

Instruction Manual

Compact Vacuum Evaporator

DEPOX

(VFR-200M/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 VFR-200M/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</p> <p>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</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>
	 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>
	 Leave open air	<p>After the oil sealed rotary vacuum pump stops, open BACK.P VENT(or RP LEAK) to leave the inside of the roughing piping open air.</p> <p>This must be done to prevent reverse oil flow.</p>
	 Confirm complete close	<p>After confirming complete closure of the main valve, let out the air in the vacuum chamber.</p> <p>If air comes into the oil diffusion pump during operation, it deteriorates the oil and lowers the performance.</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 diffusion pump and oil rotating 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
Overheating	Prevent overheating of oil diffusion pump	In the event that a cooling fan or other malfunction results in the oil diffusion pump (cooling fins) exceeding a temperature of 85°C, a thermostat will cut power to the heater. Automatic 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	8.0×10^{-4} Pa (Unloaded, clean vacuum chamber) 6.0×10^{-4} Pa (Using liquid nitrogen in unloaded, clean vacuum chamber)
During evacuation	Up to 4.0×10^{-3} Pa for 15 minutes (For unloaded, clean vacuum chamber) Up to 3.0×10^{-3} Pa for 15 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 × D603 mm × H1,161 mm W480 mm × D435.3 mm × H149 mm Approx. 142 kg Approx. 40 kg
Color of main unit	JIS S5-462 baked (Munsell 5GY8/0.5)

Refer to specification sheet for custom-built specifications.

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) Oil diffusion pump (DP)	Model: DPF-200 Evacuation flow: 200 l/second Ultimate pressure: 10 ⁻⁵ Pa Intake and evacuation ports: VG65 or equivalent, NW25 Required electric power: 0.45 kW Hydraulic oil: SX 0.07 L	1

Device name	Model/Specification	Qty.
5) Oil rotary vacuum pump (RP)	Model: G-101D Evacuation flow: 100 l/minute Ultimate pressure: 6.7×10^{-2} Pa Required electric power: 0.4 kW Hydraulic oil: SMR-100 0.8 L	1
6) Main valve	Model: SBVM-2.5AX butterfly valve Bore: VG-65	1
7) Liquid nitrogen trap	Bore: 65A Injection quantity: 0.75 L (including vaporization)	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	1
	Evaporator unit: 200 V, single phase, crimped terminals, 2 m	1
2) Operation manual	Ordinary paper	1
3) Vacuum performance test sheet	Ordinary paper	1
4) Allen wrench	3 mm	1
5) BACK.P VENT (or RP VENT) cap	Rough vacuum piping vent valve cap	1

Refer to specification sheet for custom-built specifications.

6. Using the switch, handle, and operating lever



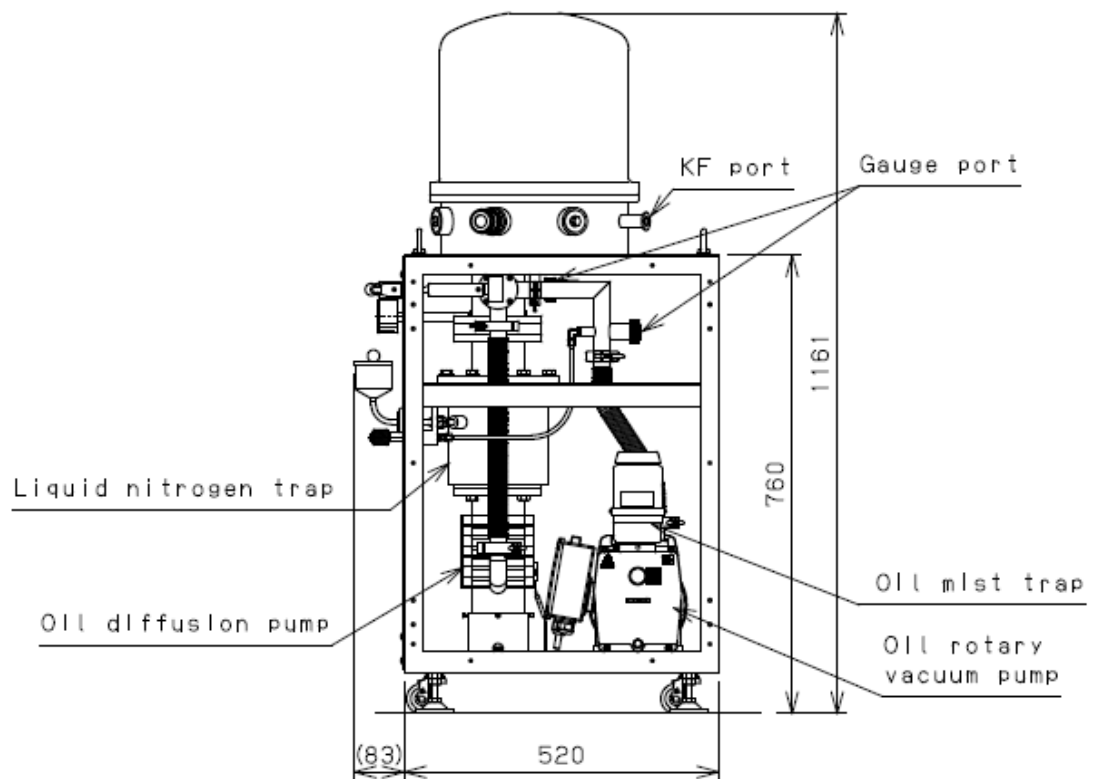
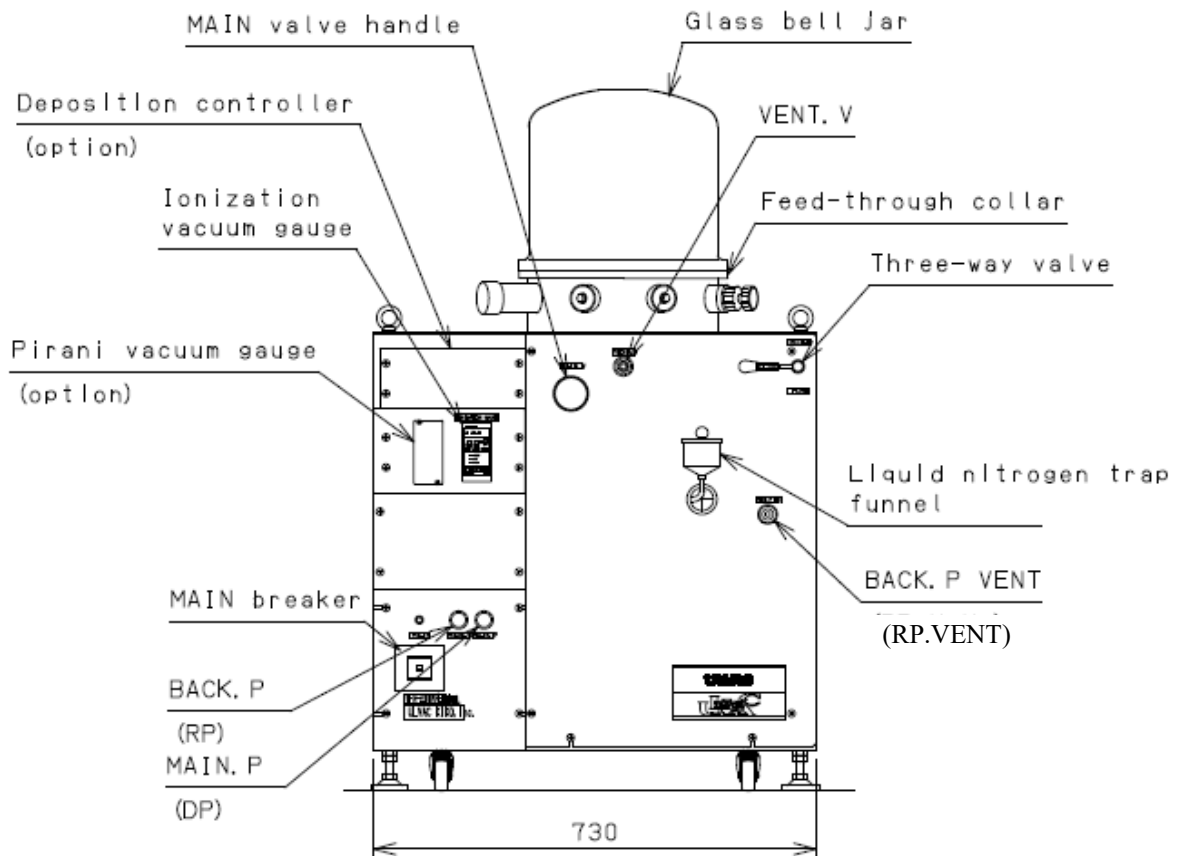
CHECK

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

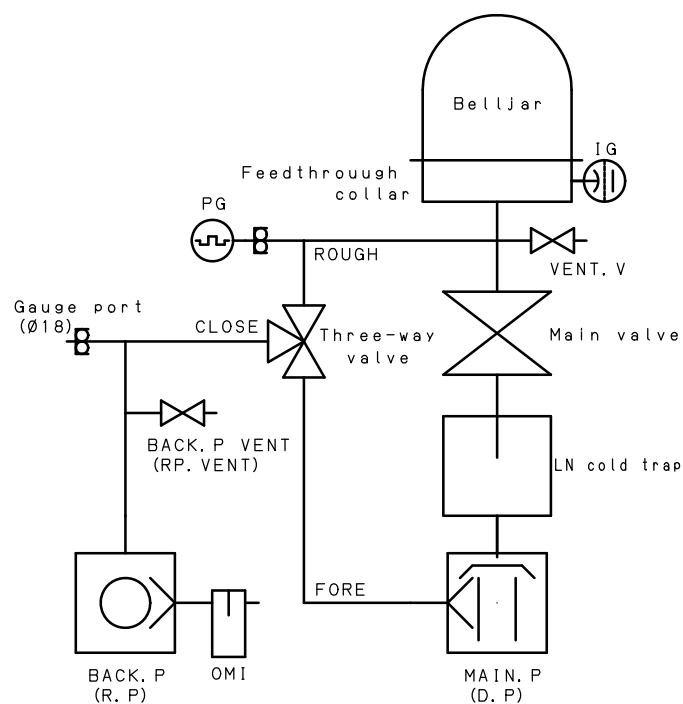
Name	Operation
Main switch	Manual on/off. Lamp comes on.
BACK.P(or R.P) switch	Manual on/off. Lamp comes on.
MAIN.P(or D.P) switch	Manual on/off. Lamp comes on.
Main valve handle	Counterclockwise to open, clockwise to close
Three-way valve	Operate by turning lever to fore, close, or rough position.
BACK.P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

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

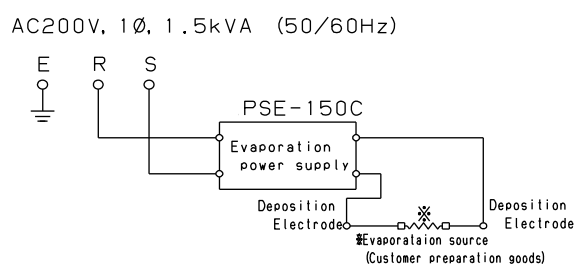
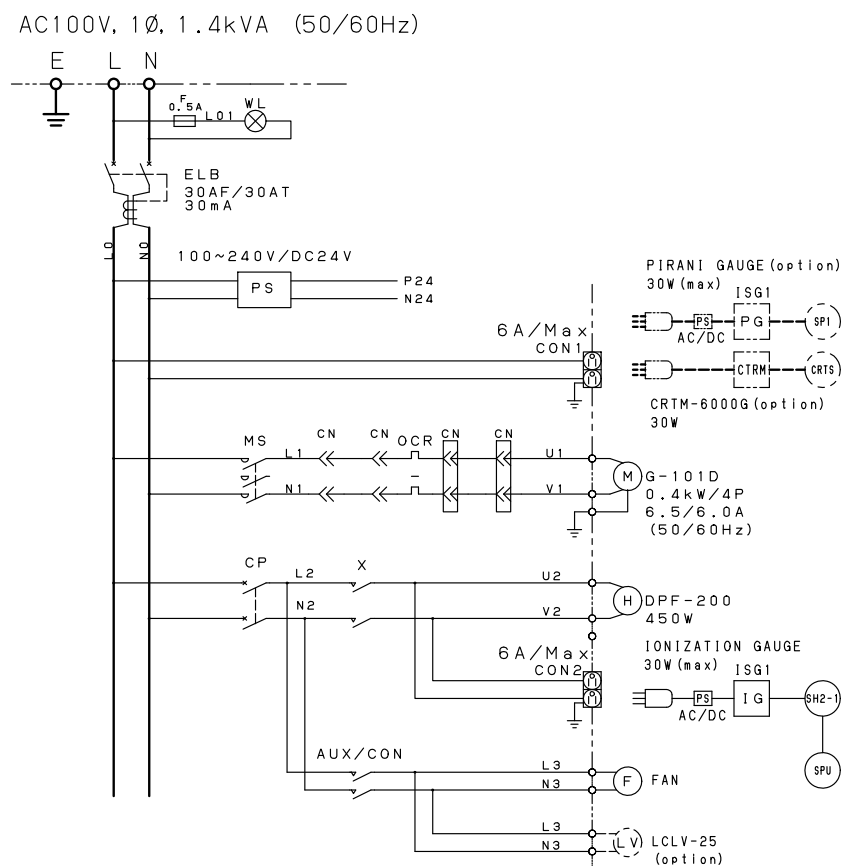
7. Switch, handle, and operating lever layout



Evacuation system schematic




Electrical system schematic



(3) Unpacking and installation




1. General precautions

 CHECK	<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.

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	<p>To ensure safety after installation, maintain a 50 cm clearance to walls and keep all maintenance space free of obstruction.</p>	

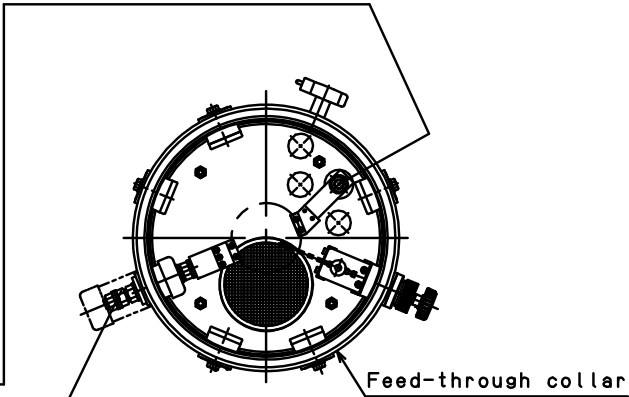
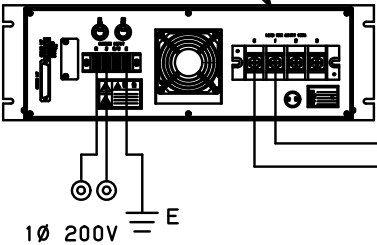
4. Electric power

 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>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>
	 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>

Evaporation power supply output wiring diagram

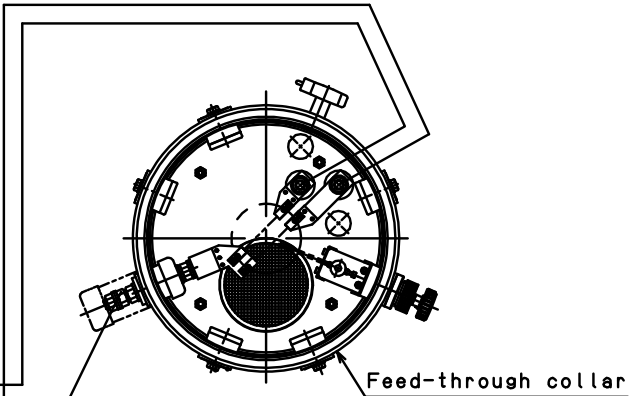
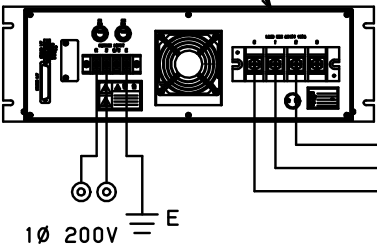
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Evaporation power supply
PSE-150C:PSE-15C11111



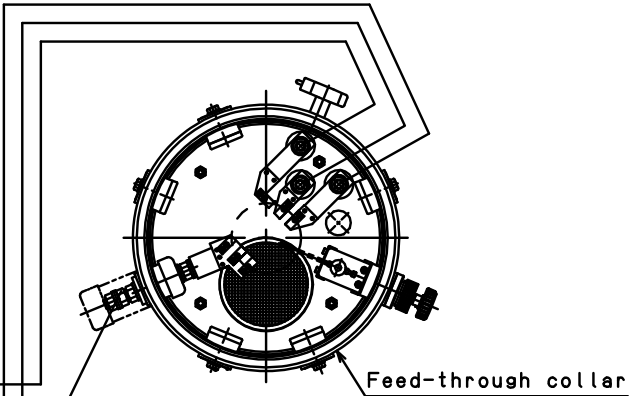
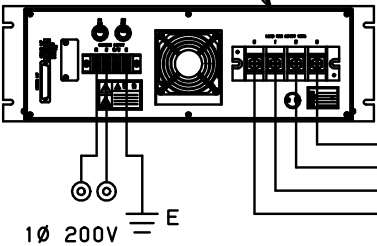
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Evaporation power supply
PSE-150C:PSE-15C21111



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Evaporation power supply
PSE-150C:PSE-15C31111










5. Required Tool List

Name	Where to be Used
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. 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>
	 Open to atmosphere	<p>After stopping the oil rotary vacuum pump, always open the BACK.P VENT(or RP VENT) to open the roughing piping to the atmosphere.</p> <p>Doing so will prevent backflow of oil.</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 oil diffusion pump during operation could result in deterioration of the oil and significant loss of performance.</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 BACK.P VENT(or RP VENT) cap (appurtenant part) to close off the vent.
- 2) Attach the pirani gauge to the gauge port of the vacuum chamber bottom.
- 3) Attach the ionization vacuum gauge head to the vacuum chamber KF port.
- 4) Close the three-way valve and the main valve.
- 5) Turn off all switches on the operation panel.
- 6) 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).
 - Set the DP cooling fan to Rotation.
- 3) Set the three-way valve to Fore
- 4) After 1 minute exhaust, Turn on the MAIN.P (or DP)
- 5) Allow the DP to warm up for 15 minutes.
- 6) Fill with liquid nitrogen (as necessary)

Reference:

Liquid nitrogen quantities:

Fill to a maximum of 0.75 L (including vaporization)
0.75 L should last four to five 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) Close the main valve.
- 3) Turn off the MAIN.P(or DP).
- 4) Allow the DP to cool for 30 minutes.
- 5) Close the three-way valve
- 6) Open the BACK.P VENT(or RP VENT).
- 7) Turn off the BACK.P(or RP).
 - Turn off the DP cooling fan. Cooling water: STOP
- 8) Turn off the main switch.
- 9) Turn off the customer-side power breaker. (as necessary)
 - Unit power supply lamp: OFF
- 10) Allow any residual liquid nitrogen to evaporate naturally.

3. Vapor deposition operation

3-1 Opening the vacuum chamber

- 1) Close the main valve.
- 2) Verify that the three-way valve is set 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 V coupler

Synflex coupler: C1N1/4 × PT1/8 (appurtenant part)

3-2 Vacuum chamber evacuation

- 1) Close Vent V.
- 2) Attach the bell jar.
- 3) Set the three-way valve to Rough.
Obtain rough vacuum inside vacuum chamber.
- 4) Verify that the vacuum gauge reads 13Pa 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) Evacuate the vacuum chamber, as described in section 3-2.
Evacuate to the desired pressure level.

4. Creating a film

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

All devices automatically return to status prior to loss of power.

5-2 Long term loss of power

- 1) Close main valve fully.
- 2) Close the three-way valve
- 3) Open the BACK.P VENT(or RP VENT).
- 4) Turn off all switches on the operation panel.











5-3 Operation after power is restored

Refer to the following:

2. Evacuation device operation
 - 2-1 Preparation
 - 2-2 Operation

(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 diffusion pump or oil rotary vacuum pump.</p> <p>Failure to do so could result in illness.</p>
	 CHECK	<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>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>
	 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 to the oil rotary vacuum pump and oil diffusion pump.
- 4) Replacing the oil mist trap element.
- 5) Replacing the thermostat (oil diffusion pump).
- 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.
- Remove all clamps and flexible tubing.
- Disconnect both the lead wire connectors to the motor by pulling them laterally.
Disconnect the ground wire to the RP base.
- Remove four nuts for anti-vibration rubber pads.
- 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.
- Connect both the lead wire connectors to the motor.
- Connect the ground wire to the RP base.
- Attach all flexible tubing and clamps.
- Attach the side panels and the back panel, as necessary.

3. Removal, maintenance, and reinstallation of devices

3-2 Oil diffusion pump

1) Required tools: Two spanner wrenches

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.
- Verify that the BACK.P VENT(or RP VENT) is open.
- Set the three-way valve to Fore (Open DP to atmosphere.)
- Remove the lead wire connectors to the heater, thermostat, and cooling fan. Remove all evacuation port clamps, flexible tubing, and O-rings.
- Remove the intake port flange attachment bolts.
(Provide support for the oil diffusion pump when removing bolts.)
- Remove the oil diffusion pump by pulling it forward.

3) Replacing the oil heater

Refer to the DPF-200 Oil Diffusion Pump Operation Manual.

4) Attachment

- Mate the oil diffusion pump evacuation port to the rough vacuum piping, and place it at the bottom of the liquid nitrogen trap.
- Lift the oil diffusion pump into place, attach and hand tighten two M10 attachment bolts to hold in place, then attach the remaining two bolts.
- Tighten the attachment screws evenly (tighten bolts in opposing pairs).
- Attach the centering O-ring, flexible tubes, and clamps to the evacuation port.
- Attach the lead wire connectors to the heater, thermostat, and cooling fan.
- Attach the side panels and the back panel, as necessary.

3. Removal, maintenance, and reinstallation of devices

3-3 Oil mist trap OMI-100

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) Replacing the 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
Oil diffusion pump	Replace oil If changes in ultimate pressure and evacuation time are observed after unintentional exposure to the atmosphere. If gradual changes in ultimate pressure and evacuation time are observed after long-term use.	As necessary
	The cooling fan operates normally.	Prior to operation
Main valve	Clean seal surfaces.	Every 6 to 12 months, or when foreign substances are observed.
Vacuum gauge	Replace the gauge head.	As necessary
Electrical cables	All terminals and set screws are securely in place.	As necessary
Oil mist trap	Replace element	Every 6 to 12 months

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.
	Deterioration of oil in oil diffusion pump.	Replace oil after accidental exposure to atmosphere, leaks, or other clear cause of oil deterioration has occurred.
	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 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.
The oil diffusion pump does not heat sufficiently.	Defective heater	Replace heater.
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 protect to the oil rotary vacuum pump trips.	Overload	Refer to the Oil rotary vacuum pump Operation Manual Push the Recover button.

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



7. List of consumable parts

Location of Use	Parts	Specifications	Material	Quantity	Replacement by user
Lower conversion flange	O-ring for intake flange	V85	NBR	1	Yes
Main valve	O-ring for intake flange	V85 (appurtenant part)	FPM	1	Yes
	O-ring for valve body	----- (appurtenant part)	FPM	1	Yes
	O-ring for valve stem	P10 (appurtenant part)	FPM	2	×
Oil diffusion pump	Gasket for intake flange	85 mm dia. × 95 mm dia. × T5	NBR	1	Yes
	Hydraulic oil	SX	---	0.07 L	Yes
	Seed heater	Single phase, 100 V, 0.45 kW	---	1	×
Oil rotary vacuum pump	Oil	SMR-100	---	0.8 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	×
	Center ring O-ring	NW25	FPM	2	Yes
Rough vacuum piping	O-ring for vent valve	N8	NBR	1	Yes
	O-ring for gauge port	N16	NBR	1	Yes
Operation panel	Indicator lamp	LMS-4BH	---	1	×
	Lighted push button switch	AR22F5L	---	2	×
Liquid nitrogen trap	O-ring for intake flange	V85	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> <p>1) Transportation is to be performed by an entity licensed to collect and transport industrial waste.</p> <p>2) Disposal is to be performed by an entity licensed to dispose of industrial waste.</p>		

(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	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 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
Automatic leak valve	To protect main pump during power outages.	Can be attached by customer
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