Moving and carrying the packed product

Thank you for purchasing this product.

This product is delivered in a cardboard box.

The descriptions here cover the following items: 1. Moving and carrying the packed product, 2. Opening the cardboard box, and 3. Checking the product and accessories.

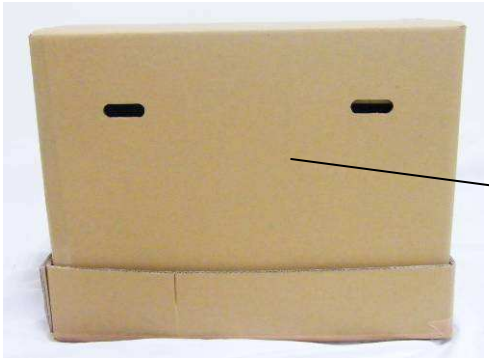
4. Moving and carrying the packed product

(1) The product is packed and delivered as shown in the picture on the left.

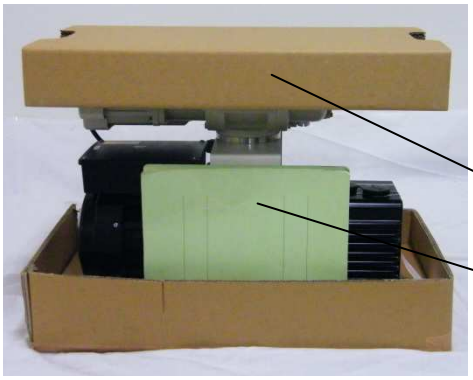
(2) Use the slits on the sides of the cardboard box as shown in the picture on the left, and always move and carry the box with at least 2 people.

Take the necessary precautions to avoid hurting your back or other body parts.

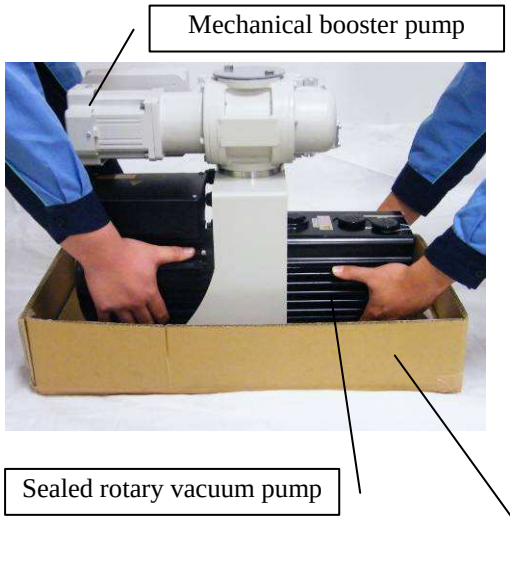
5. Opening the cardboard box



(1) Remove the plastic bands that are wrapped around the cardboard box, and lift up the exterior box and remove.



(2) Remove the inner lid.
Remove the user manual.



(3) Always perform this task with at least two people. Hold the bottom of the sealed rotary vacuum pump and remove it from the base of the cardboard box as shown in the picture on the left.

Do not lift from the mechanical booster pump to remove.

Take the necessary precautions to avoid hurting your back or other body parts.

6. Checking the product and accessories

Make sure that the product and the following accessories are included.

(1) VMR-050 product unit : Qty. 1

(2) Bolts for flange installation

- Hex socket bolts (M8×25) : Qty. 4
- Plain washers (M8) : Qty. 4
- Spring washers (M8) : Qty. 4

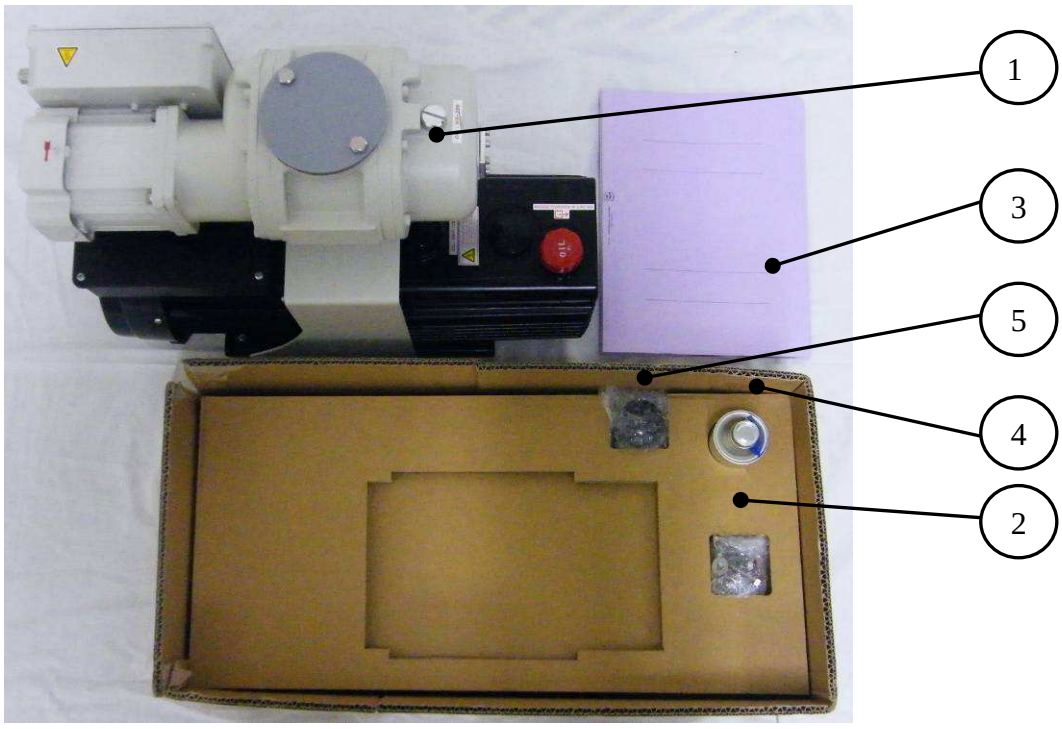
(3) User manual : Qty. 1

(4) Oil (SMR-200, 70 mL can) : Qty. 1

* This oil is for the mechanical booster pump.

The oil for the sealed rotary vacuum pump is already poured inside the pump.

(5) G1 exhaust duct (black) : Qty. 1



No. 35100-2-01-6

User Manual

Small Mechanical Booster Pump Exhaust Unit

VMR-050

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

indicates a page with safety-related content.

For safe use of the product

For safe use of the 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 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 these precautions are 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 the corresponding power supply: • Single-phase, 100 – 120 V specification Single phase, 100 – 120 V, 15.0 A or greater • Single-phase, 200 – 240 V specification Single phase, 200 – 240 V, 8.0 A or greater The customer shall make the necessary arrangements for the breaker. Note, if the capacity of the power supply is insufficient, breakers may trip during operation due to insufficient capacity.
	 Separate power supply	Prepare a separate primary power supply. Do not connect other equipment to it. The customer shall make the necessary arrangements for the breaker. Note, if the capacity of the power supply is insufficient, breakers may trip during operation due to insufficient capacity.
	 Connect to ground	Connect to a Class D ground. This equipment uses a grounded plug for 100-120 V. When using a plug adapter, connect the ground wire to the nearest ground terminal. 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. • Single-phase, 100 – 120 V specification Greater than 1.5 mm2 • Single-phase, 100 – 240 V specification Greater than 1.0 mm2 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	Do not open the terminal box cover when inserting the primary cable into the socket. 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 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 mechanical booster pump and sealed rotary vacuum pump becomes hot during operation. Therefore, do not touch either 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 (or particles) is discharged from the exhaust outlet on the sealed rotary vacuum pump during operation. We recommend using 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 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 – 40ºC. 6) 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 two or more personnel when lifting and moving this equipment. In addition, remove the oil from the mechanical booster pump before moving. Take the necessary precautions to avoid hurting your back or other body parts. Moving the equipment without removing the lubricant and while the equipment is tilted may cause the lubricant to leak into the cylinder compartment.
 Warning	 Check exhaust outlet	The sealed rotary vacuum pump that is installed on the equipment is shipped with the specified amount of oil already poured inside. Ensure that the oil cap (red) is used to plug the exhaust outlet so that oil does not leak while being transported. Before starting up the equipment, always remove the oil cap (red) and replace it with the G1 exhaust duct that is provided or an oil mist trap (sold separately). A cautionary tag is attached to the end of the power cord to remind the user to replace the cap with the exhaust duct and oil mist trap (sold separately). Remove the cautionary tag after confirming that the cap has been replaced with the exhaust duct and oil mist trap (sold separately). The sealed rotary vacuum pump is not designed to withstand pressure. The internal pressure limit for the pump is 0.03 MPa (gauge pressure). When operating a pump with a device that is obstructing the exhaust outlet or the passage of gas on the exhaust outlet side, an explosion may occur or the motor may overheat.

Operation

Caution	 Release into atmosphere	Open the leak valve after the exhaust unit stops, and release or evacuate the inside of the rough piping into the atmosphere. The customer shall make the necessary arrangements for the leak valve. To prevent the reverse flow of oil.
	 Prohibited	Do not suction corrosive gases and fluids (such as acid, alkaline or solvents) or particles. Solids such as particles leaking into the mechanical booster pump causes rotor damage.

Maintenance, Repair and Disposal

Caution	 Customer maintenance and repairs	The customer is able to perform the following maintenance and repairs. 1) Oil replacement for the sealed rotary vacuum pump and mechanical booster pump. 2) Element replacement of oil mist trap (sold separately) 3) O-ring replacement for some parts. (Refer to “7. Consumables” on page 22.) Contact the manufacturer for repairs other than those cited above.
	 Periodic replacement	As a general rule, replace the oil mist trap element every 1500 – 2000 hours of operation. 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 make any modifications beyond the manufacturer’s standard options. The manufacturer assumes no responsibility for any modifications undertaken.

(1) Before Using

1. Target Users

Only persons who have used a vacuum exhaust unit 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 - 40°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 Outline

1. Purpose of Use and Prohibited Items

This equipment is a small, lightweight exhaust unit, with all necessary components mounted onto a simple rack. The exhaust system is comprised of a mechanical booster pump, a sealed rotary vacuum pump and piping.
In addition, the equipment also includes an electric system that operates those components, etc.

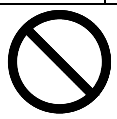
Follow the prohibited items below to ensure that the equipment is used correctly.

Prohibited

Do not resell, repair or modify without prior approval from the manufacturer.

2. Safety Equipment and its Purpose and Function

Item	Purpose	Function	Method of verification
Heat protection	Mechanical booster pump protection	The mechanical booster pump stops when the temperature rises to 80°C ±10%. After removing the cause, wait 10 seconds after the power is turned off and turn the power on again.	• Only the mechanical booster pump operation stops. • The exhaust flow rate is slow. • The ultimate pressure does not decrease.
Power overvoltage protection		The mechanical booster pump stops when the voltage is greater than AC 144 V or AC 288 V. After removing the cause, wait 10 seconds after the power is turned off and turn the power on again.	
Speed-over protection		The mechanical booster pump stops when the rotational speed exceeds 4200 min^{-1}. After removing the cause, wait 10 seconds after the power is turned off and turn the power on again.	
Current surge protection		The mechanical booster pump stops when the torque exceeds 0.96 N·m. After removing the cause, wait 10 seconds after the power is turned off and turn the power on again.	
Hall effect device IC error		The mechanical booster pump stops when a signal is not detected from the hall effect device IC. Repair is required.	
System error		The mechanical booster pump stops when a motor control component error occurs. Repair is required.	
Current surge fuse		The mechanical booster pump stops when the fuse is blown with a current that is AC 250 V, 10 A. Repair is required.	

Item	Purpose	Function	Method of verification
Overload	Sealed rotary vacuum pump: Pump protection	The sealed rotary vacuum pump has a built-in thermal protector with an automatic recovery function. When rotation stops or an overload occurs due to a pump malfunction during operation and a current surge runs through the motor, the motor power circuit is automatically disconnected in order to prevent motor damage. If the thermal protector is tripped, first, turn the switch to "OFF," and then contact the manufacturer. In this situation, the motor is extremely hot. Never touch it with your hands. After making sure that the motor temperature has lowered and removing the cause of the malfunction, turn the switch to "ON" and resume operation.	• Only the sealed rotary vacuum pump operation stops. • The mechanical booster pump rotation is slow. • The exhaust flow rate is slow. • The ultimate pressure does not decrease.
 Prohibited	Do not operate with the above safety equipment disabled.		

3. Product Specification

3-1 (Single-phase, 100 – 120 V specification)

Ultimate pressure	4.0×10^{-2} Pa (Index value based on ionization gauge)
Exhaust flow rate	833 L/min (at 100 Pa)
Maximum intake pressure	Atmospheric pressure
Ambient temperature	7 - 40°C
Power specification	AC single-phase, 100 – 120 V, 50 Hz or 60 Hz
Rated power	750 W
Full-load current	12.5 A (50/60 Hz)
External dimensions Mass	241.4 mm (W) × 532 mm (D) × 399 mm (H) Approximately 44 kg (standard model)
Inlet	VG-40 or its equivalent
Power cord	Power cord with a 3P plug (1.8 M), conversion adapter (3P → 2P + ground)

3-2 (Single-phase, 200 – 240 V specification)

Ultimate pressure	4.0 × 10-2 Pa (Indicated value based on ionization gauge)
Exhaust flow rate	833 L/min (at 100 Pa)
Maximum intake pressure	Atmospheric pressure
Ambient temperature	7 - 40°C
Power specification	AC single-phase, 200 – 240 V, 50 Hz or 60 Hz
Rated power	750 W
Full-load current	6.6 A (50/60 Hz)
External dimensions Mass	241.4 mm (W) × 581 mm (D) × 399 mm (H) Approximately 44 kg (standard model)
Inlet	VG-40 or its equivalent
Power cord	1.8 m 3 wire power cord without plug

4. Individual Component Specifications

Component	Model and specifications	Qty.
1) Mechanical booster pump	• Model: MBS-053 • Exhaust flow rate: 50 m^3/h • Ultimate pressure: 4.0 × 10^{-2} Pa (Indicated value based on ionization gauge) • Inlet: VG-40 or its equivalent • Outlet: VF-40 or its equivalent • Power requirements: 200 W • Hydraulic oil: SMR-200 70 mL	1
2) Sealed rotary vacuum pump	• Model: GLD-202B • Exhaust flow rate: 200/240 L/min (50/60 Hz) • Ultimate pressure: 6.7 × 10^{-2} Pa (Indicated value based on McLeod gauge) • Inlet: NW-25 • Outlet: G-1 • Power requirements: 550 W • Hydraulic oil: SMR-100 1.1 L	1
3) VG40 connecting pipe	• Inlet diameter: VG-40 / NW-25	1

5. Standard Accessories

1) Bolts for flange installation	• Hex socket bolts: M8×25 • Plain washers: M8 • Spring washers: M8 * Use when connecting to the piping for the VG40 inlet (or its equivalent) on the mechanical booster pump.	4 4 4
2) User manual	• Plain paper	1 set
3) Oil	• SMR-200 70 mL * For the mechanical booster pump	1 can
4) Exhaust duct	• G1 exhaust duct (black)	1

6. Using Switches

Check

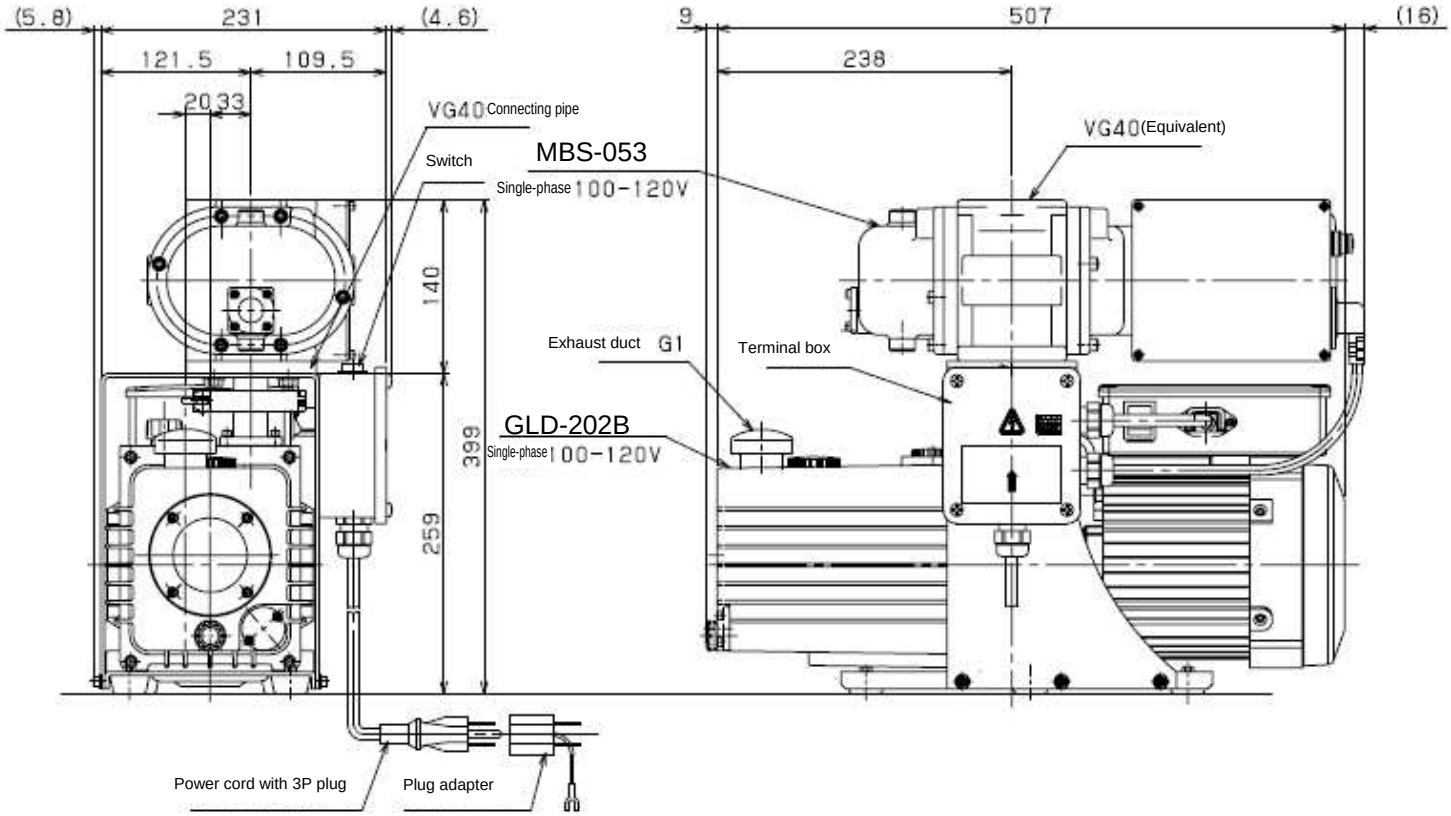
Check the safety and status of the switches before operation.

Name	Operation
Switch	Manual ON/OFF – Starts and stops the device

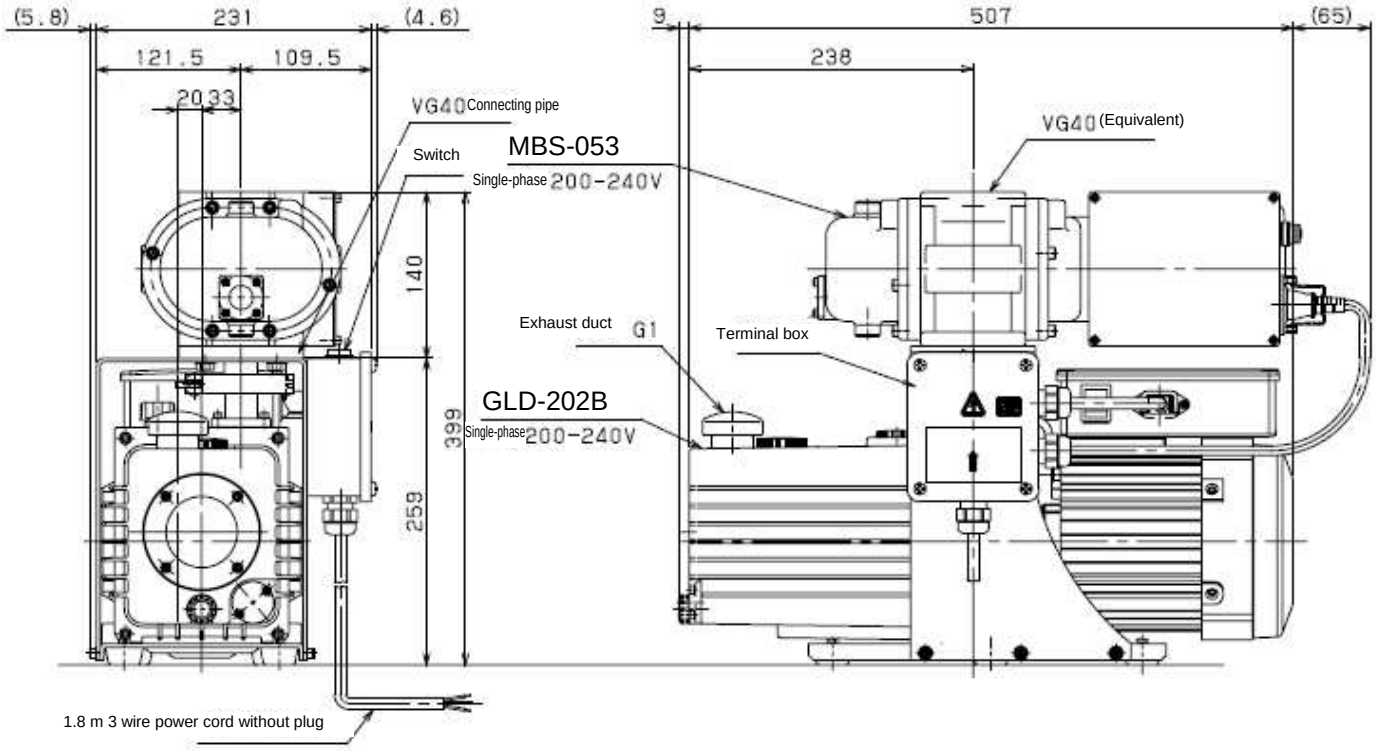
Switch when turned ON and OFF	
ON	OFF
	

7. Switch Layout & Unit Dimensions

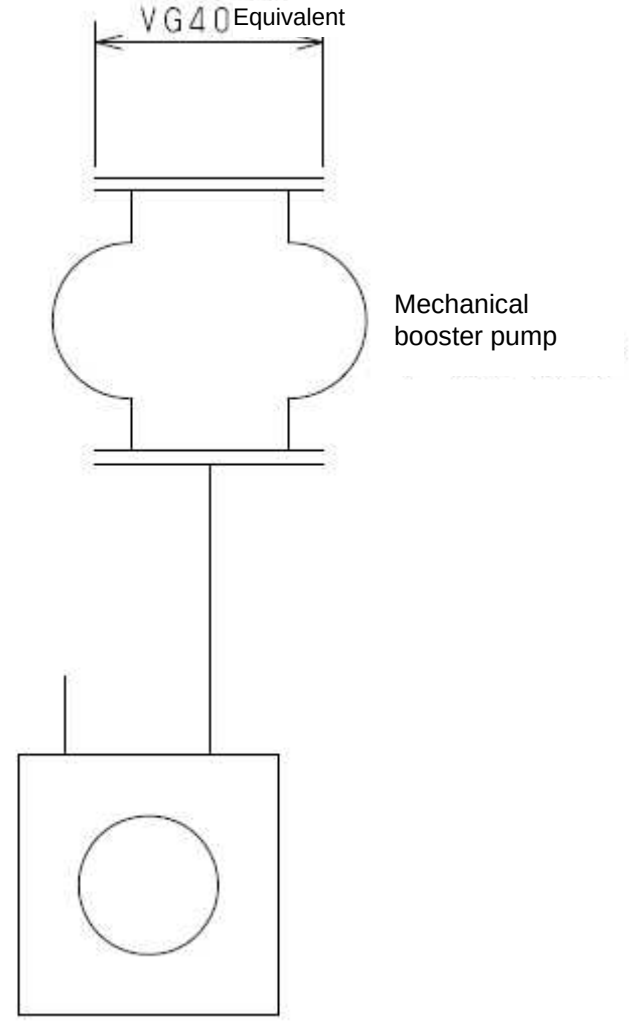
7-1 (Single-phase, 100 – 120 V specification)



7-2 (Single-phase, 200 – 240 V specification)

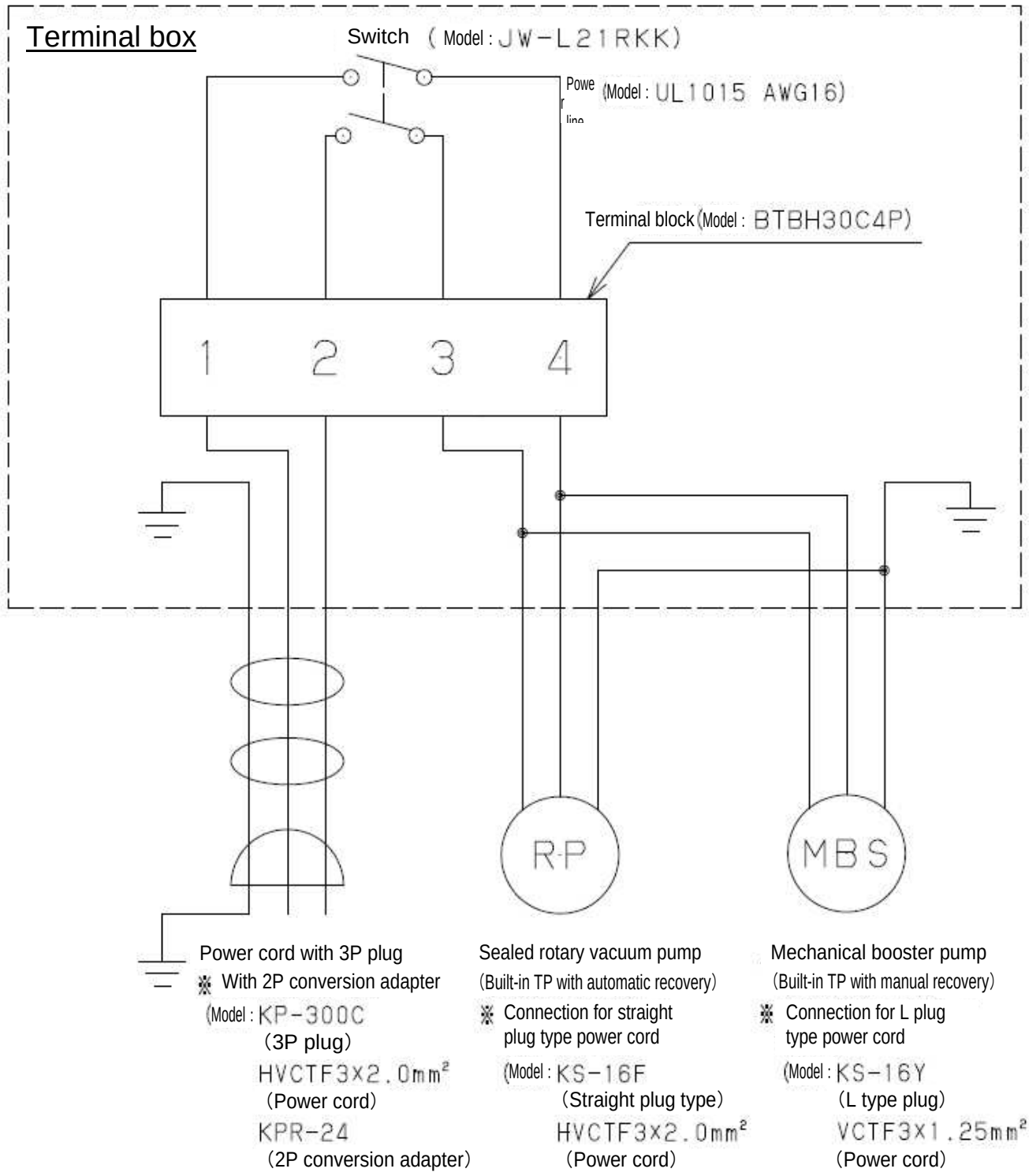


8. Exhaust System Diagram

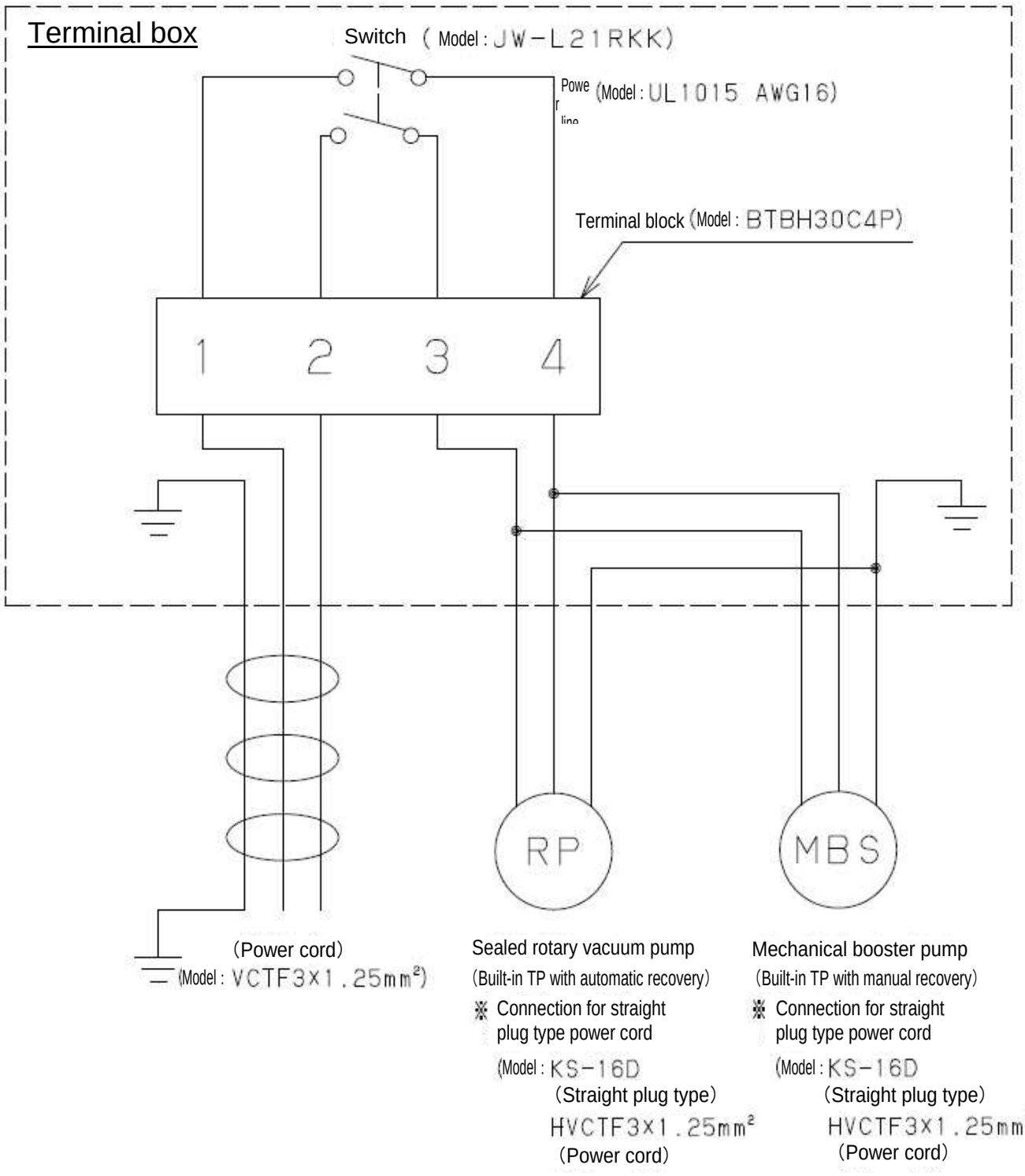


9. Electrical Wiring Diagram

9-1 (Single-phase, 100 – 120 V specification)



9-2 (Single-phase, 200 – 240 V specification)



(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 0.5 m around the equipment to ensure safety during installation.

2. Packaging at Delivery

The equipment is packed and delivered in a cardboard box.

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 – 40ºC.
6) 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. Moving the Equipment

Do not work alone	Use two or more personnel when lifting and moving this equipment. In addition, remove the oil from the mechanical booster pump before moving. Take the necessary precautions to avoid hurting your back or other body parts. Moving the unit without removing the lubricant and while the unit is tilted may cause the lubricant to leak into the cylinder compartment.

Moving the equipment

5. Filling with Oil

1) The mechanical booster pump is not filled with oil when it is packaged.
   Use the oil SMR-200 (70 mL can) that is provided.

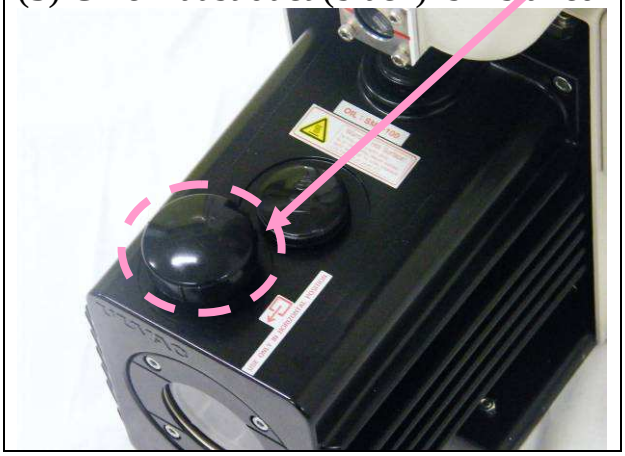
   Refer to the mechanical booster pump user manual (provided separately) for oiling directions.

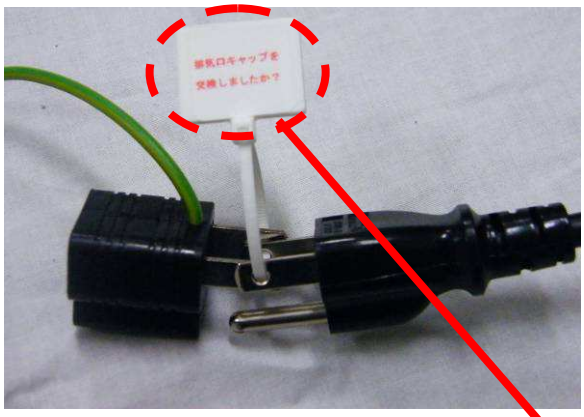
2) The sealed rotary vacuum pump is filled with the specified amount of SMR-100 oil before it is shipped.

Check oil level	Ensure that the mechanical booster pump and the sealed rotary vacuum pump are filled with the specified amount of oil. Checking the specified amount of oil: Refer to the mechanical booster pump user manual (provided separately). Refer to the sealed rotary vacuum pump user manual (provided separately).

6. Exhaust Outlet Check

 Warning	 Check exhaust outlet	The sealed rotary vacuum pump that is installed on the equipment is shipped with the specified amount of oil already poured inside. Ensure that the oil cap (red) is used to plug the exhaust outlet so that oil does not leak while being transported. Before starting up the equipment, always remove the oil cap (red) and replace it with the G1 exhaust duct that is provided or an oil mist trap (sold separately). A cautionary tag is attached to the end of the power cord to remind the user to replace the cap with the exhaust duct and oil mist trap (sold separately). Remove the cautionary tag after confirming that the cap has been replaced with the exhaust duct and oil mist trap (sold separately). The sealed rotary vacuum pump is not designed to withstand pressure. The internal pressure limit for the pump is 0.03 MPa (gauge pressure). When operating a pump with a device that is obstructing the exhaust outlet or the passage of gas on the exhaust outlet side, an explosion may occur or the motor may overheat.

Exhaust outlet check	
(1) When unit is unpacked	(2) Oil cap (red) is removed
	
(3) G1 exhaust duct (black) is installed	
	

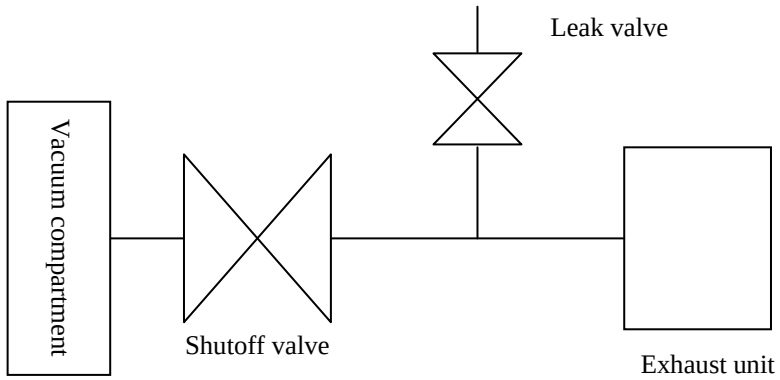
Power cord end	
Single-phase, 100 – 120 V specification	Single-phase, 200 – 240 V specification
	

Cautionary tag

7. Vacuum System

1) Thoroughly clean the inside walls of the vacuum system, such as the vacuum compartment, piping and valve. Remove all water, particles, dust or rust before connecting the system to the pump.
2) Install the shutoff valve and leak valve in between the vacuum compartment and the unit. The customer shall make the necessary arrangements for the shutoff valve and leak valve.

Basic connections for piping and vacuum



8. Power Supply

Warning	Check capacity	Primary power supply capacity Prepare the corresponding power supply: • Single-phase, 100 – 120 V specification Single phase, 100 – 120 V, 15.0 A or greater • Single-phase, 200 – 240 V specification Single phase, 200 – 240 V, 8.0 A or greater The customer shall make the necessary arrangements for the breaker. Note, if the capacity of the power supply is insufficient, breakers may trip during operation due to insufficient capacity.
	Separate power supply	Prepare a separate primary power supply. Do not connect other equipment to it. The customer shall make the necessary arrangements for the breaker. Note, if the capacity of the power supply is insufficient, breakers may trip during operation due to insufficient capacity.

Warning	 Connect to ground	Connect to a Class D ground. This equipment uses a grounded plug for 100 V - 120 V. When using a plug adapter, connect the ground wire to the nearest ground terminal. 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. Prepare the corresponding power cables: • Single-phase, 100 – 120 V specification 1.5 mm2 or greater • Single-phase, 200 – 240 V specification 1.0 mm2 or greater 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	Do not touch the terminal box cover when inserting the primary cable into the socket. Electric shock.

9. List of Required Tools

Tool	Application
13 mm spanner	Intake duct installation

(4) Operation

1. Risks During Operation, and Associated Safety Measures

Caution	 Release into atmosphere	Open the leak valve after the exhaust unit stops, and release or evacuate the inside of the rough piping into the atmosphere. The customer shall make the necessary arrangements for the leak valve. To prevent the reverse flow of oil.
	 Prohibited	Do not suction corrosive gases and fluids (such as acid, alkaline or solvents) or particles. Solids such as particles leaking into the mechanical booster pump causes rotor damage.

2. Exhaust Unit Operation

2-1 Preparation

1) Leak valve *Customer provided.	Close
2) Shutoff valve *Customer provided.	Open
3) Breaker *Customer provided.	OFF
4) Unit switch	OFF
5) Sealed rotary vacuum pump	ON

* The sealed rotary vacuum pump is normally turned ON.
  Do not operate the sealed rotary vacuum pump switch.

2-2 Operation

Start vacuum exhaust

1) The exhaust system is connected to the inlet flange:	Confirm
2) Breaker *Customer provided.	ON
3) Unit switch	ON (Exhaust unit start)

2-3 Stopping

Stop vacuum exhaust

1) Shutoff valve *Customer provided.	Close
2) Leak valve *Customer provided.	Open
3) Unit switch	OFF (Exhaust unit stop)
4) Breaker *Customer provided.	OFF

3. Handling Malfunctions

3-1 Instantaneous power failure All devices are automatically restored to the status prior to the power failure.
3-2 Long-term power failure 1) Unit switch — OFF 2) Leak valve *Customer provided. — Open
3-3 Restoration procedure after power failure 2. Exhaust Unit Operation: Refer to the previous sections "2-1 Preparation" and "2-2 Operation."

(5) Maintenance and Repairs

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

Caution	 Periodic replacement	As a general rule, replace the oil mist trap element every 1500 – 2000 hours of operation. 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) and its container. Dispose appropriately in accordance with the law.
	 Prohibited	Do not modify without prior approval from the manufacturer. The manufacturer assumes no responsibility for any modifications undertaken.

2. Maintenance and Repairs Performed by Customer.

1) Oil replacement for the sealed rotary vacuum pump and mechanical booster pump.
2) Element replacement of oil mist trap (sold separately).
3) O-ring replacement for some parts. (Refer to "7. Consumables" on page 22.)

Contact the manufacturer for repairs other than those cited above.

3. Removing, Maintaining and Fitting the Device

3-1 Mechanical booster pump

1. Oil replacement
   Refer to the mechanical booster pump user manual (provided separately)

2. Refer to the following when removing the mechanical booster pump from the exhaust unit.
   1) Required tools: 4 mm Allen wrench × 1
      13 mm spanner × 1

   2) Removal
   (1) Ensure that all devices on the equipment are stopped.
   (2) Ensure that the primary power supply for the equipment is disconnected.
   (3) Disconnect the piping when it is connected to the inlet of the mechanical booster pump.
   (4) Disconnect the power cord plugs for the mechanical booster pump and the sealed rotary vacuum pump. [Part 2 (A) in diagram on p.19]
   (5) Remove the oil from the mechanical booster pump.
   "Refer to the mechanical booster pump user manual (provided separately)"
   (6) Remove the quick coupling that connects the rack and intake pipe for the sealed rotary vacuum pump. [Part 1 (B) in diagram on p.19]
   (7) Use an Allen wrench (4 mm) to loosen the hex socket bolts (Qty. 6) on the rack that are fixed to the base of the sealed rotary vacuum pump so that the rack can be removed. [Part 1 and 2 (C) in diagram on p.19]
   * The hex socket bolts do not need to be removed.
   (8) List mechanical booster pump and the rack together to remove them from the sealed rotary vacuum pump. [Same status as Part 3 in diagram on p.19]
   (9) Use the spanner (13 mm) to remove the fixing bolts (Qty. 4) for the mechanical booster pump. Then, remove the mechanical booster pump from the rack.
   * Remove the bolts from part (D) while the pump unit is flat (Part 3 in diagram on p.19). Oil may leak into the cylinder compartment if the unit is tilted.

   3) Fitting
   (1) Lift and place the mechanical booster pump onto the rack, and then use the wrench (13 mm) to tighten the fixing bolts (Qty. 4).
   * Attach the bolts from part (D) while the pump unit is flat (Part 3 in diagram on p.19). Oil may leak into the cylinder compartment if the unit is tilted.
   * The O-ring is inserted onto the connection between the mechanical booster pump outlet and the rack. Ensure that the O-ring is inserted inside the O-ring groove and that there are no foreign objects attached to the O-ring seal.
   * Ensure that there are no loose bolts.
   (2) Lift the mechanical booster pump together with the rack, and install the rack onto the space for the hex socket bolts that were loosed in step 7 of the removal procedure. [Part 1 and 2 (C) in diagram on p.19]
   If the hex socket bolts are removed, maintain a 5 mm – 8 mm space to install the rack and fix the 6 bolt locations into place.
   * The O-ring is inserted onto the intake pipe of the mechanical booster pump.

Ensure that the O-ring is inserted inside the O-ring groove and that there are no foreign objects attached to the O-ring seal.

(3) Connect the sealed rotary vacuum pump and the rack using the quick coupling. [Part 1 (B) in diagram on p.19]

* Ensure that the quick coupling is not loose.

(4) Use an Allen wrench (4 mm) to tighten the hex socket bolts (Qty. 6) on the base of the sealed rotary vacuum pump in order to fix the rack into place. [Part 1 and 2 (C) in diagram on p.19]

* Ensure that there are no loose bolts.

(5) Connect the power cord plugs to the mechanical booster pump and the sealed rotary vacuum pump. [Part 2 (A) in diagram on p.19]

(6) Oil the mechanical booster pump.

"Refer to the mechanical booster pump user manual (provided separately)."

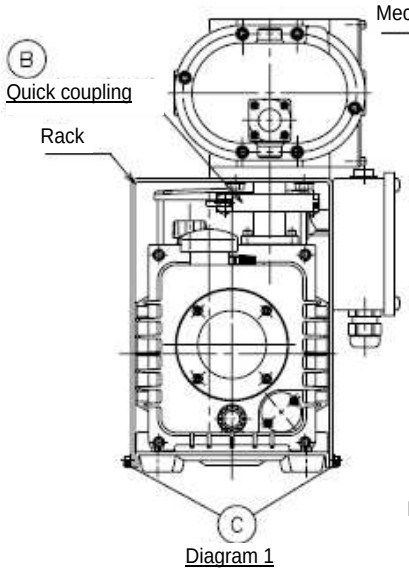


Diagram 1

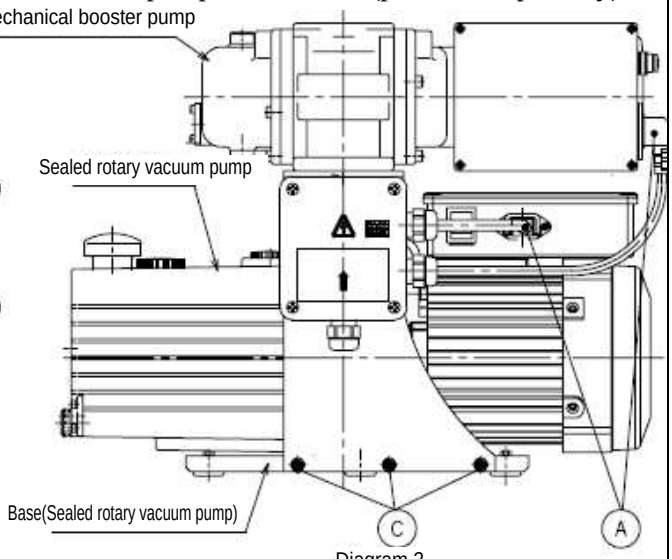


Diagram 2

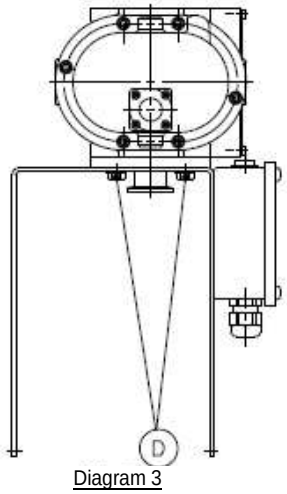


Diagram 3

3-2 Sealed rotary vacuum pump

1) Oil replacement
Refer to sealed rotary vacuum pump user manual (provided separately).

Refer to the following for the individual pump unit.

1) Required tools: 4 mm Allen wrench × 1
13 mm spanner × 1

2) Removal

(1) Remove the pump following the mechanical booster pump user manual procedure.

3) Oil replacement
Refer to the sealed rotary vacuum pump user manual (provided separately).

4) Fitting

(1) Fit the pump following the mechanical booster pump user manual procedure.

4. Maintenance and Inspection Locations

Component	Maintenance and inspection details	Timing
Mechanical booster pump	Is the oil level between the two lines on the level gauge?	Once a week
	Cloudy oil: The moisture in the exhaust gas is mixed into the oil. The oil needs to be replaced with new oil because the ultimate pressure will rise. Black oil: The bearing and timing gear may be worn. Bring the equipment to our service department for inspection.	Once a week
	The ultimate pressure rises and the oil leaks when the drain plug or the check plug is loose.	Once a week
Sealed rotary vacuum pump	Ensure that the oil level on the oil level gauge is within the indicated line.	Once every 3 days
	Is the oil color reddish or cloudy? If it is, replace it with new oil.	Once every 3 days
	Always replace the oil with new oil regularly even if there is no problem.	Once / 3000 hrs. or Once / 6 months
Oil mist trap	If the element for the oil mist tarp is clogged, the sealed rotary vacuum pump will no longer be able to separate the oil and smoke in the sealed rotary vacuum pump. The element will need to be replaced if excessive oil or smoke is output when restarting the equipment after temporarily stopping the sealed rotary vacuum pump (for more than 30 minutes).	Replace every 1500 – 2000 hrs.

5. Troubleshooting

Symptoms	Cause	Solution
Ultimate pressure is poor or Ultimate pressure is unstable or Weak exhaust performance	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 the O-ring fitting and for scratches on the surrounding parts before the change occurred when the ultimate pressure was reached.
	Problem with the sealed rotary vacuum pump.	Refer to the sealed rotary vacuum pump user manual.
	Problem with the mechanical booster pump.	Refer to the mechanical booster pump user manual.
Overload protection device is tripped on sealed rotary vacuum pump	Overload.	Refer to the 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.
   - Protect from effects of corrosion due to chemicals and gases etc.

2) Steps to be taken prior to, and during storage
   - Fit the inlet with the flange cap when storing.

7. Consumables

Location	Name	Specification	Material	Qty.	Replaceable by customer
Rack (VG40 connecting pipe)	O-ring for exhaust flange	V-55	NBR	1	○
Mechanical booster pump	Oil	SMR-200	---	70 mL	○
	O-ring for intake flange	V-55	NBR	1	○
Sealed rotary vacuum pump	Oil	SMR-100	---	1.1 L	○
	Rubber feet	K-3215	---	6	○
	Other	Refer to sealed rotary vacuum pump user manual			

For special use, specifications and quantity may differ.

(6) Disposal

1. Precautions to be taken for Disposal

 Caution	 Legal compliance	The law requires proper disposal of used pump oil (waste oil) and its container. Dispose appropriately in accordance with the law.
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 for any modifications undertaken.

1. Standard Optional Components

Optional components	Application	Fitting
Oil mist trap OMT-200A	Prevents oil and smoke outflow from sealed rotary vacuum pump outlet	May be fitted by customer.
Inline trap OMI-200	Prevents oil and smoke outflow from sealed rotary vacuum pump outlet	May be fitted by customer.
Intake flange KF40×VF40	Converts shape of inlet from VF40 or its equivalent to KF40	May be fitted by customer.