ULVAC

No.32500-2-02-5

User's Manual

High Speed Vacuum Coater

VPC-1100

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.

Table of Contents

Sections marked with a gray background ( ) are those which are concerned with the safe use of this product.

Safety Precautions

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.

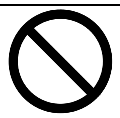
Read this section before using the VPC-1100. Follow the instructions below to safely use the device and prevent personal injuries from occurring.
Please comply with them all the time.

The symbols below have the following meaning

 Danger	There is an imminent danger of serious injury to the user, or even death, if the product is used improperly.
 Warning	There is a possibility that serious injury or death to the user could result from the improper use of this product.
 Caution	There is a possibility of minor or moderately serious injury to the user, or the danger of physical damage, if the product is used improperly.

	Be sure to do the following.
	Make sure the ground lead is connected.
	Do not do the following.
	Do not disassemble.
	Do not touch.

Power Supply

Warning	 Check capacity	Primary power capacity Three-phase 200 V 30 A+ Single phase 100 V 10 A+ If the power capacity is too low, a sudden power surge may trip the breaker.
	 Use a dedicated power source	The primary power supply should be used only for this device, and should not be connected to any other machinery. If the breaker capacity is insufficient, a power surge may trip the breaker.
	 Connect the ground lead	Connect a D-type earth lead. 200V ground leads are green cables. 100V plugs use a grounded plug. If you are using a plug adapter, connect the ground lead to the nearest terminal. If the unit is not properly grounded, you may get an electrical shock due to a malfunction or short circuit.
	 Check cable capacity	If possible, do not use an extension cord. If using one cannot be avoided, please observe the following precautions: Use one of the following power cables: 200 V 3.5 mm^2+ 100 V 2.0 mm^2+ Using a cable that is too small may cause overheating or start a fire.
	 Prohibited	Do not place any objects on top of the primary power cable. May cause electrical shock or fires.
	 Risk of electrical shock	If the receiving light is lit up, then even after the MAIN breaker is cut, electricity will still be flowing to the MAIN breaker. Do not touch the terminal block or other parts. May cause electrical shock.

Environment

Warning	 Prohibited	This device does not employ an explosion-proof construction, and therefore cannot be used with any flammable materials. May result in a fire or explosion.
	 Prohibited	Under part of the oil diffusion pump produces a lot of heat while in operation. Do not leave any flammable materials nearby. May cause fires.
	 Do not touch	While in operation, and for 30 minutes after being switched off, the oil diffusion pump and oil-sealed rotary vacuum pump are extremely hot. Do not touch directly with your hands. May cause burns.
Caution	 Use an oil mist trap	During rough operation, oil mist will be emitted from the exhaust port of the oil-sealed rotary vacuum pump. Please use an oil mist trap (sold separately). May contaminate the air and affect people's health.
	 Make sure area is well-ventilated	Heat is produced by the pump when the device is in use. May cause the room to heat up.

Installation

Warning	 Check environment	This device should be installed in a location that meets the following criteria: 1) Flat, level surface 2) Strong flooring 3) Well-ventilated 4) Not exposed to direct sunlight 5) Room temperature between 7-30°C 6) No fire hazards 7) No gases or chemicals which may affect the device 8) No noise or other electrical interference May cause the device to operate improperly or may affect its durability.
Caution	 Do not attempt alone	This device should be moved by two or more people. May cause back pains or other injuries.
	 Do not attempt alone	Attaching or removing the hoist should be done by two or more people. May cause back pains or other injuries.
	 Secure pipe	The coolant pipe should be fixed in place with a hose band. Prevents accidents caused by cooling water leakage.
	 Secure device	After installing the device, secure it in place by using the level adjuster, attached to the caster. Helps prevent movement or damage caused by earthquakes.

Operation

Warning	 Check	Make sure the vaporization power output is switched OFF before using the electrode switch. May cause sparks or damage to the switch.
	 Prohibited	Do not strike the glass bell jar or heat it to above 50°C. Damaging the inner mechanism while there is a vacuum can cause fragments to fly out. May cause damage.
	 Check ventilation	Make sure the room is well-ventilated when using liquid nitrogen. Vapor from the liquid nitrogen can lower the oxygen levels in the room. May cause accidents due to lack of oxygen.
Caution	 Wear gloves	When handling liquid nitrogen, wear rubber gloves or other protection over exposed areas of skin. A droplet coming into contact with your skin can be extremely painful.
	 Venting	After stopping the oil-sealed rotary vacuum pump, open the RP vent and vent the inside of the rough pipe to the atmosphere. Prevents oil backflow.
	 Check it is completely closed	After confirming that the main valve is completely closed, vent the inside of the bell jar to the atmosphere. If air enters the oil diffusion pump while it is in operation, the oil from the oil diffusion pump will be degraded and its performance will deteriorate sharply. If air is allowed to enter while liquid nitrogen is being poured in, large amounts of condensed gas will gather in the trap and the performance will deteriorate sharply.

Maintenance, Repair and Disposal

Warning	 Use protective equipment	Wear a dusk mask and gloves when cleaning the thin film of the feed through collar of the bell jar. The thin film can turn into a fine dust and may be inhaled.
	 Do not attempt alone	The glass bell jar weighs approximately 13 kg. It should only be installed or removed by at least two people. Risk of accidents or back pain.
	 Inspection	The fixing clip and eye bolt at either end of the hoist's wire rope should be inspected daily to make sure they have not come loose. May cause the bell jar to fall.
Caution	 Periodic replacements	The oil mist trap element (sold separately) should be replaced every six months to one year. If the element becomes clogged, exhaust resistance can build up and cause oil leakage from the shaft seal or damage to the oil level gauge.
	 Follow all regulations	Waste oil used in the pump must be disposed of in accordance with all relevant laws and regulations. Please handle waste oil in accordance with the laws and regulations. If anything is unclear, please contact us directly.
	 Prohibited	Do not modify this product using any parts other than the standard optional parts provided by our company. We will not be responsible for any consequences.

Warning Labels

Caution	 Check labeling	Warning labels are attached to the following locations: 1) bell jar cover 2) main valve handle 3) hoist brace 4) liquid nitrogen trap 5) rough pipe 6) upper right side of the electrode switch Please contact us if the labels become dirty and difficult to read, or begin to peel off.

(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) Product Overview

1. Uses of this product and prohibitions

This device is a vacuum coater which uses resistance heating evaporation in a vacuum to evaporate materials and create a thin film.

In order to use this device properly, please do not put it to any of the prohibited uses outlined below.

Prohibited

- Using this device as a vacuum vessel.
- Placing anything other than evaporation or test materials inside the glass bell jar.
- Any resale, repair or modification not approved by our company.

2. Purpose and function of safety equipment

Item	Purpose	Mechanism	How to check
Water supply cut off	Prevents the oil diffusion pump from overheating	Pressure switch detects cutoff. Oil diffusion pump heater interlock. Alarm warns if water supply cut off. Auto reset when supply restored.	Simulate a water cutoff.
Short circuit	Prevents electrical shocks	Main breaker circuit interrupter. Sensed current 30 mA Manual reset.	Use the circuit interrupter's test button.
Power surge	Protects the motor from burnout	Oil-sealed rotary vacuum pump magnetic contact's thermal relay shuts off current. Manual reset.	Start the oil-sealed rotary vacuum pump and lower the thermal relay setting. Reset to 3.6 A afterwards.
	Protects the oil diffusion pump heater	Oil diffusion pump circuit protector shuts off current.	N/A

Prohibited

Disable the safety equipment before using this device.

3. Specifications

Max. Pressure	1.3×10^{-4} Pa (Using liquid nitrogen, with no load in the vacuum tank)
Evacuation time	Less than 10 min. to 10^{-4} Pa (Using liquid nitrogen, with no load in the vacuum tank)
Power consumption	100 V single phase 1.0 kVA 200 V three-phase 5.0 kVA
Water consumption Water temp./pressure	1.5 L/min. 20 °C / 200-300 kPa (gauge pressure)
Dimensions Weight	W 1235 mm x D 836 mm x H 2155 mm About 313 kg
Coating	JIS S-5-462 printing (Munsell 5GY8/0.5)

Listed above are the standard specifications.
Please refer to the VPC-1100 (Special) specifications for details of special configurations.

4. Individual equipment specifications

Equipment Name	Type / Specifications	Number
1) Glass bell jar	・Dimensions Inner diameter Ø 390 mm x H 350 mm ・Material Pyrex	1
2) Evaporation power supply	- 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) - Load output 3-Position - Appurtenant devices: - Output cable (38 mm2 × 2 m)	1

Equipment Name	Type / Specifications		Number
3) Oil diffusion pump	・Type	ULK-06A	1
	・Evacuation speed	1100L/sec.	
	・Max. pressure	< 2.6 x 10^{-6} Pa	
	・Exhaust port	VG100, VG40	
	・Power consumption	1.2 kW	
	Hydraulic oil	D-31 0.35 L	
	Cooling water	1.5 L/min.	
4) Oil-sealed rotary vacuum pump	・Type	GLD-202A	2
	・Evacuation speed	200L/min.	
	・Max. pressure	6.7 x 10^{-1}Pa (Measured by Pirani vacuum gauge)	
	・Power consumption	0.55 kW	
	Oil	SMR-100 1.1 L	
5) Main valve	・Type	SBVM-6AX	1
	・Butterfly valve		
6) Liquid nitrogen trap	・Bore diameter	150 A	1
	・Injection amount	Approx. 3.5 L (Including vapor)	
7) Three-way valve	・Type	Slide	1
	・Bore diameter	20 A	
8) Feed through collar	・Number of ports	20	1
	・Dimensions	Inner diameter 390 mm x H 150 mm	
	・Material	Nickel-plated iron	4
	・Accessories	3-switch electrode	3
		Hermetic port	1
		Gauge port	1
		Shutter	4
	Backup ports Electrode		2
		UFC flange	1
		Shutter	4
		Service port	
9) Hoist	・Type	Balance weight	1
	・Stroke	400 mm	

Equipment name	Type / Specifications		Number
10) Bell jar cover	・Material ・Coating	Perforated plate 5GY8/0.5	1
11) Pirani vacuum gauge	・Type ・Probe	GP-1G WP-01	1

Listed above are the standard specifications. Specifications and numbers will vary for special models.
Please refer to the VPC-1100 (Special) specifications manual for details.

5. Standard accessories

1) Power cable	・200 V three-phase ・100 V single phase	crimp-style terminal 4m with plug 4m	1 1
2) Hermetic seal port	・Sealing plate ・Socket		3 3
3) Gauge port sealing plug	・Ø 18		2
4) User manual	・Paper		1
5) Vacuum performance test table	・Paper		1
6) Cap	・For GLD-202A suction port		1
7) Hose cap	・Ø 10		2
8) Hexagonal wrench	・3 mm		1

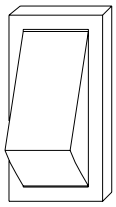
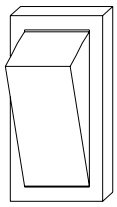
Listed above are the standard specifications.
Please refer to the VPC-1100 (Special) specifications for details of special configurations.

6. How to use the switches, handles and operation lever

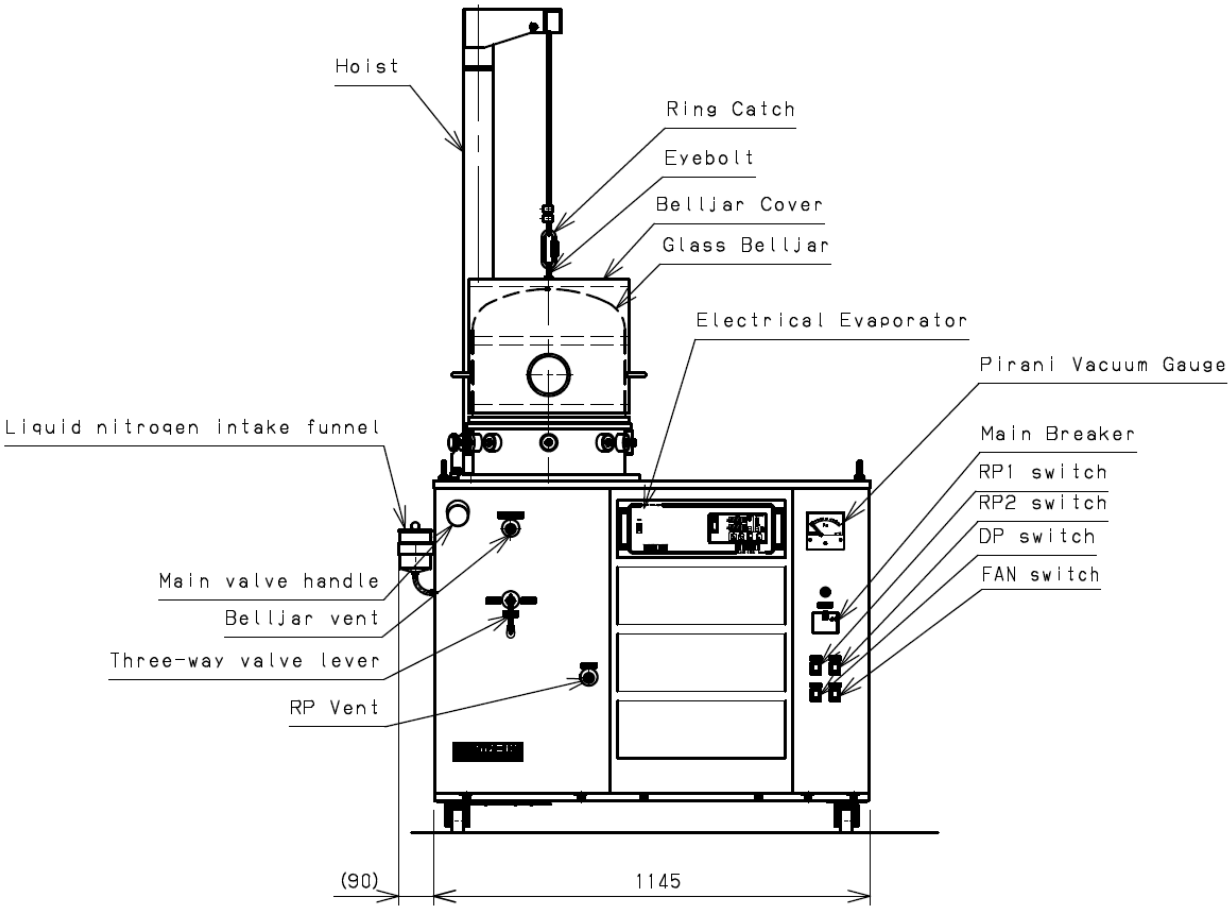
Check

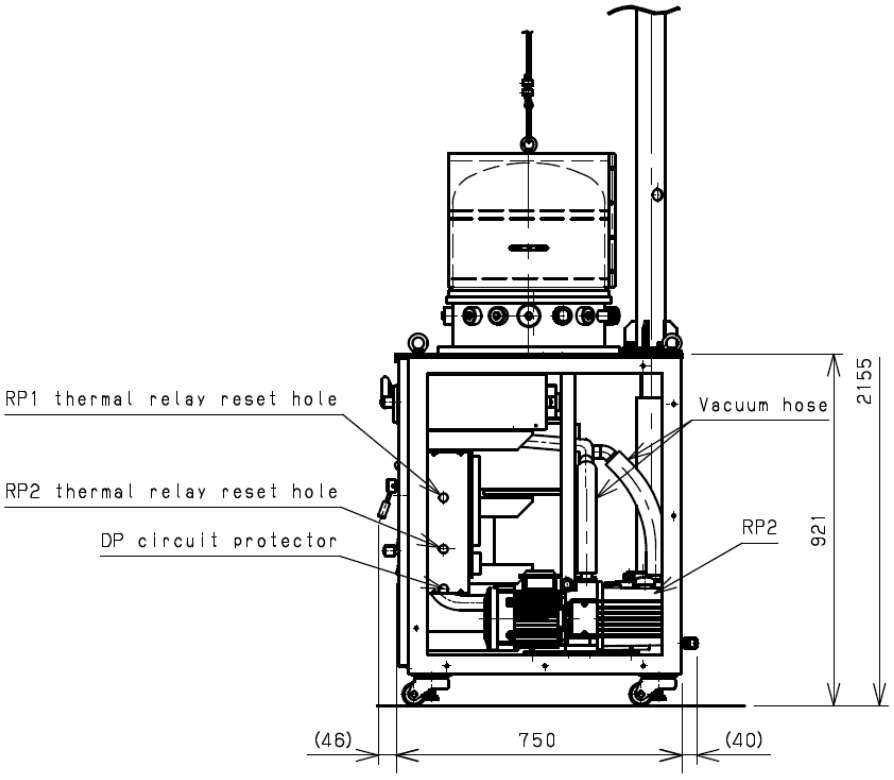
Please check the position of the switches, handles and operating lever before using, and make sure they are secure.

Name	Operation
Main breaker	Manual ON—OFF Power surge or short circuit trip
RP switch	Manual ON—OFF ON: lamp is lit up.
DP switch	Manual ON—OFF ON: lamp is lit up.
FAN switch	Manual ON—OFF ON: lamp is lit up.
Main valve handle	Open: Move counter-clockwise Close: Move clockwise Fully open: Rotate the handle counter-clockwise until it grows heavy, then turn back a quarter-turn. Fully close: Rotate the handle clockwise until it grows heavy, then tighten a little further.
Electrode switch handle	Align the arrow on the handle with the electrode number labels to switch.
Three-way valve	Align the lever with the FORE, CLOSE and ROUGH indicators.
BELL JAR VENT	Screw type Open: Move counter-clockwise Close: Move clockwise
RP VENT	Screw type Open: Move counter-clockwise Close: Move clockwise

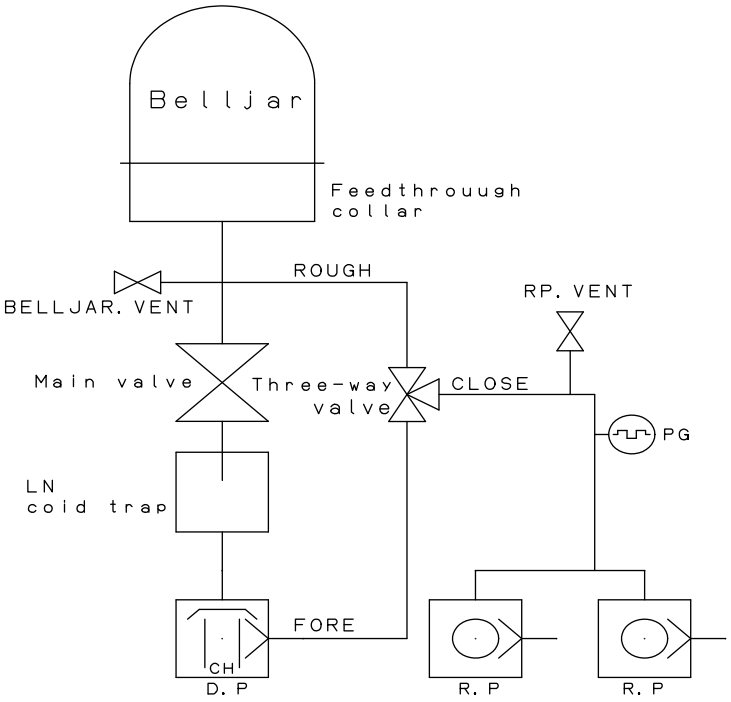
Turning the RP, DP and FAN switches On or Off	
ON	OFF
	

7. Layout of the switches, handle and operation lever

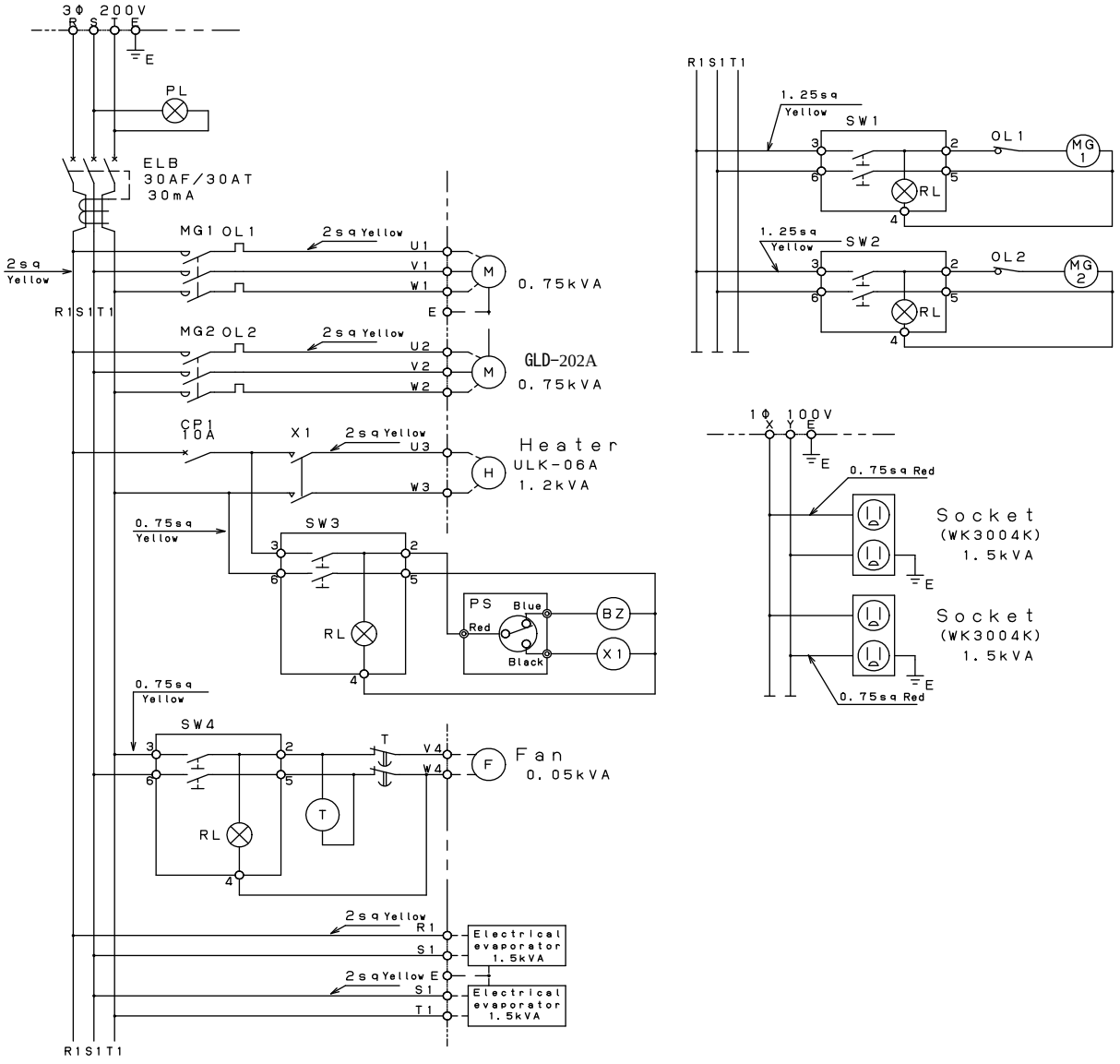




Flow chart



Wiring diagram



(3) Unpacking and installation

1. General precautions

Check

1) When the device is delivered, please install it as instructed by our representative, or by the representative of our sales agent.
2) Installation should be performed by two or more people.
3) For your safety during installation, please clear a space of at least 1 m around the device.
4) Once the positioning of the device has been finalized, fix it in place using the level adjuster.

2. Delivery packaging

The unpacked main body of the device (including casters), hoist (assembled) and box of accessories will be delivered.

The hoist will be attached on-site.

3. Installation

Warning

Check environment

This device should be installed in a location that meets the following criteria:

1) Flat, level surface
2) Strong flooring
3) Well-ventilated
4) Not exposed to direct sunlight
5) Room temperature between 7-30°C
6) No fire hazards
7) No gases or chemicals which may affect the device
8) No noise or other electrical interference

May cause the machine to operate improperly or may affect its durability.

Check

For your safety, when this device is installed please ensure it is at least 0.5 m away from any walls.

4. Power supply

<table>
<tr><td> 
Warning</td><td> 
Check capacity</td><td>Primary power capacity
Three-phase 200 V 30 A+
Single phase 100 V 10 A+

If the power capacity is too low, a sudden power surge may trip the breaker.</td></tr>
<tr><td colspan="3">Primary power cable connector specifications (included with device)
100 V cable length 4 m with three-prong plug with ground lead (with adapter)
200 V cable length 4 m with crimp-type terminal Ø 5</td></tr>
<tr><td rowspan="5"> 
Warning</td><td> 
Use a dedicated power source</td><td>The primary power supply should be used only for this device, and should not be connected to any other machinery.

If the breaker capacity is insufficient, a power surge may trip the breaker.</td></tr>
<tr><td> 
Connect the ground lead</td><td>Connect a D-type ground lead.
200 V ground leads are green cables.
100 V plugs use a grounded plug. If you are using a plug adapter, connect the ground lead to the nearest terminal.

If the device is not properly grounded, you may get an electrical shock due to a malfunction or short circuit.</td></tr>
<tr><td> 
Check the cable capacity</td><td>If possible, do not use an extension cord. If using one cannot be avoided, please observe the following precautions:

Use one of the following power cables:

200 V 3.5 mm^2+
100 V 2.0 mm^2+

Using a cable that is too small may cause overheating or start a fire.</td></tr>
<tr><td> 
Prohibited</td><td>Do not place any objects on top of the primary power cable.

May cause electrical shock or fires.</td></tr>
<tr><td> 
Risk of electrical shock</td><td>If the receiving light is lit up, then even after the MAIN breaker is cut, electricity will still be flowing to the MAIN breaker. Do not touch the terminal block or other parts.

May cause electrical shock.</td></tr>
</table>

5. Water

Water capacity	1.5 L/min.
Water temperature	20°C
Water pressure	200-300 kPa (Gauge pressure)

We recommend that you use pH-controlled purified water, either from the water mains or from a cooling water circulation system.

Primary piping connector specifications (included with the device)

Hose bore diameter Outer diameter 11 mm Inner diameter 7 mm

(Hose connector screw diameter R 1/4)

Recommended hose Please use a Tetron blade hose.

Inner diameter 9 mm x Outer diameter 15 mm

Caution	 Secure pipe	The coolant pipe should be fixed in place with a hose band. Prevents accidents caused by cooling water leakage.

Note

The Japan Refrigeration and Air Conditioning Industry Association

Water standard JRA GL-02-1994

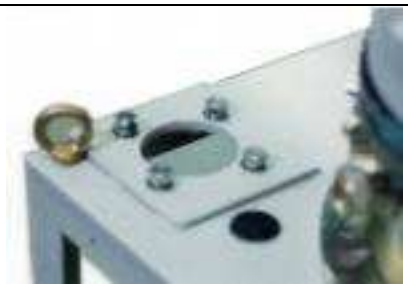
pH value (25°C)	Between 6.5 and 8.2
Electrical conductivity	800 μS/cm. 25°C
Chloride ions	200 mg. Cl^-/L
Sulfate ions	200 mg. SO_4^{2-}/L
Acid consumption	100 mg. $CaCO_3$/L
Total hardness	200 mg. $CaCO_3$/L
Calcium hardness	150 mg. $CaCO_3$/L
Ion silica	50 mg. SiO_2/L

6. List of necessary tools

Name	Use
+ Screwdriver	Connecting the primary power cable
25 mm monkey wrench	Attaching the hoist and liquid nitrogen intake pipe

7. Attaching the hoist

Caution	Do not attempt alone	Attaching or removing the hoist should be done by two or more people. May cause back pains or other injuries.

Attachment 1) Preparation Remove the hexagonal bolts, flat washers and spring washers (4 sets) from the hoist mounting plate on the rear left of the top panel.	
2) Attach hoist With the weight-fixing bolt in place, get two people to carry the hoist into place and insert it into the hoist mounting plate.	
3) Secure hoist Move the hoist's upper arm so it faces the glass bell jar. Secure the hoist using the flat washers, spring washers and hexagonal bolts (in that order) removed in step (1).	
4) Attach ring catch Attach the ring catch on the end of the wire rope hanging from the end of the arm to the eyebolt on the bell jar cover. Make sure the loose stopper nut is secured.	
5) Remove the weight-fixing bolt Remove the nut of the weight-fixing bolt, lift up the weight by pulling the wire rope, and remove the weight-fixing bolt. Loosen the wire rope and allow the weight to hang down.	

Attaching the hoist continued

6) Adjusting the hoist main body position Temporarily loosen the hoist's fixing bolts, and adjust the main body by moving it forwards, backwards, left or right, until the wire rope hangs perpendicular from the arm. Once you have adjusted the hoist, tighten the hexagonal bolts to fix the hoist in place.	
7) Removal Perform steps (5) to (2) in reverse order.	

8. Attaching the liquid nitrogen intake pipe

Attachment 1) Preparation Remove the liquid nitrogen intake pipe and funnel/cap bracket from the box of accessories. 2) Attach the liquid nitrogen intake pipe Tighten the cap nut on the liquid nitrogen trap intake pipe joint, so the funnel is vertical. 3) Attach the funnel bracket Fix the funnel with the funnel bracket to the mounting. Use an M5 pan-head screw (provided). 4) Attach the cap Put the cap on top of the funnel.	

9. Checking the direction of the oil-sealed rotary vacuum pump

Caution	 Check	Since a three-phase motor is used, be sure to check the direction of rotation of the oil-sealed rotary vacuum pump when the device is installed or whenever the input power cable is changed. Using a counter-rotating pump can cause accidents.
Warning	 Risk of electrical shock	Be sure to switch off the breaker at your end when changing the input power cable to adjust the direction of rotation. May cause electrical shock.

Checking

1) Preparation

- ・Check that the device's main breaker (earth leakage breaker) is OFF.
- ・Switch breaker at your end ON. Check that the receiving light is lit up. (If the light is not lit up, then no electricity is reaching the device.)
- ・Make sure all switches are OFF.
- ・Turn the main breaker ON.
- ・Make sure the three-way valve lever is set to CLOSE. Make sure the RP VENT is fully open.

2) Check

- ・Switch on RP1. The rear pump will start up.
- ・If the pump is rotating in the opposite direction, you will soon hear a rattling sound. Immediately turn RP1 OFF.
  If the pump is running correctly, it should run silently after about 10 seconds. Turn RP1 OFF.

When the device is shipped from the factory, RP2 is set to rotate in the same direction as RP1. However, please use the above procedure to make sure.

Adjusting the direction of rotation

- ・Turn the breaker at your end OFF. The receiving light should go off.
- ・At the output terminal of your breaker, interchanging two of the three-phase cable (R/S/T) will change the direction of rotation.
- ・After making any adjustments, use the steps outlined above to confirm the pump is working properly.

Caution	 Check	If the oil-sealed rotary vacuum pump is removed for inspection or other reasons, be sure to match up the wiring connectors and cable numbers when connecting again. Direction of rotation may change.

(4) Operating

1. Dangers and safety precautions during operation

Warning	 Check	Make sure the vaporization power output is switched OFF before using the electrode switch. May cause sparks or damage to the switch.
	 Prohibited	Do not strike the glass bell jar or heat it to above 50°C. Damaging the inner mechanism while there is a vacuum can cause fragments to fly out. May cause damage.
	 Check ventilation	Make sure the room is well-ventilated when using liquid nitrogen. Vapor from the liquid nitrogen can lower the oxygen levels in the room. May cause accidents due to lack of oxygen.
Caution	 Wear gloves	When handling liquid nitrogen, wear rubber gloves or other protection over exposed areas of skin. A droplet coming into contact with your skin can be extremely painful.
	 Venting	After stopping the oil-sealed rotary vacuum pump, open the RP vent and vent the rough pipe to the atmosphere. Prevents oil backflow.
	 Check it is completely closed	After confirming that the MAIN valve is completely closed, vent the inside of the bell jar to the atmosphere. If air enters the oil diffusion pump while it is in operation, the oil from the oil diffusion pump will be degraded and its performance will deteriorate sharply. If air is allowed to enter while liquid nitrogen is being poured in, large amounts of condensed gas will gather in the trap and the performance will deteriorate sharply.

2. Inspecting the device before use

Warning	 Inspection	The fixing clip at either end of the hoist's wire rope should be inspected daily to make sure they have not come loose. May cause the glass bell jar to fall.
	 Inspection	Make sure the hoist's weight and the glass bell jar cover's eyebolt have not come loose. May cause the glass bell jar to fall.

3. Using the exhaust system

3-1 Preparation

1) RP VENT Three-way valve main valve CLOSE
2) All switches on the operating panel OFF
3) If using an ionization vacuum gauge, attach the probe to the feed through collar's gauge port.

3-2 Operation

Exhaust system warm up

1) Your breaker ON
   Receiving light on main breaker Should light up
2) Main breaker ON
3) Cooling water ON
4) RP1, RP2 ON
5) Three-way valve FORE
6) Pirani vacuum gauge 10Pa or less DP ON
7) Liquid nitrogen Pump in
8) DP warming up completes in 15 minutes.

Note

The amount of liquid nitrogen pumped in

Maximum intake 3.2 L (Including evaporated quantity)

Vapor Approx. 0.3L/h (At maximum intake)

If 3.2L is used, will remain effective for approx. 10 hours.

When all of the liquid nitrogen has evaporated, desorption of the trapped condensed gas will take approximately 30 minutes, during which time the pressure will be reduced. This is not a malfunction. Completely close the main valve to prevent the inside of the bell jar from being contaminated.

3. Using the exhaust system

3-3 Shutting down

Exhaust system shut down

1) Vacuum evacuation to retain vacuum inside the bell jar
2) If using an ionization vacuum gauge, filament OFF
3) Main valve Completely closed
4) DP OFF
5) FAN ON
6) Wait 15 minutes
   - ・cooling water OFF
   - ・Three-way valve CLOSE
   - ・RP VENT Open
   - ・RP1, RP2 OFF
7) 90 minutes later, FAN automatically switches OFF
* 8) Main breaker OFF
* 9) Your breaker OFF

*Steps (8) and (9) should be performed when possible. Usually the procedure is complete at the end of step (6).

4. Using the evaporator

4-1 Opening the bell jar

1) If using an ionization vacuum gauge filament OFF
2) Main valve Completely closed
3) Three-way valve FORE Check
4) Bell Jar Vent Gradually open

Note

Using dry air or nitrogen gas can prevent the inside of the bell jar from being contaminated when opening it.
Opening the bell jar can contaminate its interior with moisture from the atmosphere.

Connecting the bell jar vent tube

Joint specifications: 1/4 synflex joint

Connector tube: 1/4 synflex tube

4. Using the evaporator

4-2 Bell jar evacuation

1) Bell jar vent	Completely closed
2) Glass bell jar	Attach
3) Three-way valve	ROUGH
4) Pirani vacuum gauge 10Pa or less	Check
5) Three-way valve	FORE
6) Main valve	Completely closed

5. Using the coating equipment

5-1 Preparation

1) Open the bell jar	See section 4-1
2) Attach electrode to the evaporation source (board or filament)	
3) Supply the evaporation material to the evaporation source	
4) Shutter	Closed
5) Attach sample (base material)	
6) Bell jar evacuation	See section 4-2

5-2 Film formation

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 4-1, and remove the coated material (substrate).
Repeat as necessary from step 4-2.

Note: If using an PSE－150C electrical evaporator (optional part), please refer to the PSE-150C electrical evaporator user manual.

Note

Film thickness: Adjusted by the coating time
Coating speed: Adjusted by varying the current applied to the evaporation source.

6. Handling Emergencies

6-1 Temporary power failure

All machinery will automatically return to its state prior to the power failure.

6-2 Prolonged power failure

Immediately

1) Main valve	Completely close
2) Three-way valve	CLOSE
3) RP VENT	Open
4) All switches on the operation panel	OFF
5) One hour later, turn off the cooling water	

6-3 When power is restored

Please refer to the following subsections of Section 3, Using the Exhaust System

3-1 Preparation

3-2 Operation

6-4 Water supply temporarily cut off

All machinery will automatically return to its state prior to the cutoff.

6-5 Water supply cut off for a prolonged period

Stop the device

1) If using an ionization vacuum gauge filament	OFF
2) Main valve	Completely close
3) DP	OFF
4) FAN	ON
5) 90 minutes later	
・Three-way valve	CLOSE
・RP VENT	Open
・RP1, RP2	OFF
・FAN	Automatically switches off
* 6) Main breaker	OFF
* 7) Your breaker	OFF

*Steps (6) and (7) should be performed when possible. Usually the procedure is complete at the end of step (5).

6-6 When the water supply is restored

Please refer to the following subsections of Section 3, Using the Exhaust System

3-1 Preparation

3-2 Operation

(5) Maintenance and repairs

1. Dangers and safety guidelines during maintenance and repairs

Warning	 Use protective equipment	Wear a dusk mask and gloves when cleaning the thin film of the feed through collar of the bell jar. The thin film can turn into a fine dust and may be inhaled.
	 Do not attempt alone	The glass bell jar weighs approximately 13kg. It should only be installed or removed by at least two people. Risk of accidents or back pain.
	 Inspection	The fixing clip at either end of the hoist's wire rope should be inspected daily to make sure they have not come loose. May cause the glass bell jar to fall.
Caution	 Follow all regulations	Waste oil used in the pump must be disposed of in accordance with all relevant laws and regulations. Please handle waste oil in accordance with the laws and regulations. If anything is unclear, please contact us directly.
	 Periodic replacements	The oil mist trap element (sold separately) should be replaced every six months to one year. If the element becomes clogged, exhaust resistance can build up and cause oil leakage from the shaft seal or damage to the oil level gauge.
	 Do not attempt alone	The oil diffusion pump and oil-sealed rotary vacuum pump should only be attached or removed by two or more people. May fall or lead to back injury.
	 Prohibited	Do not make any modifications which are not approved by our company. We will not be responsible for any consequences.

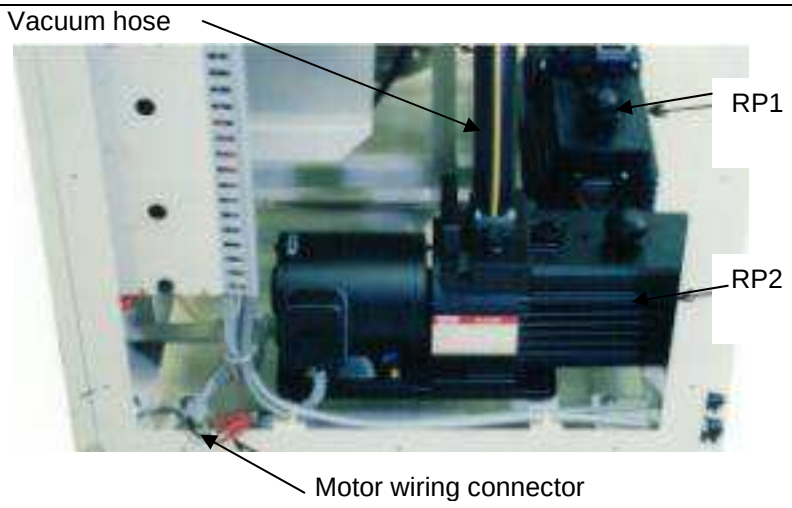
2. Maintenance and repairs by the customer

1) Replacing the oil in the oil-sealed rotary vacuum pump and oil diffusion pump.
2) Replacing the element in the oil mist trap (sold separately).
3) Replacing the O-rings (except for the oil-sealed rotary vacuum pump)
4) Cleaning the feed through collar and inside the glass bell jar.
Please contact us for any maintenance other than those listed above.

3. Removing, maintaining and installing equipment

3-1 Oil-sealed rotary vacuum pump

1) Tools needed: 8mm spanner×1 +screwdriver×1
2) Removal
   - Make sure all equipment is turned off.
   - Make sure the primary power is disconnected.
   - Remove the vacuum hose by pulling it towards you.
   - disconnect the motor wiring connectors (3 places) by pulling them to the left or right.
     Disconnect the ground lead from the mounting frame.
   - Remove the vibration-proof rubber nuts. (4 places)
   - Get two people to lift the motor and front cover, and remove the main body of the pump.
   - Remove the vibration-proof rubber. (4 places)
3) Replace the oil
   See the separate oil-sealed rotary vacuum pump user manual.
4) Attachment
   - Attach the vibration-proof rubber. (4 places)
   - Get two people to lift the motor and front cover, and reinstall the pump.
   - Attach the motor wiring connectors. (3 places)
     (Match up the wiring numbers, 1-1, 2-2 and 3-3)
     If the wiring numbers do not match up, the pump will rotate in the opposite direction.
   - Attach the ground lead.
   - Attach the vibration-proof rubber nuts. (4 places)
   - Attach the vacuum hose.



3. Removing, maintaining and installing equipment

3-2 Oil diffusion pump

1) Tools needed 13mm, 17mm spanner (1 each)

2) Removal

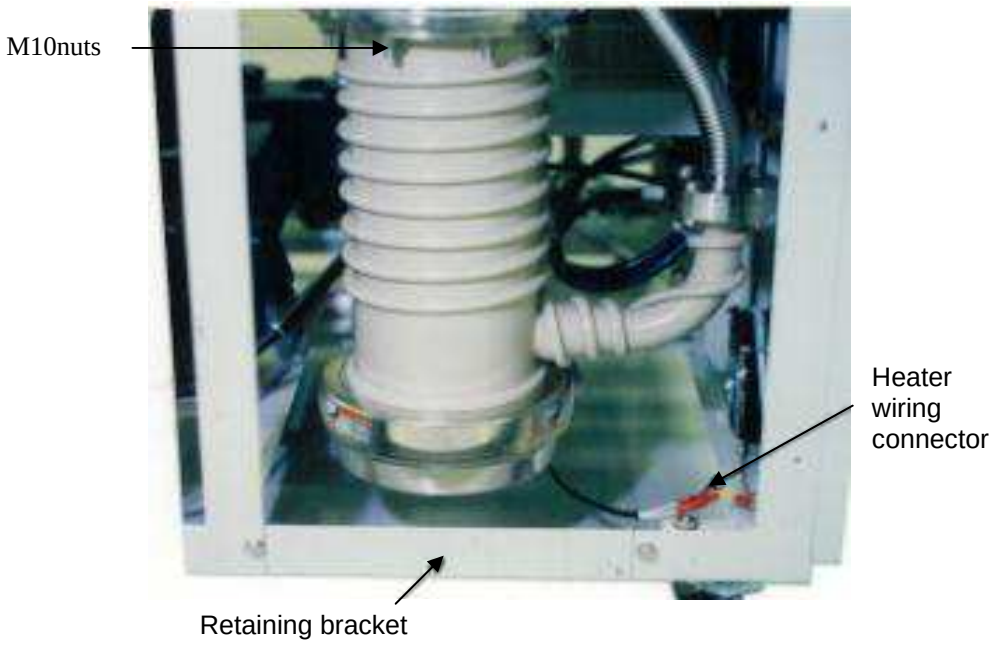
- Make sure all equipment is turned off and the cooling water has been shut off.
- Open the bell jar vent.
- Three-way valve FORE (Vent the DP interior)
- Disconnect the heater wiring connectors. (2 places)
- Remove the exhaust port rough pipe.
- Remove the oil diffusion pump's cooling water pipes. (intake and outflow, 2 locations)
- Remove the M10 fixing nuts on the intake flange. (8 places)
- Remove the retaining bracket.
- Remove the oil diffusion pump by pulling it towards you.

3) Replace oil

See the separate ULK-06A oil diffusion pump user manual.

4) Attachment

- Place the oil diffusion pump underneath the liquid nitrogen trap.
- Get two people to lift the oil diffusion pump and tighten 2 M10 nuts 3 to 4 turns. Then attach the remaining 6 nuts.
- Align the rough pipe with the exhaust port, and tighten the M10 nuts equally. (In order, starting from the far corner)
- After cleaning the exhaust port's O-ring, attach the rough pipe.
- Attach the oil diffusion pump's cooling water pipes. (intake and outflow, 2 locations)
- Connect the heater wiring connectors. (2 places)
- Attach the retaining bracket.



3. Removing, maintaining and installing equipment

3-3 Oil mist trap (sold separately)

1) Tools needed none

2) Removal

Using both hands, rotate the underside of the oil mist trap in a counter-clockwise direction.

3) Replacing the element

Please refer to the separate oil mist trap user manual.

4) Attachment

- Attach the O-ring located on the underside of the oil mist trap.
- Align the oil mist trap with the exhaust port of the oil-sealed rotary vacuum pump, and then use both hands to rotate it in a clockwise direction.

Caution: Make sure the O-ring does not drop off while tightening.

3-4 Glass bell jar O-ring

1) Tools needed none

2) Removal

- Be careful not to damage the O-ring groove during removal.

3) Attachment

- Coat the surface of the new O-ring with vacuum grease.
- (As thinly as possible, so that a film forms)
- Clean the inside of the O-ring groove.
- Fit the O-ring inside the groove.

3-5 Glass bell jar

1) Necessary equipment dust mask gloves

2) Removal

Loosen the drop-stopper nut on the ring catch at the end of the wire rope and remove the ring catch from the eyebolt.

- Move the ring catch upwards until the weight touches the base of the support.
- Get two people to lift and remove the bell jar by holding the bell jar cover's handgrip.

3) Cleaning

- Wear protective equipment (dust mask and gloves), and wipe away any spatter with alcohol.

4) Attachment

- Get two people to hold the bell jar cover's handgrip and attach it so the flange on the underside of the glass bell jar makes even contact with the surface of the O-ring.

Caution: If the underside flange is on an angle, contact between the metal parts will cause damage.

- Lower the ring catch and attach it to the bell jar cover eyebolt, and then tighten the drop-stopper nut.

4. Maintenance and inspection checklist

Part name	Details	Period
Hoist	Make sure the fixing clip and eyebolt at either end of the wire rope have not come loose.	Daily, before use
Oil-sealed rotary vacuum pump	Make sure the oil level on the oil level gauge is within the line shown.	Daily, before use
Water cutoff alarm	Make sure the DP switches on and the alarm rings if the cooling water is cut off. Make sure the DP switch light is off.	Daily, before use
Glass bell jar	Clean the inside.	As necessary
Oil-sealed rotary vacuum pump	Replace the oil RP VENT closed. Three-way valve set to CLOSE, start RP 1 and RP 2 at the same time. If the Pirani vacuum gauge pressure is 5 Pa or higher, replace the oil.	As necessary
Oil diffusion pump	Replace the oil If atmosphere is accidentally allowed to enter, the maximum pressure and evacuation time will be affected. If the device is used for a number of years, the maximum pressure and evacuation time will gradually change.	As necessary
Pirani vacuum gauge	Replace the probe	6 months to 1 year
Main valve	Clean the surface of the valve seat seal	6 months to 1 year If a foreign particle falls out.
Oil mist trap	Replace the element	6 months to 1 year

5. Troubleshooting

Situation	Cause	Countermeasure
Max. pressure low or Max. pressure unsteady or Evacuation power reduced	Room temperature is too high.	Adjust the room temperature to 25°C or less.
	Used for a short time directly after installation or after prolonged disuse.	Let the device run for 24 to 48 hours and then recheck.
	There is a leak.	Examine the area around the affected part before the maximum pressure is affected. Ex: Hermetic, etc.
		Clean the glass bell jar's O-ring.
	Oil from the oil diffusion pump has degraded.	If air has accidentally been allowed to enter or if there is some other obvious reason for the oil to degrade, replace the oil.
	Coolant water is too hot. Insufficient cooling water.	Set the water temperature to 20°C. Maintain supply of 1.5 L/min.
	Using a sample which emits a large amount of gas. Ex: Plastic base material, etc.	Change the sample material. Extend the evacuation time.
	Oil-sealed rotary vacuum pump is defective.	Refer to the oil-sealed rotary vacuum pump user manual.
	Measurement device is defective.	Replace the device.
Oil diffusion pump does not warm up	Heater broken.	Replace the heater.
Current does not flow to the electrode even when the electrical evaporator control is used	Evaporation source short circuit.	Replace evaporation source.
	Electrode short circuit inside the feed through collar.	Repair the location of the short circuit and restore the insulation.
Oil-sealed rotary vacuum pump thermal overload relay of electro-magnetic contactor moves.	Overloading.	Refer to the oil-sealed rotary vacuum pump user manual. Manual reset .
The Pirani vacuum gauge pressure is reduced when the bell jar is vented to the atmosphere	Main valve shutoff defective.	Rotate the handle clockwise until is grows heavy, then tighten more.
		Clean the main valve seat seal.
		Overhaul the main valve. (handled at our location)

6. Handling the oil-sealed rotary vacuum pump during repairs (when only 1 is in use)

Two oil-sealed rotary vacuum pumps are normally run simultaneously. However, if two cannot be run together, due to a malfunction or for other reasons, then it is possible to run the device with only one pump while the other is being repaired, if the following procedures are followed. (We cannot guarantee the performance of the device under such circumstances.)

Once repairs are completed, please run the two pumps simultaneously.

Using one pump

1) Check that the device has stopped.
2) Remove the vacuum hose of the malfunctioning oil-sealed rotary vacuum pump and fit the cap to the exhaust port of the rough pipe.
3) Disconnect the motor wiring connectors of the malfunctioning oil-sealed rotary vacuum pump to prevent it from being used accidentally.

Precautions when using only one pump

1) Do not operate the device while the vacuum hose of the malfunctioning oil-sealed rotary vacuum pump is connected.
   Oil or air may back up and affect the pressure inside the rough evacuation pipe.
2) Rough evacuation will take longer. Use the Pirani vacuum gauge to check the rough pressure, and then use the three-way valve.
   The main valve will open more slowly than it would if there were two pumps. There is no change when the valve is closing.

7. Storing the device

Please take the following steps when storing the device for a prolonged period.

1) Storage location

- Sturdy flooring ・Well-ventilated location
- No direct sunlight ・No chemicals or gases which may corrode or otherwise affect the device

2) Preparation before and during storage

- Evacuate the interior of the bell jar.
- Remove the ring catch from the bell jar cover and lower the hoist weight until it touches the base.
- Use the level adjuster attached to the caster to fix the device in place.

8. List of consumable supplies

Location used	Name	Specification	Material	Number	Can customer replace?
Feed through collar	Flange O-ring	P-400	NBR	1	OK
	Hermetic O-ring	P-26	NBR	3	OK
	Gauge port O-ring	N-16	NBR	1	OK
	Service port S O-ring	P-30	NBR	7	OK
	Service port L O-ring	P-44	NBR	2	OK
	Shutter port O-ring	N-32	NBR	1	OK
	Shutter shaft O-ring	N-7	NBR	2	OK
	Base plate stopper O-ring	P-22A	NBR	2	OK
	Base plate welding rod gasket	KV-1297-01-096	FPM	4	OK
	Shutter bevel gear	KV-1297-01-118	S45C	2	OK
Upper portion conversion flange	O-ring for suction flange	V-175	NBR	1	OK
	O-ring for leakage valve	N-6	NBR	1	OK
	O-ring for leakage valve	N-8	NBR	1	OK
Main valve	O-ring for suction flange	V-175(Attached component)	FPM	1	OK
	O-ring for valve body	(Attached component)	FPM	1	OK
	O-ring for leakage valve	P-15(Attached component)	FPM	2	×
Lower portion conversion flange	O-ring for suction flange	V-175	NBR	1	OK
Type 6 liquid nitrogen trap	O-ring for suction flange	V-175	NBR	1	OK
Three-way valve	O-ring	Attached	---	1	×
BELLJAR VENT	O-ring	N-6	NBR	1	OK
	O-ring	N-8	NBR	1	OK
RP VENT	O-ring	N-8	NBR	1	OK

The numbers listed above are for the standard specification. If optional parts are attached, these numbers will differ.

8. List of consumable supplies

Location used	Name	Specification	Material	Number	Can customer replace?
Oil diffusion pump	Intake flange gasket	For ULK-06A	NBR	1	OK
	Evacuation flange O-Ring	V-55	NBR	1	OK
	Hydraulic oil	D-31	---	0.35 L	OK
Oil-sealed rotary vacuum pump	Oil	SMR-100	---	1.1 L per nut	OK
	RP1 vacuum hose	Ø 25 Ø 50 L=370	Special rubber	1	OK
	RP2 vacuum hose	Ø 25 Ø 50 L=310	Special rubber	1	OK
Rough pipe	Pirani vacuum gauge probe	WP-01	---	1	OK
Measurement panel	Receiving light	LMU-6MS	---	1	×
	RP, DP, FAN switches	LLK25L2 2P 10A	---	4	×
Bell jar cover	Rubber lip	KV-1297-01-143	EPDM	0.31m	OK

The numbers listed above are for the standard specification. If optional parts are attached, these numbers will differ.

(6) Disposal

1. Precautions when disposing

Caution	Follow all regulations	Waste oil from the pump must be disposed of in accordance with all relevant laws and regulations. Please handle waste properly in accordance with the laws and regulations. If anything is unclear, please contact us directly.
Applicable regulations: The law concerning the disposal and cleaning of waste matter		
Handling method: Entrust 1) transportation to industrial waste collection and transportation contractors 2) handling to industrial waste disposal contractors		

(7) Optional parts

 Caution	 Prohibited	Do not modify this product using any parts other than the standard optional parts specified by us. We will not be responsible for any consequences.

1. Table of standard optional parts

Optional parts name	Use	Location for fitting
Evaporator electrode 1-button + 2-button switch	Simultaneous evaporation using multiple sources To create multi-layer films	Factory
Evaporator electrode 2-button + 2-button switch		
Evaporator electrode 2-button + 3-button switch		
Ø 340 sample holder	Holds the sample in place	On-site
Base material heater	Heats the sample	On-site
Electrode partition board	Separates evaporation source Prevents contamination	On-site
Non-stick board	Prevents evaporation from sticking to the glass bell jar	On-site
UFC070 adapter	To fit an 070 Conflat flange	On-site
Measurement rack	Built-in ionization vacuum gauge GI-M2, film thickness controller CRTM-6000G rack	On-site
Side panel, rear panel	To comply with safety regulations	On-site
Supplemental shutter	To fit mask holder	On-site
Carbon electrode	To create a carbon thin film	On-site
Gas intake port	To inject gas into the bell jar	On-site
Film sensor	Film, coating speed measurement	On-site
Oil mist trap	To prevent oil fumes from escaping from the oil-sealed rotary vacuum pump's exhaust port.	On-site
Evaporation power supply: SEREM	Power supply for deposition (with external automatic control function) Film formation speed control can be made in combination with the film controller.	On-site

Optional parts name	Use	Location for fitting
Evaporation power supply cables	Power supply out cables for deposition.	Factory
Metal bell jar	For heating the inside of the bell jar.	Factory
Metal bell jar (with water-cooling coil)	For heating the inside of the bell jar.	Factory
Film formation controller	For measurement and control of film thickness and film formation speed.	On-site
Film thickness sensor	Sensor for film controller measurement.	On-site
Cooling water piping for film thickness sensor	Introduction piping for cooling water for film thickness sensor.	Factory
Automatic leakage valve	For main pump protection upon power outage.	On-site