option specification - Three point type



※蒸発電源に接続する出力ケーブルは、締めトルク：12N・mで締め付けてください。








※The output cable connected with the evaporation power supply is a tightening torque: Please tighten by 12N・m,

5. List of Required Tools

Tool	Application
Phillips screwdriver	For connecting the evaporation power supply input cable
Torque wrench/socket (Width across flats: 13)	For connecting the evaporation power supply cable
Spanner (Width across flats: 13)	For connecting the evaporation power supply cable

(4) Operation

1. Hazards During Operation, and Associated Safety Measures

 Warning	 Prohibited	<p>Do not expose the glass chamber to shock or heat that is 50°C or higher. Broken pieces or shards may shoot out if the inside is damaged when a vacuum is created.</p> <p>This can cause equipment damage.</p>
	 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>
 Caution	 Check top lid	<p>When opening the chamber to remove the vapor source or deposition materials, etc., remove the top lid before opening the chamber.</p> <p>If opened without removing the top lid, the top lid may fall down and become damaged when the chamber is opened.</p>
	 Pressurize to atmospheric pressure	<p>When pressurizing the vacuum tank to atmospheric pressure, stop the turbomolecular pump and turn the back pump switch OFF. Then, open the vent valve on the turbomolecular pump to pressurize the inside of the equipment piping to atmospheric pressure.</p> <p>When equipped with a solenoid valve (option), first, turn OFF the back pump switch to automatically pressurize to atmospheric pressure.</p> <p>To prevent the reverse flow of oil.</p>
	 Close completely	<p>When equipped with a main valve (option), make sure it is completely closed before pressurizing the inside of the vacuum tank to atmospheric pressure.</p> <p>If air from the atmosphere enters the turbomolecular pump during operation, it will damage the pump.</p>

2. Operation Procedure (Standard)

2-1 Preparation

- | | |
|---|---------|
| 1) Front panel switch: | OFF |
| 2) Primary power cable: | Connect |
| 3) Turbomolecular pump VENT.V: | Close |
| 4) Vapor source for electrodes (boat and filament, etc.): | Install |
| 5) Supply source material to vapor source | |
| 6) Shutter: | Close |
| 7) Chamber: | Close |
| 8) Mount substrate onto top lid holder | |
| 9) Put top lid onto glass chamber | |
| 10) Customer breaker: | ON |

2-2 Operation

Equipment startup

- | | |
|---|-------------------------------|
| 1) BACK.P: | ON |
| • Roughing inside vacuum tank and TMP: | Under 100 Pa (approx. 5 min.) |
| • Press the center part of top lid downward if the back pump exhaust sound becomes weaker or quieter. | |
| 2) TMP controller [START]: | Press (TMP starts) |
| • When accelerating: | ACCELERATION lights up |
| 3) TMP operates normally after approx. 2.5 min.: | NORMAL lights up |

2-3 Deposition

- | | |
|--|-----------------------------------|
| 1) Evaporation power supply MAIN: | ON |
| 2) SELECT: | ON (Select conducting electrodes) |
| 3) HIGH (Lamp lights up): | Check |
| 4) MANUAL (Lamp lights up): | Check |
| 5) POWER (Lamp lights up): | ON |
| 6) Press the UP ▲ key so the current gradually passes to the vapor source. | |
| 7) Monitor the red heat of the vapor source. Once the vapor source begins to melt, remove any impurities or contaminants in the vapor source that adhere to the shutter. | |
| 8) Open the shutter to deposit onto the sample (substrate) | |
| 9) Shutter after deposition: | Close |
| 10) POWER (Lamp turns off): | OFF |
| 11) Evaporation power supply MAIN: | OFF |

2-4 Stopping

Stopping equipment

- 1) Evaporation power supply MAIN after deposition: OFF (Check)
- 2) TMP controller [STOP/RESET]: Press (TMP free run)
 - Controller: NORMAL turns off
The TMP begins to slow down and stop in free run (no brake operation).
It takes approximately 25 minutes for the TMP to stop completely.
- 3) BACK.P: OFF
- 4) Turbomolecular pump VENT.V: Open
 - The TMP can be stopped faster by pressurizing with atmospheric air.
The vent valve can also be opened at the same time as TMP [STOP].
The TMP vent valve also functions as a release valve for atmospheric air for the back pump.
- 5) Remove the top lid and remove the substrate.
 - Perform the procedure 2-1 again to continue deposition.
- 6) Close the chamber and place the top lid on it to quit deposition.
- 7) Customer breaker (when necessary): OFF

3. Operation Procedure (Option)

3-1 Preparation

- 1) Front panel switch: OFF
- 2) Primary power cable: Connect
- 3) Turbomolecular pump VENT.V: Close
- 4) Vacuum tank VENT.V: Close
- 5) Main valve: CLOSE
- 6) 3 way valve: CLOSE
- 7) Attach probe for vacuum gauge onto piping port and connect wire cable.
- 8) Customer breaker: ON

3-2 Operation

Equipment startup

- 1) BACK.P: ON (Close solenoid valve)
- 2) 3 way valve: FORE
 - TMP internal roughing: approx. 2 min
- 3) TMP controller [START]: Press (TMP starts)
 - When accelerating: ACCELERATION lights up
- 4) TMP operates normally after approx. 2.5 min.: NORMAL lights up
- 5) Evacuate until target pressure

3-3 Stopping

Stopping equipment

- 1) Evaporation power supply MAIN after deposition: OFF (Check)
- 2) Evacuate to maintain vacuum in vacuum tank
- 3) Vacuum gauge filament: OFF (In the case of SH-2 alone mode)
- 4) 3 way valve: FORE (Check)
- 5) Main valve: CLOSE
- 6) TMP controller [STOP/RESET]: Press (TMP free run)
 - Controller: NORMAL turns off
 - The TMP begins to slow down and stop in free run (no brake operation).
 - It takes approximately 25 minutes for the TMP to stop completely.
- 7) 3 way valve: CLOSE
- 8) BACK.P: OFF (Open solenoid valve)
- 9) Turbomolecular pump VENT.V: Open
 - The TMP can be stopped faster by pressurizing with atmospheric air.
 - The vent valve can also be opened at the same time as TMP [STOP].
- 10) Customer breaker (when necessary): OFF

3-4 Open Vacuum Tank

- 1) Vacuum gauge filament: OFF (In the case of SH-2 alone mode)
- 2) Main valve: CLOSE
- 3) 3 way valve FORE: Check
- 4) Vacuum tank VENT.V (when necessary): Open slowly
- 5) Top lid: Remove
- 6) Chamber: Open

3-5 Evacuate Vacuum Tank

- 1) Vacuum tank VENT.V: Close
- 2) Chamber: Close
- 3) Deposition-preventing plate (when using one): Install
- 4) Top lid: Attach
- 5) 3 way valve: ROUGH
 - Roughing inside vacuum tank
- 6) Less than 100 Pa on Pirani gauge: Check
- 7) 3 way valve: FORE
- 8) Main valve: OPEN

3-6 Preparation for Deposition

- 1) Open vacuum tank: Procedure 3-4
- 2) Vapor source for electrodes (boat and filament, etc.): Install
- 3) Supply source material to vapor source
- 4) Shutter: Close
- 5) Mount substrate onto top lid holder
- 6) Put top lid onto glass chamber
- 7) Evacuate vacuum tank: Procedure 3-5
 - Evacuate until target pressure

3-7 Deposition

- 1) Evaporation power supply MAIN: ON
- 2) SELECT: ON (Select conducting electrodes)
- 3) HIGH (Lamp lights up): Check
- 4) MANUAL (Lamp turns off): Check
- 5) POWER (Lamp lights up): ON
- 6) Press the UP ▲ key so the current gradually passes to the vapor source.
- 7) Monitor the red heat of the vapor source. Once the vapor source begins to melt, remove any impurities or contaminants in the vapor source that adhere to the shutter.
- 8) Open the shutter to deposit onto the sample (substrate)
- 9) Shutter after deposition: Close
- 10) POWER (Lamp turns off): OFF
 - Perform the procedure 3-7 starting from step 2 again to continue deposition.
- 11) Evaporation power supply MAIN: OFF
- 12) Open vacuum tank and remove sample (substrate): Procedure 3-4

Reference Items

Film thickness: Adjust with the deposition time

Deposition rate: Adjust with the current that passes to the vapor source

*Refer to each user manual for details on the operation of option devices.

4. Handling Malfunctions

4-1 Instantaneous Power Failure

- All devices except the TMP are automatically restored to the status prior to the power failure.
- The TMP does not restore automatically after a power failure.
POWER and STOP light up.
Press [START] on the TMP controller again to start up.
First, check the NORMAL display before operating.

4-2 Long-term Power Failure

- Remove the primary cable plug from the socket and open the TMP vent valve.

When equipped with valve piping

- 1) Main valve: Open completely
- 2) 3 way valve: CLOSE
- 3) BACK.P switch: OFF

The TMP stops, but it goes into free run status because there is no brake operation. (It takes approximately 25 minutes to come to a stop.)

4-3 Restoration Procedure after Power Failure









Press [STOP/RESET] on the TMP controller to stop the TMP.

(It takes approximately 25 minutes to come to a stop when in free run.)

Follow the procedures “2-1 Preparation” and “2-2 Operation” in section “2. Operation Procedure” to operate. However, considering that the inside of the TMP is still rotating, you need to thoroughly discharge the inside of the piping for the back pump.

(5) Maintenance and Repairs

1. Hazards During Maintenance and Repairs, and Associated Safety Measures

 Warning	 Protective clothing	<p>Put on a dust mask and gloves when cleaning the thin film that builds up and adheres to the inside of the vacuum tank.</p> <p>The thin film turns into fine particles dispersing into the air and can enter your body through inhalation.</p>
	 Protective clothing	<p>Put on a dust mask and gloves when changed the oil on the sealed rotary vacuum pump.</p> <p>Exposure can harm your physical condition.</p>
	 Inspection check	<p>Inspect the equipment every day and make sure that the screws that secure the protective cover to the glass chamber and the hinges are not loose.</p> <p>If loose, the glass chamber can fall down and cause an accident.</p>
 Caution	 Periodic replacement	<p>As a general rule, replace the oil mist trap element every 6 months to a year.</p> <p>If the element is clogged, the exhaust resistance increases and can cause an oil leak from the axis seal or damage the oil level gauge.</p>
	 Legal compliance	<p>The owner and/or operator are legally obliged to dispose of the equipment and pump, etc., as industrial waste.</p> <p>Please dispose according to the rules or regulations established under law and by the local governing body.</p>
	 Prohibited	<p>Do not modify without prior approval from the manufacturer.</p> <p>The manufacturer assumes no responsibility for modifications undertaken.</p>

2. Customer Maintenance and Repairs

- 1) Replace the sealed rotary vacuum pump and the turbomolecular pump.
 - 2) Change the oil for the sealed rotary vacuum pump.
 - 3) Replace the oil mist trap element.
 - 4) Replace the O-ring. (Excluding the sealed rotary vacuum pump)
 - 5) Clean the inside of the vacuum tank.
- Contact the manufacturer for repairs other than those cited above.

3. Removing, Maintaining and Fitting the Device

3-1 Sealed Rotary Vacuum Pump

- 1) Tools required: Spanner (Width across flats: 8 mm) × 1 and Phillips screwdriver
- 2) Removal
 - Ensure that all devices on the equipment are stopped.
 - Ensure that all primary power supplies for the equipment are disconnected.
 - Loosen the hose band on the inlet and remove the piping hose.
 - Remove the wiring connectors for the motor.
 - Remove the ground wire.
 - Remove the nuts (Qty.4) for the anti-vibration rubber mounts on the pump base.
 - Lift up the motor and front cover, and remove the pump unit.
- 3) Change oil

Refer to sealed rotary vacuum pump user manual (provided separately).
- 4) Fitting
 - Lift up the motor and front cover, and fit onto the anti-vibration rubber mounts.
 - Attach the nuts (Qty.4) for the anti-vibration rubber mounts.
 - Connect the piping hose onto the inlet and fasten the hose band to secure it.
 - Connect the ground wire.
 - Attach the wiring connectors for the motor.

3. Removing, Maintaining and Fitting the Device

3-2 Turbomolecular Pump

1) Tools required: Spanner (Width across flats: 13 mm)

2) Removal

- Ensure that all devices on the equipment are stopped.
- Ensure that all primary power supplies for the equipment are disconnected.
- Remove the TMP wiring and fan connector.
- Remove the outlet clamp, and remove the exhaust duct and center ring O-ring.
- Remove the claw clamps (Qty.4) for securing the intake flanges.
(Perform this task with a partner to help hold the turbomolecular pump.)
- Pull out the turbomolecular pump toward the rear to remove.
- Keep the removed components in a safe place until reassembly.

3) Maintenance and repairs

- After receiving the equipment, maintenance and repairs are performed by the TMP manufacturer.
- Protect the equipment from large impacts or vibration during transport.
- There are no specific restrictions for securing the TMP during transport.

4) Fitting

- Face the position of the turbomolecular pump outlet on the front at a downward angle toward the right, and place it on the flange under the conversion flange.
- Lift up the turbomolecular pump. Screw in the claw clamp about 3 to 4 threads at 2 places, and attach the remaining two places.
(Perform this task with a partner to help hold the turbomolecular pump.)
- Screw in the claw clamp evenly (alternating and tightening the opposing bolts in order).
- Attach the center ring O-ring and the exhaust duct onto the outlet, and secure it with the clamp.
- Attach the TMP wiring and fan connector.

3. Removing, Maintaining and Fitting the Device

3-3 Oil Mist Trap OMT-050A

1) Tools required: Phillips screwdriver (Used for replacing element.)

2) Removal

- Use both hands to turn the base of the oil mist trap unit counterclockwise.

3) Replace element

Refer to the OMT-050A Mist Trap User Manual (provided separately).

4) Fitting

- Attach the O-ring provided in the accessories to the bottom of the oil mist trap unit.
- Align with the outlet on the sealed rotary vacuum pump, and use both hands to turn the base of the oil mist trap unit clockwise.

Note: Fasten while ensuring that the O-ring does not fall off.

3-4 Replace Base Plate and Top Lid O-ring

1) Tools required: Precision flathead screwdriver

2) Removal

- Remove with care so as to avoid scratching or damaging the O-ring groove.

3) Fitting

- Apply vacuum grease to the surface of the new O-ring.
(Just enough so there is a very thin layer of grease.)
- Clean the inside of the O-ring groove.
- Fit the O-ring into the groove.

3-5 Clean Inside of Glass Chamber

1) Required gear: Dust mask and gloves

2) Cleaning

- Put on the protective clothing (dust mask and gloves), and wipe down with alcohol, etc., to remove any contaminants that adhere to the inside wall.

4. Maintenance and Inspection Locations

Inspection locations (device name)	Maintenance and inspection details	Timing
Glass chamber	Clean the inside.	When necessary
Sealed rotary vacuum pump	Ensure that the oil level on the oil level gauge is within the indicated line.	Each time before use
	Change oil. If the pressure is 5 Pa or greater for a single operation.	When necessary
Turbomolecular pump	Ensure that the cooling fan is rotating.	Each time used
	Replace bearing.	Every 20,000 hrs.
Turbomolecular pump vent valve	Replace the O-ring.	Every 12 months
Piping hose	Ensure that it is not notably deformed.	Each time before use
Wire cable	Ensure that the wire terminals and connecting screws are not loose.	When necessary
Main valve (Option)	Clean the sealing surface on the valve seat.	Every 6 to 12 months to remove contaminants.
Pirani gauge (Option)	Replace probe.	When necessary
Ionization gauge (Option)	Replace probe.	When necessary
Oil mist trap	Replace element.	Every 6 to 12 months.

Periodic Inspection for Equipment Performance

Inspect the equipment periodically, about once or twice a month, for the following items.

Ultimate pressure test

Create a vacuum for a long period on this equipment independently, and measure the ultimate pressure.

If there performance a decline in the performance since the time of purchase, one of the following may be the cause.

- 1) Dirty inside vacuum system
- 2) Leak

Exhaust characteristics test

If there is a performance decline in the exhaust characteristics even though the ultimate pressure is not particularly bad, one of the following may be the cause.

- 1) Too much moisture in the gas being introduced.
- 2) Dirty or rusty inside vacuum system.

*Perform the prescribed inspection based on the user manual of each device when performing the periodic inspection for the system devices.

Pay particular attention to maintenance management because the TMP is an expensive product.

5. Troubleshooting

Symptoms	Cause	Solution
Ultimate pressure is poor or Ultimate pressure is unstable or 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 – 48 hours and check again.
	Leaks.	Check around the parts touched before change occurred when ultimate pressure was reached.
		Clean the O-ring for the glass chamber. Or, replace consumable parts.
	When using samples (substrates) with lots of emission gases. Ex: Resin substrates, etc.	Change the material of the sample. Increase the exhaust time.
	Problem with turbomolecular pump.	Refer to the Turbomolecular Pump User Manual.
	Problem with the sealed rotary vacuum pump.	Refer to the Sealed Rotary Vacuum Pump User Manual.
	Problem with measuring equipment.	Refer to the user manual for each measuring device.
Problem with turbomolecular pump	Problem with wiring connection. Problem with internal parts.	Refer to the Turbomolecular Pump User Manual.
Problem with TMP controller	Insufficient roughing pressure. Overcurrent. Abnormal temperature. Open phase. Internal problem with system.	Refer to the Power Supply User Manual for the TMP.
Current does not pass through electrodes even when evaporation power supply is turned on	There is a disconnection with the vapor source.	Replace the vapor source.
	There is a short circuit on the electrodes inside the base plate.	Fix the short circuit, and restore the insulation.
	Problem with the evaporation power supply.	Refer to the Evaporation Power Supply User Manual.

6. Storing the Equipment

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

7. Consumables

Standard specification

Location	Name	Specification	Material	Qty.	Replaceable by customer
Vacuum tank	O-ring for top lid	G 2 5 0	F P M	1	○
	O-ring for base plate	G 2 5 0	F P M	1	○
	Electrode gasket	KV-1020-01-019	F P M	2	○
	O-ring for service port sealing plug	P 3 0	F P M	2	○
	O-ring for base plate sealing plug	P 1 6	F P M	2	○
	O-ring for shutter shaft	N 8	F P M	1	○
Conversion flange	O-ring for intake flange	V 4 0	F P M	1	○
	O-ring for sealing shaft	N 7	F P M	1	○
	Center ring O-ring	K F 1 6	F P M	1	○
Turbomolecular pump	O-ring for intake flange	I S O 6 3	F K M	1	○
	Center ring O-ring	K F 1 6	F P M	1	○
	O-ring for vent valve adapter	P 1 0 A	F P M	1	○
	Bearing	————	——	1	×
Sealed rotary vacuum pump	Oil	S M R — 1 0 0	——	0.18L	○
Oil mist trap	Element	C100-084-371Q-F935	——	1	○

For special use, specifications and quantity may differ.



Option specification

Location	Name	Specification	Material	Qty.	Replaceable by customer
Vacuum tank	O-ring for KF16 entry port	P 3 2	F P M	1	○
	Center ring O-ring	K F 1 6	F P M	1	○
Main valve	O-ring for intake flange	V 4 0	F P M	1	○
	O-ring for sealing shaft	N 7	F P M	1	○
	Center ring O-ring	K F 1 6	F P M	1	○
	Valve seat (rubber lining)	KV-1009-01-012R4	N B R	1	×
3 way valve	Sealing material for Legris sealing material (Ball seal/stem seal)	0482 0917	N B R	2/1	×
	Flat sealing material	φ24×φ16×2 t	N B R	3	○
Solenoid valve	Flat sealing material	φ24×φ16×2 t	N B R	1	○
Roughing piping	Center ring O-ring	K F 1 6	F P M	8	○
	O-ring for leak port	N 7	F P M	1	○
	O-ring for roughing flange	V 2 4	F P M	1	○
Vacuum gauge	Multi-ionization gauge probe	M-3 4	---	1	○
	Pirani gauge probe	WP-1 6	---	1	○
Substrate heating (350°C)	Heater	1 0 0 V / 2 0 0 W	---	1	○
Substrate heating (650°C)	Heater Unit	1 0 0 V / 8 0 0 W	---	1	○
Film thickness sensor	Crystal	CRTS gold specification – 5 pcs.	---	1	○
Carbon electrode	Carbon bar	4 piece set φ 5×100	C	1	○



For special use, specifications and quantity may differ.

(6) Disposal

1. Precautions to be taken for Disposal

 Caution	 Legal compliance	<p>The owner and/or operator are legally obliged to dispose of the equipment and pump, etc., 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: 1) Transport - Outsourced to an industrial waste product collection and transport contractor.</p> <p>2) Treatment – Outsourced to an industrial waste product processing contractor.</p>		

(7) Optional Components

 Caution	 Prohibited	<p>Do not make any modifications beyond the manufacturer's standard options.</p> <p>The manufacturer assumes no responsibility for modifications undertaken.</p>
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1. Standard Optional Components

Optional components	Application	Fitting
Oil mist trap	Prevents oil and smoke outflow from sealed rotary vacuum pump outlet	Can be fitted by customer
Valve piping set [Main valve 3 way valve Vent valve Solenoid valve Roughing piping]	<p>By adding the valves and piping to the exhaust system, it ensures that the main pump does not stop and makes the system able to pressurize the inside of the vacuum tank to atmospheric pressure.</p> <p>In addition, there is a solenoid valve that stops the auxiliary pump and opens to pressurize to atmospheric pressure.</p>	Factory assembled
Vacuum gauge	When combined with the ionization gauge or Pirani gauge on the display unit, it can measure the pressure.	Factory assembled
KF16 gauge port	For diameter conversion (KF16/ ø18)	Can be fitted by customer
Evaporation electrode – 2 point type (switching)	Deposition with two point switching (equipped with electrode partition) Single phase 100 V / 80 A (Max.)	Factory assembled
Evaporation electrode – 3 point type (switching)	Deposition with three point switching (equipped with electrode partition) Single phase 100 V / 80 A (Max.)	Factory assembled
Evaporation power supply: SEREM	When the deposition power supply with resistance heating evaporation (equipped with external automatic control function) is combined with a deposition controller, the deposition rate can be controlled. Single phase 200 V / 150 A (Max.)	Can be fitted by customer

1. Standard Optional Components

Optional components	Application	Fitting
Sample holder A (ø200)	Secures sample (without drilling)	Can be fitted by customer
Sample holder B (ø200)	Secures sample (M4 tapping)	Can be fitted by customer
Deposition-preventing plate	Helps prevent the adhering of the vapor onto the glass chamber.	Can be fitted by customer
Substrate heater	Heats the sample (Max.350°C)	Factory assembled
Substrate heater	Heats the sample (Max.650°C)	Factory assembled
Carbon electrode set	For fine carbon layer deposition	Can be fitted by customer
Measuring device rack	For storing control devices	Factory assembled
Deposition controller	Measures and controls the film thickness and deposition rate	Factory assembled
Film thickness sensor	Measurement sensor for deposition controller	Factory assembled
Water cooling pipe for film thickness sensor	Water cooling pipe for thickness sensor	Factory assembled
Substrate rotation mechanism	Improves consistent film thickness	Factory assembled