

Instruction Manual

Compact Vacuum Evaporator

DEPOX

(VTR-350M/ERH)

Please read this manual thoroughly to ensure safe and effective operation of this equipment.

Keep this manual in a safe place.

Please note that due to performance upgrade, the equipment described in this manual is subject to changes in dimensions and specifications without prior notice.

ULVAC KIKO, Inc.

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Highlighting indicates safety-critical items.

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To Safely Use This Equipment

Thank you for purchasing our product. This pump is designed exclusively for vacuum evacuation, and it may malfunction or cause accidents if operated inappropriately. Please read the manual thoroughly, and pay specific attention to inspection, maintenance and safety guidelines. Read and fully understand the description of this manual to prevent serious accidents from occurring.




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Read this section before using the VTR-350M/ERH. Follow the instructions below to safely use the device and prevent personal injuries from occurring.



Please comply with them all the time.

The symbols below have the following meaning








	Danger	Incorrect handling of the equipment is very likely to result in death or serious injury to the operator.
	Warning	Incorrect handling of the equipment may result in death or serious injury to the operator.
	Caution	Incorrect handling of the equipment may result in light or medium injuries to the operator or damage to the equipment.

	This indicates action or practice that should be made.
	Always make connection with the earth.
	This indicates the action or practice that should be prohibited.
	Do not disassemble.
	Do not touch.








Warning Label

 CAUTION	 Check label	<p>Warning labels have been applied to the following locations.</p> <ol style="list-style-type: none"> 1) Glass bell jar (PL001, PL005) For units with a liquid nitrogen trap, 2) Near the liquid nitrogen funnel (PL006) For units with a bell jar cover (holder), 3) Bell jar cover (PL001, PL005) For units with a lifter, 4) Lifter (PL003) <p>In the event that a label becomes illegible or begins to peel off, please contact your sales representative.</p>
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Power Supply

 Warning	 Check the capacity	<p>Primary power supply</p> <p>Prepare the following.</p> <p>Single-phase 100 V, 14.0 A or more Single-phase 200 V, 7.5 A or more</p> <p>Failure to use the correct power supply could result in circuit breakers tripping during operation due to overcurrent.</p>
	 Do not share	<p>Primary electric power supply should be reserved exclusively for this equipment and not shared with any other device.</p> <p>Lack of circuit breaker capacity could result in the circuit breakers tripping during operation due to overcurrent.</p>
	 Ground the grounding wire	<p>Always make sure that the equipment is properly connected to a type D ground.</p> <p>Ground cables are color-coded green.</p> <p>A faulty ground connection could result in electrical shock or damage to equipment.</p>
	 Check the cable capacity	<p>Avoid using extension cables if possible. In the event that an extension cable must be used, be sure it conforms to the following:</p> <p>100 V, 3.5 mm² or larger 200 V, 2.0 mm² or larger</p> <p>A cable that is too small could easily overheat and result in a fire.</p>
	 Avoid this action	<p>Do not place objects on top of primary power supply cables.</p> <p>To do so could result in electrical shock or cause a fire.</p>
	 Avoid electrical shock	<p>Even after opening the main circuit breakers, the cables are live up to the breaker itself. Do not touch the terminals.</p> <p>To do so could result in electrical shock.</p>







Environment

 Warning	 Avoid this action	<p>This equipment is not equipped with an explosion-proof structure and should not be used any area where it would be exposed to an open flame. To do so could results in an explosion, fire, or personal injury.</p>
	 Avoid this action	<p>The area near the pump is subject to high temperatures during operation. Do not place flammable substances anywhere near the pump. To do so could result in a fire.</p>
	 Do not touch	<p>During rough vacuum operations, an oil mist could escape from the oil rotary vacuum pump evacuation port. Be sure to equip the device with an oil mist trap. Failure to do so could result in a contaminated interior that could affect the health of the operator.</p>
 Caution	 Oil mist trap in use	<p>Oil mist will be spread from the evacuation outlet of the oil sealed rotary vacuum pump during roughing operation. Use an oil mist trap (sold separately). Otherwise, oil spread may contaminate the room or affect human health.</p>
	 Requires ventilation	<p>The pump emits heat while the device is operating. Room temperature will rise.</p>











Installation

 Warning	 Check the environment	<p>Install the equipment where the following conditions are satisfied.</p> <ol style="list-style-type: none"> 1) Flat surface 2) Floor with sufficient strength 3) Well-ventilated place 4) Place without direct sunlight 5) Room with temperatures between 7°C and 30°C. 6) Location where there is no risk of fire 7) Location where no corrosive chemicals or gases are present. 8) Place without electrical noises, which may cause adverse effect to the product. <p>Otherwise, operation failure or durability degradation may occur.</p>
 Caution	 Work by two or more people	<p>Lifting and moving of the equipment should be made by two or more people. Otherwise, you could injure your back.</p>
	 Work by two or more people	<p>Installation or removal of lift (sold separately) should be made by two or more people. Otherwise, you could injure your back.</p>
	 Fix the product	<p>After installation, secure the device in place using the adjusters. This is made to prevent movement or damage upon earthquake.</p>

Operations

 Warning	 Avoid this action	<p>Do not apply any shock to the glass bell jar, and avoid heating it to 50°C or higher.</p> <p>In a case of explosion upon vacuum condition, the exploded pieces will spread.</p> <p>This may cause a serious damage to the product.</p>
	 Check ventilation	<p>Please make sure to ventilate the room when using liquid nitrogen.</p> <p>The nitrogen can potentially reduce the oxygen in the room.</p> <p>This may cause an oxygen deficiency accident.</p>
 Caution	 Wear gloves	<p>When using liquid nitrogen, wear gloves to protect your hands.</p> <p>If liquid nitrogen splashes and adheres to your skin, you may feel acute pain momentary.</p>
	 Confirm complete close	<p>After confirming complete closure of the main valve, let out the air in the vacuum chamber.</p> <p>Air entering the turbo molecular pump during operation could result in damage to the pump.</p> <p>An inflow of air during liquid nitrogen injection will cause condensable gases to adhere to the trap excessively, thus degrading the performance.</p>

Maintenance, Repair, and Disposal

 WARNING	 Wear protective equipment	<p>Always wear gloves and a protective mask when cleaning the thin film that forms on the bell jar and feed-through collar.</p> <p>The thin film comprises fine particulate that could become suspended in the air and enter the lungs while breathing.</p>
	 Wear protective equipment	<p>Always wear gloves and a protective mask when changing the oil to the oil rotary vacuum pump.</p> <p>Failure to do so could result in illness.</p>
	 Be careful	<p>The glass bell jar weighs approximately 7 kg. Always maintain proper posture when attaching it to or removing it from the device.</p> <p>Failure to do so could result in injuries to the spine or pelvis as well as damage to the bell jar.</p>
	 Inspection	<p>If the lifter (optional) is installed, inspect the eyebolt and attachment clip at the end of the wire rope for looseness on a daily basis.</p> <p>Failure to do so could result in damage to the glass bell jar.</p>
 CAUTION	 Requires more than one person	<p>Installation or removal of the oil diffusion pump or oil rotary vacuum pump is to be performed by two or more people.</p> <p>Take the necessary precautions to avoid dropping it or hurting your back.</p>
	 Periodic replacement	<p>Replace the oil mist trap element once every 6 to 12 months.</p> <p>A clogged element will cause higher evacuation resistance and could result in leakage from the spindle seal or damage to the oil level gauge.</p>
	 Abide by the law	<p>Proper disposal of this device and its pumps as industrial waste is stipulated by law.</p> <p>Dispose of properly in accordance with all applicable laws and local regulations.</p>
	 Prohibited	<p>Do not modify this device in anyway.</p> <p>We cannot be responsible for modifications.</p>

(1) Before Using

1. Target Users

Only persons who have used vacuum deposition equipment 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: 7 - 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 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 including used oil.

Comply with regulations upon disposal.

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) Overview of the product

1. The purpose of the product and general prohibitions

This device is used to perform vacuum evaporation and deposition, a process for applying a thin film of material to the solid surface of an object by using an electrically resistive heater to produce a flux of vapor in a vacuum.


The following prohibitions are intended to ensure proper operation of the device.



Prohibited

Using this device as a vacuum container
Placing substances other than the vapor source and the material to be coated in the vacuum chamber
Repairing, modifying, or attempting to resell this device without the approval of the manufacturer.

2. Safety devices, their purpose and functionality

Item	Objective	Function	Confirmation
Electrical leakage	Prevent electrical shock	Earth leakage breaker located in vapor deposition unit main breaker. Rated capacity: 1 kA Manual reset after the problem is rectified	None
<div> Prohibited</div> <div>Do not operate the device with any of the above items deactivated.</div>			

3. Product Specifications

Ultimate pressure	4.0×10^{-4} Pa (For unloaded, clean vacuum chamber) 2.0×10^{-4} Pa (Using liquid nitrogen in unloaded, clean vacuum chamber)
During evacuation	Up to 4.0×10^{-3} Pa for 10 minutes (For unloaded, clean vacuum chamber) Up to 3.0×10^{-3} Pa for 10 minutes (Using liquid nitrogen in unloaded, clean vacuum chamber)
Required electric power	100 V, single phase, 1.4 kVA 200 V, single phase, 1.5 kVA
External dimensions Main unit: Power unit: Mass Main unit: Power unit:	W730 mm × D584 mm × H1,161 mm W480 mm × D435.3 mm × H149 mm Approximately 162 kg Approximately 40 kg
Color of main unit	JIS S5-462 baked (Munsell 5GY8/0.5)

Refer to specification sheet for custom-built specifications.

A liquid nitrogen trap (optional) is needed when using liquid nitrogen.

4. Specifications for component parts

Device name	Model/Specification	Qty.
1) Glass bell jar	Internal diameter: 300 mm dia. × H300 mm Material: hard glass	1
2) Feed-through collar	No. of ports: 12 (8 side ports, 4 bottom ports) Internal diameter: 305 mm dia. × H100 mm Material: Nickel-plated steel Appurtenant devices: Single point electrode KF port Shutter Service port sealing flange Base plate sealing flange	1 2 1 1 5 3
3) Evaporator power unit	Model: PSE-150C Dimensions: W480 mm × D435.3 mm × H149 mm Input: Single phase 200 V Output: 150 A max. Rating: 30 minutes Control method Thyristor AC phase control method Output control Constant power operation Constant current operation Constant voltage operation (Setting when shipped out: constant current) Appurtenant devices: Output cable (38 mm ² × 2 m)	1
4) Turbo molecular pump (TMP)	Model: Turbovac 361 Evacuation flow: 345 l/second of N ₂ Ultimate pressure: 10 ⁻⁸ Pa Maximum intake pressure: 53 Pa Intake and evacuation ports: 100 ISO-K, 25KF Mass: 12 kg	1

Device name	Model/Specification	Qty.
5) Oil rotary vacuum pump (RP)	Model: GLD-202B Evacuation flow: 200 l/minute Ultimate pressure: 6.7×10^{-2} Pa Required electric power: 0.55 kW Hydraulic oil: 1.1 L of SMR-100	1
6) Automatic leak valve	Model: LCLV-25-100V Caliber: MW-25	1
7) Main valve	Model: SBVM-4AX butterfly valve Caliber: VG-100	1
8) Three-way valve	Model: 3W-25K Caliber: 20A	1
9) Vacuum gauge	Model: ISG1 Gauge head: M-34/WP-01	1

Refer to specification sheet for custom-built specifications.

5. Standard accessories

1) Electric power cable	Main unit: 100 V, single phase, crimped terminals, 4 m Evaporator unit: 200 V, single phase, crimped terminals, 2 m	1 1
2) Operation manual	Ordinary paper	1
3) Vacuum performance test sheet	Ordinary paper	1
4) Allen wrench	3 mm	1
5) TMP intake cap	Turbo molecular pump intake cap (for shipping)	1

Refer to specification sheet for custom-built specifications.

6. Using the switch, handle, and operating lever



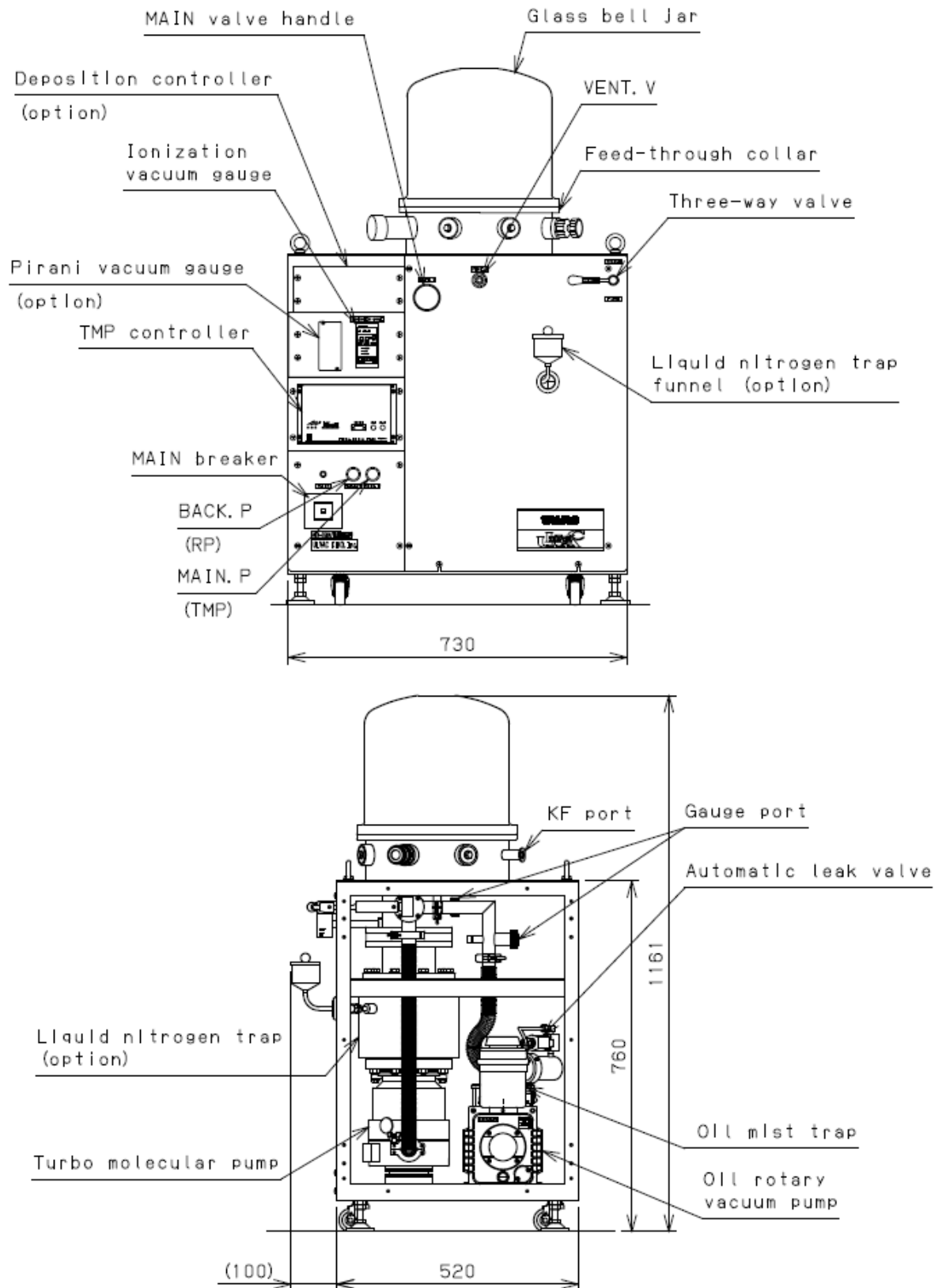
Be careful

Always perform a safety check and condition of the device before operating the switch, handle, or operating lever.

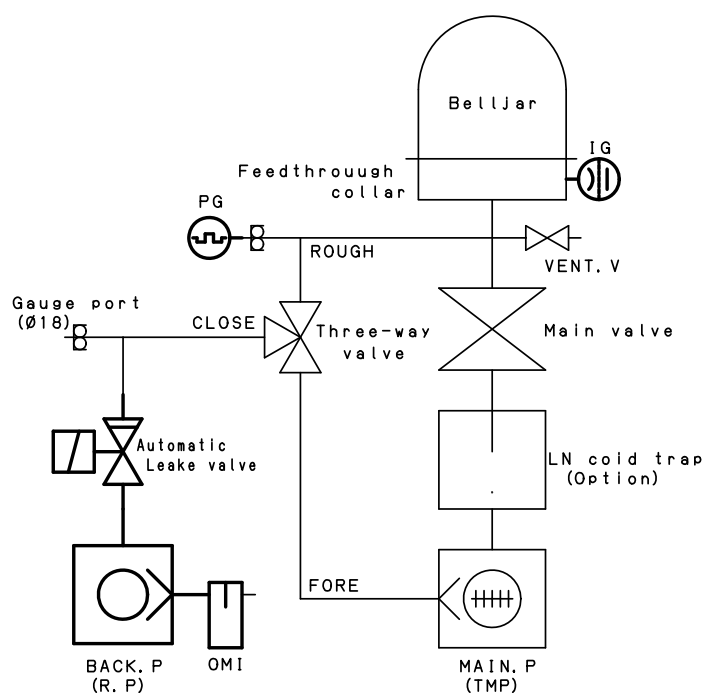
Name	Operation
Main switch	Manual on/off. Lamp comes on.
BACK.P(or R.P) switch	Manual on/off. Lamp comes on.
MAIN.P(or TMP) switch	Manual on/off. Lamp comes on.
Main valve handle	Counterclockwise to open, clockwise to close
Three-way valve	Operate by turning lever to fore, close, or rough position.
VENT V	Screw type Counterclockwise to open, clockwise to close

Note: Refer to the appropriate operation manual for details on component device switches.

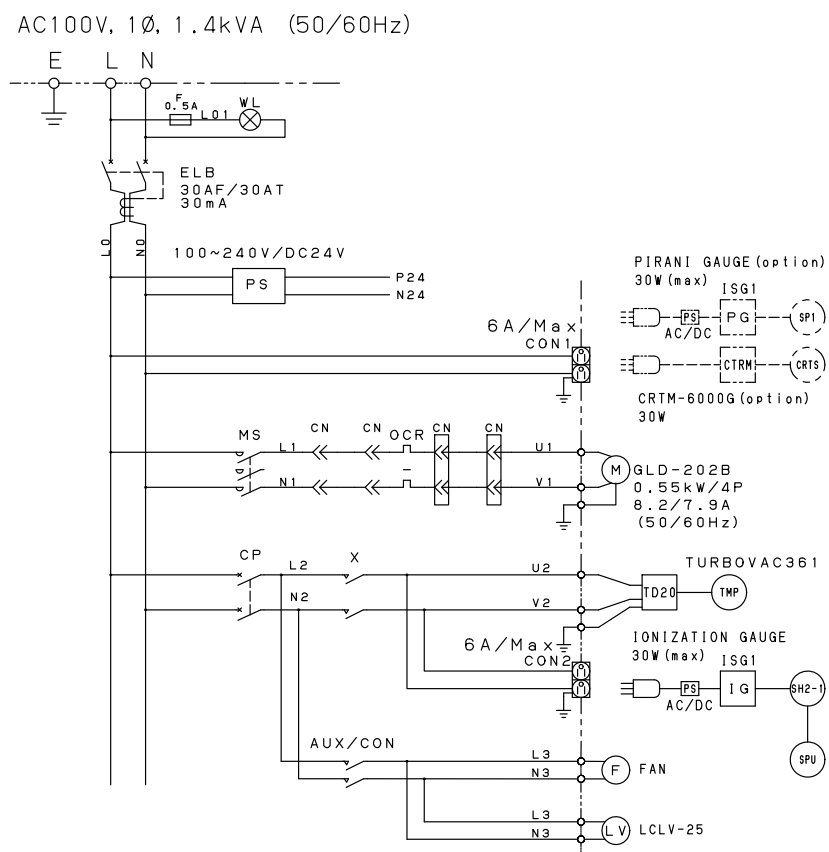
7. Switch, handle, and operating lever layout



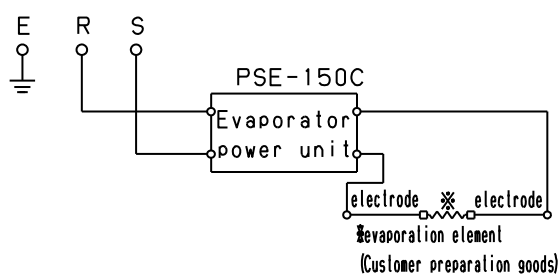
Evacuation system schematic



Electrical system schematic




AC200V, 1Ø, 1.5kVA (50/60Hz)



(3) Unpacking and installation




1. General precautions

 Review	<ol style="list-style-type: none">1) Verify that the product conforms to what was ordered.2) Verify that all necessary appurtenant parts are included.3) To ensure safety during installation, maintain a 1-meter-wide space around the perimeter of the device.4) Once the location is finalized, secure the device in place using the adjusters.
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2. Packaging at time of delivery

The main unit (with casters) will be packed in a wooden crate and the appurtenant parts will be packaged in a box at time of delivery.
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3. Location

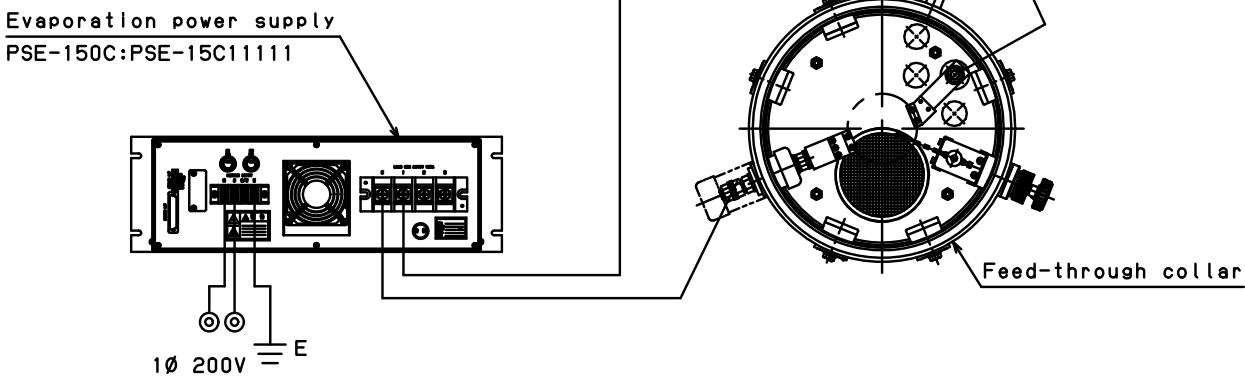
 WARNING	 Location Verification	<p>This device is to be installed in an area that satisfies the following conditions.</p> <ol style="list-style-type: none">1) Has a level floor.2) Has a floor of sufficient strength.3) Is well ventilated.4) Is not subject to direct sunlight.5) Has a temperature range of 7–30°C.6) Is not subject to open flame.7) Is not exposed to chemicals or other substances likely to cause corrosion.8) Is not subject to noise or other forms of electromagnetic interference. <p>Failure to satisfy these conditions could result in malfunctions or reduce the durability of the device.</p>
 Check	To ensure safety after installation, maintain a 50 cm clearance to walls and keep all maintenance space free of obstruction.	

4. Power source

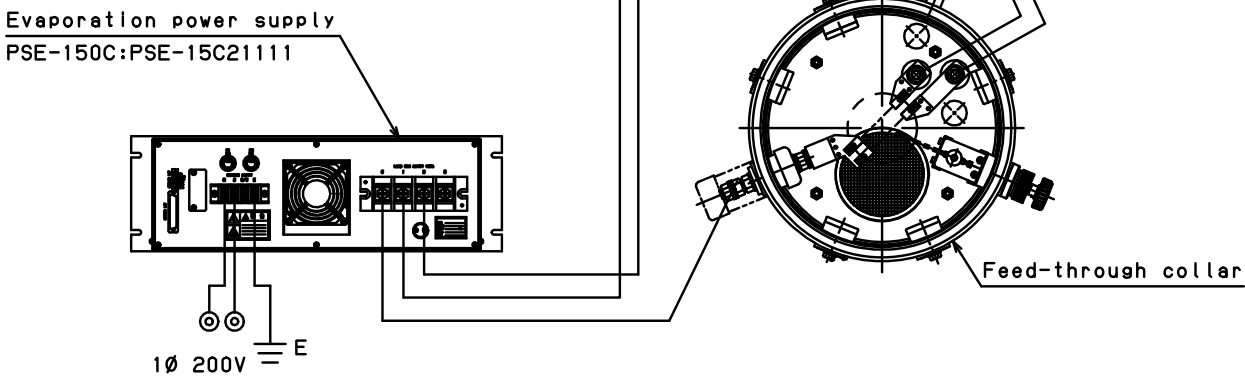
 WARNING	 Check rating	<p>Primary power supply</p> <p>Prepare the following.</p> <p>Single-phase 100 V, 14.0 A or more</p> <p>Single-phase 200 V, 7.5 A or more</p> <p>Failure to use the correct power supply could result in the circuit breakers tripping during operation due to overcurrent.</p>
<p>Primary cable specifications</p> <p>For single phase, 100 V: 4 m cable with 4 mm dia. crimped terminals</p> <p>For single phase, 200 V: 2 m cable with 5 mm dia. crimped terminals</p>		
 WARNING	 Exclusive use	<p>The primary electrical power supply should be reserved for the exclusive use with this equipment and not shared with any other device.</p> <p>Lack of circuit breaker capacity could result in the circuit breakers tripping during operation due to overcurrent.</p>
	 Electrical Ground	<p>Always make sure that the equipment is properly connected to a type D ground.</p> <p>Ground cables are color-coded green.</p> <p>A faulty ground connection could result in electrical shock or damage to equipment.</p>
	 Check cable rating	<p>Avoid using extension cables if possible. In the event that an extension cable must be used, be sure it conforms to the following:</p> <p>100 V, 3.5 mm² or larger</p> <p>200 V, 2.0 mm² or larger</p> <p>A cable that is too small could easily overheat and result in a fire.</p>
	 Prohibited	<p>Do not place objects on top of primary power supply cables.</p> <p>To do so could result in electrical shock or cause a fire.</p>
	 Electrical Shock	<p>Even after opening the main circuit breakers, the cables are live up to the breaker itself. Do not touch the terminals.</p> <p>To do so could result in electrical shock.</p>

Evaporator power source schematic

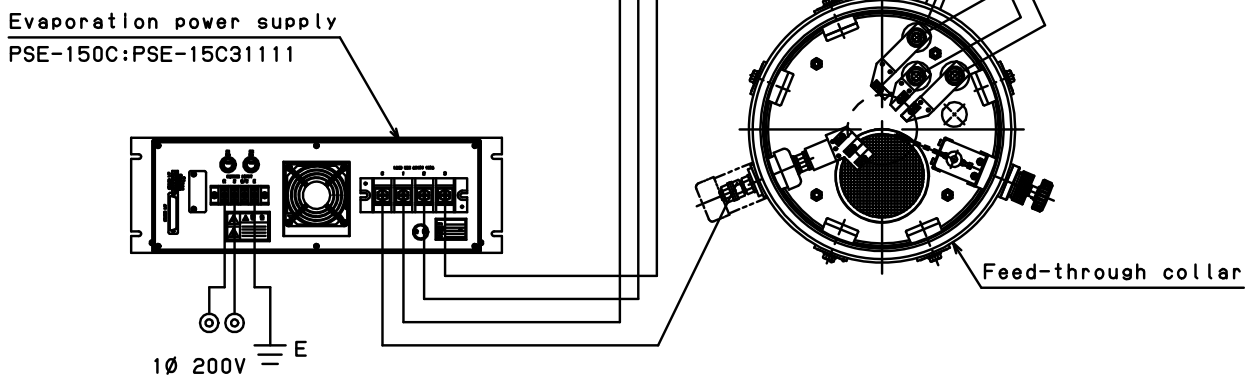
<1 points>



<2 points (option) >



<3 points (option) >









5. Required Tool List

Name	Use
Phillips screwdriver	Installation of primary power cable Attaching the Vacuum gauge head
Hexagonal wrench (WAF1.5)	Attaching the Vacuum gauge head
Torque wrench or socket (WAF13)	Installation of evaporator power cable

(4) Operation

1. Potential dangers and safety precautions during operation

 WARNING	 Prohibited	<p>The glass bell jar should not be exposed to either shock or temperatures above 50°C. Breakage while the bell jar is depressurized could result in the scattering of glass fragments.</p> <p>Could result in breakage.</p>
	 Requires ventilation	<p>Forced ventilation is required when using liquid nitrogen (optional). Gasification of liquid nitrogen could result in reduced interior oxygen levels.</p> <p>Could result in illness due to oxygen deficiency.</p>
 CAUTION	 Wear gloves	<p>When handling liquid nitrogen, always wear rubber gloves or otherwise protect exposed parts of the body.</p> <p>Direct exposure of the skin to liquid nitrogen droplets could result in momentary but intense pain.</p>
	 Valve fully closed	<p>After confirming that the main valve is fully closed, open the vacuum chamber to the atmosphere.</p> <p>Air entering the turbo molecular pump during operation could result in damage to the pump.</p> <p>If air is mixed in during injection of liquid nitrogen, a considerable volume of condensable gas will form on the trap, resulting in significant loss of performance.</p>

2. Evacuation device operation

2-1 Preparation

- 1) Attach the Pirani gauge to the gauge port of the vacuum chamber bottom.
- 2) Attach the ionization vacuum gauge head to the vacuum chamber KF port.
- 3) Close the three-way valve and the main valve.
- 4) Turn off all switches on the operation panel.
- 5) Turn on the customer-side power breaker.
 - Unit power supply lamp: ON

2-2 Operation

Starting up the device

- 1) Turn on the main switch.
- 2) Turn on the BACK.P(or RP). (Open automatic leak valve.)
- 3) Set the three-way valve to Fore.
- 4) After 1 minute exhaust, Turn on the MAIN.P(or TMP). (power supply energized)
- 5) Press the START button on the TMP controller. The STATUS lamp will begin to flash.
- 6) After approximately two minutes, the TMP rated speed status lamp comes on.
- 7) Fill with liquid nitrogen. (as necessary)

Reference:

Liquid nitrogen quantities: (Liquid nitrogen trap is optional)

Fill to a maximum of 1.4 L (including vaporization)
1.4 L should last five to six hours.

Once the liquid nitrogen has evaporated completely, the condensable gas that was trapped will separate and pressure will worsen for approximately 30 minutes. This is not a malfunction.
Close the main valve completely to prevent contamination of the vacuum chamber.

2-3 Shut down

Shutting down the device

- 1) Evacuation for maintaining vacuum in the vacuum chamber.
- 2) If using an ionization vacuum gauge, turn the filament off.
- 3) Close the main valve.
- 4) Press the STOP button on the TMP controller. (STATUS lamp begins to flash.)
- 5) After 40 to 50 minutes, the TMP will shut down. (STATUS lamp goes out.)
- 6) Turn off the MAIN.P(or TMP).
- 7) Close the three-way valve.
- 8) Turn off the BACK.P(or RP).
Close the automatic leak valve, open the RP to the atmosphere.
- 9) Turn off the main switch.
- 10) Turn off the customer-side power breaker. (as necessary)
- 11) Allow any residual liquid nitrogen to evaporate naturally.

3. Vapor deposition operation

3-1 Opening the vacuum chamber

- 1) Close the main valve.
- 2) Set the three-way valve to Fore.
- 3) If necessary, open the vent valve slowly.

Reference:

Filling the vacuum chamber with dry air or nitrogen gas when opening will help prevent contamination.

Opening the vacuum chamber to the atmosphere could cause contamination by allowing moisture to enter.

Vent valve/Synflex coupling: C1N1/4 × PT1/8 (Appurtenant part)

3-2 Vacuum chamber evacuation

- 1) Close vent valve.
- 2) Attach bell jar.
- 3) Set the three-way valve to Rough.
Obtain rough vacuum inside vacuum chamber.
- 4) Verify that the vacuum gauge reads 10 Pa or less.
- 5) Set the three-way valve to Fore.
- 6) Open the main valve.

4. Creating a film

4-1 Preparation

- 1) Open the vacuum chamber, as described in section 3-1.
- 2) Attach the evaporation element (boat, filament, etc.) to the electrode.
- 3) Supply a vapor source to the evaporation element.
- 4) Close the shutter.
- 5) Attach the material to be coated (substrate).
- 6) Open the vacuum chamber, as described in section 3-2.
Evacuate to the desired pressure level.

4-2 Creating a film

- 1) Turn on the evaporator main power.
 - 2) Turn on the evaporator select switch.
 - 3) HIGH (lamp lighting) Confirmation
 - 4) MANUAL (lamp lights out) Confirmation
 - 5) Turn on the evaporator power switch.
 - 6) The current is gradually thrown to the evaporation source pushing the
UP ▲ key.
 - 7) Once the evaporation element is red hot and the vapor source has started to
melt, use the shutter to remove impurities from the evaporation element.
 - 8) Open the shutter to apply film to the material to be coated (substrate).
 - 9) Once vapor deposition is completed, close the shutter.
 - 10) Turn off the evaporator power switch.
 - 11) Turn off the evaporator main power.
 - 12) Open the vacuum chamber, as described in section 3-1, and remove the
coated material (substrate).
- Repeat as necessary from step 4-1.

Reference:

- Film thickness: Adjusted by the time of formation
- Rate: Adjusted by the current flown through the evaporation source

5. Handling malfunctions

5-1 Instantaneous loss of power

- With the exception of the TMP, all devices automatically return to status prior to loss of power.
- The TMP does not recover automatically after power is restored.
The POWER and STOP lamps come on.
Once again, press the START button on the TMP controller.
After verifying that the NORMAL indicator is on, perform valve and other operations.

5-2 Long term loss of power

- 1) Fully close the main valve.
- 2) Close the three-way valve.
- 3) Turn off all switches on the operation panel.

The TMP will shut down, but because the break does not function, the rotor will continue to spin. Since the rotor continues to spin at a high speed, DO NOT open the TMP to the atmosphere under any circumstances.

Note: A solenoid valve is installed to protect the TMP during long-term loss of power.

5-3 Operation after power is restored











Press the STOP button on the TMP controller to shut down the TMP.

(It will require 40 to 50 minutes for the rotor to stop spinning.)

To restart operation, once again follow the procedures given in 2-1 Preparation and 2-2 Operation in section 2. Evacuation device operation, but since the TMP rotor could still be in motion, be sure to perform sufficient evacuation of the rough vacuum piping with the three-way valve set to Close before switching to Fore.

(5) Maintenance and repair

1. Potential dangers and safety precautions during maintenance and repair

 WARNING	 Wear protective equipment	<p>Always wear gloves and a protective mask when cleaning the thin film that forms on the bell jar and feed-through collar.</p> <p>The thin film comprises fine particulate that could become suspended in the air and enter the lungs while breathing.</p>
	 Wear protective equipment	<p>Always wear gloves and a protective mask when changing the oil to the oil rotary vacuum pump.</p> <p>Failure to do so could result in illness.</p>
	 Be careful	<p>The glass bell jar weighs approximately 7 kg. Always maintain proper posture when attaching it to or removing it from the device.</p> <p>Failure to do so could result in injuries to the spine or pelvis as well as damage to the bell jar.</p>
	 Inspection	<p>If the lifter (optional) is installed, inspect the eyebolt and attachment clip at the end of the wire rope for looseness on a daily basis.</p> <p>Failure to do so could result in damage to the glass bell jar.</p>
 CAUTION	 Requires more than one person	<p>Installation or removal of the turbo molecular pump or oil rotary vacuum pump is to be performed by two or more people.</p> <p>Take the necessary precautions to avoid dropping it or hurting your back.</p>
	 Periodic replacement	<p>Replace the oil mist trap element once every 6 to 12 months.</p> <p>A clogged element will cause higher evacuation resistance and could result in leakage from the spindle seal or damage to the oil level gauge.</p>
	 Abide by the law	<p>The proper disposal of oil used in this device is stipulated by law.</p> <p>Disposal of this device is to conform to all applicable laws and regulations.</p> <p>Please contact your sales representative if you have questions regarding proper disposal.</p>
	 Prohibited	<p>Do not modify this device in anyway.</p> <p>We cannot be responsible for modifications.</p>

2. Maintenance and repairs that the customer can perform

- 1) Replacing O-rings. (Except for the oil rotary vacuum pump)
 - 2) Cleaning the feed-through collar and glass bell jar.
 - 3) Replacing the oil rotary vacuum pump or turbo molecular pump.
 - 4) Replacing the oil in the oil rotary vacuum pump.
 - 5) Replacing the oil mist trap element.
 - 6) Replacing the vacuum Gauge head.
- Please contact your sales representative about any item not listed here.

3. Removal, maintenance, and reinstallation of devices

3-1 Oil rotary vacuum pump

- 1) Required tools: 8-mm spanner wrench, 4-mm Allen wrench
- 2) Removal
 - Verify that all devices are turned off.
 - Verify that all primary power sources are disconnected.
 - Remove the side panels and the back panel, as necessary.
 - Disconnect both the wiring connectors to the motor by pulling them laterally.
 - Disconnect the automatic leak valve wiring and ground wiring
 - Remove the flexible tubing and the automatic leak valve.
 - Remove four nuts for anti-vibration rubber pads from the inside of the base bottom.
 - Remove the pump unit by lifting at the motor and front cover. (requires two people)
 - Remove four anti-vibration rubber pads.
- 3) Replace oil

Refer to the Oil rotary vacuum pump Operation Manual.
- 4) Attachment
 - Attach four anti-vibration rubber pads.
 - Attach the pump unit by lifting at the motor and front cover. (requires two people)
 - Attach four nuts for anti-vibration rubber pads.
 - Attach the flexible tubing and the automatic leak valve.
 - Connect the automatic leak valve wiring and ground wiring.
 - Connect both the wiring connectors to the motor.
 - Attach the side panels and the back panel, as necessary.

3. Removal, maintenance, and reinstallation of devices

3-2 Turbo molecular pump (TMP)

1) Required tools: a 13-mm spanner wrench

2) Removal

- Verify that all devices are turned off.
- Verify that all primary power sources are disconnected.
- Remove the front panel.
- Remove the side panels and the back panel, as necessary.
- Set the three-way valve to Fore. (Open TMP to atmosphere.)
- Remove the wiring connectors to the TMP.
- Remove all evacuation port clamps, flexible tubing, and center ring O-rings.
- Remove the four intake flange claw clamps.
(Provide support for the turbo molecular pump when removing bolts.)
- Remove the turbo molecular pump by pulling it forward.

3) Shipping procedure

- Place desiccant in the splinter guard of the pump intake port before closing the port with its cap (appurtenant part).
- Take care that the device is not subject to vibration or impact during transport.
Refer to the Turbo Molecular Pump Operation Manual.

4) Attachment

- Refer to the Turbo Molecular Pump Operation Manual for details on preparation.
- The turbo molecular pump evacuation port should be placed on the left-hand side of the device beneath the main valve (or LN trap (optional)) flange.
- Lift the turbo molecular pump into place, attach and hand tighten two claw clamps to hold in place, then attach the remaining two claw clamps.
- Tighten the claw clamps evenly (tighten bolts in opposing pairs).
- Attach the centering O-ring, flexible tubes, and clamps to the evacuation port.
- Attach the wiring connectors to the TMP.
- Attach the front panel.
- Attach the side panels and the back panel, as necessary.

3. Removal, maintenance, and reinstallation of devices

3-3 Oil mist trap OMI-200

- 1) Required tools: Rod (appurtenant part)
- 2) Removal
 - Insert the rod into the bottom of the oil mist trap unit and turn counterclockwise to loosen.
 - Holding the oil mist trap unit in both hands, turn it counterclockwise to remove.
- 3) Replace element
Refer to the Oil Mist Trap Operation Manual.
- 4) Attachment
 - Attach an O-ring to the bottom of the oil mist trap unit.
 - Mate the trap to the oil rotary vacuum pump evacuation port, and holding it in both hands, rotate clockwise to tighten.
Note: Take care that the O-ring does not fall out when tightening the trap.
 - Insert the rod into the bottom of the oil mist trap unit and tighten.

3-4 Glass bell jar O-ring.

- 1) Required Tools: none
- 2) Removal
 - Take care not to damage the groove when removing O-ring.
- 3) Attachment
 - Apply vacuum grease to the surface of the new O-ring.
(Apply as thin a coat as possible.)
 - Clean the inside of the O-ring groove.
 - Insert the new O-ring into the groove.

3-5 Glass bell jar

- 1) Required tools: Protective mask, gloves
- 2) Removal
 - Remove the glass bell jar by lifting it up.
- 3) Cleaning
 - Put on protective equipment (protective mask, gloves) and remove any foreign substances using alcohol, etc.
- 4) Attachment
 - Replace the glass bell jar, making sure that the flange at the bottom of the jar seats evenly atop the O-ring. (Note: If the flange is not seated evenly, the jar could come be damaged by contact with metal.)

4. Maintenance and inspection

Location (device)	Description	Timing
Glass bell jar	Clean interior	As necessary
Oil rotary vacuum pump	Oil level within markings on oil level gauge.	Prior to operation
	Replace oil When pressure during exclusive operation exceeds 5 Pa.	As necessary
Turbomolecular pump	Ensure that the cooling fan is rotating.	Each time used
Main valve	Clean valve seal surfaces.	Every 6 to 12 months, or when foreign substances are observed.
Vacuum gauge	Replace the gauge head.	As necessary
Oil mist trap	Replace element	Every 6 to 12 months
Electrical cables	All terminals and set screws are securely in place.	As necessary

Periodic inspection of functionality

The following tests are to be performed periodically, at least once or twice a month.

Ultimate pressure test

Measure ultimate pressure after maintaining a vacuum for an extended period of time exclusively with the main unit.

Any degradation of performance is likely caused by either of the following:

- 1) Soiling of the vacuum system
- 2) Leakage

Evacuation characteristics test

If evacuation performance is poor in spite for the fact that ultimate pressure does not show significant degradation, consider either of the following:

- 1) Gas being used has high moisture content.
- 2) The vacuum system is either soiled or corroded.

Note: During periodic inspections, follow the procedures given in the respective manuals of each device.

In particular, since the TMP is very expensive, it should be maintained very carefully.

5. Troubleshooting

Status	Cause	Countermeasure
Poor ultimate pressure or Unstable ultimate pressure or Loss of evacuation pressure	High ambient temperature	Use HVAC to lower ambient temperature to a maximum of 25°C.
	Operating time is very short immediately after installation or long-term shutdown.	Operate for 24 to 48 hours, then review.
	Leakage	Investigate area near last processed part prior to loss of ultimate pressure.
		Clean glass bell jar O-ring. Replace worn parts.
	Use of material to be coated (substrate) that gives off a considerable volume of gas. Example: Plastic substrate, etc.	Use different material. Use longer evacuation time.
	Defective turbo molecular pump	Refer to the Turbo Molecular Pump Operation Manual.
	Defective oil rotary vacuum pump	Refer to the Oil Rotary Vacuum Pump Operation Manual
	Defective measurement instruments.	Refer to the operation manual for the relevant instrument.
Malfunction of the turbo molecular pump	Defective wiring or electrical contact. Defective component parts.	Refer to the Turbo Molecular Pump Operation Manual.
Malfunction of the turbo molecular pump power source	Open phase TD20 control malfunction Roughing pressure defect Abnormal temperature Overcurrent Internal system defect	Refer to the Turbo Molecular Pump Power Source Operation Manual.
There is no current supplied to the evaporator electrode even though the power is on.	Defective evaporation element.	Replace the evaporation element.
	The electrode is shorting to the feed-through collar.	Replace insulation to repair the short.
	Defective evaporator power source.	Refer to Evaporator Power Source Operation Manual.
Pressure measured on the roughing side indicates wrong values when the vacuum chamber is exposed to open air.	Defective main valve gate.	Clean the main valve seal surface.
The thermal protector to the oil rotary vacuum pump trips.	Overload	Refer to the Oil Rotary Vacuum Pump Operation Manual.

6. Storage

Refer to the following guidelines if the unit is to be placed in long-term storage.					
1) Storage area					
<ul style="list-style-type: none"> Has a floor of sufficient strength. Is well ventilated. Is not subject to direct sunlight. Is not exposed to chemicals or other substances likely to cause corrosion. 					
2) Prior to and during storage					
<ul style="list-style-type: none"> Maintain a vacuum in the vacuum chamber. Secure the device in place using the adjusters. If a lifter (optional) is installed, remove the bell jar cover ring latch and lower the lifter unit so that its weight is supported by the bracing. 					

7. List of consumable parts

Location of Use	Parts	Specifications	Material	Quantity	Replacement by user
Feed-through collar	O-ring for flange	P315	NBR	1	Yes
	Center ring O-ring for KF port	NW16 (KF16)	FPM	1	Yes
	O-ring for service port seal	P30	NBR	5	Yes
	O-ring for base plate seal	P22A	NBR	3	Yes
	O-ring for shutter axle	N7	NBR	2	Yes
	O-ring for shutter unit	P32	NBR	1	Yes
	Electrode gasket	KS-1022-14-004R2	FPM	1	Yes
	Electrode gasket	KV-1297-01-096	FPM	1	Yes
	Ionization vacuum gauge head	M-34	--	1	Yes
Upper conversion flange	O-ring for intake flange	V120	NBR	1	Yes
	O-ring for gauge port	N16	NBR	1	Yes
	O-ring for leak valve	N6	NBR	1	Yes
	O-ring for leak valve	N8	NBR	1	Yes
	Pirani vacuum gauge head	WP-01	---	1	Yes
Lower conversion flange	O-ring for intake flange	V120	NBR	1	Yes



7. List of consumable parts

Location of Use	Parts	Specifications	Material	Quantity	Replacement by user
Main valve	O-ring for intake flange	V120 (appurtenant part)	FPM	1	Yes
	O-ring for valve body	P85 (appurtenant part)	FPM	1	Yes
	O-ring for valve stem	P10A (appurtenant part)	FPM	2	×
Turbo molecular pump (TMP)	O-ring for intake flange	100ISO-K (appurtenant part)	FPM	1	Yes
	Center ring O-ring	NW25 (appurtenant part)	FPM	1	Yes
Oil rotary vacuum pump	Oil	SMR-100	--	1.1 L	Yes
	Anti-vibration rubber pads	ME-20	--	4	Yes
Three-way valve	O-ring	S42 (appurtenant part)	FPM	3	×
	O-ring	P25 (appurtenant part)	FPM	2	×
	O-ring	P10A (appurtenant part)	FPM	3	×
	Centering O-ring	NW25	FPM	2	Yes
Rough vacuum piping	O-ring for gauge port	N16	NBR	1	Yes
Operation panel	Indicator lamp	LMS-4BH	--	1	×
	Lighted push button switch	AR22F5L	--	2	×
ISO conversion flange	O-ring for ISO conversion flange	V120	NBR	1	Yes



Quantity and type will vary for custom-built specifications.

(6) Disposal

1. Precautions during disposal

 CAUTION	 Abide by the law	<p>Proper disposal of this device and its pumps as industrial waste is stipulated by law.</p> <p>Dispose of properly in accordance with all applicable laws and local regulations.</p>
<p>This device is subject to Waste Management and Public Cleansing Law of Japan.</p>		
<p>Disposal:</p> <ol style="list-style-type: none"> 1) Transportation is to be performed by an entity licensed to collect and transport industrial waste. 2) Disposal is to be performed by an entity licensed to dispose of industrial waste. 		

(7) Optional parts

 CAUTION	 Prohibited	<p>Do not modify this device in any way other than the installation of standard options.</p> <p>We cannot be responsible for modifications.</p>
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1. List of standard optional parts

Name of Optional Part	Application	Installation
Two-point evaporator electrode (switchable)	Two-point switchable deposition	Factory assembly only
Two-point evaporator electrode (simultaneous)	Two-point simultaneous deposition	Factory assembly only
Three-point evaporator electrode (switchable)	Three-point switchable deposition	Factory assembly only
Three-point evaporator electrode (simultaneous)	Three-point simultaneous deposition	Factory assembly only
Three-point evaporator electrode (custom)	One-plus-two-point switchable deposition	Factory assembly only
Four-point evaporator electrode (custom)	Two-plus-two-point switchable deposition	Factory assembly only
Four-point evaporator electrode (custom)	One-plus-one-plus-two-point switchable deposition	Factory assembly only
20-port feed-through collar	Feed port expansion	Factory assembly only
Filament holder	Secure the evaporation element.	Can be attached by customer

1. List of standard optional parts

Name of Optional Part	Application	Installation
Electrode set (for service port)	Electrode for deposition	Can be attached by customer
Electrode set (for base plate)	Electrode for deposition	Can be attached by customer
Gauge port set	Addition of 18 mm dia. gauge port	Can be attached by customer
Hermetic port set	Addition of hermetically sealed port	Can be attached by customer
Sealing flange set	For sealing service port	Can be attached by customer
Sealing flange set	For sealing base plate	Can be attached by customer
UFC070 adapter	For attaching 070 conflat flange	Can be attached by customer
NW25 adapter	For attaching NW25 flange	Can be attached by customer
Gas filling port	For filling vacuum chamber with gas	Can be attached by customer
SEREM evaporator power source	Power source for evaporator (with automated external controller) Used in combination with coating controller to control coating speed	Can be attached by customer
Evaporator power cable	Power cable for evaporator	Factory assembly only
Glass bell jar	Glass container for creating thin film coating	Can be attached by customer
Bell jar holder	Handle for glass bell jar	Can be attached by customer
Bell jar cover	Handle for glass bell jar Prevent scattering of chipped glass	Can be attached by customer
Metallic bell jar	For heating bell jar interior	Factory assembly only
Metallic bell jar (with cooling coil)	For heating bell jar interior	Factory assembly only
Lifter	For lifting bell jar	Factory assembly only
Pirani gauge	Meter to measure pressure	Factory assembly only

1. List of standard optional parts

Name of Optional Part	Application	Installation
Holder for material to be coated (260 mm dia.)	To secure material	Can be attached by customer
Anti-soiling plate	Prevents vapor from sticking to glass bell jar	Can be attached by customer
Electrode partition (two points)	Evaporation element partition for preventing contamination	Can be attached by customer
Electrode partition (three points)	Evaporation element partition for preventing contamination	Can be attached by customer
Electrode partition (four points)	Evaporation element partition for preventing contamination	Can be attached by customer
Substrate heater	Heat material up to 350°C	Can be attached by customer
Substrate heater	Heat material up to 650°C	Factory assembly only
Substrate heater/cooler	Heat or cool material	Factory assembly only
Carbon electrode set	For creating carbon coating	Can be attached by customer
Oil mist trap	For trapping oil mist from oil rotary vacuum pump at evacuation port.	Can be attached by customer
In-line type oil mist trap	For trapping oil mist from oil rotary vacuum pump at evacuation port. Connects to evacuation duct.	Can be attached by customer
Side panel	Conformance with safety regulations	Can be attached by customer
Back panel	Conformance with safety regulations	Can be attached by customer
Control and operation panel	Houses control devices	Factory assembly only
Side panel (for control and operation panel)	Conformance with safety regulations	Can be attached by customer
Back panel (for control and operation panel)	Conformance with safety regulations	Can be attached by customer
Liquid nitrogen trap	For catching reverse oil flow and condensable gas	Factory assembly only
Coating controller	For measuring and controlling coating thickness and speed	Can be attached by customer
Coating thickness sensor	Sensor for use with coating controller	Can be attached by customer
Cooling piping for use with coating thickness sensor	For adding cooling piping for use with coating thickness sensor	Factory assembly only