Instruction Manual

Compact Vacuum Evaporator DEPOX (VWR-400M/ERH)

Please read this manual thoroughly to ensure safe and effective operation of this equipment. Keep this manual in a safe place.

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

Ulvac Kiko, Inc.

Table of Contents Items with shade include description on safety.

To Safely Use This Equipment

| (1) Before Using | 1 |
|---|------------|
| 1. Target Users | 1 |
| 2. Read the Manual Thoroughly | 1 |
| 3. Keep This Manual in a Safe Place | 1 |
| 4. Warranty | 1 |
| 5. Statutory Requirements for Disposal | 1 |
| 6. Safety during Repair | 1 |
| (2) Product Overview | 2 |
| 1 Purpose of This Product and Actions that are Prohibited | 2 |
| 2 Safety Device and its Purpose and Functions | 2 |
| 3 Product Specifications | 3 |
| 4 Individual Unit Specifications | 4 |
| 5 Standard Accessories | 5 |
| 6 How to Use Switches Handles and Operation Levers | 6 |
| 7 Layout of Switches, Handles, and Operation Levers | 7 |
| Fyaculation system drawing | _ 8 |
| Evacuation system drawing | - 0 - 8 |
| | - 0 |
| (3) Opening the Package and Installation | 9 |
| 1. General Cautions | 9 |
| 2. Package upon Delivery | 9 |
| 3. Installation Site | 9 |
| 4. Power Supply | 10 |
| Evaporation electrode power output diagram | 11 |
| 5. Water | 12 |
| 6. Required Tool List | 13 |
| • | |

| (4) Operations | 13 |
|---|--|
| 1. Potential dangers and safety precautions during operation | 13 |
| 2. Evacuation device operation | 14 |
| 2-1 Preparation | 14 |
| 2-2 Operations | 14 |
| 2-3 Shut down | 14 |
| 3. Vapor deposition operation | 15 |
| 3-1 Opening the vacuum chamber | 15 |
| 3-2 Vacuum chamber evacuation | 15 |
| 4. Creating a film | 16 |
| 4-1 Preparation | 16 |
| 4-2 Creating a film | 16 |
| 5. Handling malfunctions | 17 |
| 5-1 Instantaneous power outage | 17 |
| 5-2 Long power outage | 17 |
| 5-3 Operation after power recovery | 17 |
| 5-4 Instantaneous water outage | 17 |
| 5-5 Long water outage | 17 |
| 5-6 Operation after water recovery | 17 |
| | 10 |
| (5) Maintenance and repair | 18 |
| 1. Risks and Safety Measure upon Maintenance and Repair | 18 |
| 2. Maintenance and Repair that Can be Made by User | 19 |
| 3. Removal, Maintenance, and Installation of Devices | 19 |
| | 10 |
| 3-1 Oil sealed rotary vacuum pump | 19 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 |
| 3-1 Oil sealed rotary vacuum pump 3-2 Oil diffusion pump 3-3 Oil mist trap | 19 20 21 |
| 3-1 Oil sealed rotary vacuum pump 3-2 Oil diffusion pump 3-3 Oil mist trap 3-4 Glass bell jar O-ring | 19 20 21 21 |
| 3-1 Oil sealed rotary vacuum pump 3-2 Oil diffusion pump 3-3 Oil mist trap 3-4 Glass bell jar O-ring 3-5 Glass bell jar | 19 20 21 21 21 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 22 23 24 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 24 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 26 26 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 26 26 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 26 26 26 |
| 3-1 Oil sealed rotary vacuum pump | 19 20 21 21 21 22 23 24 24 26 26 26 26 |

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.

The copyright of this user's manual and safety guides are reserved by Technical Division of Ulvac Kiko. No part of this document, in whole or part may not be reproduced without permission of Ulvac Kiko Inc.

Read this section before using the VWR-400M/ERH. Always follow the instructions below to safely use the device and prevent personal injuries from occurring.

The symbols below have the following meaning.

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

| 0 | This indicates action or practice that should be made. |
|------------|--|
| | Always make connection with the earth. |
| \bigcirc | This indicates the action or practice that should be prohibited. |
| | Do not disassemble. |
| | Do not touch. |

Warning Label

| 4) Lift (PL003) Contact us if the label is contaminated or peeling off. | Caution | Check labels | The warning labels are pasted on the following parts. 1) Glass bell jar (PL001) (PL005) When accompanied by a liquid nitrogen trap. 2) Around the introduction funnel for liquid nitrogen. (PL006) When accompanied by a bell jar cover. 3) Bell jar cover (PL001) (PL005) When accompanied by a lift. |
|--|---------|--------------|--|
| | | | 4) Lift (PL003) Contact us if the label is contaminated or peeling off. |

Power Supply

| Warning | Check the capacity | Primary power supply Prepare the following. Single-phase 100 V, 16.0 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 is the green wire. 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: 3.5 mm ² or more For 200-V power supply: 2.0 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 | Electricity flows through the MAIN breaker even the MAIN breaker is turned OFF. Do not touch the terminal block or other connectors. Otherwise, the operator may suffer electrical shock. |

Use Environment

| | 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. |
|-------------|----------------------|--|
| Warning | Avoid this action | Temperature around the 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. |
| \bigwedge | 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. Otherwise, oil spread may contaminate the room or affect human health. |
| Caution | Ventilate | Pump is heated during operation. Room temperature rises. |

Installation

| Marning | 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. |
|----------------|-------------------------------|---|
| | Work by two or more people | Use a trolley to carry the product. Lifting should be done by two or more people. Otherwise, you could injure your back. |
| Caution | Work by two or | Installation or removal of lift (sold separately) should be made by two or more people. |
| | more people | Otherwise, you could injure your back. |
| | | After the installation, fix the product using an adjuster. This is made to prevent movement or damage upon earthquake. |
| | Fix the product | |

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 | Always ventilate the room when using liquid nitrogen because the oxygen content may be decreased due to increase of liquid nitrogen gases. This may cause an oxygen deficiency accident. |
| | 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. |
| \wedge | Leave open air | After the oil sealed rotary vacuum pump stops, open BACK.P VENT(or RP VENT) to leave the inside of the roughing piping open air. This must be done to prevent reverse oil flow. |
| Caution | Confirm complete close | After confirming complete closure of the main valve, open the vacuum chamber and expose it to the air. If air comes into the oil diffusion pump during operation, it deteriorates the oil and lowers the performance. 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

| | 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. |
|-------------|-------------------------------|---|
| \bigwedge | Wear protective gear | Wear a dust-proof mask and gloves to replace the oil of the oil diffusion pump and the oil sealed rotary vacuum pump. This could cause risk to human health. |
| Warning | Check | 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 the accompanying lift (sold separately). If they are loose, the bell jar could accidentally drop. |
| | 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. |
| Caution | Replace periodically | Oil mist trap 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. q) 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.



Using this vacuum coater as a vacuum vessel.

Putting in materials other than evaporation materials and sample materials in the vacuum chamber.

Reselling, repairing, and refurbishing of the product that are not permitted by us.

Avoid this action

| Item | Purpose | Functions | How to Check |
|---|--|--|--------------|
| Current leakage | Preventing electrical shock | Uses current leakage breaker for the MAIN breaker of the vacuum coater. Nominal breaking capacity: 1 kA Manual reset after troubleshooting | N/A |
| Water supply stop | Preventing excess temperature increase of the oil diffusion pump. | Detects the interruption of the water supply by a flow switch. Inter-locks the oil diffusion pump heater. Turn off the power for the heater. Auto-reset after troubleshooting | N/A |
| Operation with the safety devices above disabled is prohibited. | | | |

2. Safety Device and its Purpose and Functions

3. Product Specifications

| Ultimate pressure | 4.0 x 10 ⁻⁴ Pa (Upon no-load cleaning in vacuum chamber) 3.0 x 10 ⁻⁴ Pa (Using liquid nitrogen, upon no-load cleaning in vacuum chamber) |
|---|---|
| Evacuation time | 10 minutes or less up to 4.0 x 10 ⁻³ Pa (Upon no-load cleaning in vacuum chamber) 10 minutes or less up to 3.0 x 10 ⁻³ Pa (Using liquid nitrogen, upon no-load cleaning in vacuum chamber) |
| Necessary power | 100 V single-phase 1.6 kVA |
| | 200 V single-phase 1.5 kVA |
| Necessary water | 2 L/min Water temperature: 20°C to 25°C Water pressure: 200 kPa to 300 kPa (gage pressure) |
| External dimensions (Main unit) (Power) Weight (Main unit) (Power) | Width:730 mm × Depth: 731 mm × Height: 1,161 mm Width:480 mm × Depth: 435.3 mm × Height: 149 mm (except the protruding part) Approx. 145 kg Approx. 40 kg |
| Paint (Main unit) | JIS S5-462 baking finish (Munsell 5GY8/0.5) |

Refer to the specification sheet for special models.

4. Individual Unit Specifications

| Unit | Model and Specifications | |
|-----------------------------|--|-------|
| 1) Glass bell jar | - Dimensions: Internal diameter 300 mm × Height 300 mm - Material: Hard glass | |
| 2) Feed-through Collar | Number of port: 12 ports (Side: 8 pcs., Bottom: 4 pcs.) Dimensions: Internal diameter 305 mm × Height 100 mm Material: Iron and nickel coating | 1 set |
| | - Accessories: 1-point electrode | 2 pc. |
| | KF port | 1 set |
| | Shutter | 1 set |
| | Sealing flange for service port | 5 set |
| | Flange for base plate | 3 set |
| 3) Evaporation power | - Model: PSE-150C | 1 set |
| supply | - Dimensions: W480 mm × D435.3 mm × H149 mm | 1 001 |
| | - 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) | |
| 4) Oil diffusion pump (D.P) | - Model: OFK-3US | 1 set |
| | - Evacuation speed: 400 L/sec | |
| | - Ultimate pressure: 5.3 x 10 ⁻⁵ Pa | |
| | - Evacuation or suction opening: VG 100 or equivalent, NW 25 | |
| | - Required power: 0.6kW | |
| | - Oil for use: Lion-S 0.1 L | |
| | - Cooling water: 2 L/min | |
| | | |

| Unit | Model and Specifications | Quantity |
|---|--|----------|
| 5) Oil sealed rotary vacuum pump (R.P) | Model: GLD-202B Evacuation speed: 200 L/min Ultimate pressure: 6.7 x 10⁻² Pa Required power: 0.55 kVA Oil for use: SMR-100, 1.1L | 1 set |
| 6) Main valve | - Model: SBVM-4A X - Internal diameter: VG-100 | 1 set |
| 7) Liquid nitrogen trap | - Bore diameter: 100 A - Injection volume: Approx. 1.4L (including evaporation amount) | 1 set |
| 8) Three-way valve | - Model: 3W-25K - Bore diameter: 20 A | 1 set |
| 9) Vacuum gauge | - Model: ISG1 - Gauge head: M-34 ∕ WP-01 | 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 crimp-type terminal, 4 m For evaporation power: 200 V single-phase, with crimp-type terminal, 2 m | 1 pc. 1 pc. |
|---|--|----------------|
| 2) Instruction manual | - Standard paper | 1 pc. |
| 3) Vacuum performance test result table | - Standard paper | 1 pc. |
| 4) Hexagonal wrench | - 3 mm | 1 pc. |
| 5) Cap for BACK.P(0r RP). and VENT. | - Cap for the ventilator valve of the roughing piping | 1 pc. |

Refer to the specification sheet for special models.

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



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

| Name | How to Operate | |
|--------------------------|---|--|
| MAIN switch | Manual ON-OFF | |
| 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 | |
| Three-way valve | Lever operation to the direction or FORE, CLOSE, or ROUGH. | |
| BACK.P VENT(or R.P VENT) | Screw tightening type OPEN: Counter clockwise CLOSE: Clockwise | |
| VENT. V | Screw tightening type OPEN: Counter clockwise CLOSE: Clockwise | |

* Refer to each manual for detailed description of switches of units.

7. Layout of Switches, Handles, and Operation Levers



Evacuation system drawing



Electrical system drawing



(3) Opening the Package and Installation

1. General Cautions



2. Package upon Delivery

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

3. Installation Site



4. Power Supply

| | | Primary power supply |
|---|--|---|
| $\overline{\mathbb{N}}$ | 0 | Please prepare the following. Single-phase 100 V, 16.0 A or more Single-phase 200 V, 7.5 A or more |
| Warning | Check the capacity | Smaller power supply capacity may cause the breaker to trip due to overcurrent during the operation. |
| Specifications of For 100-V p For 200-V p | of Primary Cable Col ower supply Cable le ower supply Cable le | nnection ength: 4 m End: Φ 4 crimp-type terminal ength: 2 m End: Φ 5 crimp-type terminal |
| | | For the primary power supply, a single power supply should be provided for the device, and other equipment should not be connected with it. |
| | Do not share | to trip due to overcurrent during the operation. |
| | | Employ Level D grounding. |
| Warning | | The grounding wire is the green wire. |
| | Ground the grounding wire | 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. |
| | | 100 V, 3.5 mm² or larger 200 V, 2.0 mm² or larger |
| | | If a thinner cable is used, this may cause overheating, ignition, or fire. |
| | | Do not place any object on the cable for the primary |
| | Avoid this action | Otherwise, such action may cause electrical shock or fire. |
| | A | Electricity flows through the MAIN breaker even the MAIN breaker is turned OFF. Do not touch the terminal block or other connectors. |
| | Avoid electrical shock | Otherwise, the operator may suffer electrical shock. |

Evaporator electrode power output diagram

<1 points> Evaporation power supply PSE-150C:PSE-15C11111 0 Feed-through collar 1Ø 200V = E <2 points (option) > Evaporation power supply PSE-150C:PSE-15C21111 Feed-through collar 1Ø 200V = E <3 points(option)> Evaporation power supply PSE-150C:PSE-15C31111 Feed-through collar

Е

1ø 200V =

5. Water

| Volume | | 2.0 L/min |
|--|----------------------|--|
| Temperature | | 20°C to 25°C |
| Pressure | | 200 kPa to 300 kPa (gage pressure) |
| We recommend tap water or pH o circulator. | | controlled pore water circulating in a cooling water |
| Specifications | of primary piping co | onnection (portions connected with the equipment) |
| Equipment cor | nection (socket) R | p1/4 (Tool-less joint) |
| Recommended | d hose Tetro | onic braided hose (prepared by a user) |
| | Inter | nal diameter 9 mm, Outer diameter 15 mm |
| Caution | Fix piping | Piping for cooling water should be secured with a tool-less joint. This is done to prevent water leakage. |
| - | | |
| Note The Japan Refrigeration and Air Conditioning Industry Association's GL-02-1994 water quality standard | | Conditioning Industry Association's d |
| pH (25°C) | | 6.5 or more, 8.2 or less |
| Electric conduc | ctivity | 800 µS/cm.25°C |
| Chloride ion | | 200 mg.Cl ⁻ /L |
| Sulfate ion | | 200 mg. SO ₄ ²⁻ /L |
| Acid consumption | | 100 mg.CaCO₃/L |
| Total hardness | | 200 mg.CaCO₃/L |
| Calcium hardn | ess | 150 mg.CaCO₃/L |
| lonic silica | | 50 mg.SiO ₂ /L |

6. Required Tool List

| Name | Where to be Used | |
|-------------------------------|--|--|
| Phillips screwdriver | Installation of primary power cable Attaching the Vacuum gauge head | |
| Hexagonal wrench (WAF1.5) | Attaching the Vacuum gauge head | |
| Torque wrench/socket (WAF 13) | Installation of the evaporation power cable. | |
| 250 crescent wrench | Installation of the piping for cooling water. | |

(4) Operations1. Potential dangers and safety precautions during operation

| | a dangere e | |
|---------|---------------------------|--|
| 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 | Always ventilate the room when using liquid nitrogen because the oxygen content may be decreased due to increase of liquid nitrogen gases. 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 VENT) 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. 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

2-1 Preparation

- 1) Attach the BACK.P VENT(or RP VENT) cap (appurtenant part) to close off the vent.
- 2) Attach the pirani gauge to the gauge port of the vacuum chamber bottom.
- 3) Attach the ionization vacuum gauge head to the vacuum chamber KF port.
- 4) Close the three-way valve and the main valve.
- 5) Turn off all switches on the operation panel.
- 6) Turn on the customer-side power breaker
 - Unit power supply lamp:ON

2-2 Operation

Starting up the device

- 1) Turn on the main switch.
- 2) Cooling water: FLOW
- 3) Turn on the BACK.P(or RP).
 - Set the DP cooling fan to Rotation.
- 4) Set the three-way valve to Fore
- 5) After 1 minute exhaust, Turn on the MAIN.P (or DP)
- 6) Allow the DP to warm up for 15 minutes.
- 7) Fill with liquid nitrogen (as necessary)

Reference:

Liquid nitrogen quantities: (Liquid nitrogen trap is optional)

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

Once the liquid nitrogen has evaporated completely, the condensable gas that was trapped will separate and pressure will worsen for approximately 30 minutes. This is not a malfunction.

Close the main valve completely to prevent contamination of the vacuum chamber.

2-3 Shut down

Shutting down the device

1) Evacuation for maintaining vacuum in the vacuum chamber.

- 2) Close the main valve.
- 3) Turn off the MAIN.P(or DP).
- 4) Allow the DP to cool for 30 minutes.
- 5) Close the three-way valve
- 6) Open the BACK.P VENT(or RP VENT).
- 7) Turn off the BACK.P(or RP).
- 8) Stop the DP cooling water.
- 9) Turn off the main switch.
- 10) Turn off the customer-side power breaker. (as necessary) Unit power supply lamp: OFF
- 10) Allow any residual liquid nitrogen to evaporate naturally.

3. Vapor deposition operation

3-1 Opening the vacuum chamber

1) Close the main valve.

2) Verify that the three-way valve is set to Fore.

3) If necessary, open the vent valve slowly.

Reference:

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

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

Vent V coupler

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

3-2 Vacuum chamber evacuation

1) Close Vent V.

2) Attach the bell jar.

3) Set the three-way valve to Rough.

Obtain rough vacuum inside vacuum chamber.

4) Verify that the vacuum gauge reads 13Pa or less.

5) Set the three-way valve to Fore.

6) Open the main valve.

4. Creating a film

4-1 Preparation

1) Open the vacuum chamber, as described in section 3-1.

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

4-2 Creating a film

1) Turn on the evaporator main power.

- 2) Turn on the evaporator select switch.
- 3) HIGH (lamp lighting)
- 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.

Confirmation

- 7) Once the evaporation element is red hot and the vapor source has started to melt, use the shutter to remove impurities from the evaporation element.
- 8) Open the shutter to apply film to the material to be coated (substrate).
- 9) Once vapor deposition is completed, close the shutter.
- 10) Turn off the evaporator power switch.
- 11) Turn off the evaporator main power.
- 12) Open the vacuum chamber, as described in section 3-1, and remove the coated material (substrate).

Repeat as necessary from step 4-1.

Reference:

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

5. Handling malfunctions

| 5-1 Instantaneous power outage - All devices automatically return to the conditions before the power outage. | | |
|---|---|--|
| 5-2 Long power outage 1) Main valve: 2) Three-way valve: 3) BACK.P VENT(or RP VENT): 4) All switches on the operation panel: | CLOSE CLOSE OPEN OFF | |
| 5-3 Operation after power recovery 2.Evacuation Device Operation Procedure Please re | 2-1 Preparation fer to 2-2 Operations | |
| 5-4 Instantaneous water outage - All devices automatically return to the outage. | conditions before the water | |
| 5-5 Long water outage Devices are stopped. When an ionization gauge is use. Filan Main valve: MAIN.P(or D.P) After 60 minutes Three-way valve: BACK.P VENT(or RP. VENT): BACK.P(or R.P): 5) MAIN: Breaker of user side: | nent: OFF CLOSE OFF CLOSE OPEN OFF OFF OFF | |
| 5-6 Operation after water recovery 2.Evacuation Device Operation Procedure 2-1 Preparation Please refer to 2-2 Operations. | | |

(5) Maintenance and repair1. <u>Risks and Safety Measure upon Maintenance and Repair</u>

| | | 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. |
|----------|----------------------------|---|
| | Wear protective gear | The thin film could by broken into minute particles, and float in the air, which could be inhaled into the human body. |
| | 0 | Wear a dust-proof mask and gloves to replace the oil of the oil diffusion pump and the oil sealed rotary vacuum pump. |
| \wedge | Wear protective gear | This could cause risk to human health. |
| Warning | Check | 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 everyday for looseness of the fixture clips and eyebolts of both ends of the wire rope for lift (sold separately). |
| | Check | If they are loose, the bell jar could accidentally drop. |
| | 0 | Installation and removal of the oil diffusion pump and oil sealed rotary vacuum pump should be performed by two or more people. |
| | Work by two or more people | Otherwise, you could injure your back. |
| | | Oil mist trap (sold separately) should be replaced every six months to one year. |
| \wedge | Replace periodically | Clogging in the element increases evacuation resistance, which may cause oil leakage from the axis sealing area or oil level gauge damage. |
| Caution | | To dispose the oil (waste oil) for the pump, comply with industrial waste disposal rules. |
| | Comply with regulations | Comply with regulations upon disposal. |
| | \bigtriangledown | Do not make any modification of the product that is not permitted by Ulvac Kiko, Inc. |
| | Avoid this action | due to such modifications. |

2. Maintenance and Repair that Can be Made by User

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

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 tools | Phillips head (+) screwdriver, 8 mm spanner x 1, 4 mm Hexagonal wrench x 1 | |
| 2) Removal procedur All devices of the The breaker of th The primary power Remove the side Remove the clarred Remove the moto Remove the earth Remove the vibration and front of Remove the vibration | e coater stop.: Confirm e devices are turned off.: Confirm er supply of the coater is removed.: Confirm panel and rear panel (optional) if they are attached. p and the flexible tube. or wiring (2 locations). n wire from the R. P base. ation-control rubber nuts (4 locations). p unit. In this case two or more people lift the motor cover. ation-control rubber (4 locations). | |
| 3) Oil replacement Refer to the separa – Oil Sealed Rotat | ate sheet ion Vacuum Pump User's Manual | |
| 4) Order of attachme Vibration-control Attach the motor people lift them to Attach the nuts for Attach wiring for t Attach the earth w Attach the flexible Attach the side page | nt rubber (4 locations) portion and front cover. In this case, two or more attach. or vibration control (4 locations) the motor (2 locations) wire to the R.P base. tube and fix it with clamp. anel and rear panel (optional). | |

3. Removal, Maintenance, and Installation of Devices

3-2 Oil diffusion pump Phillips head (+) screwdriver, 17 mm spanner x 2 1) Required tools 2) Removal procedure - All devices of the coater stop .: Confirm - The breaker of the devices is turned off. Confirm - The primary power supply of the coater is removed.: Confirm - Remove the side panel and rear panel (optional) if they are attached. - BACK.P VENT(or R.P VENT) is open .: Confirm - Three-way valve: FORE (Leave the inside of the DP open air) - Discharge the cooling water from the cooling water piping of the oil diffusion pump. - Remove the heater wiring. - Remove the piping of the oil diffusion pump. (2 locations for inlet and outlet) - Remove the clamp of the exhaust opening, and then the flexible tube and O-ring of the center ring. - Remove the tightening bolt from the suction opening flange. (Remove it while supporting the oil diffusion pump.) - Draw the oil diffusion pump forward and take it out. 3) Oil heater replacement Refer to the separate sheet - OFK-3US Oil Diffusion Pump User's Manual 4) Order of attachment - Check that there is no dirt on the suction opening 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, tighten the M10 bolts (2 locations) by three or four ridges, and then tighten other two locations left. - Tighten the fixing bolts evenly (orthogonally). - Attach the O-ring for the center ring and the flexible tube to the exhaust opening. Fix it with clamp. - Attach the cooling water piping to the oil diffusion pump (2 locations for inlet and outlet.) - Attach the heater wiring. - Attach the side panel and rear panel (optional).

3. Removal, Maintenance, and Installation of Devices

3-3 Oil Mist Trap (Sold Separately) OMI-200 1) Required tools Rod (Attached component) 2) Removal procedure - Insert the rod into the lower part of the oil mist trap, and then rotate it counter-clockwise to loosen. - Rotate the whole unit counter-clockwise with both hands to remove. 3) Replace the element. Please refer to Oil Mist Trap Use's Manual 4) Order of attachment - Place the attached O-ring on the lower face of the oil mist trap body. - Rotate 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. - Insert the rod into the lower part of the oil mist trap to fix. 3-4 Glass bell jar O-ring 1) Required tools None 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 - Lift the glass bell jar to remove. 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

| Location (device) | Description | Timing |
|-------------------------------|---|---|
| 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 |
| | Cooling water is flowing. | Every time before using |
| Main valve | Clean the sealing surface. | 6 months to 1 year |
| | | When foreign material is dropped on the surface. |
| Vacuum gauge | Replace the gauge head. | As necessary |
| 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 |

5. Troubleshooting

| Status | Cause | Troubleshooting | |
|---|--|---|--|
| Ultimate pressure is low or unstable, or evacuation performance | The ambient temperature at the installation site is high. | Decrease the ambient temperature to 25°C by cooling. | |
| IS IOW. | 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. | |
| | The temperature o the water is too high. The amount if the water is not sufficient. | Adjust it to 20°C to 25°C. Adjust it to 2 L/min. | |
| | 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 | Refer to the user's manual of each instrument. | |
| The oil diffusion pump stays cold. | The heater is disconnected. | Replace the heater. | |
| No current flows through the electrode even when | Evaporation power supply is disconnected. | Replace the evaporation power supply. | |
| the evaporation power supply is operated. | 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. | |
| 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. | Clean the internal face of the seal on the main valve. | |
| The thermal protector for oil sealed vacuum pump operates. | Overloaded | Refer to the Oil Sealed Vacuum Pump User's Manual. | |

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 equipments on their designated place with accompanying adjusters.
- 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.

| Location of Use | Parts | Specifications | Material | Quantity | Replacemen t by user |
|------------------------------------|------------------------------------|------------------|----------|----------|-------------------------|
| Feed-through collar | O-ring for flange | P315 | NBR | 1 | OK |
| | Center ring O-ring for KF port | NW16 (KF16) | FPM | 1 | ОК |
| | O-ring for service sealing plug | P30 | NBR | 5 | ОК |
| | O-ring for base-plate sealing plug | P22A | NBR | 3 | ОК |
| | O-ring for shutter axis | N7 | NBR | 2 | ОК |
| | O-ring for shutter | P32 | NBR | 1 | ОК |
| | Electrode pole gasket | KS-1022-14-004R2 | FPM | 1 | ОК |
| | Electrode pole gasket | KV-1297-01-096 | FPM | 1 | ОК |
| | lonization vacuum meter probe | M-34 | | 1 | ОК |
| Upper portion conversion flange | O-ring for suction flange | V120 | NBR | 1 | ОК |
| | O-ring for gauge port | N16 | NBR | 1 | ОК |
| | O-ring for leakage valve | N6 | NBR | 1 | ОК |
| | O-ring for leakage valve | N8 | NBR | 1 | ОК |
| | Pirani vacuum gauge head | WP-01 | | 1 | ОК |
| Lower portion conversion flange | O-ring for suction flange | V120 | NBR | 1 | OK |

7. Consumable List

7. Consumable List

| Location of Use | Parts | Specifications | Material | Quantity | Replacemen t by user |
|-------------------------------|------------------------------|-------------------------------|----------|----------|-------------------------|
| Main valve | O-ring for suction flange | V120 (Attached component) | FPM | 1 | ОК |
| | O-ring for valve body | (Attached component) | FPM | 1 | ОК |
| | O-ring for valve pole | P10 (Attached component) | FPM | 2 | NG |
| Oil diffusion pump | Gasket for suction flange | V100 | NBR | 1 | ОК |
| | Oil for use | Lion-S | | 0.1L | ОК |
| | Sheathed Heater | Single-phase 100 V, 0.6 kW | | 1 | ОК |
| Oil sealed rotary vacuum pump | Oil | SMR-100 | | 1 | ОК |
| | Vibration-control rubber | ME-20 | | 4 | ОК |
| Three-way valve | O-ring | S 42 (Attached component) | FPM | 3 | NG |
| | O-ring | P-25 (Attached component) | FPM | 2 | NG |
| | O-ring | P-10A (Attached component) | FPM | 3 | NG |
| | O-ring for center healing | NW25 | FPM | 2 | ОК |
| Roughing piping | O-ring for VENT. Valve. | N8 | NBR | 1 | ОК |
| | O-ring for gauge port | N16 | NBR | 1 | ОК |
| | Pirani vacuum meter probe | WP-01 | | 1 | ОК |
| Operational panel | Indicator lamp | LMS-4BH | | 1 | NG |
| | Illuminated Button Switch | AR22F5L | | 2 | NG |
| Liquid nitrogen trap | O-ring for suction flange | V120 | NBR | 1 | ОК |

Specifications and quantity is different for special models.

(6) Disposal

1. Cautions upon Disposal



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.

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



1. Standard Optional Parts List

| Name of optional parts | Applications | Installation conditions |
|--|---|-------------------------|
| Two-point evaporation electrode (switching) | 2-point switching vapor-deposition. | Factory assembled |
| Two-point 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-point + 2-point switching vapor-deposition. | Factory assembled |
| Four-point evaporation electrode (variable) | 2-point + 2-point switching vapor-deposition. | Factory assembled |
| Four-point evaporation electrode (variable) | 1-point + 1-point + 2-point switching vapor-deposition. | Factory assembled |
| Feed-through collar 20 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 |
|---|---|--------------------------|
| Basic electrode set (for service port) | Evaporation electrode. | Installable by user |
| Basic electrode set (for base plate) | 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 |
| 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. | Factory assembled |
| Pirani gauge | Meter to measure pressure | Factory assembly only |

1. Standard Optional Parts List

| Name of optional parts | Applications | Installation conditions |
|--|--|-------------------------|
| Sample holder (Ø 260) | Fixing material. | Installable by user |
| 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 |
| Side panel | For safety regulation. | Installable by user |
| Rear panel | For safety regulation. | 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 |
| 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 |