ULVAC

No.35006-2-02-1

User Manual

Small High-Vacuum Exhaust System

DEPOX

(VTR-350M/X)

Please read the following before using this product.
Keep this manual in a safe place ready for use.

The content of this manual is liable to change without prior notice due to changes in product specifications, product improvements and revisions.

Ulvac Kiko, Inc.

Table of Contents

(gray highlight) indicates a page with safety-related content.

For Safe Use of This Product

Thank you for purchasing this product. This manual presents guidelines for the safe use of this equipment. It covers basic precautions that are necessary when handling, procedures for operation, and procedures for inspection and maintenance. Please read the information provided and make sure you understand it correctly so as to prevent a serious accident.

Read the section “For safe use of the product” thoroughly before using the equipment. The precautions noted here are provided to ensure that the product is used safely, and to avoid danger and injury to users and other personnel.

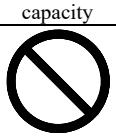
Ensure that the safety information is always followed.

A description of the symbols used in this manual is provided below.

Danger	Incorrect use poses an imminent threat and can result in a fatality or a serious injury for the users.
Warning	Incorrect use poses a serious threat and can result in a fatality or a serious injury for the users.
Caution	Incorrect use poses a risk and can result in light or moderate injury to users, or physical damage.

	Always perform this task or step.
	Always connect to a ground.
	Prohibited.
	Do not disassemble.
	Do not touch.

Power Supplies

Warning	 Check capacity	Primary power supply capacity Prepare single phase, 100 V, 14.0 A or greater. When the capacity of the power supply is insufficient, breakers may trip if there is an overcurrent during operation.
	 Separate power supply	Prepare a separate primary power supply. Do not connect other equipment to it. When the capacity of the breaker is insufficient, the breaker may trip if there is an overcurrent during operation.
	 Connect to ground	Connect to a Class D ground. The ground must be a green cable. An incomplete ground may result in electric shock in the event of a malfunction or short circuit.
	 Check cable capacity	Avoid using extension cables as much as possible. If an extension cable must be used, make sure it is used as follows. Use a 100 V cable with a minimum cross-section of 3.5 mm^2. A thin cable may result in overheating, ignition, or fire.
	 Prohibited	Do not place objects on the primary cables. Placing objects on the cables may result in electric shock or fire.
	 Caution – electric shock	Even after turning the MAIN breaker OFF, there is still an electrical current up to the MAIN breaker. Therefore, never touch the terminal block or other electrified parts. Otherwise, you will suffer electric shock.

Environment

Warning	 Prohibited	This equipment is not explosion-proof, and therefore cannot be used in environments where there is a danger of explosion. Use in such environments may result in ignition and explosion causing a fire and burn injury.
	 Prohibited	The area around the pump becomes hot during operation. Therefore, do not place any flammable objects close to the pump. There is danger of ignition.
	 Do not touch	The oil-sealed rotary vacuum pump become hot during operation. Therefore, do not touch the pump with your hands during operation or for 30 minutes after stopping operation. Touching the pump causes burn injury.
Caution	 Use oil mist trap	Oil mist is discharged from the exhaust outlet on the oil-sealed rotary vacuum pump during roughing operation. Use an oil mist trap (sold separately). Oil mist contaminates the room and affects personnel.
	 Ventilation required	The area around the pump may become hot during the operation of this equipment. This will increase the room temperature.

Installation

Warning	 Check the environment	Install the equipment in a location that satisfies the following requirements. 1) Flat and level. 2) Floor with sufficient strength. 3) Good ventilation. 4) Protected from direct sunlight. 5) Room temperature: 7–30ºC. 6) Make sure there is no danger of ignition. 7) No chemicals or gases liable to corrode the equipment. 8) Not subject to electrical interference (e.g. electrical noise). Failure to install in accordance with these requirements may cause problems with the operation of the equipment and may reduce its operating life.
Caution	 Do not work alone	Use casters when moving this equipment. Always use two or more personnel when lifting this equipment. Take the necessary precautions to avoid hurting your back or other body parts.
	 Secure equipment	Use the adjuster to secure the equipment after installation is complete. This helps prevent the equipment from moving and/or damage during an earthquake, etc.

Operation

Warning	 Ventilate	When using liquid nitrogen (sold separately), always actively ventilate the room. Gas from the liquid nitrogen can lower the oxygen level in the room. This may result in an accident and/or injury due to oxygen deficiency.
Caution	 Gloves required	When handling liquid nitrogen, use rubber gloves and other items to protect exposed body parts. If the liquid nitrogen splashes onto your skin, it will cause irritation as well as severe momentary pain.
	 Close completely	After making sure the main valve is completely closed, open the inside of the exhaust system to atmosphere. If air from the atmosphere enters the turbomolecular pump during operation, it will damage the pump. If air from the atmosphere enters when injecting liquid nitrogen, a large amount of condensable gas will adhere to the trap causing the performance to significantly drop.

Maintenance, Repair and Disposal

Warning	 Protective clothing	Put on a dust mask and gloves when changing the oil on the oil-sealed rotary vacuum pump. Exposure can harm your physical condition.
Caution	 Do not work alone	Always use two or more personnel when installing or removing the turbomolecular pump or oil-sealed rotary vacuum pump. Take the necessary precautions to prevent dropping the pump or hurting your back.
	 Periodic replacement	As a general rule, replace the oil mist trap (sold separately) element every 6 months to a year. If the element is clogged, the exhaust resistance increases and can cause an oil leak from the axis seal or damage the oil level gauge.
	 Legal compliance	The owner and/or operator is legally obliged to dispose of the equipment and pump, etc., as industrial waste. Please dispose according to the rules or regulations established under law and by the local governing body.
	 Prohibited	Do not modify without prior approval from the manufacturer. The manufacturer assumes no responsibility if modified.

Warning Labels

Caution	 Check labels	A warning label is affixed at the following location. When equipped with a liquid nitrogen trap: 1) Affix close to the funnel for filling with liquid nitrogen. (PL006) Contact the manufacturer if the labels become dirty and difficult to read, or if they are peeling off.

(1) Introduction

1. Users

This equipment is to be operated by personnel with experience using vacuum exhaust systems, or by personnel who have received training that is based on this manual.

2. Reading and Understanding the User Manual

Read the manual thoroughly before use, and ensure that the equipment is used correctly.
It is particularly important to read the section entitled “For safe use of this product.”

3. Storing the User Manual

Keep the user manual in a safe place.
After reading the manual, store it in a safe place where it is readily available to users.

4. Warranty

(1) The warranty for 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 this equipment. In addition, the scope of the warranty coverage concerning repairs is limited to the repair and/or replacement of parts.
Refer to the following for normal usage conditions:
a) Ambient temperature and humidity during operation: 5°C – 30°C ; Maximum 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 or failures due to natural disasters, earth movements, or fire.
b) Malfunctions or failures 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 noted in the User Manual (performance specifications, maintenance and inspection, etc.).
d) Malfunctions caused by modification or repair that is 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 determined by the manufacturer’s technical personnel to be caused by conditions that do not comply with the usage conditions for this vacuum pump (this equipment).
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 falls within the warranty period, nor be liable for any loss of opportunity for the customer’s clients or for compensation of any damages to other products, labor costs, production loss, transportation expenses and other related work.
b) We shall not be liable for any secondary damages that occur for the customer due to filed claims and patent infringements of a third party.

5. Legal Compliance

When disposing the equipment, and specifically, when disposing used oil, there are legal obligations.
Dispose appropriately in accordance with the law.

6. Safety During Repairs

To ensure the safety of repair personnel, please note the usage conditions, particularly the presence of any dangerous substances, when making a repair request to the manufacturer.
Fill out the usage conditions check sheet and attach it to the equipment.
The repair request may be refused if the usage conditions are unclear.

(2) Product Outline

1. Purpose of Use and Prohibited Items

This equipment is a small, lightweight high vacuum exhaust unit, with all necessary components mounted onto a simple rack. It is comprised of a turbomolecular pump, an oil-sealed rotary vacuum pump as well as various valves and pipes. In addition, the equipment also includes an electric system that operates those components and a gauge port for measuring pressure.

Observe the prohibited items below to ensure that the equipment is used correctly.

Prohibited

Reselling, repairing or modifying without prior approval from the manufacturer is prohibited.

2. Safety Equipment and its Purpose and Function

Item	Purpose	Function	Method of verification
Ground fault	Preventing electric shock	A ground fault circuit interrupter is used on the MAIN breaker for a deposition system. Rated breaking capacity: 1 kA After troubleshooting and fixing the cause, reset it manually.	None

Prohibited

Operating while the above safety equipment is disabled.

3. Product Specification

Ultimate pressure	10^{-4} Pa range (When there is no load and it is clean inside the vacuum chamber) 10^{-5} Pa range (When liquid nitrogen is used, and there is no load and it is clean inside the vacuum chamber)
Exhaust time	Under 10 minutes and up to 10^{-4} Pa range (When there is no load and it is clean inside the vacuum chamber) Under 5 minutes and up to 10^{-4} Pa range (When liquid nitrogen is used, and there is no load and it is clean inside the vacuum chamber)
Suction inlet flange	VG100
Power requirements	100 V, single phase, 1.4 kVA
External dimensions Weight	730 mm (W) × 520 mm (D) × 804 mm (H) Approximately 140 kg
Color	JIS S5-462 Baked finish (Munsell 5GY8/0.5)

For special use, refer to the specifications sheet.
When using liquid nitrogen, a liquid nitrogen trap (sold separately) is required.

4. Individual Component Specifications

Component	Model and specifications	Qty.
1) Turbomolecular pump (TMP)	• Model: TURBOVAC361 • Exhaust flow rate: 345 L/sec N_2 • Ultimate pressure: 10^{-8} Pa • Maximum intake pressure: 53 Pa • Suction inlet/exhaust outlet: 100 ISO-K, 25KF • Weight: 12 kg	1
2) Oil-sealed rotary vacuum pump (R.P)	• Model: GLD-202B • Exhaust flow rate: 200 L/min • Ultimate pressure: 6.7×10^{-2} Pa • Required power: 0.55 kW Hydraulic oil: SMR-100 1.1 L	1
3) Automatic leak valve	• Model: LCLV-25-100V • Diameter: NW-25	1
4) Main valve	• Model: SBVM-4AX Butterfly valve • Diameter: VG-100	1
5) Three-way valve	• Model: 3W-25K • Diameter: 20A	1

For special use, refer to the specifications sheet.

5. Standard Accessories

1) Power cable	• For equipment unit: 100 V single phase with crimped terminal, 4 m	1
2) User manual	• Plain paper	1
3) Vacuum performance testing table	• Plain paper	1
4) TMP intake cap	• Intake cap for transporting the turbomolecular pump	1

For special use, refer to the specifications sheet.

6. Using Switches, Handles and Operation Levers

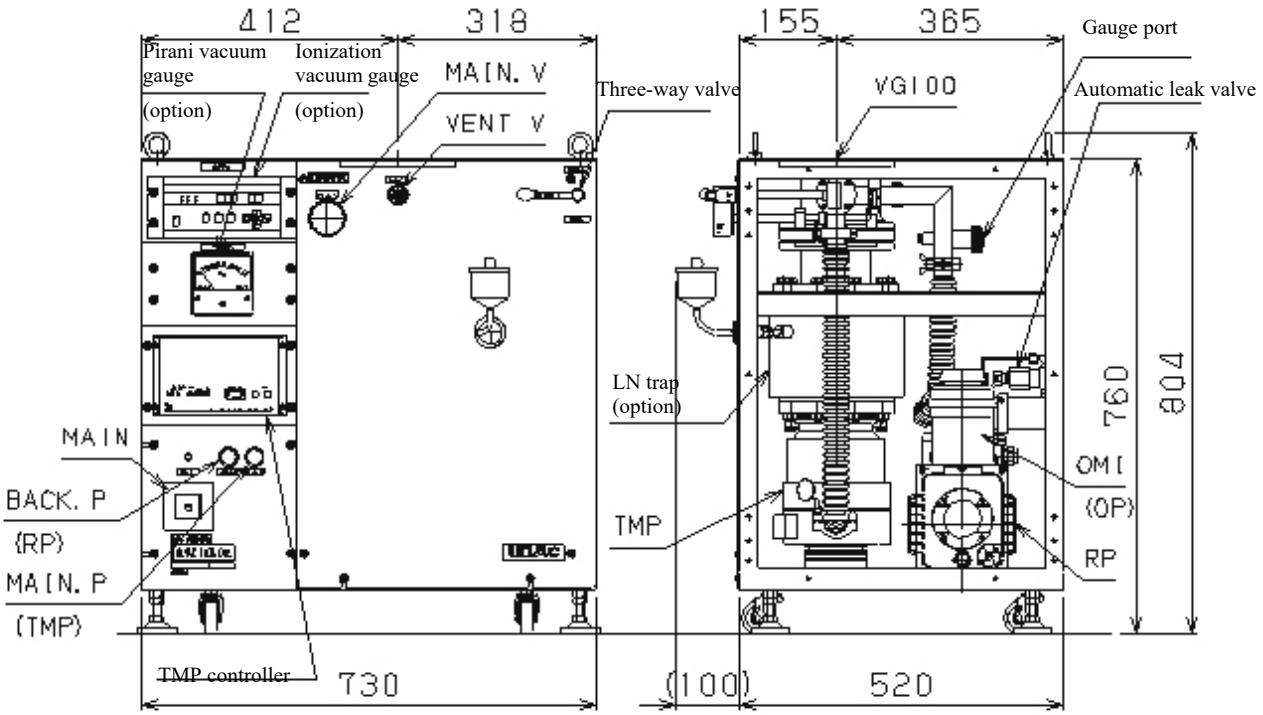
Check

Check the safety and status of the switches, handles and operation levers before operating the equipment.

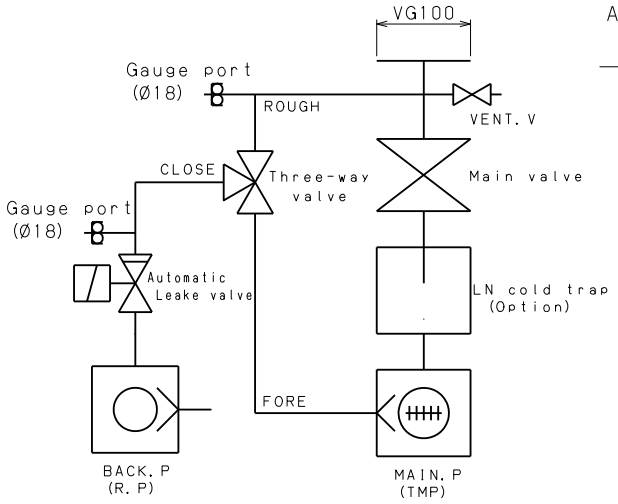
Name	Operation
MAIN switch	Manual ON/OFF ON: Lamp lights up
BACK.P (or R.P) switch	Manual ON/OFF ON: Lamp lights up
MAIN.P (or TMP) switch	Manual ON/OFF ON: Lamp lights up
Main valve handle	Counterclockwise: OPEN Clockwise: CLOSE
Three-way valve	Turn lever in the direction of FORE/CLOSE/ROUGH to operate accordingly.
VENT.V	Screw-in type Open: Counterclockwise Close: Clockwise

*Refer to each user manual for details on the device switches.

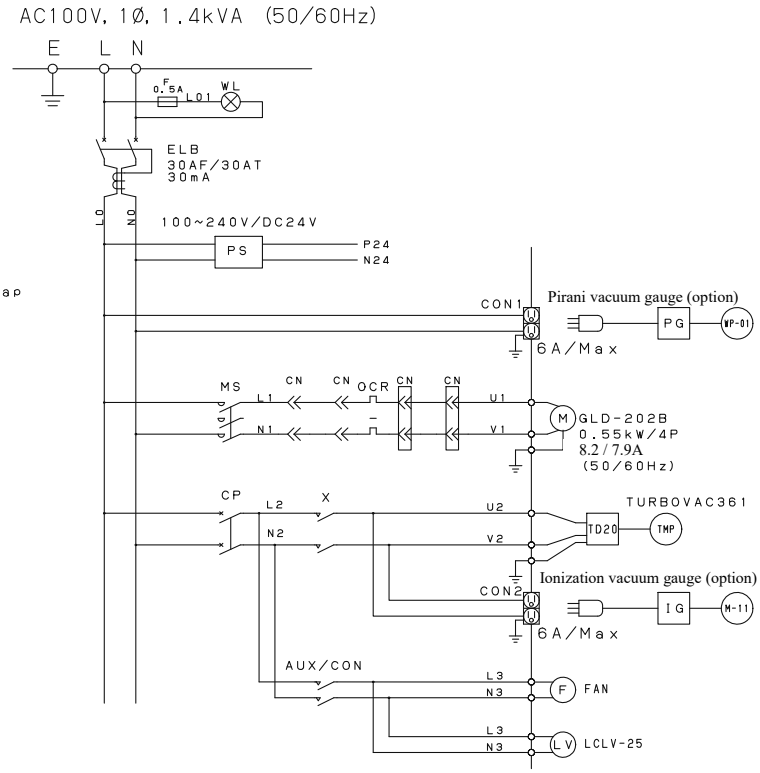
7. Layout of Switches, Handles and Operation Levers



Exhaust system diagram



Electrical system diagram



(3) Opening the Packaging and Installation

1. General Precautions

Check

1) Verify that the contents match the product that was ordered.
2) Verify that the specified accessories are included.
3) Clear a space at least 1 m around the equipment to ensure safety during installation.
4) After the installation position is decided, use the adjuster to secure the equipment.

2. Packaging at Delivery

This product is delivered with the equipment (w/casters) packed in a crate and the accessories in a cardboard box, etc.

3. Location of Installation

Warning

Check the environment

Install the equipment in a location that satisfies the following requirements.

1) Flat and level.
2) Floor with sufficient strength.
3) Good ventilation.
4) Protected from direct sunlight.
5) Room temperature: 7 – 30ºC.
6) Make sure there is no danger of ignition.
7) No chemicals or gases liable to corrode the equipment.
8) Not subject to electrical interference (e.g. electrical noise).

Failure to install in accordance with these requirements may cause problems with the operation of the equipment and may reduce its operating life.

Check

For safety reasons, move the equipment at least 0.5 m from the wall after installation so that all obstructions are cleared away for maintenance and repair.

4. Power Supply

<table>
<tr><td>Warning</td><td> 
Check capacity</td><td>Primary power supply capacity
Prepare single phase, 100 V, 14.0 A or greater.

When the capacity of the power supply is insufficient, breakers may trip if there is an overcurrent during operation.</td></tr>
<tr><td colspan="3">Primary cable connection specifications
4 m cable with 4 dia. crimped terminal for 100 V single phase</td></tr>
<tr><td rowspan="5">Warning</td><td> 
Separate power supply</td><td>Prepare a separate primary power supply. Do not connect other equipment to it.

When the capacity of the breaker is insufficient, the breaker may trip if there is an overcurrent during operation.</td></tr>
<tr><td> 
Connect to ground</td><td>Connect to a Class D ground.

The ground must be a green cable.

An incomplete ground may result in electric shock in the event of a malfunction or short circuit.</td></tr>
<tr><td> 
Check cable capacity</td><td>Avoid using extension cables as much as possible. If an extension cable must be used, make sure it is used as follows.

Use 100V cable with a cross-section of at least 3.5 mm^2.

A thin cable may result in overheating, ignition, or fire.</td></tr>
<tr><td> 
Prohibited</td><td>Do not place objects on the primary cables.

Placing objects on the cables may result in electric shock or fire.</td></tr>
<tr><td> 
Caution – electric shock</td><td>Even after turning the MAIN breaker OFF, there is still an electrical current up to the MAIN breaker. Therefore, never touch the terminal block or other electrified parts.

Otherwise, you will suffer electric shock.</td></tr>
</table>

5. List of Required Tools

Tool	Application
Phillips screwdriver	For connecting the primary power supply cable
25 mm monkey wrench	Suction inlet duct installation

(4) Operation

1. Hazards During Operation, and Associated Safety Measures

Warning	 Ventilate	When using liquid nitrogen (sold separately), always actively ventilate the room. Gas from the liquid nitrogen can lower the oxygen level in the room. This may result in an accident and/or injury due to oxygen deficiency.
Caution	 Gloves required	When handling liquid nitrogen, use rubber gloves and other items to protect exposed body parts. If the liquid nitrogen splashes onto your skin, it will cause irritation as well as severe momentary pain.
	 Close completely	After making sure the main valve is completely closed, open the inside of the exhaust system to atmosphere. If air from the atmosphere enters the turbomolecular pump during operation, it will damage the pump. If air from the atmosphere enters when injecting liquid nitrogen, a large amount of condensable gas will adhere to the trap causing the performance to significantly drop.

2. Exhaust System Operation Procedure

2-1 Preparation

1) Three-way valve and main valve: CLOSE
2) All switches for the operation panel: OFF
3) When using a ionization vacuum gauge probe into the gauge port.
4) Customer breaker: ON

2-2 Operation

Equipment startup

1) MAIN: ON
2) BACK.P (or R.P): ON (Automatic leak valve open)
3) Three-way valve: FORE
4) After exhausting for 1 min., MAIN.P (or TMP): ON (Power supply energized)
   (When using a Pirani vacuum gauge, make sure that it is 13 Pa or less.)
5) TMP controller [START]: Press (STATUS flashes)
6) TMP rated speed after approx. 2 min.: NORMAL lights up
7) Liquid nitrogen (when necessary): Fill

Start vacuum exhaust

1) Exhaust system is connected to the intake flange: CHECK
2) VENT.V: Close
3) Three-way valve: ROUGH
   Roughing is 13 Pa or less: CHECK
4) Three-way valve: FORE
5) Main valve: FULLY OPEN
6) Filament when using ionization gauge: ON

Reference Items

Filling volume of liquid nitrogen (Liquid nitrogen trap is an option.)

Maximum fill volume: Approx. 1.4 L (including evaporating gas when filling)
When filled with 1.4 L, it is effective for approximately 5 to 5 hours.

If the liquid nitrogen stops evaporating, the condensable gas that is trapped detaches, and the pressure will become worse temporarily (about 30 minutes).
This does not indicate that there is a failure.
Close the main valve completely, in order to prevent contamination on the inside of the exhaust system.

2-3 Stopping

Stop vacuum exhaust

1) Filament when using ionization vacuum gauge: OFF
2) Main valve: CLOSE
3) Three-way valve FORE: CHECK
4) VENT.V (as necessary): OPEN SLOWLY

Reference Items

When opening the exhaust system and using dry air or nitrogen gas, this can prevent the inside of the exhaust system from becoming contaminated.
When opening with atmosphere, the moisture in the atmosphere can contaminate the inside of the exhaust system.

VENT. V piping connection
• Synflex joint: C1N1/4×PT1/8 (Accessory)

Stopping equipment

1) Evacuate vacuum to maintain vacuum in exhaust system
2) Filament when using ionization vacuum gauge: OFF
3) Main valve: CLOSE
4) TMP controller [STOP]: Press (STATUS flashes)
   TMP after approx. 40–50 min.: STOP (STATUS turns off)
5) MAIN.P (or TMP): OFF
6) Three-way valve: CLOSE
7) BACK.P (or R.P): OFF
   • Automatic leak valve closed, RP side atmosphere released
8) MAIN OFF
9) Customer breaker (when necessary): OFF
10) If liquid nitrogen is present, it will evaporate naturally.

3. Handling Malfunctions

3-1 Instantaneous Power Failure

- All devices except the TMP are automatically restored to the status prior to the power failure.
- The TMP does not restore automatically after a power failure.
  POWER and STOP light up.
  Press [START] on the TMP controller again to start up.
  First, check the NORMAL display before operating the valve, etc.

3-2 Long-term Power Failure

1) Main valve: FULLY CLOSE
2) Three-way valve: CLOSE
3) All switches for the operation panel: OFF
   The TMP stops, but it goes into free run status because there is no brake operation. Inside the TMP is rotating at a high speed, therefore never let atmosphere enter.

* A solenoid valve is installed for TMP protection during a power failure for a long period of time.

3-3 Restoration Procedure after Power Failure

Press [STOP] on the TMP controller to stop the TMP.
(It takes approximately 40–50 minutes to stop naturally when in free run.)
Follow the procedures “2. Exhaust System Operation Procedure,” “2-1 Preparation” and “2-2 Operation” to operate again. However, considering that the inside of the TMP is still rotating, close the three-way valve and thoroughly discharge the inside of the rough piping and then switch the setting to FORE.

(5) Maintenance and Repairs

1. Hazards During Maintenance and Repairs, and Associated Safety Measures

Warning	 Protective clothing	Put on a dust mask and gloves when changing the oil on the oil-sealed rotary vacuum pump. Exposure can harm your physical condition.
Caution	 Do not work alone	Always use two or more personnel when installing or removing the turbomolecular pump or oil-sealed rotary vacuum pump. Take the necessary precautions to prevent dropping the pump or hurting your back.
	 Periodic replacement	As a general rule, replace the oil mist trap (sold separately) element every 6 months to a year. If the element is clogged, the exhaust resistance increases and can cause an oil leak from the axis seal or damage the oil level gauge.
	 Legal compliance	The law requires proper disposal of used pump oil (waste oil). Dispose appropriately in accordance with the law.
	 Prohibited	Do not modify without prior approval from the manufacturer. The manufacturer assumes no responsibility if modified.

2. Customer Maintenance and Repairs

1) Replace the O-ring. (Excluding the oil-sealed rotary vacuum pump)
2) Replace the oil-sealed rotary vacuum pump and the turbomolecular pump.
3) Change the oil for the oil-sealed rotary vacuum pump.
4) Replace element of oil mist trap (sold separately).

Contact the manufacturer for repairs other than those cited above.

3. Removing, Maintaining and Fitting the Device

3-1 Oil-Sealed Rotary Vacuum Pump

1) Required tools:Needle-nose pliers × 2
8 mm spanner × 1
4 mm Allen wrench × 1

2) Removal
- Ensure that all devices on the equipment are stopped.: Check
- Ensure that all primary power supplies for the equipment are disconnected.: Check
- When equipped with the side panel and back panel (option), remove them.
- Pull and remove the motor wiring connectors (two) to the left and right, and remove.
  (Use the needle-nose pliers to pinch and pull the connector to the left and right.)
- Remove the automatic leak valve wire and ground wire.
- Remove the flexible tube and automatic leak valve.
- Remove the nuts (Qty.4) for the anti-vibration rubber mounts at the rear on the bottom of rack.
- Use two personnel to lift up the motor and front cover, and remove the pump unit.
- Remove the anti-vibration rubber mounts (Qty.4).

3) Change oil
Refer to oil-sealed rotary vacuum pump user manual (provided separately).

4) Fitting
- Attach the anti-vibration rubber mounts (Qty.4).
- Use two personnel to lift up the motor and front cover, and attach them.
- Attach the nuts (Qty.4) for anti-vibration rubber mounts.
- Attach the flexible tube and automatic leak valve.
- Connect the automatic leak valve wire and ground wire.
- Attach the motor wiring connectors (two).
- When equipped with the side panel and back panel (option), attach them.

3. Removing, Maintaining and Fitting the Device

3-2 Turbomolecular Pump

1) Required tools: 13 mm spanner

2) Removal
   - Ensure that all devices on the equipment are stopped.: Check
   - Ensure that all primary power supplies for the equipment are disconnected.: Check
   - Remove the front panel.
   - When equipped with the side panel and back panel (option), remove them.
   - Three-way valve: FORE (Open inside of TMP to atmosphere)
   - Remove the TMP wiring connector.
   - Remove the exhaust outlet clamp, and remove the flexible tube and the centering O-ring.
   - Remove the claw clamps (Qty.4) for securing the intake flanges. (Hold the turbomolecular pump when removing.)
   - Pull out the turbomolecular pump toward the front to remove.

3) Reshipping
   - After inserting the desiccant into the sprinter guard for the pump's suction inlet, cover the suction inlet with the cap (accessory) provided.
   - Be careful with the equipment and protect it from large impacts or vibration during transport.
     For further details, refer to the Turbomolecular Pump User Manual provided separately.

4) Fitting
   - Refer to the Turbomolecular Pump User Manual to prepare for fitting.
   - Face the position of the turbomolecular pump exhaust outlet toward the left side of the equipment, and place it on the flange under the main valve (or LN trap (OP).
   - Lift up the turbomolecular pump with another worker. Screw in the claw clamp about 3 to 4 threads at 2 places, and attach the remaining two places.
   - Screw in the claw clamp evenly (alternating and tightening the opposing bolts in order).
   - Attach the centering O-ring and the flexible tube onto the exhaust outlet, and secure it with the clamp.
   - Attach the TMP wiring connector.
   - Attach the front panel.
   - When equipped with the side panel and back panel (option), attach them.

3. Removing, Maintaining and Fitting the Device

3-3 Oil Mist Trap (sold separately) OMT-200A/OMI-200

1) Required tools OMI: None / OMI: Rod (accessory)

2) Removal
   - Use both hands or insert a rod to turn the base of the oil mist trap unit counterclockwise to loosen it.
   - Use both hands to turn the oil mist trap unit counterclockwise to remove it.

3) Replace element
   Refer to the Oil Mist Trap User Manual (provided separately).

4) Fitting
   - Attach the O-ring provided in the accessories to the bottom of the oil mist trap unit.
   - Align with the exhaust outlet on the oil-sealed rotary vacuum pump, and use both hands to turn the oil mist trap unit clockwise.
     Note: Fasten while ensuring that the O-ring does not fall off.

4. Maintenance and Inspection Locations

Inspection locations (device name)	Maintenance and inspection details	Timing
Oil-sealed rotary vacuum pump	Ensure that the oil level on the oil level gauge is within the indicated line.	Each time before use
	Change oil. If the pressure is 5 Pa or greater for a single operation.	When necessary
Turbomolecular pump	Ensure that the cooling fan is rotating.	Each time used
Main valve	Clean the sealing surface on the valve seat.	Every 6 to 12 months to remove contaminants.
Pirani vacuum gauge (sold separately)	Replace probe.	When necessary
Ionization vacuum gauge (sold separately)	Replace probe.	When necessary
Oil mist trap (sold separately)	Replace element.	Every 6 to 12 months.
Wire cable	Ensure that the wire terminals and connecting screws are not loose.	When necessary

Periodic Inspection of Equipment Performance

Inspect the equipment periodically, about once or twice a month, for the following items.

Ultimate pressure test

Evacuate this equipment for a long period independently, and measure the ultimate pressure. If there is a decline in the performance since the time of purchase, one of the following may be the cause.

1) Dirty inside exhaust system
2) Leak

Exhaust characteristics test

If there is a performance decline in the exhaust characteristics even though the ultimate pressure is not particularly bad, one of the following may be the cause.

1) Too much moisture in the gas being introduced.
2) Dirty or rusty inside the exhaust system.

* Perform the prescribed inspection based on the user manual of each device when performing the periodic inspection on the system devices.
  Pay particular attention to maintenance management because the TMP is an expensive product.

5. Troubleshooting

Symptoms	Cause	Solution
Insufficient ultimate pressure, ultimate pressure unstable or drop in exhaust capacity	High ambient temperature in area of installation.	Use air conditioning to reduce ambient temperature to 25ºC or lower.
	Short operation time following installation or long-term stoppage of equipment.	Run for 24 – 48 hours and check again.
	Leaks.	Check around the parts touched before change occurred when ultimate pressure was reached.
		Clean exhaust system O-ring. Or, replace consumable parts.
	Problem with turbomolecular pump.	Refer to the Turbomolecular Pump User Manual.
	Problem with the oil-sealed rotary vacuum pump.	Refer to the Oil-Sealed Rotary Vacuum Pump User Manual.
	Problem with measuring equipment.	Refer to the user manual for each measuring device.
Problem with turbomolecular pump	Problem with wiring connection. Problem with internal parts.	Refer to the Turbomolecular Pump User Manual.
Problem with the power supply for the turbomolecular pump	Open phase. Control error on TD20. Insufficient roughing pressure. Abnormal temperature. Overcurrent. Internal problem with system.	Refer to the Power Supply User Manual for the turbomolecular pump.
Pressure on Pirani vacuum gauge is poor when opening the exhaust system to atmosphere	Main valve does not completely close.	Clean the sealing surface inside the main valve.
Filament on the ionization vacuum gauge does not turn on	There is a disconnection with the probe filament. Problem with the pressure.	Replace probe.
Thermal protector for oil-sealed rotary vacuum pump is activated	Overload.	Refer to the Oil-Sealed Rotary Vacuum Pump User Manual.

6. Storing the Equipment

Refer to the following instructions when storing the equipment for a long period of time.

1) Storage location

- Floor with sufficient strength.
- Good ventilation.
- Protected from direct sunlight.
- Protected from effects of corrosion due to chemicals, gases etc.

2) Steps to be taken prior to, and during storage

- Evacuate the inside of the exhaust system.
- Use the adjuster provided to secure the entire system.

7. Consumables

Location	Name	Specification	Material	Qty.	Replaceable by customer
Upper conversion flange	O-ring for intake flange	V120	NBR	1	○
	O-ring for gauge port	N16	NBR	1	○
	O-ring for leak valve	N6	NBR	1	○
	O-ring for leak valve	N8	NBR	1	○
Lower conversion flange	O-ring for intake flange	V120	NBR	1	○
Main valve	O-ring for intake flange	V120 (Accessory)	FPM	1	○
	O-ring for valve element	P85 (Accessory)	FPM	1	○
	O-ring for valve rod	P10A (Accessory)	FPM	2	×
Turbomolecular pump	O-ring for intake flange	100 ISO-K (Accessory)	FPM	1	○
	Centering O-ring	NW25 (Accessory)	FPM	1	○
Three-way valve	O-ring	S42 (Accessory)	FPM	3	×
	O-ring	P25 (Accessory)	FPM	2	×
	O-ring	P10A (Accessory)	FPM	3	×
	Centering O-ring	NW25	FPM	2	○
Roughing piping	O-ring for gauge port	N16	NBR	1	○
Operation panel	Indicator lamp	LMS-4BH	——	1	×
	Shoko button switch	AR22F5L	——	2	×

For special use, specifications and quantity may differ.

(6) Disposal

1. Precautions to Be Taken for Disposal

 **Caution**	 Legal compliance	The owner and/or operator is legally obliged to dispose of the equipment and pump, etc., as industrial waste. Please dispose according to the rules or regulations established under law and by the local governing body.
Applicable laws: Laws related to the handling and cleanup of waste products.		
Handling: 1) Transport – by industrial waste product collection and transport contractor. 2) Treatment – Outsourced to an industrial waste product processing contractor.		

(7) Optional Components

 **Caution**	 Prohibited	Do not make any modifications beyond the manufacturer's standard options. The manufacturer assumes no responsibility if modified.

1. Standard Optional Components

Optional components	Application	Fitting
Liquid nitrogen trap	Adhesion of backflow oil and condensable gas	Factory assembled
Oil mist trap	Prevents oil and smoke outflow from oil-sealed rotary vacuum pump outlet	Can be fitted by customer
Inline oil mist trap	Prevents oil and smoke outflow from oil-sealed rotary vacuum pump outlet, and provides support for exhaust duct connection	Can be fitted by customer
Side panel	For compliance with safety regulations	Can be fitted by customer
Back panel	For compliance with safety regulations	Can be fitted by customer
Pirani vacuum gauge	Pressure measurement	Can be fitted by customer
Ionization vacuum gauge	Pressure measurement	Can be fitted by customer
Flange with hose fixture	For diameter conversion (VF100 × ⌀30)	Can be fitted by customer
Flange with quick coupling	For diameter conversion (VF100 × NW40)	Can be fitted by customer