ULVAC

No.32100-2-02-6

User's Manual

Compact Vacuum Coater

VPC-260F

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

Items with shade include description on safety.

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.

Read this section before using the VPC-260F. 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.

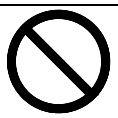
Warning Label

Caution	 Check labels	The warning labels are pasted on the following parts. 1) Glass bell jar (PL001) (PL005) 2) Left back of the rack (PL004) 3) Main valve handle (PL008) 4) Around the oil diffusion pump (D. P) (PL007) 5) Liquid nitrogen trap (PL006) When accompanied by a bell jar cover. 6) Bell jar cover (PL001) (PL005) When accompanied by a lift. 7) Lift (PL003) Contact us if label is contaminated or peeled off.

Power Supply

Warning	 Check the capacity	Primary power supply Please prepare the following: Single-phase 100 V, 13.5 A or more Single-phase 200 V, 7.5 A or more Smaller power supply capacity may cause the breaker to trip due to overcurrent during the operation.
	 Do not share	For the primary power supply, a single power supply should be provided for the device, and other equipment should not be connected with it. Breaker capacity shortage may cause the breaker to trip due to overcurrent during the operation.
	 Ground the grounding wire	Employ Level D grounding. The grounding wire for 200-V power supply is the green wire. Use a plug with grounding wire for 100-V power supply. If you use a plug adapter, connect the grounding wire with a nearest grounding terminal. If incorrect grounding is made, this may cause electrical shock in case of failure or current leakage.
	 Check the cable capacity	Avoid using an extension cable. However, if it must be used by necessity, use the following cable. For 100-V power supply: 2.0 mm^2 or more For 200-V power supply: 1.25 mm^2 or more If a thinner cable is used, this may cause overheating, ignition, or fire.
	 Avoid this action	Do not place any object on the cable for the primary side. Otherwise, such action may cause electrical shock or fire.
	 Avoid electrical shock	Do not touch the terminal block or other connectors if the primary cable plug is being inserted into a socket. Otherwise, the operator may suffer electrical shock.

Environment

Warning	 Avoid this action	This product does not have explosion-proof design, and thus use in environments where inflammable substances are present should be avoided. Otherwise, explosion could occur, causing fire and burns.
	 Avoid this action	Temperature at a lower part of the oil diffusion pump is extremely high during operation. Do not place flammable objects around it. This can cause fire.
	 Do not touch	Do not touch the product with a bare hand during operation or within 30 minutes after operation ceases because the temperature of the oil diffusion pump and the oil sealed rotary vacuum pump temperature rise. Otherwise, your hands may be burned.
Caution	 Use oil mist trap	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.
	 Ventilate	Pump is heated during operation. Room temperature rises.

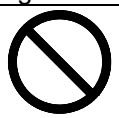
Installation

Warning	 Check the environment	Install the equipment where the following conditions are satisfied. 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. Otherwise, operation failure or durability degradation may occur.
Caution	 Work by two or more people	Lifting and moving of the equipment should be made by two or more people. Otherwise, you could injure your back.
	 Work by two or more people	Installation or removal of lift (sold separately) should be made by two or more people. Otherwise, you could injure your back.
	 Fix the product	After the installation, secure the product with the stoppers that are attached to the casters. This is made to prevent movement or damage upon earthquake.

Operations

Warning	 Avoid this action	Do not apply any shock to the glass bell jar, and avoid heating it to 50°C or higher. In a case of explosion upon vacuum condition, the exploded pieces will spread. This may cause a serious damage to the product.
	 Check ventilation	Please make sure to ventilate the room when using liquid nitrogen. The nitrogen can potentially reduce the oxygen in the room. This may cause an oxygen deficiency accident.
Caution	 Wear gloves	When using liquid nitrogen, wear gloves to protect your hands. If liquid nitrogen splashes and adheres to your skin, you may feel acute pain momentary.
	 Leave open air	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. This must be done to prevent reverse oil flow.
	 Confirm complete close	After confirming complete closure of the main valve, let out the air in the vacuum chamber. If air comes into the oil diffusion pump during operation, it deteriorates the oil and lowers the performance. Operation failure of the three-way valve may occur. An inflow of air during liquid nitrogen injection will cause condensable gases to adhere to the trap excessively, thus degrading the performance.

Maintenance, Repair, and Disposal

Warning	 Wear protective gear	Wear a dust-proof mask and gloves to clean the thin film adhered to the inside of the bell jar and feed-through collar. The thin film could by broken into minute particles, and float in the air, which could be inhaled into human body.
	 Confirm	Since the glass bell jar weighs 7 kg, installation and removal should be made with correct posture. Work without correct posture may cause an accidental drop of jar or lower back injuries. Otherwise, you could injure your back.
	 Check	Check everyday for looseness of the fixture clips and eyebolts of both ends of the wire rope for lift (sold separately). If they are loose, the bell jar could accidentally drop.
Caution	 Work by two or more people	Installation and removal of the oil diffusion pump and oil sealed rotary vacuum pump should be performed by two or more people. Otherwise, you could injure your back.
	 Replace periodically	Oil mist trap (sold separately) should be replaced every six months to one year. Clogging in the element increases evacuation resistance, which may cause oil leakage from the axis sealing area or oil level gauge damage.
	 Comply with regulations	To dispose this product or pumps, comply with industrial waste disposal rules. Correctly dispose the products following the regulations stipulated in laws or by the local government.
	 Avoid this action	Do not make any modification of the product that is not permitted by Ulvac Kiko, Inc. We do not assume any responsibility for any damage due to such modifications.

(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. Purpose of This Product and Actions that are Prohibited

This product is a system that evaporates substances in a vacuum space by means of resistance heating evaporation source to form a thin film.

To safely and correctly use this product, avoid the following actions that are prohibited.

Avoid this action

Using this vacuum coater as a vacuum vessel.
Putting in materials other than evaporation materials and sample materials in the bell jar.
Reselling, repairing, and refurbishing of the product that are not permitted by us.

2. Safety Device and its Purpose and Functions

Item	Purpose	Functions	How to Check
Overload Short-circuit	Protection for the oil-sealed rotary vacuum pump, oil diffusion pump and short-circuit	Uses current leakage breaker for the MAIN switch of the vacuum coater. Nominal breaking current: 1.5 kA Nominal sensitivity current: 30 mA Manual reset after troubleshooting	N/A
Overheated	Oil diffusion pump Preventing overheat	If the temperature on the oil diffusion pump side (cooling fin) gets higher than 85 °C due to any circumstances including a cooling fan failure, thermostat turns off the power for the heater. Auto-reset after troubleshooting	N/A
Abnormality of internal wiring circuit and function parts	Protection of Power Supply unit	Turn the power off with Power Switch type Circuit Protector. Protection of internal wiring short circuit and wiring burnout when function parts abnormal. Replacement of Power Supply unit.	N/A
SCR Over load SCR failure	Protection of Power Supply unit	Over load protection equipment operates (Overload warning). Gate blocking method: Rated current 130% (Main body alarm flashing: Output OFF) After solving cause, reset with Power Switch.	N/A
DC Power Supply failure	Protection of operation circuit	Fast response fuse for operation circuit protection blowout (output OFF) and DC Power Supply in the main body failure is considered. Replacement of Power Supply unit.	N/A
Open circuit of the evaporation source	Protection of Power Supply unit	Protector operates and stop output after 3 seconds in case no load such as evaporation source open circuit SCR output voltage is larger than10% and zero current) Voltage indication field _ _ hb Current indication field _ _ _ _ After solving cause, reset with Reset Key.	Output without evaporation source

Avoid this action

Operation with the safety devices above disabled is prohibited.

3. Product Specifications

Ultimate pressure	1.3×10^{-3} Pa (Upon no-load cleaning in vacuum chamber) 6.6×10^{-4} Pa (Using liquid nitrogen, upon no-load cleaning in vacuum chamber)
Evacuation time	20 minutes or less up to 4.0×10^{-3} Pa (Upon no-load cleaning in vacuum chamber) 20 minutes or less up to 1.3×10^{-3} Pa (Using liquid nitrogen, upon no-load cleaning in vacuum chamber)
Necessary power	100 V single phase 1.35 kVA 200 V single phase 1.5 kVA
External dimensions Weight	Width:530 mm × Depth: 550 mm × Height: 1135 mm Approx. 72 kg (Standard type)
Finished color (Rack)	JIS S18-250 baking finish (Munsell 7.5YR5/2)
(Panel)	JIS S3-309 baking finish (Munsell 2.5YG8/1)

Refer to the specification sheet for special models.

4. Individual Unit Specifications

Unit	Model and Specifications	Quantity
1) Glass bell jar	- Dimensions: Internal diameter Φ300 mm × Height 300 mm - Material: Hard glass	1 pc.
2) Feed-through Collar	- Number of ports: 8 ports - Dimensions: Internal diameter 305 mm × Height 100 mm - Material: Iron and nickel coating - Accessories: 1-point electrode Hermetic port Gauge port Service port (including sealing flange) Shutter Column	1 set 2 pc. 1 pc. 1 pc. 4 pc. 1 set 4 pcs.

Unit	Model and Specifications	Quantity
3) 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) - Appurtenant devices: - Output cable (38 mm2 × 2 m)	1 set
4) Oil diffusion pump (D.P)	- Model: DPF-200 - Evacuation speed: 200 L/sec - Ultimate pressure: 10^{-5} Pa - Evacuation or suction opening: VG 65 or equivalent, φ27 - Required power: 0.45 kW Oil for use: SX, 0.07L	1 set
5) Oil sealed rotary vacuum pump (R.P)	- Model: G-101D - Evacuation speed: 100 L/min - Ultimate pressure: 6.7×10^{-2} Pa - Required power: 0.4 kW Oil for use: SMR-100, 0.8L	1 set
6) Main valve	- Model: Clapper valve - Internal diameter: VG-65	1 set
7) Liquid nitrogen trap	- Bore diameter: 65 A - Injection volume: Approx. 0.75L (including evaporation amount)	1 set
8) Three-way valve	- Model: Ball valve type	1 set

Refer to the specification sheet for special models.

5. Standard Accessories

1) Power supply cable	- For the main unit: 100 V single-phase, with plug, 2 m - For evaporation power: 200 V single-phase, with crimp-type terminal, 2 m	1 pc. 1 pc.
2) Plug adapter	- Plug with grounding wire for 100-V power supply	1 pc.
3) User's manual	- Standard paper	1 pc.
4) Vacuum performance test result table	- Standard paper	1 pc.
5) Hexagonal wrench	- 3 mm	1 pc.
6) Cap for BACK.P VENT (or RP. LEAK)	- Cap for the leak valve of the roughing piping	1 pc.

Refer to the specification sheet for special models.

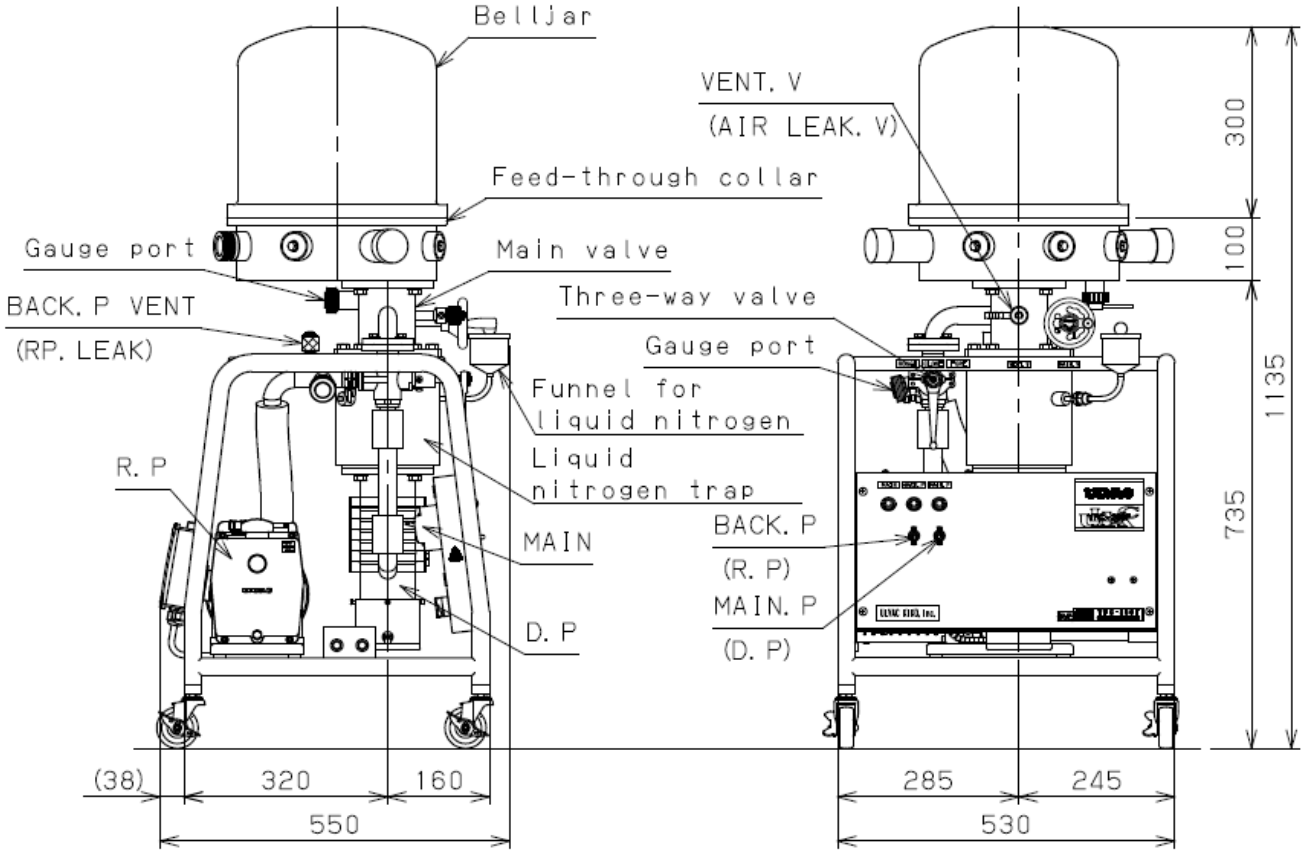
6. How to Use Switches, Handles, and Operation Levers

Confirm

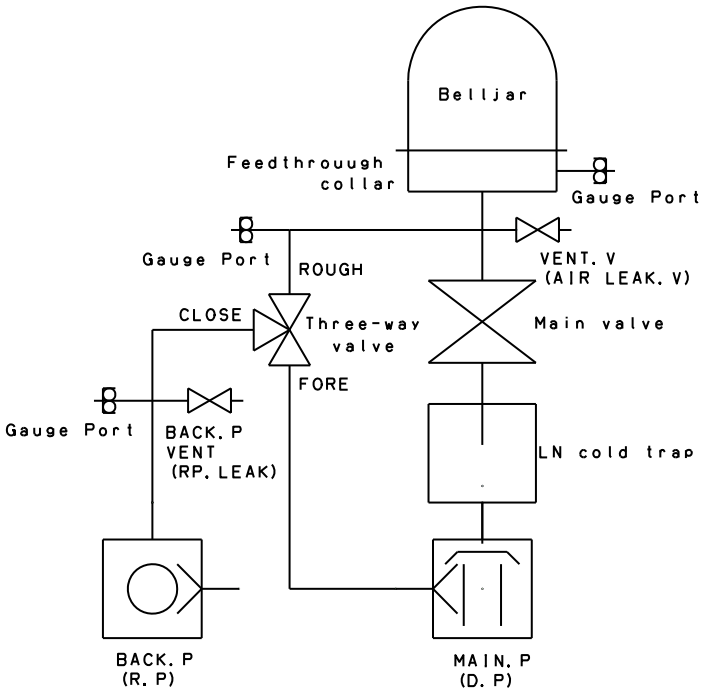
Before handling switches, handles, or operation levers, confirm the safety and conditions.

Name	How to Operate
MAIN switch	Manual ON-OFF　ON: lamp illumination
BACK.P(or R.P) switch	Manual ON-OFF　ON: lamp illumination
MAIN.P(or D. P) switch	Manual ON-OFF　ON: lamp illumination
Main valve handle	Counter clockwise: OPEN　Clockwise: CLOSE Important Complete open: Turn the handle counter clockwise until you feel a resistance. Then return it 90 degrees and stop it. Complete close: Turn the handle clockwise until you feel a resistance. Then turn it 90 degrees further to tighten and stop it.
Three-way valve	Lever operation to the direction or FORE, CLOSE, or ROUGH.
VENT.V(or AIR LEAK.V) BACK.P VENT(or RP. LEAK)	Screw tightening type Open: Counterclockwise　Close: Clockwise

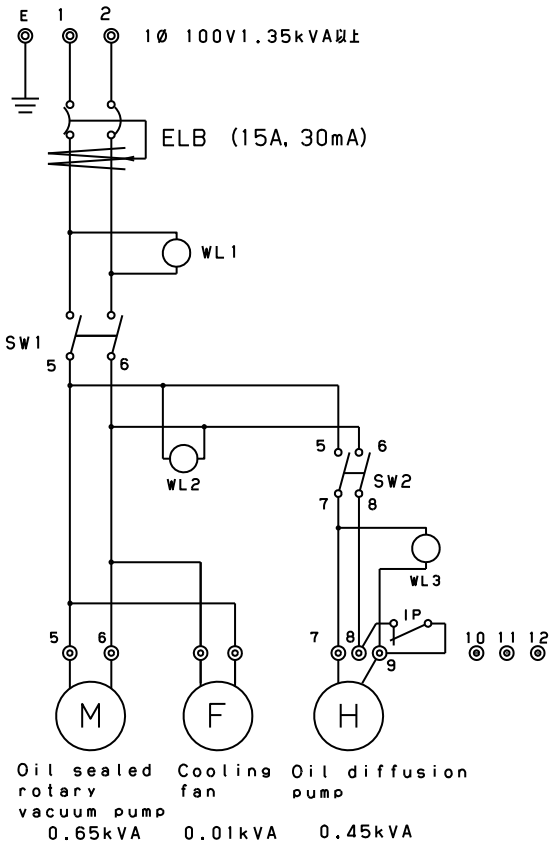
7. Layout of Switches, Handles, and Operation Levers



Evacuation system drawing



Electrical system drawing



(3) Opening the Package and Installation

1. General Cautions

 Confirm	1) Is the product what you requested? 2) Are the accessories and all necessary parts included? 3) Maintain a space of more than 1 m from the equipment for safety upon installation. 4) After the installation position is determined, fix the equipment with the stoppers that are attached to the casters.

2. Package upon Delivery

The main unit (with wheels at the bottom) and accessories are packed in wooden crate when delivered.

3. Installation Site

 **Warning**	 Check the environment	Install the equipment where the following conditions are satisfied. 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 without chemicals or gases, which affect the product. 8) Place without electrical noises, which may cause adverse effect to the product. Otherwise, operation failure or durability degradation may occur.
 Confirm	After the installation, make sure that the product has a clearance of at least 0.5 m from the wall to make space without any hindrance for maintenance and for safety.	

4. Power Supply

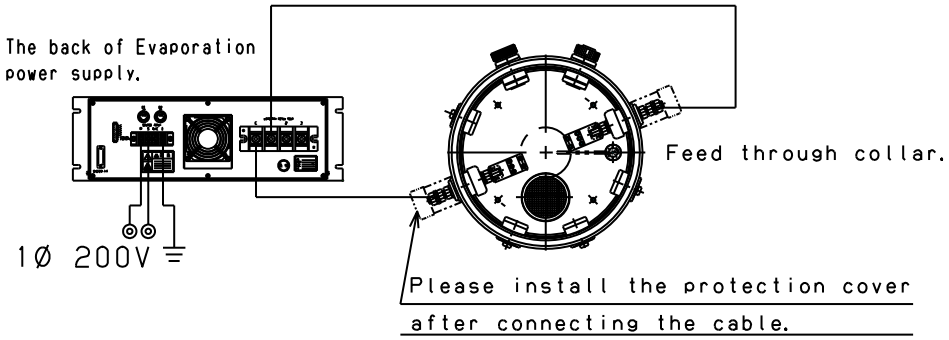
<table>
<tr><td> 
Warning</td><td> 
Check the capacity</td><td>Primary power supply
Please prepare the following.
Single-phase 100 V, 13.5 A or more
Single-phase 200 V, 7.5 A or more
Smaller power supply capacity may cause the breaker to trip due to overcurrent during the operation.</td></tr>
<tr><td colspan="3">Specifications of Primary Cable Connection
For Single-phase 100-V power supply, Cable length: 2 m End: 3P plug with ground
For Single-phase 200-V power supply, Cable length: 2 m End: Φ5 crimp-type terminal</td></tr>
<tr><td rowspan="5"> 
Warning</td><td> 
Do not share</td><td>For the primary power supply, a single power supply should be provided for the device, and other equipment should not be connected with it.
Breaker capacity shortage may cause the breaker to trip due to overcurrent during the operation.</td></tr>
<tr><td> 
Ground the grounding wire</td><td>Employ Level D grounding.
The grounding wire for 200-V power supply is the green wire.
Use a plug with grounding wire for 100-V power supply.
If you use a plug adapter, connect the grounding wire with a nearest grounding terminal.
If incorrect grounding is made, this may cause electrical shock in case of failure or current leakage.</td></tr>
<tr><td> 
Check the cable capacity</td><td>Avoid using an extension cable. However, if it must be used by necessity, use the following cable.
For 100-V power supply: 2.0 mm^2 or more
For 200-V power supply: 1.25 mm^2 or more
If a thinner cable is used, this may cause overheating, ignition, or fire.</td></tr>
<tr><td> 
Avoid this action</td><td>Do not place any object on the cable for the primary side.
Otherwise, such action may cause electrical shock or fire.</td></tr>
<tr><td> 
Avoid electrical shock</td><td>Do not touch the terminal block or other connectors if the primary cable plug is being inserted into a socket
Otherwise, the operator may suffer electrical shock.</td></tr>
</table>

5. Necessary Tool List

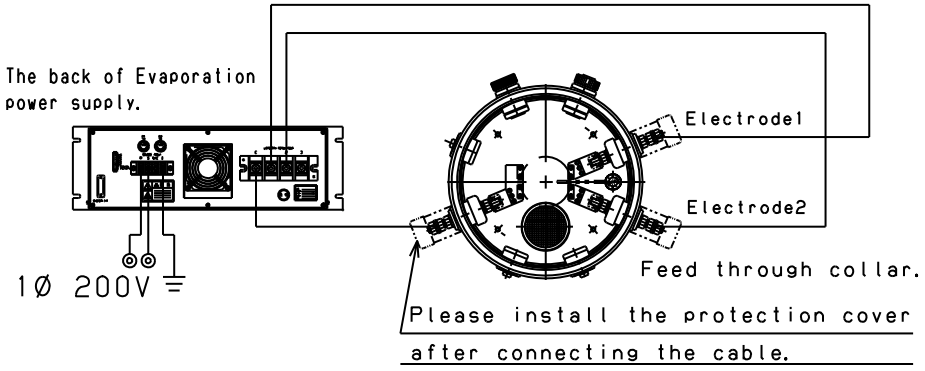
Tool	Where to be Used
Phillips head (+) screwdriver	Installation of the evaporation input power cable
25-mm crescent wrench	Installation of the evaporation output power cable
Torque wrench/socket (WAF 13)	Attachment of the evaporation power supply output cable

Evaporation power supply cables connection diagram

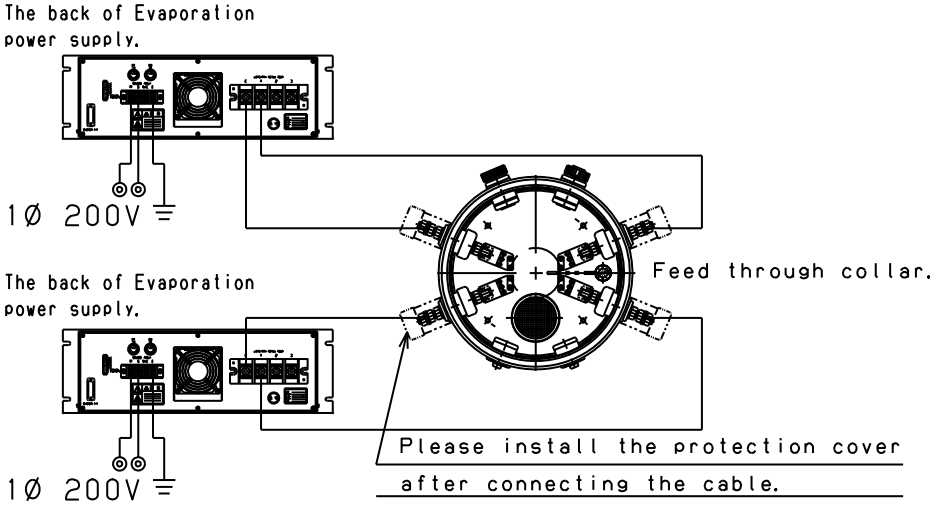
【One point expression】



【Two point swich type. (OPTION)】



【Twon point simultaneous type (OPTION)】



※Please tighten a fixed screw enough when you connect the cable.

(4) Operations

1. Risks and Safety Measures upon Operations

Warning	 Avoid this action	Do not apply any shock to the glass bell jar, and avoid heating it to 50°C or higher. In a case of explosion upon vacuum condition, the exploded pieces will spread. This may cause a serious damage to the product.
	 Check ventilation	Please make sure to ventilate the room when using the liquid nitrogen trap. The nitrogen can potentially reduce the oxygen in the room. This may cause an oxygen deficiency accident.
Caution	 Wear gloves	When using liquid nitrogen, wear gloves to protect your hands. If liquid nitrogen splashes and adheres to your skin, you may feel acute pain momentary.
	 Leave open air	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. This must be done to prevent reverse oil flow.
	 Confirm complete close	After confirming complete closure of the main valve, let out the air in the vacuum chamber. If air comes into the oil diffusion pump during operation, it deteriorates the oil and lowers the performance. Operation failure of the three-way valve may occur. An inflow of air during liquid nitrogen injection will cause condensable gases to adhere to the trap excessively, thus degrading the performance.

2. Evacuation Device Operation Procedure

2-1 Preparation

1) Close completely by attaching BACK.P VENT(or RP. LEAK) cap (accessory).
2) Three-way valve, main valve: CLOSE
3) All switches on the operation panel: OFF
4) Attach the probe to the gauge port for vacuum chamber when using the ionization gauge.
5) User side breaker: ON

2-2 Operations

Unit setup

1) MAIN: ON
2) BACK.P(or R.P): ON
   DP cooling fan: ROTATE
3) Three-way valve: FORE
4) Confirm 13 Pa or lower by using a tool such as a Pirani gauge. (Evacuation for around 1 min)
5) MAIN.P(or D.P): ON
6) D.P warming up in 15 mins: COMPLETE
7) Liquid nitrogen (when necessary): INJECT

Note

Liquid nitrogen volume
Max. fill-in volume: Approx. 0.75 liters
(including vaporization volume upon fill-in)
The liquid nitrogen lasts approx. 5 hours when a volume of 0.75 liters is filled.

If all of the liquid nitrogen is vaporized, the trapped condensable gases are released, which causes an adverse effect on the pressure for about 30 minutes. This is not a failure.
Open the MAIN valve to prevent inside of the vacuum chamber from contamination.

2-3 Stop

Unit shutdown

1) Vacuum evacuation for maintaining vacuum condition inside the vacuum chamber
2) When an ionization gauge is use Filament: OFF
3) Main valve: COMPLETE CLOSE
4) MAIN.P(or D.P): OFF
5) D.P cooling for 30 mins:
6) Three-way valve: CLOSE
7) BACK.P VENT(or RP LEAK): OPEN
8) BACK.P(or R.P): OFF
   DP cooling fan: STOP
9) MAIN: OFF
10) User side breaker (when necessary): OFF
11) If there is any liquid nitrogen inside, it evaporates naturally.

3. Deposition Steps

3-1 Releasing the vacuum chamber

1) When an ionization gauge is used Filament: OFF
2) Main valve: Complete close
3) Three-way valve set to FORE: Confirm
4) VENT.V(or AIR LEAK. V (of Main Valve))
when necessary : Open gradually

Note

When the vacuum chamber is opened, use dry air or nitrogen gas in order to prevent contamination of the vacuum chamber.
If atmospheric air is used, the inside of the chamber will be contaminated by the moisture contained in the air.
Pipe joint of VENT.V(or AIR LEAK. V (of Main Valve))
Hose bore diameter: External diameter 10 mm

3-2 Vacuum evacuation of vacuum chamber

1) VENT.V(or AIR LEAK. V (of Main Valve)): CLOSE
2) Bell jar: Attach
3) three-way valve: ROUGH
- Rough evacuation of the inside of the bell jar, Check: 13 Pa or lower
4) Three-way valve: FORE
5) Main valve: Complete open
6) When an ionization gauge is use. Filament: ON

4. Film Formation Steps

4-1 Preparation

1) Releasing vacuum chamber: Steps of 3-1
2) Attaching the evaporation source (substrate or filament) to the electrode
3) Provide the evaporation material to evaporation source
4) Shutter: CLOSE
5) Attaching the material (substrate)
6) Vacuum evacuation of vacuum chamber: Steps of 3-2
   - Executing the vacuum evacuation up to a certain pressure

4-2 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 3-1, and remove the coated material (substrate).

Repeat as necessary from step 4-1.

Note

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

5. Measures upon Abnormal Conditions

5-1 Instantaneous power outage

- All devices automatically return to the conditions before the power outage.

5-2 Long power outage

1) Main valve: PROMPT and COMPLETE CLOSE
2) Three-way valve: CLOSE
3) BACK.P VENT(or RP LEAK): Open
4) All switches on the operation panel: OFF

5-3 Operation after power recovery

Please refer to 2-1 Preparation and 2-2 Operations in “2. Evacuation Device Operation Procedure”.

(5) Maintenance and Repair

1. Risks and Safety Measure upon Maintenance and Repair

Warning	 Wear protective gear	Wear a dust-proof mask and gloves to clean the thin film adhered to the inside of the glass bell jar and feed-through collar. The thin film could by broken into minute particles, and float in the air, which could be inhaled into human body.
	 Wear protective gear	When replacing the oil of the oil diffusion pump, wear a dust-proof mask and gloves. This could cause risk to human health.
	 Work by two or more people	Since the glass bell jar weighs 7 kg, installation and removal should be made with correct posture. Installation or removal should be made by two or more people. Otherwise, you could injure your back.
	 Check	Check everyday for looseness of the fixture clips and eyebolts of both ends of the wire rope for lift (sold separately). If they are loose, the bell jar could accidentally drop.
Caution	 Comply with regulations	To dispose the oil (waste oil) for the pump and container, comply with industrial waste disposal rules. Comply with regulations upon disposal.
	 Replace periodically	Oil mist trap (sold separately) should be replaced every six months to one year. Clogging in the element increases evacuation resistance, which may cause oil leakage from the axis sealing area or oil level gauge damage.
	 Work by two or more people	Installation and removal of the oil diffusion pump and oil sealed rotary vacuum pump should be performed by two or more people. Otherwise, you could injure your back.
	 Avoid this action	Do not make any modification of the product that is not permitted by Ulvac Kiko, Inc. We do not assume any responsibility for any damage due to such modifications.

2. Maintenance and Repair that Can be Made by User

1) Replacement of oil for the sealed vacuum pump and oil diffusion pump.
2) Replacement of the element of oil mist trap (sold separately)
3) O-ring replacement (except for oil sealed rotary vacuum pump)
4) Replacement of the heater of the oil diffusion pump.
5) Replacement of the thermostat (oil diffusion pump).
6) Cleaning of the feed-through collar and the glass bell jar.

To make repair or maintenance other than the above, contact us.

3. Removal, Maintenance, and Installation of Devices

3-1 Oil sealed rotary vacuum pump

1) Required tool: Phillips head (+) screwdriver x 1, 8 mm spanner x 1, 4 mm Hexagonal wrench x 1
2) Removal procedure
   - All devices of the coater stop.: Confirm
   - The primary power supply of the coater is removed.: Confirm
   - Draw the vacuum hose forward and remove it.
   - Remove the motor wiring from the electric panel.
   - Remove the earth wire from the R.P base.
   - Remove the vibration-control rubber nuts (4 points) from the rear side of the equipment rack bottom.
   - Remove the pump unit. In this case two or more people lift the motor portion and front cover.
   - Remove the vibration-control rubber (4 points).
3) Oil replacement

   Refer to the separate sheet – Oil Sealed Rotation Vacuum Pump User's Manual
4) Order of attachment
   - Vibration-control rubber (4 points)
   - Attach the motor portion and front cover. In this case, two or more people lift them to attach.
   - Attach the nuts for vibration control (4 points)
   - Attach the wiring for grounding.
   - Attach wiring connectors for the motor (2 locations)
   - Attach the earth wire from the R.P base.
   - Attach the vacuum hose.

3-2 Oil diffusion pump

1) Required tools: 17 mm spanner x 1

2) Removal procedure

- All devices of the coater stop.: Confirm
- The primary power supply of the coater is removed.: Confirm
- BACK.P VENT(or RP.LEAK): OPEN
- Three-way valve: FORE (Leave the inside of the DP open air)
- Remove the heater wiring from the electric panel.
- Remove the thermostat and cooling fan wiring connectors.
- Remove the tightening bolt from the suction opening flange, and draw out the vacuum hose attached to the exhaust outlet. (Remove the bolt while supporting the oil diffusion pump.)
- Draw the oil diffusion pump forward and remove it.

3) Oil replacement

Refer to the separate sheet – DPF-200 Oil Diffusion Pump User's Manual

4) Order of attachment

- Insert the roughing piping to the exhaust outlet of the oil diffusion pump.
- Position the oil diffusion pump with its pump suction opening faced to the front of the roughing piping and below the liquid nitrogen trap.
- Lift the oil diffusion pump, insert the vacuum hose to the roughing piping and tighten the M10 bolts (2 locations) by three or four ridges. Then tighten the other two locations left.
- Tighten the fixing bolts evenly (orthogonally).
- Attach the heater, thermostat and cooling fan wiring connectors.

3-3 Oil Mist Trap OMT-100A (Sold Separately)

1) Required tools: Not needed

2) Removal procedure

- Rotate the lower portion of the oil mist trap counter-clockwise with both hands

3) Replace the element.

Please refer to Oil Mist Trap OMT-100A User's Manual

4) Order of attachment

- Place the attached O-ring on the lower face of the oil mist trap body.
- Rotate the lower portion of the oil mist trap clockwise with both hands to adjust to the evacuation opening of the oil sealed vacuum pump.

Caution: Tighten with the O-ring held.

3. Removal, Maintenance, and Installation of Devices

3-4 O-ring at gas bell jar

1) Required tools: Not needed
2) Removal procedure
   - Remove the O-ring. In this case, do not cause any damage on the O-ring groove.
3) Order of attachment
   - Apply vacuum grease on the surface of a new O-ring. (Apply thin layer of oil)
   - Clean the inside of the O-ring groove.
   - Place the O-ring into the groove.

3-5 Glass bell jar

1) Necessary safety equipment for task: Dust-proof mask and gloves
2) Removal procedure
   - To remove the glass bell jar, lift the jar with two people to remove it.
3) Cleaning
   - Wear protective equipment (dust-proof mask and gloves) and wipe the adhered materials using alcohol.
4) Order of attachment
   - Attach the jar in such a way that the flange at the lower part of the glass bell jar contacts with the O-ring face in parallel. (Caution: If it is tilted, it may contact with the metal part, causing damage.)

4. Maintenance and Inspection Points

Instruments to be inspected	Maintenance and Inspection	Timing of Maintenance and Inspection
Glass bell jar	Clean the inside.	As necessary
Oil sealed rotary vacuum pump	Confirm that the oil level of the oil level gauge is within the indicated lines.	Every time before using
	Replace oil. If the pressure during isolated operation is 5 Pa or more.	As necessary
Oil diffusion pump	Replace oil. If the ultimate pressure and the exhaust time is changed after an incorrect air intake. If the ultimate pressure and the exhaust time is changed after long years of continuous use.	As necessary
	Confirm that cooling fan rotates.	Every time before using
Main valve	Clean the surface of the valve seat.	6 months to 1 year When foreign material is dropped on the surface.
Wiring cable	Confirm that there is no looseness in wiring terminals and screws.	As necessary
Oil mist trap	Replace the element.	6 months to 1 year
Vacuum hose	Confirm that there is no deformation either externally or internally.	Every time before using

5. Troubleshooting

Symptom	Cause	Troubleshooting
Ultimate pressure is low or unstable, or evacuation performance is low.	The ambient temperature at the installation site is high.	Decrease the ambient temperature to 25°C by cooling.
	Operation time is too long after installation or long termination.	Operate 24 hours to 48 hours, and then perform checking.
	Leakage is detected.	Check components that were maintained before ultimate pressure changes.
		Clean glass bell jar and O-ring, or replace consumables.
	Deterioration of the oil for the oil diffusion pump.	If the cause of the deterioration is clear (incorrect air intake, leakage, etc.), replace the oil.
	Material (substrate) that involves large-amount gas release was used (e.g., resin substrate).	Change the material. Take longer evacuation time.
	Failure in the oil sealed vacuum pump	Refer to the Oil Sealed Vacuum Pump User's Manual.
	Failure in measuring instrument	Replace the measuring instrument.
The oil diffusion pump stays cold.	The heater is disconnected.	Replace the heater.
No current flows through the electrode even when the evaporation power supply is operated.	Evaporation power supply is disconnected.	Replace the evaporation power supply.
	The electrode may be shorted in the feed-through collar.	Repair the point of short to recover isolation.
	Failure in evaporation power supply	Refer to the Evaporation Power Supply User's Manual.
The thermal protector for oil sealed vacuum pump operates.	Overloaded	Refer to the Oil Sealed Vacuum Pump User's Manual. Press the return button.
Pressure measured on the roughing side indicates wrong values when the vacuum chamber is exposed to open air.	The main valve is not opened completely.	Turn the handle clockwise until you feel a resistance, and then turn it a further 90 degrees to tighten.
		Clean the internal face of the valve seat seal on the main valve.
		Overhaul of the main valve (at our factory)

6. Storage of Equipment

Observe the following guidelines to store the equipment.
1) Place of storage - Floor with sufficient strength - Location with good ventilation - Location without direct sunlight - Location where no corrosive chemicals or gases are present.
2) Cautions before and upon storing - Perform roughing evacuation inside the vacuum chamber - Fix the vacuum coater with the stoppers that are attached to the casters. - For units with lift (option), remove the ring catch of the vacuum chamber and suspend the elevating weight up to the level of pillar floor.

7. Consumable List

Location of Use	Parts	Specifications	Material	Quantity	Replacement by user
Feed-through collar	O-ring for flange	P-315	NBR	1	OK
	O-ring for hermetic sealing	P-26	NBR	1	OK
	O-ring for gauge port	N-16	NBR	1	OK
	O-ring for service port	P-32	NBR	2	OK
	O-ring for service port sealing flange	P-30	NBR	4	OK
	O-ring for shutter	N-16	NBR	1	OK
	Electrode pole gasket	KS-1022-14 -004R2	FPM	2	OK
Rack	Warning Label	PL001	---	1	OK
	Warning Label	PL004	---	1	OK
	Warning Label	PL005	---	1	OK
	Warning Label	PL006	---	1	OK
	Warning Label	PL007	---	1	OK
	Warning Label	PL008	---	1	OK

7. Consumable List

Location of Use	Parts	Specifications	Material	Quantity	Replacement by user
Main valve	O-ring for suction flange	V-85	NBR	1	OK
	O-ring for exhaust flange	V-34	NBR	1	OK
	O-ring for axis	N-7	NBR	1	NG
	Valve seat fixed packing	Connector-3614, No. 3	NBR	1	NG
	O-ring for gauge port	N-16	NBR	1	OK
	O-ring for leakage valve	N-6	NBR	1	OK
	O-ring for leakage valve	N-8	NBR	1	OK
Oil diffusion pump	Gasket for suction flange	φ85×φ95×t5	NBR	1	OK
	Oil for use	SX	---	0.07L	OK
	Sheathed Heater	Single-phase 100 V, 0.45 kW	---	1	NG
	Vacuum hose for DP	φ25×φ50, L=60	Special rubber	2	OK
Oil sealed rotary vacuum pump	Oil	SMR-100	---	0.8L	OK
	Vibration-control rubber	ME-20	---	4	OK
	Vacuum hose for RP	φ25×φ50, L=210	Special rubber	1	OK
Three-way valve	O-ring for leakage port	N-8	NBR	1	OK
	O-ring for gauge port	N-16	NBR	1	OK
	O-ring for piping	S-28	NBR	3	NG
	Packing set	Attached component	NBR	1set	NG
	O-ring for center healing	NW25	FPM	1	OK
Instrument panel	Indicator lamp	B-5M, 100V	---	3	NG
	Snap switch	ST215KT	---	2	NG
Liquid nitrogen trap	O-ring for suction flange	V-85	NBR	1	OK

Specifications and quantity is different for special models.

(6) Disposal

1. Cautions upon Disposal

 **Caution**	 Comply with regulations	To dispose the oil (waste oil) for the pump and container, comply with industrial waste disposal rules. Comply with regulations upon disposal.
Applied regulations: Rules of waste disposal and cleaning		
Consign the disposal work to: 1) Transportation: Collector and carriers of industrial waste. 2) Disposal: Assigned to collector and carriers of industrial waste.		

(7) Optional Parts

 **Caution**	 Avoid this action	Do not make any modification of the product that is not permitted by Ulvac Kiko, Inc. We do not assume any responsibility for any damage due to such modifications.

1. Standard Optional Parts List

Name of optional parts	Applications	Installation conditions
Two-point evaporation electrode (switching)	2-points switching vapor-deposition	Factory assembled
2-points evaporation electrode (simultaneous)	2-point simultaneous vapor-deposition.	Factory assembled
Three-point evaporation electrode (switching)	3-point switching vapor-deposition.	Factory assembled
Three-point evaporation electrode (simultaneous)	3-point simultaneous vapor-deposition	Factory assembled
Three-point evaporation electrode (simultaneous)	1-points + 2-points switching vapor-deposition.	Factory assembled
4-points evaporation electrodes (variable)	2-point + 2-point switching vapor-deposition.	Factory assembled
Feed-through collar 16 ports	Increase the number of intake port.	Factory assembled
Filament holder	Secure the evaporation power.	Installable by user

1. Standard Optional Parts List

Name of optional parts	Applications	Installation conditions
Standard electrode set (for service port)	Evaporation electrode.	Installable by user
Gauge port set	For adding Ø 18 gauge port.	Installable by user
Hermetic port set	For adding Hermetic seal port.	Installable by user
8P Hermetic	Terminals for energizing.	Installable by user
Socket for 8P Hermetic	Terminal socket for energizing.	Installable by user
Sealing flange set	For service port sealing.	Installable by user
Sealing flange set	For base plate sealing.	Installable by user
UFC070 adapter	For 070 con flat flange attachment.	Installable by user
NW25 adaptor	For attaching the NW25 flange.	Installable by user
Gas intake port	For gas intake into the vacuum chamber	Installable by user
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.	Installable by user
Evaporation power supply cables	Power supply out cables for deposition	Factory assembled
Glass bell jar	Glass container for film formation.	Installable by user
Bell jar holder	Glass bell jar handle	Installable by user
Bell jar cover	Glass bell jar handle Prevents glass explosion.	Installable by user
Metal bell jar	For heating the inside of the bell jar	Factory assembled
Metal bell jar (with water-cooling coil)	For heating the inside of the bell jar	Factory assembled
Lift	Raises and lowers the bell jar.	Installable by user
Sample holder (Ø 260)	Fixing material	Installable by user

1. Standard Optional Parts List

Name of optional parts	Applications	Installation conditions
Plate preventing adhesion	Preventing evaporated material from adhering to glass bell jar.	Installable by user
Electrode separation plate (2-point type)	Plate for separating evaporation source Contamination prevention.	Installable by user
Electrode separation plate (3-point type)	Plate for separating evaporation source Contamination prevention.	Installable by user
Electrode separation plate (4-point type)	Plate for separating evaporation source Contamination prevention.	Installable by user
Substrate heating device	For sample heating (Max.350°C).	Installable by user
Carbon electrode set	For carbon film formation	Installable by user
Oil mist trap	To prevent the oil and smoke flow from the exhaust opening of the oil sealed rotary vacuum pump.	Installable by user
Oil mist Trap (Inline type)	To prevent oil and smoke flow from the exhaust opening of the oil sealed rotary vacuum pump. Can be connected to exhaust duct.	Installable by user
Control operational panel	For storing the control devices.	Factory assembled
Side panel (for control operational panel)	For safety regulation	Installable by user
Rear panel (for control operational panel)	For safety regulation	Installable by user
Automatic leakage valve	For main pump protection upon power outage	Installable by user
Vacuum meter	Meter to measure pressure	Installable by user
φ15GP Attachment	Attachment to convert the bore diameter	Installable by user
Film formation controller	For measurement and control of film thickness and film formation speed.	Installable by user
Film thickness sensor	Sensor for film controller measurement	Installable by user
Cooling water piping for film thickness sensor	Introduction piping for cooling water for film thickness sensor.	Factory assembled