



Rotary Evaporator RE212-G

Instruction Manual

First Edition

- Thank you for choosing RE series Rotary Evaporators from KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd.
- For equipment operation, please read and become thoroughly familiar with this instruction manual before use. Always keep equipment documentation safe and close at hand for convenient future reference.


 **Warning:** Read instruction manual warnings and cautions carefully and completely before proceeding.

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1. SAFETY PRECAUTIONS

Explanation of Symbols

A Word Regarding Symbols

Various symbols are provided throughout this text and on equipment to ensure safe operation. Failure to comprehend the operational hazards and risks associated with these symbols may lead to adverse results as explained below. Become thoroughly familiar with all symbols and their meanings by carefully reading the following text regarding symbols before proceeding

 **Warning** Signifies a situation which may result in serious injury or death (Note 1.)

 **Caution** Signifies a situation which may result in minor injury (Note 2) and/or property damage (Note 3.)

(Note 1) Serious injury is defined as bodily wounds, electrocution, bone breaks/fractures or poisoning, which may cause debilitation requiring extended hospitalization and/or outpatient treatment.

(Note 2) Minor injury is defined as bodily wounds or electrocution, which will not require extended hospitalization or outpatient treatment.

(Note 3) Property damage is defined as damage to facilities, equipment, buildings or other property.

Symbol Meanings



Signifies warning or caution.
Specific explanation will follow symbol.



Signifies restriction.
Specific restrictions will follow symbol.



Signifies an action or actions which operator must undertake.
Specific instructions will follow symbol.

1. SAFETY PRECAUTIONS

Symbol Glossary

WARNING / CAUTION



General



Danger!
Blast Hazard



Caution: Indoor
Use Only

RESTRICTION



General
Restriction



Do Not
Disassemble

ACTION



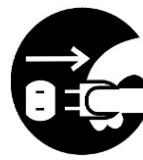
General Action
Required



Connect Ground
Wire



Level Installation



Disconnect Power



Inspect
Regularly

1. SAFETY PRECAUTIONS

Warnings and Cautions



WARNING



Install in a location free of flammables and explosives.



Never install or operate unit in a flammable or explosive gas atmosphere.
See "LIST OF HAZARDOUS SUBSTANCES" (P.44) for information on flammable and explosive gases.



Ground wire **MUST** be connected properly



- Connect power cable to a grounded outlet in order to avoid electric shock.
- Never connect ground wire to gas lines or water pipes. · Fire, accident or equipment malfunction may result.
- Never connect ground wire to telephone grounding lines or to lightning conductor rods. Fire or electric shock may result.
- Never insert multiple plugs into a single outlet. Doing so may result in power cable overheating, fire or drop in voltage.



Connect power cable properly

Insert power cable firmly into the AC adapter inlet. Failure to do so may result in overheating, fire, and/or electric shock.

1. SAFETY PRECAUTIONS

Warnings and Cautions



Turn OFF (○) power immediately when an abnormality occurs.

If unit begins emitting smoke or abnormal odours for reasons unknown, turn OFF (○) power immediately, disconnect power cable from power supply, and contact original dealer of purchase for assistance.

Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should always be performed by a certified technician.



Handle power cable with care.

- Do not operate unit with power cable bundled or tangled. Operating unit with the power cable bundled or otherwise tangled, may cause power cable to overheat and/or catch fire.
- Do not modify, bend, forcibly twist or pull on power cable. Fire or electric shock may result.
- Do not risk damage to power cable by positioning it under desks or chairs, or by allowing it to be pinched in between objects. Fire or electric shock may result.
- Do not place power cable near kerosene/electric heaters or other heat-generating devices. Doing so may cause power cable insulation to overheat, melt and/or catch fire, which may result in electric shock.
- Turn OFF (○) power immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Contact original dealer of purchase for information about replacing power cable. Failure to do so may result in fire or electric shock.
- Always connect power cable to appropriate facility outlet or terminal.



DO NOT disassemble or modify equipment

Never attempt to disassemble or modify unit. Doing so may cause malfunction, fire, electric shock, or personal injury. Note that any malfunction resulting from unauthorized modifications or customizations to unit will void the warranty.



Exercise caution when handling flammable chemicals.

Unit is NOT fire or blast resistant. When processing flammable samples, be sure to provide adequate ventilation and not to allow anything that may be a source of fire or ignition (static electricity, etc.) approached. Do not use this unit in an atmosphere of substances shown in LIST OF HAZARDOUS SUBSTANCES (P.44). Never vaporize explosive substances. Fire or explosion causing serious injury or death may result.



CAUTION



DO NOT operate equipment during thunderstorms

In the event of a thunderstorm, turn OFF (○) power and disconnect power cable immediately. A direct lightning strike may cause equipment damage, fire or electric shock, resulting in serious injury or death.

1. SAFETY PRECAUTIONS

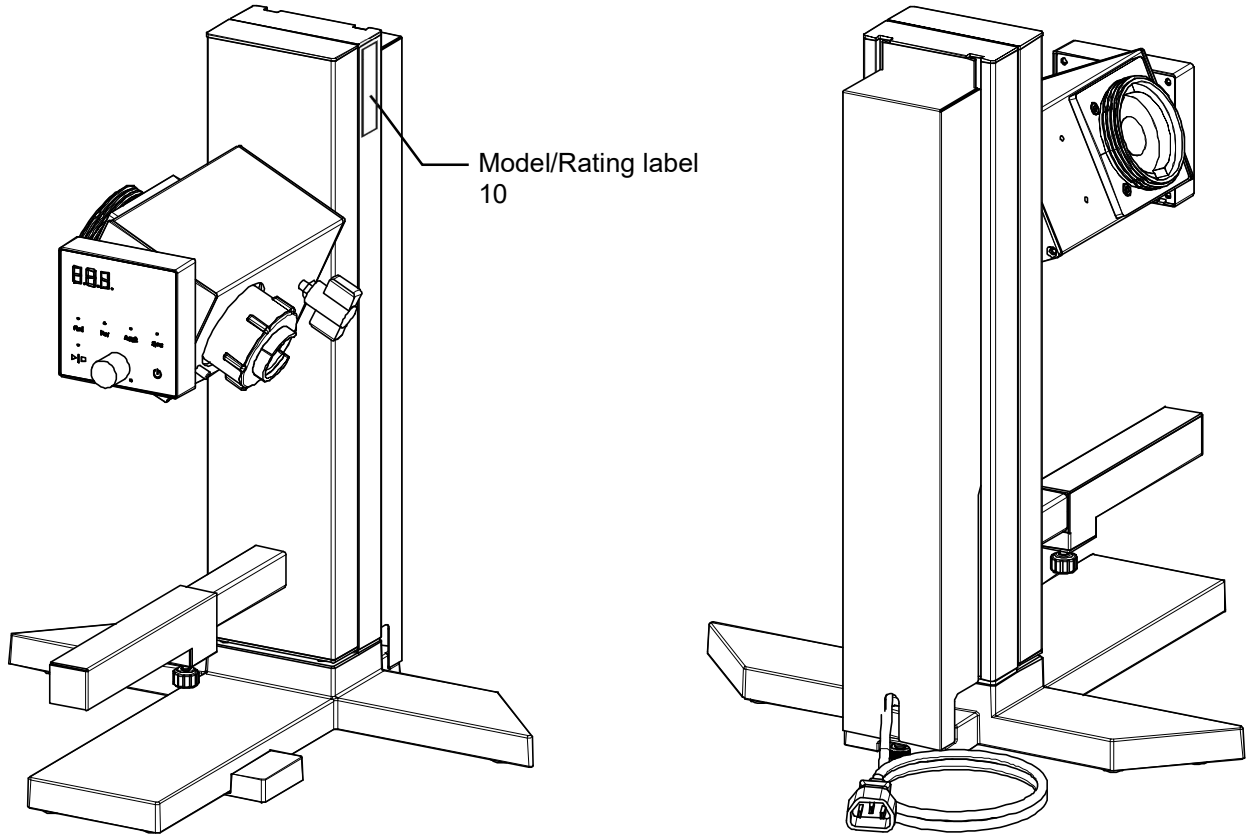
Residual Risk Map

These figures indicate positions of caution labels.

The numbers shown in the figure indicate the numbers listed in the "List of Residual Risks" in this manual.

For details of individual residual risks, see the List of Residual Risks.

□



*** Contact us if the caution signs are no longer visible because the nameplate has is-peeled off or the text is no longer legible. We will send you a new nameplate. (Chargeable)**

1. SAFETY PRECAUTIONS

List of Residual Risks

List of residual risks (instructions for risk avoidance)

This list summarizes residual risks to avoid personal injuries or damages to properties during or related to the use of equipment.

Be sure to fully understand or receive instructions on how to use, maintain and inspect equipment before starting operation.

EN

Loading/Installation				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page
1	WARNING	Fire/ Electric shock	Install in a location free of flammables and explosives.	P.3
2	CAUTION	Fire/ Electric shock	Ground wire MUST be connected properly	P.3
3	CAUTION	Fire/ Electric shock	Connect power cable properly.	P.3
4	WARNING	Fire/ Electric shock	Turn OFF (○) power immediately when an abnormality occurs.	P.4
5	WARNING	Fire/ Electric shock	Handle power cable with care.	P.4
6	WARNING	Fire/ Electric shock	DO NOT disassemble or modify equipment.	P.4
7	WARNING	Fire	Exercise caution when handling flammable chemicals.	P.4
8	WARNING	Fire	Choose an appropriate installation site.	P.11
9	WARNING	Injury	Install unit on a level surface.	P.11
10	WARNING	Fire/ Electric shock	Always connect power cable to appropriate facility outlet or terminal.	P.12
11	WARNING	Fire/ Electric shock	Install in a dry location.	P.12
12	WARNING	Injury	Pay attention to the surroundings whenever operating jack.	P.12
13	WARNING	Injury	Be aware that slide panel may spring up	P.13
14	WARNING	Injury	Install glassware and piping with slide panel lifted up.	P.13
15	CAUTION	Injury	Use caution when handling glassware	P.15

Use				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page
16	WARNING	Explosion/ Fire	Exercise caution when handling flammable chemicals.	P.29
17	WARNING	Fire/ Electric shock	Turn OFF (○) power immediately when an abnormality occurs.	P.29
18	WARNING	Fire/ Electric shock	DO NOT operate equipment during thunderstorms	P.4
19	CAUTION	Injury	Select appropriate gasket for organic solvents	P.29

1. SAFETY PRECAUTIONS

List of Residual Risks

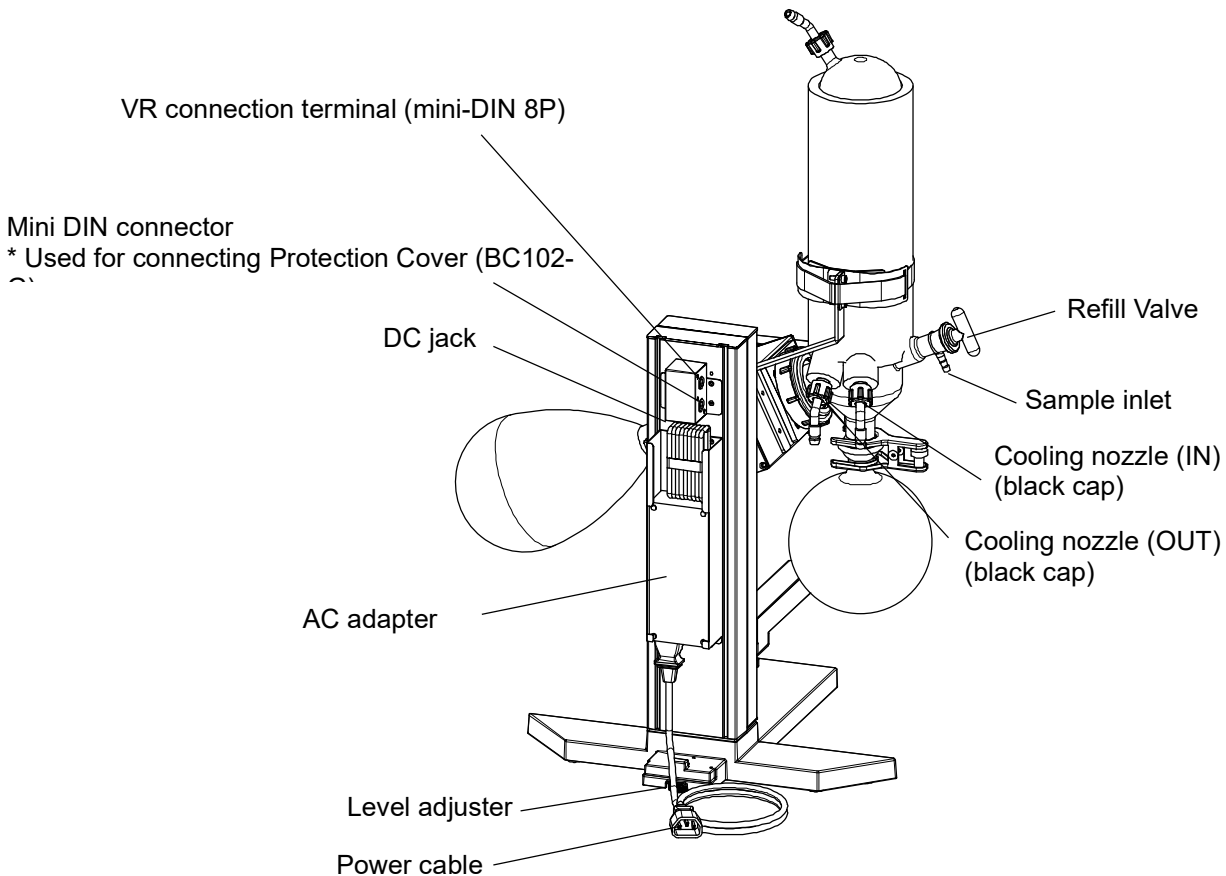
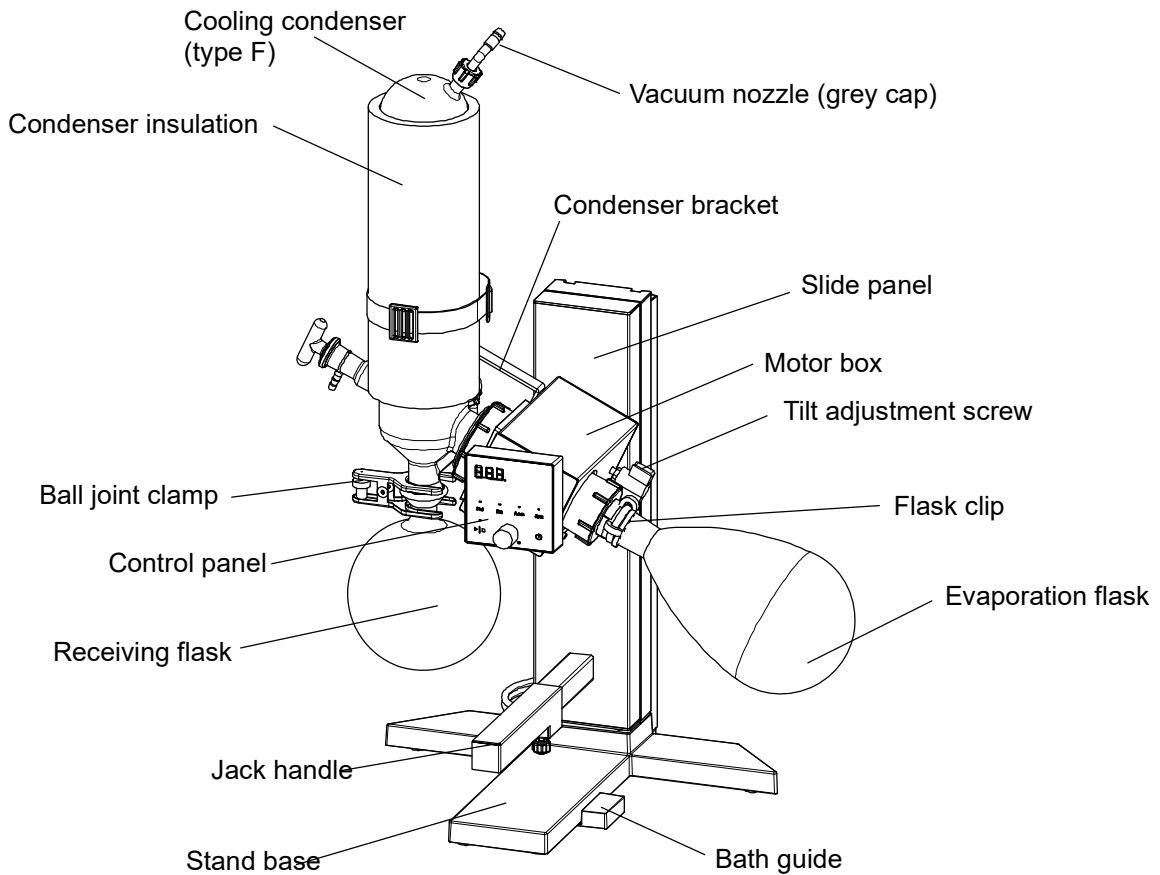
Daily inspection/maintenance				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page
20	WARNING	Fire/ Electric shock	Remove power cable for inspection and maintenance.	P.30
21	WARNING	Fire/ Electric shock	NEVER disassemble or modify unit	P.30

Extended storage/disposal				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page
22	WARNING	Fire/ Electric shock	Turn OFF (○) power and disconnect power cable.	P.31
23	CAUTION	Injury	Do not leave unit in a location where children may have access	P.31

2. COMPONENT NAMES AND FUNCTIONS

Main Unit

EN

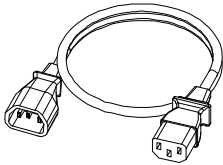
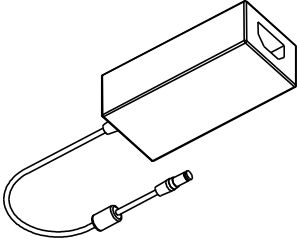
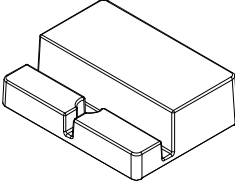
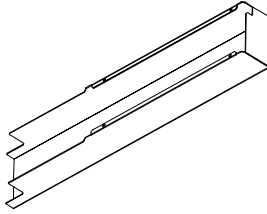
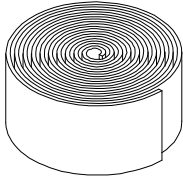
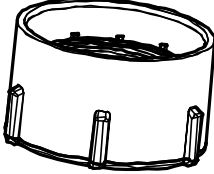
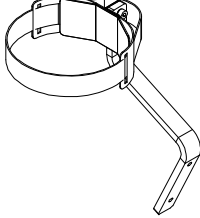
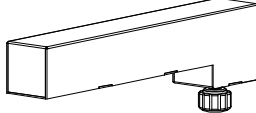
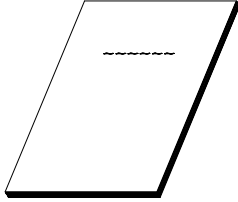


2. COMPONENT NAMES AND FUNCTIONS

Accessories

Check before operation that all the accessories are complete.

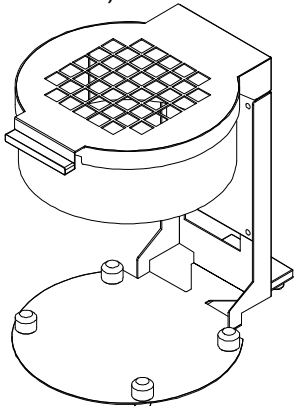
Contact original dealer of purchase if anything is missing.

<p>① Power cable (approx. 0.7 m)</p> 	<p>② AC adapter</p> 	<p>③ Bath guide</p> 	<p>④ Rear cover</p> 
<p>⑤ Tape fastener</p>  <p>Used for binding condenser and hoses</p>	<p>⑥ Joint nut</p> 	<p>⑦ Condenser bracket</p> 	<p>⑧ Handle extension adapter</p> 
<p>⑨ Instruction manual</p> 			

* Check the accessories for each condenser unit on the list of condenser unit accessory included with condenser unit.

Peripheral equipment (sold separately)

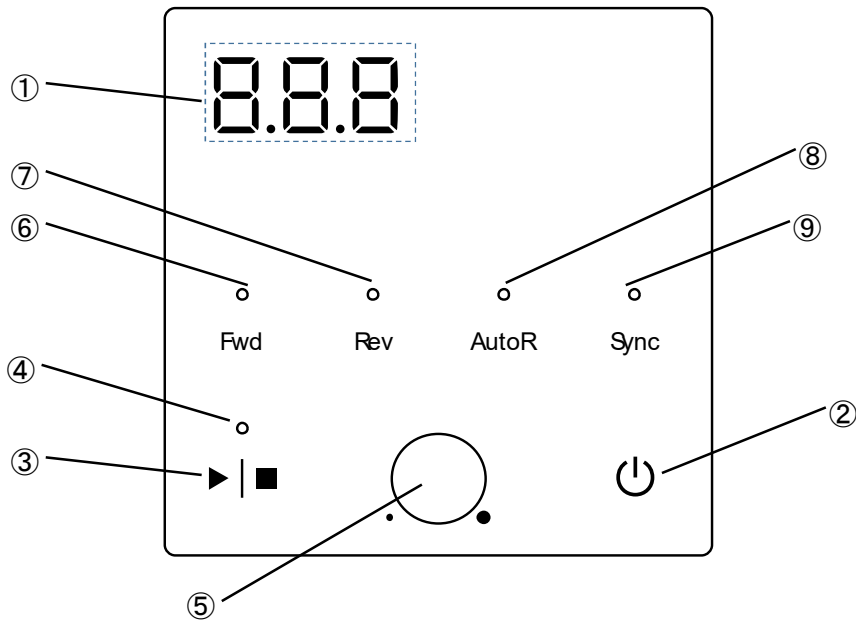
Protection Cover
(BC102-G/255698)



It covers the water chamber of BM312-G / BO312-G and suppresses splashing due to the rotation of the flask.
Refer "11. BC102-G instruction manual (P.41)"

2. COMPONENT NAMES AND FUNCTIONS

Control Unit



No.	Panel item	Description
①	RPM display	Shows rotation speed reading and setting, and each parameter.
②	Power key	Press to turn ON () or OFF (○) power.
③	Run/Stop key	Press to start or stop rotation.
④	Run/Stop lamp	Illuminates during operation.
⑤	Control knob	Turn to increase or decrease set value, scroll items in user setting, and press to switch or finalize settings.
⑥	Fwd lamp	Forward lamp; illuminates in forward rotation mode
⑦	Rev lamp	Reverse lamp; illuminates in reverse rotation mode
⑧	AutoR lamp	Auto Rotation lamp; illuminates in auto inversion mode
⑨	Sync lamp	Synchro lamp; not used for this unit.

Display Characters

All characters displayed when making settings are defined as follows

Character	Letters	Description
rot	rot	Indicates rotation mode setting. See "Rotation Modes" (P. 23)
4EC	SEC	Indicates time setting for automatic inversion. See "Timed Auto Inversion Mode" (P. 24)
Pon	Pon	Indicates setting of the behavior of unit at power loss restoration. See "Auto-resume Function" (P.25)
d4P	dSP	Indicates LED brightness setting. See "LED Brightness Setting" (P.26)

3. PRE-OPERATION PROCEDURES

Installation Precautions



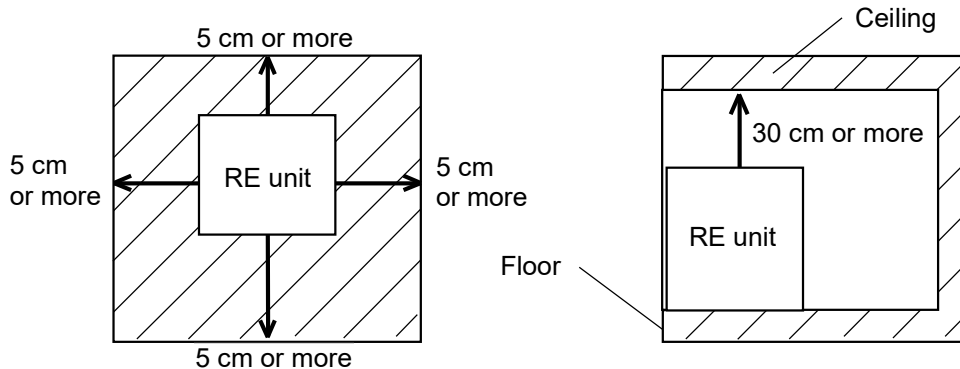
Choose an appropriate installation site.

DO NOT install unit:

- where installation surface is not completely level, not even or not clean.
- where flammable or corrosive gases/fumes may be present
- where external temperature will exceed 35°C, will fall below 5°C or will fluctuate largely.
- where liquid is assumed to splash on unit
- in excessively humid or dusty locations.
- in direct sunlight or outdoors.
- where there is constant vibration.
- in direct contact with the outside air
- where power supply is erratic.
- where there is combustible material nearby.
- in the proximity of, particularly directly below a fire alarm.
- where there is a risk of freezing or condensation.



Install unit, including glass set, in a location with sufficient space as specified below.

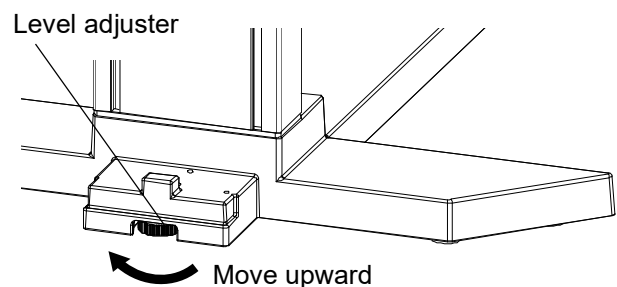


Install unit on a level surface.

Install unit on a level and even surface. Failure to do so may cause abnormal vibrations or noise, possibly resulting in complications and/or malfunction.

Use level adjuster on the back of unit when unit still wobbles despite level installation.

Turn the wheel left to raise, turn it right to lower.



3. PRE-OPERATION PROCEDURES

Installation Precautions



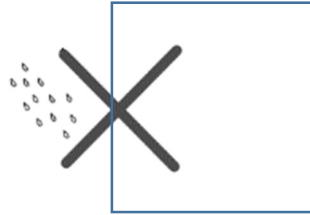
Connect the power supply of this unit to BM312-G (BO312-G).

The power cable attached to this unit is exclusively for BM312-G (BO312-G) connection. When using it, connect it to BM312-G (BO312-G) and do not use any cable other than the dedicated cable.



Install in a dry location.

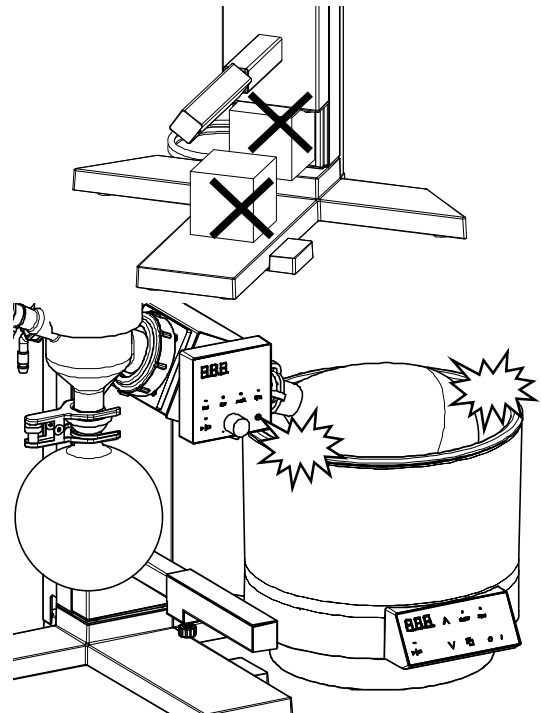
Install unit where it will be free from liquid spray and other moisture. Failure to do so may result in control mechanisms becoming wet, causing malfunction, electric shock and/or fire.



Pay attention to the surroundings whenever operating jack.

Do not place any objects under the slide panel. Such objects may cause damage to unit or personal injury when using the jack handle.

Always lower the slide panel slowly to prevent damage to glassware on contact with the bath



3. PRE-OPERATION PROCEDURES

Installation Procedure



Be aware that slide panel may spring up

Slide panel on this unit employs a spring-loaded jack to lift it up. The spring tension is adjusted to achieve balance when all the connection with glassware and piping are made. The panel jumps up when releasing the lock of the jack without glassware mounted. Be sure to hold the top of the slide panel by hand whenever releasing the lock.



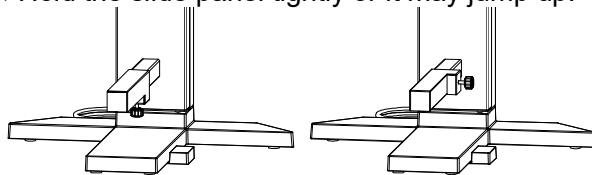
Always install glassware and piping with the slide panel lifted up.

If the lock of the jack is unintentionally released while setting up glassware and piping, there is a risk of damage to glassware, and/or personal injury.

1. Jacking up

(1) Release the lock by turning jack handle counterclockwise while holding the slide panel top.

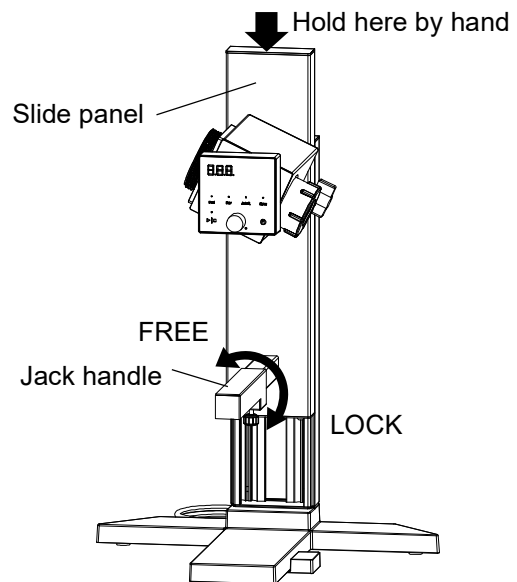
❖ Hold the slide panel tightly or it may jump up.



LOCK

FREE

(2) Lift up the slide panel to top, turn the handle clockwise to lock.



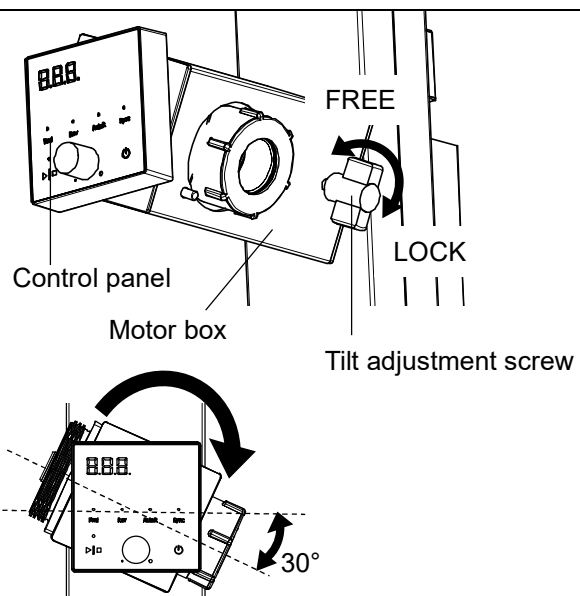
2. Motor box tilt adjustment

(1) Hold motor box by hand and turn tilt adjustment screw counterclockwise to release the lock.

(2) Motor box can now rotate. Rotate the box to the position for use and turn tilt adjustment screw clockwise to lock the driving unit.

(3) Adjust the control panel angle for better visibility

❖ Tilt the driving unit at about 30° before installation.



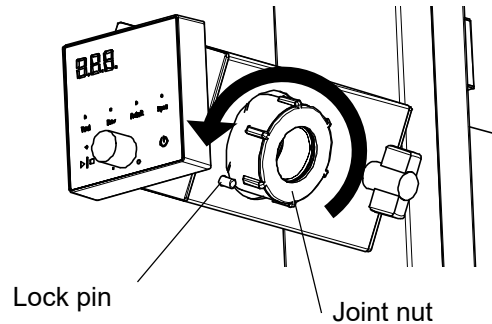
3. PRE-OPERATION PROCEDURES

Installation Procedure

3. Installing Vapor Tube

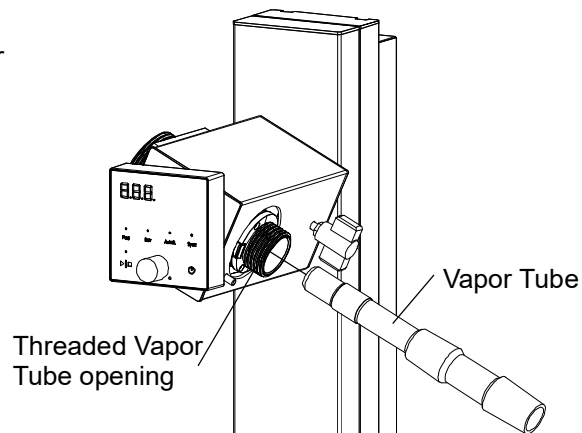
(1) Remove joint nut

Press in the lock pin with the thumb to lock the rotary part. Take off joint nut by turning it counterclockwise with the other hand.



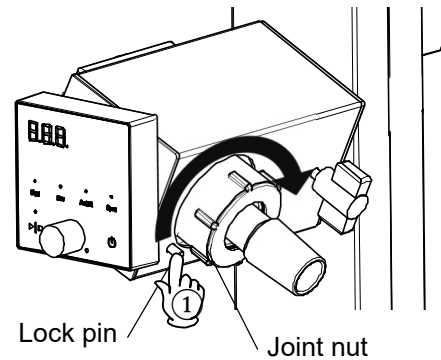
(2) Install Vapor Tube

Insert Vapor Tube into the Vapor Tube opening until it clicks, while holding motor box tightly with the other hand.



(3) Replace joint nut

As with step (1), press in the lock pin to lock the rotary part. Screw in joint nut clockwise with the other hand.

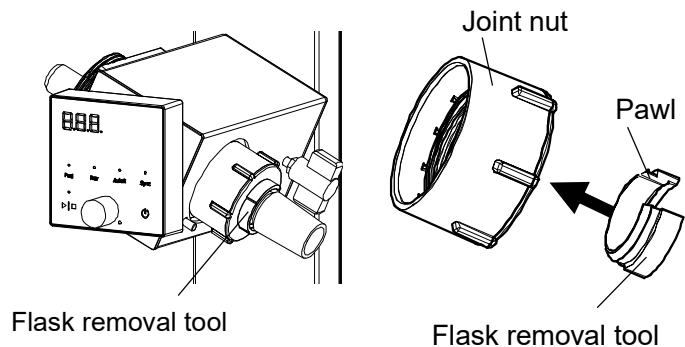


(4) Attach flask removal tool (included with glass set)

- ① Fit flask removal tool over Vapor Tube.
- ② Pinch flask removal tool and slip it in joint nut.

* There is a direction for flask removal tool. Pawl should come to the joint nut side.

Flask removal tool facilitates removing flask and Vapor Tube. See "Operation Stop" (P.28)



3. PRE-OPERATION PROCEDURES

Installation Procedure



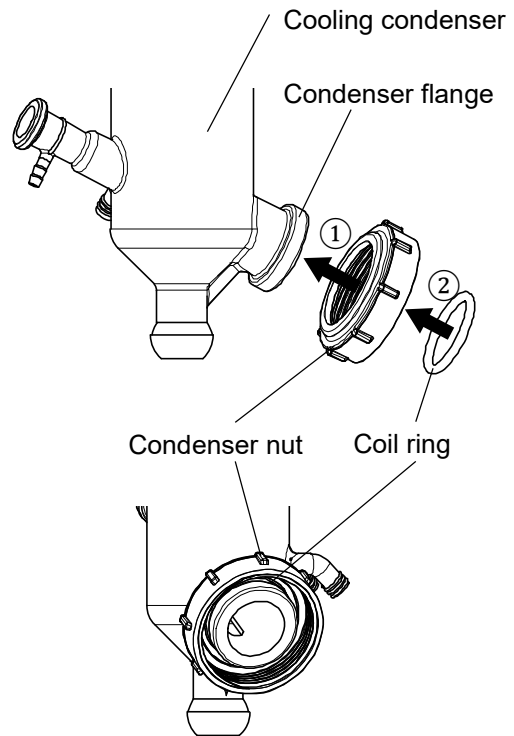
Use caution when handling glassware

Any damage on glassware may lead to serious accidents. Check glassware for damage before operation.

4. Attaching condenser nut

Attach condenser nut for mounting condenser on main unit

- ① Pass condenser nut on condenser flange.
- ② Put coil ring over condenser flange.
- ③ Lightly pull on condenser nut to ensure it does not come off condenser flange.



3. PRE-OPERATION PROCEDURES

Installation Procedure

5. Installing vacuum seal



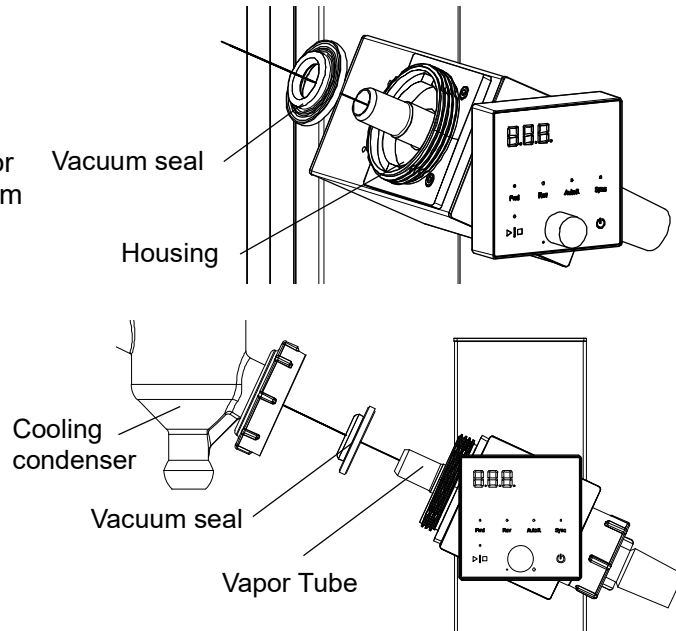
Pay attention to the direction of vacuum seal.

Installing vacuum seal in the opposite direction may lead to poor vacuum, or may wear the seal, resulting in damage to driving unit.

Install vacuum seal.

Fit vacuum seal into the housing by passing it on Vapor Tube with the side where the spring is visible facing motor box.

- ❖ Be sure to install vacuum seal after Vapor Tube is set, to prevent damage to vacuum seal.



Make pipe connection properly

Be sure to install all tubing in right positions. Improper connection and looseness of nozzle caps may cause leakage or damage to peripherals.

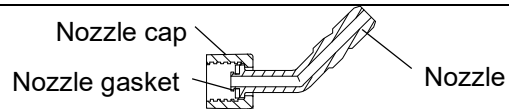
6. Installing nozzle unit

- ❖ Nozzle unit has two types, with grey cap and black cap.
Grey: for vacuum line
Black: for cooling water line

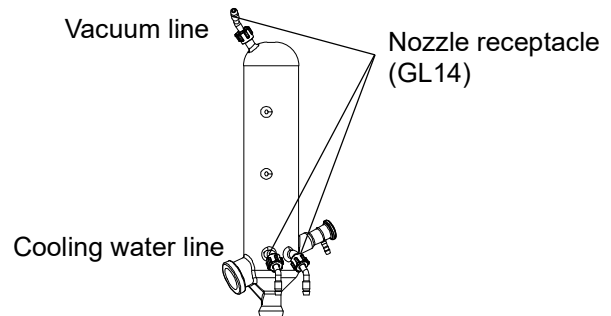
- ❖ Three parts of "Nozzle", "Nozzle cap", and "Nozzle gasket" comprise the nozzle unit.

Ensure that nozzle gasket is placed in nozzle cap.

- ① Screw down nozzle cap against nozzle receptacle on cooling condenser.
- ② Turn nozzle cap clockwise to fasten.



Nozzle unit sectional diagram



3. PRE-OPERATION PROCEDURES

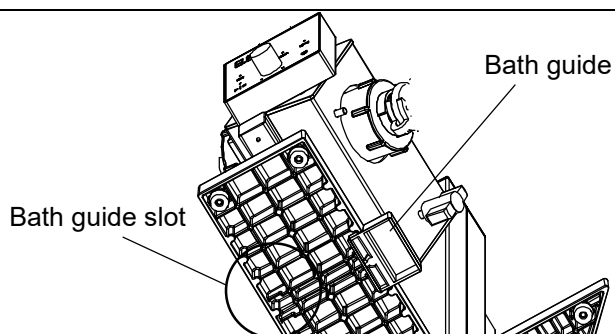
Installation Procedure

7. Installing bath guide

Attach supplied bath guide to main unit stand base.

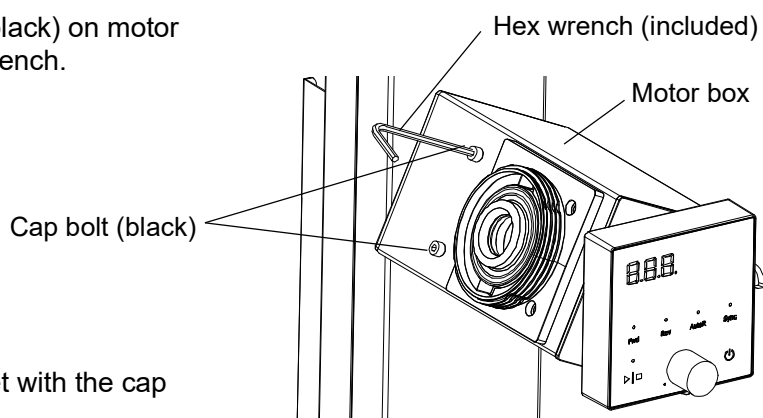
- (1) Insert bath guide into the slot on bottom of stand base.

The bath guide slots are positioned on both right and left. Choose the side on which an evaporation flask is to be attached.

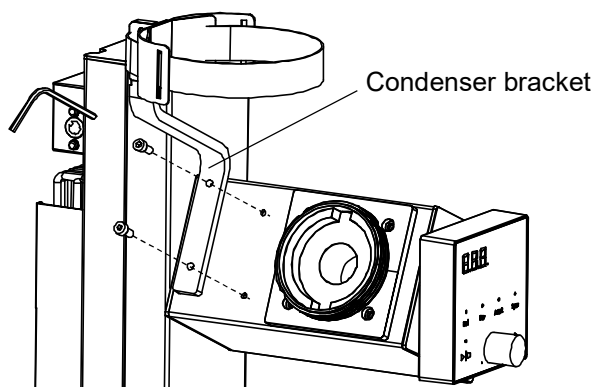


8. Installing condenser bracket

- (1) Remove two cap bolts (black) on motor box with supplied hex wrench.



- (2) Attach condenser bracket with the cap bolts removed.



3. PRE-OPERATION PROCEDURES

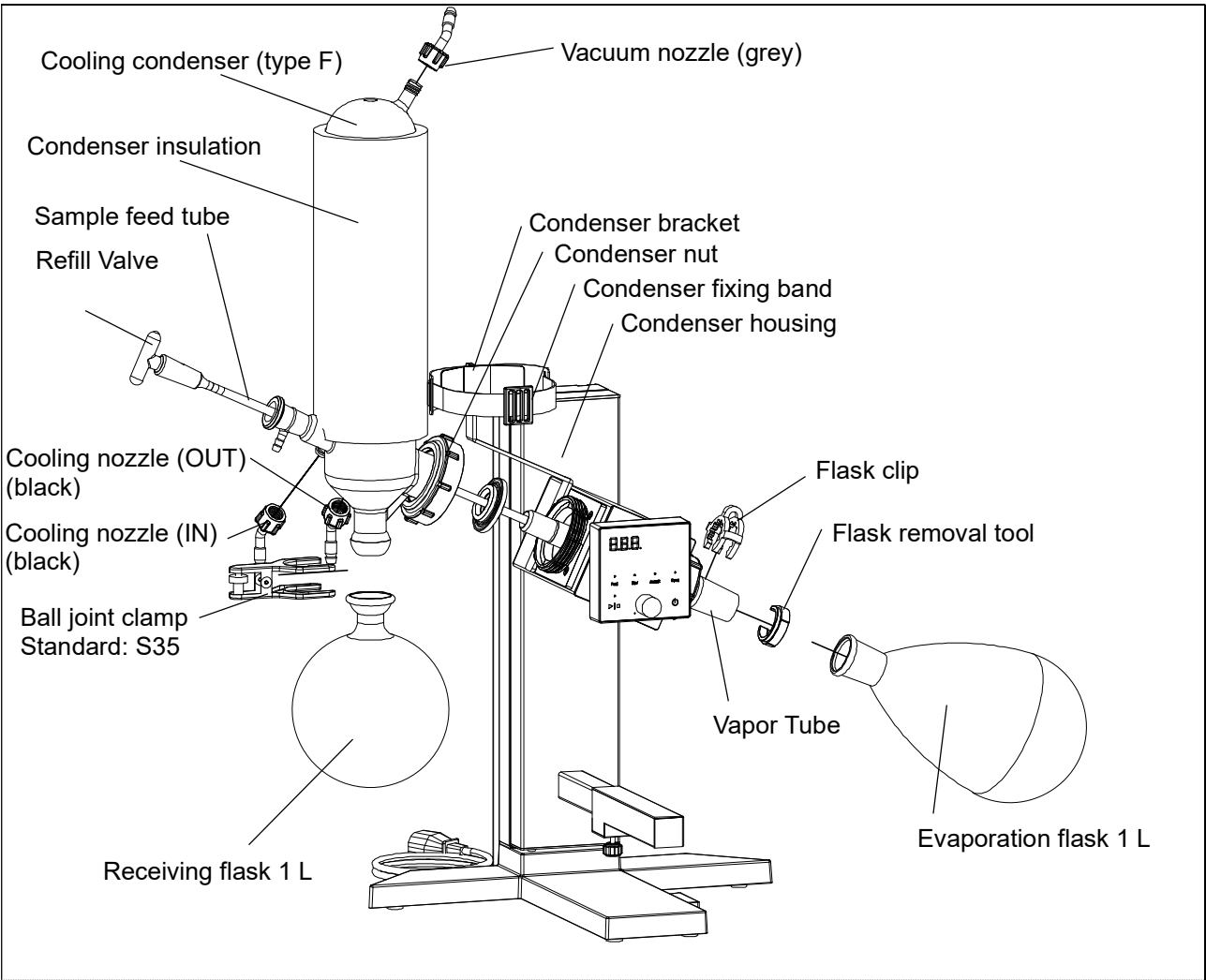
Installation Procedure

9. Installing cooling condenser and flask



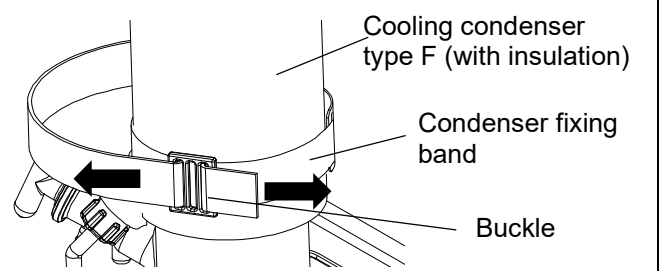
Install glassware while slide panel is lifted up.

If slide panel springs up during setting, glass breakage and/or personal injury may result. Be sure to hold down slide panel top when unlocking the jack.



- (1) Attach condenser bracket. (See P.17)
- (2) Bring condenser flange into close contact with vacuum seal in condenser housing and tighten condenser nut clockwise to some extent. Turn cooling condenser and the nut simultaneously to re-tighten. Ensure that the joint for receiving flask faces down.
- (3) Slide condenser insulation over the condenser.
- (4) Pull out one end of condenser fixing band from the buckle and put the condenser onto condenser bracket. Pass the fixing band through the buckle and pull on both sides to fasten the condenser. (see right figure)

- (5) Attach receiving flask to the condenser with ball joint clamp. Lock the clamp by turning a dial inside.
- (6) Put evaporation flask on Vapor Tube and secure it with flask clip.
- (7) Insert Refill Valve carefully into the condenser so that sample feed tube does not become bent or twisted.

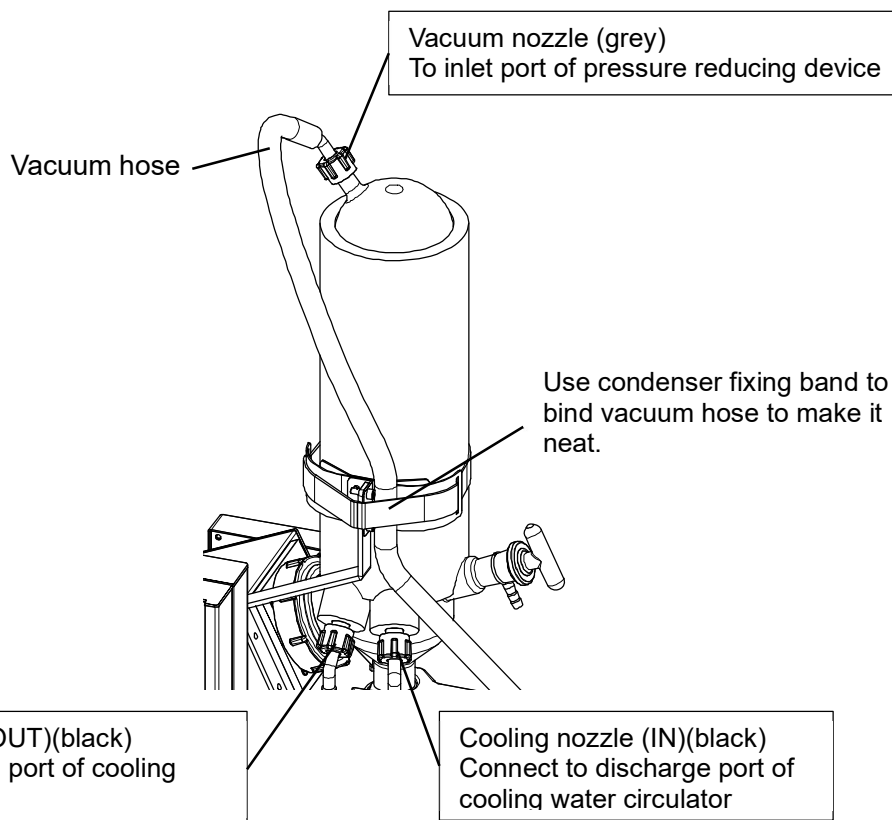


3. PRE-OPERATION PROCEDURES

Installation Procedure

10. Connecting vacuum/cooling hose

- ❖ Vacuum hose is not included. Please prepare optional vacuum hose (product code: 255297) separately.
- (1) Connect vacuum nozzle and the inlet of a pressure reducing device with a vacuum hose.
- ❖ Be cautious not to connect vacuum nozzle to the exhaust port of the pressure reducing device. Doing so may cause RE unit to be pressurized, resulting in equipment malfunction.
- (2) Connect cooling nozzles and the circulation ports of a cooling water circulator.
- ❖ Be sure to attach the hose to cooling nozzle before threading it onto cooling condenser. Using excessive force may damage glassware.

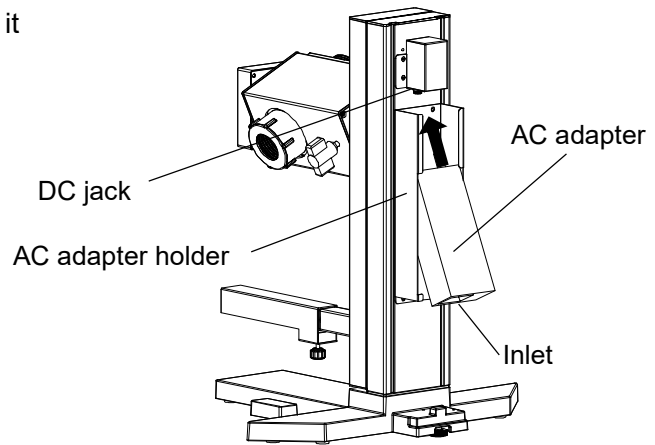


3. PRE-OPERATION PROCEDURES

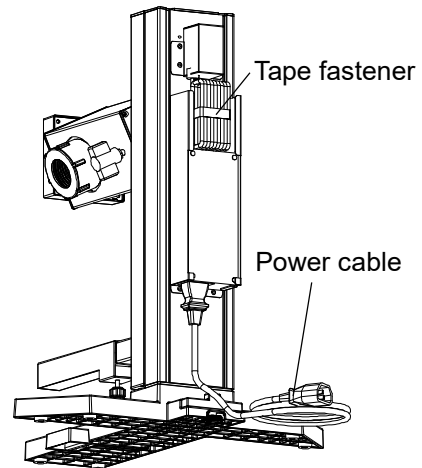
Installation Procedure

11. Connecting AC adapter/power cable

- (1) Hold AC adapter with the inlet facing the bottom left viewed from the back and insert it into the AC adapter holder at an angle.



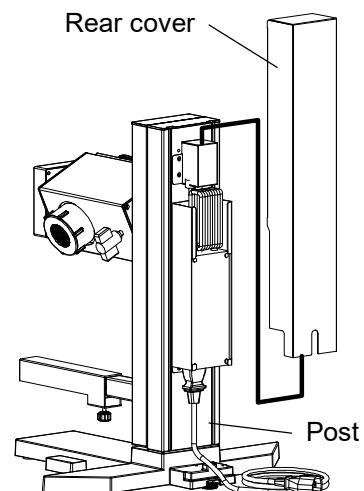
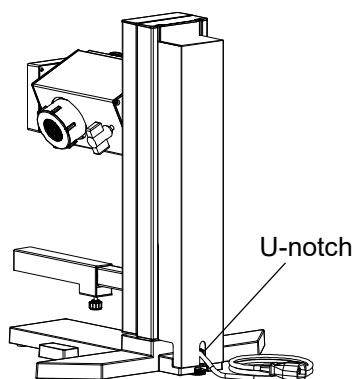
- (2) Connect the plug from AC adapter to the DC jack. Use included tape fastener to bind excess cable to keep it in the holder.



- (3) Insert power cable into the inlet of AC adapter.

- (4) Slide supplied rear cover over the post along its groove. Draw power cable through the U-shaped opening in the bottom of rear cover.

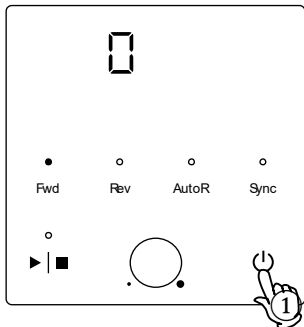
- ❖ Exercise caution not to pinch AC adapter cable and power cable in rear cover when attaching it.



4. OPERATION PROCEDURES

Operation Procedure

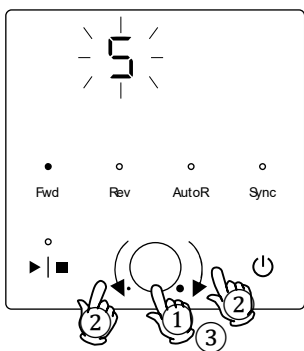
1. Turn ON (I) power



- 1 Press the Power key.
RPM display: shows software version at start up, then shows current rpm.

Indicator lamp: One of the Fwd/Rev/AutoR lamps illuminates according to operation mode at the time of last power OFF (○).

2. Set rotation speed



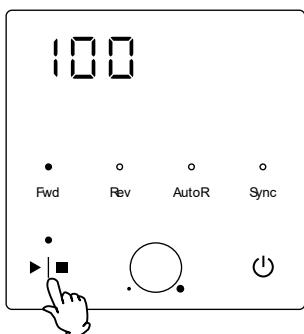
- 1 Press the Control knob.
RPM display: Shows speed setting, flashing.
- 2 Set desired speed by turning the Control knob.
Speed setting range: 5-315 rpm

Turning the Control knob slowly increases or decreases the value by 1, turning it quickly changes the value by 10.

- 3 Press the Control knob to finalize.
RPM display: Shows current rpm.

※ indicates flashing.

3. Start operation



Press 1 sec to start

Press and hold ▶|■ for one second.
Run/Stop lamp: ON

<To stop>
Press ▶|■ again.
Run/Stop lamp: OFF

❖ Speed setting can also be changed during operation.

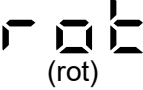



4. OPERATION PROCEDURES

User Setting

List of user setting items

- Press and hold the Control knob for two seconds. User setting items will be shown. Select an item by turning the Control knob. Press the Control knob again to edit the displayed item.
- Holding down the Control knob for two seconds while the user setting item is displayed or leaving unit without key operation for about two minutes, will discard the changes, and the display returns to previous screen.
- It is not possible to enter user setting mode during operation.

EN

Setting Item	Description	Page
Rotation mode setting 	Rotation mode can be selected. F.ro: Forward rotation mode r.ro: Reverse rotation mode Ato: Timed auto inversion mode Auto inversion mode repeatedly changes rotation direction between forward and reverse, in accordance with time setting "SEC". Default setting is "F.ro"	P.23
Auto inversion time setting 	Time interval for auto inversion mode can be set. Setting range: 5-999 sec Default setting is "5"	P.24
Auto-resume function 	Select operation for the time power is restored from outage. OFF: Unit goes into idle at power recovery. ON: Unit automatically reverts to status just before power loss and begin operation once again from that point. Default setting is "OFF"	P.25
LED brightness setting 	Change the LED brightness of the control panel. The brightness can be set in 8 levels Setting range: 0-7 Default setting is "3"	P.26

4. OPERATION PROCEDURES

Rotation Modes

Set rotation direction

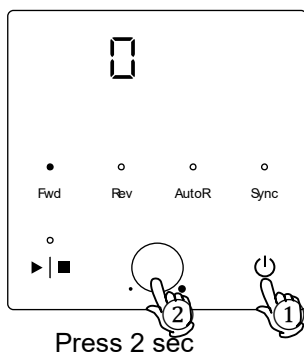
F.ro: Forward rotation mode

r.ro: Reverse rotation mode

Ato: Timed auto inversion mode

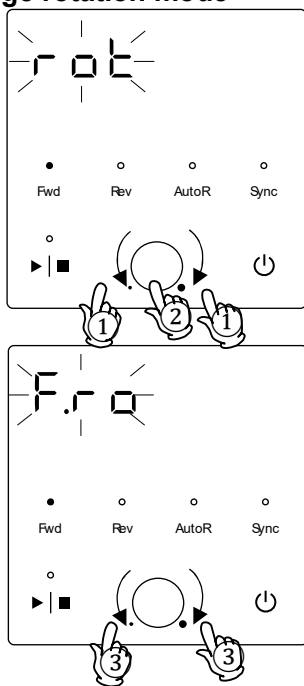
Default setting is "F.ro"

1. Enter user setting



- ① Press the Power key.
- ② Press the Control knob for two seconds while current rpm is on the screen. Unit enters user setting.

2. Change rotation mode

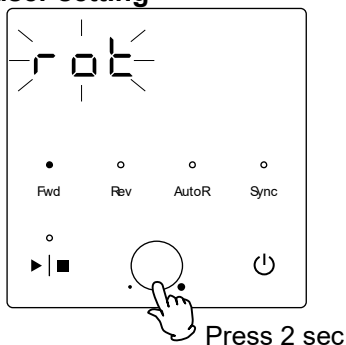


- ① Turn the Control knob and select "rot".
RPM display: "rot" flashes
- ② Press the Control knob.
RPM display: Current setting flashes
F.ro: Forward rotation mode
r.ro: Reverse rotation mode
Ato: Timed auto inversion mode
- ③ Turn the Control knob to select rotation mode
- ④ Press the Control knob to finalize.

A corresponding lamp among Fwd/Rev/AutoR lamps illuminates

- ❖ When operating RE unit in reverse position (bath on left), reverse rotation mode can prevent evaporation flask from scattering bath fluid toward the front by its rotation.

3. Exit user setting



After completing the setting, press the Control knob for two seconds. Display reverts to previous screen and shows current rpm.

4. OPERATION PROCEDURES

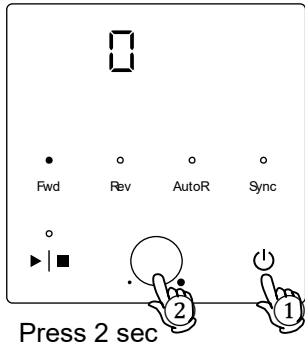
Auto Inversion Time Setting

Set time interval for auto inversion mode.

Setting range: 5-999 sec

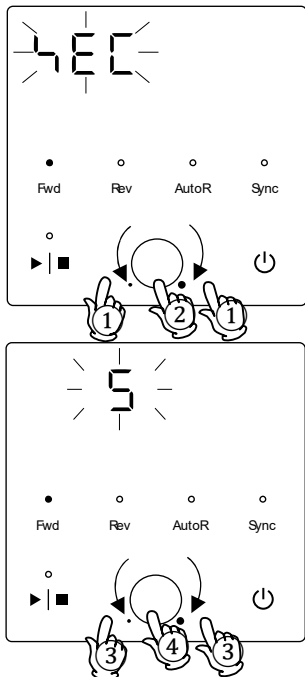
Default setting is "5"

1. Enter user setting



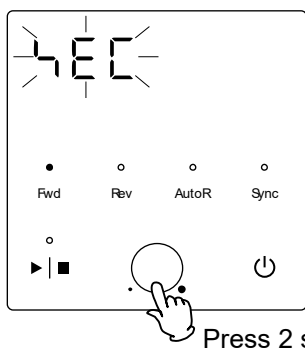
- ① Press the Power key.
- ② Press the Control knob for two seconds while current rpm is on the screen. Unit enters user setting.

2. Change auto inversion time setting



- ① Turn the Control knob and select "SEC". RPM display: "SEC" flashes
- ② Press the Control knob. RPM display: Current setting flashes
- ③ Turn the Control knob to set desired time Setting range: 5-999 sec
- ④ Press the Control knob to finalize.

3. Exit user setting



After completing the setting, press the Control knob for two seconds. Display reverts to previous screen and shows current rpm.

4. OPERATION PROCEDURES

Auto-resume Function

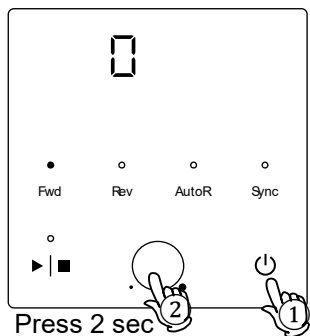
Select recovery mode for the event of a power failure.

OFF: Unit goes into idle at power recovery.

ON: Unit automatically reverts to status just before power loss and begin operation once again from that point.

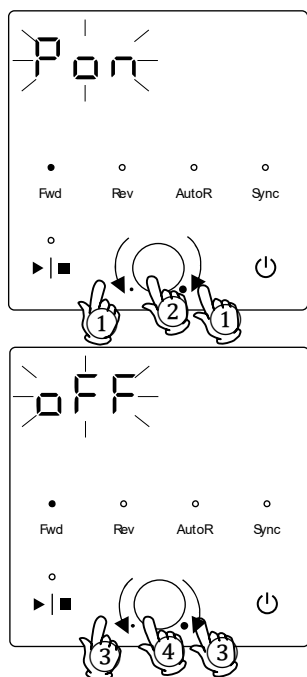
Default setting is "OFF"

1. Enter user setting



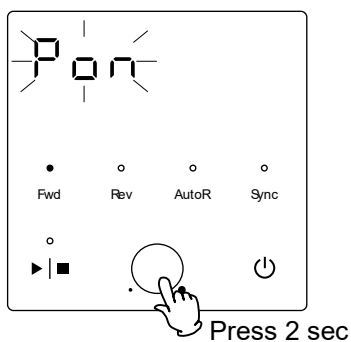
- ① Press the Power key.
- ② Press the Control knob for two seconds while current rpm is on the screen. Unit enters user setting.

2. Change the Auto-resume setting



- ① Turn the Control knob and select "Pon". RPM display: "Pon" flashes
- ② Press the Control knob. RPM display: Current setting flashes
- ③ Turn the Control knob to select ON/OFF.
- ④ Press the Control knob to finalize.

3. Exit user setting



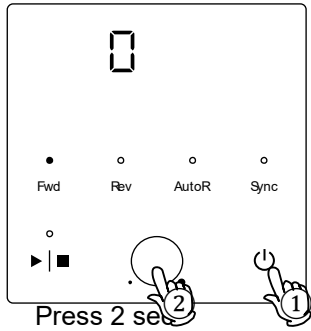
After completing the setting, press the Control knob for two seconds. Display reverts to previous screen and shows current rpm.

4. OPERATION PROCEDURES

LED Brightness Setting

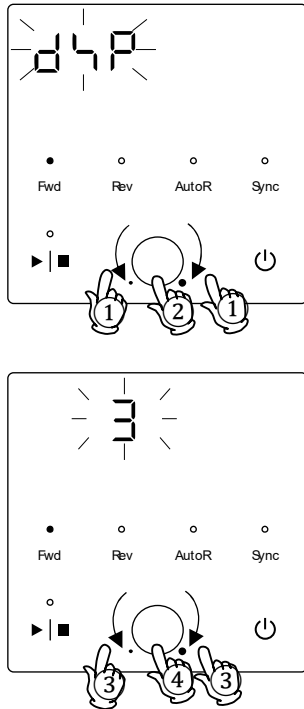
Change the LED brightness of the control panel.
The brightness can be set in 8 levels from 0 to 7.
Default setting is "3"

1. Enter user setting



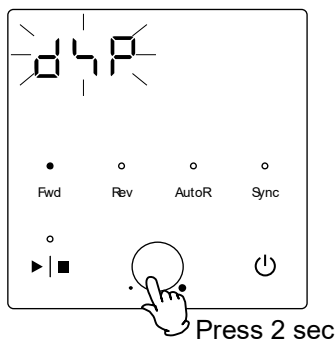
- ① Turn power ON (I).
- ② Press the Control knob for two seconds while current rpm is on the screen. Unit enters user setting.

2. Change LED brightness



- ① Turn the Control knob and select "dSP". RPM display: "dSP" flashes
- ② Press the Control knob. RPM display: Current setting flashes
- ③ Turn the Control knob to set desired value. 0 (dim) ⇔ 7 (bright)
- ④ Press the Control knob to finalize.

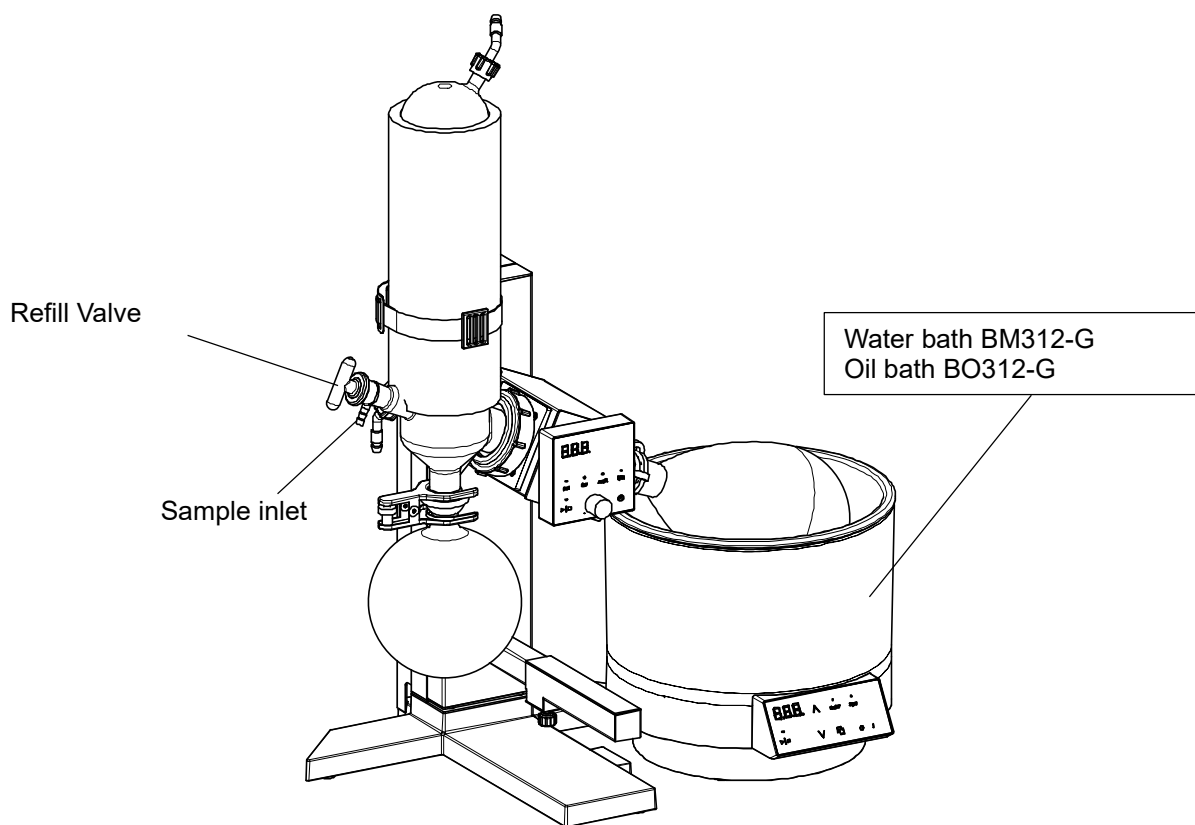
3. Exit user setting



After completing the setting, press the Control knob for two seconds. Display reverts to previous screen and shows current rpm.

4. OPERATION PROCEDURES

Operation Start

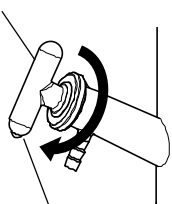


- (1) Run water bath, oil bath, or cooling water circulator at desired temperature.
- (2) Turn RE unit ON (I)
- (3) Rotate Refill Valve to close sample inlet. (The color marking on stopcock faces front)
- (4) Sample liquid may be fed as follows. The procedure differs by the way of sample feed.

(4-A) Where samples are continuously fed by sample feed tube.

- ① Connect sample inlet and sample container with sample feed tube.
- ② Lower slide panel gently to immerse evaporation flask in the bath.
- ❖ Do not let the bath fluid overflow.
- ③ Press and hold the Run/Stop key to start rotating evaporation flask.
- ④ Start up the pressure reducing device and decompress RE unit.
- ⑤ Rotate Refill Valve slowly so that the color marking on the stopcock faces down. Sample liquid is drawn into the flask.

Refill Valve



Color marking

❖ Feeding sample rapidly may bump the liquid. Rotate the stopcock slowly to avoid a loss of sample, and other complications.

(4-B) Where samples are not continuously fed (manually added)

- ① Detach evaporation flask and pour sample liquid directly in it, then re-attach the flask to Vapor Tube.
- ② Start up the pressure reducing device and evacuate RE unit.
- ③ Lower slide panel gently to immerse evaporation flask in the bath.
- ❖ Do not let the bath fluid overflow.
- ④ Press and hold the Run/Stop key to start rotating evaporation flask.

4. OPERATION PROCEDURES

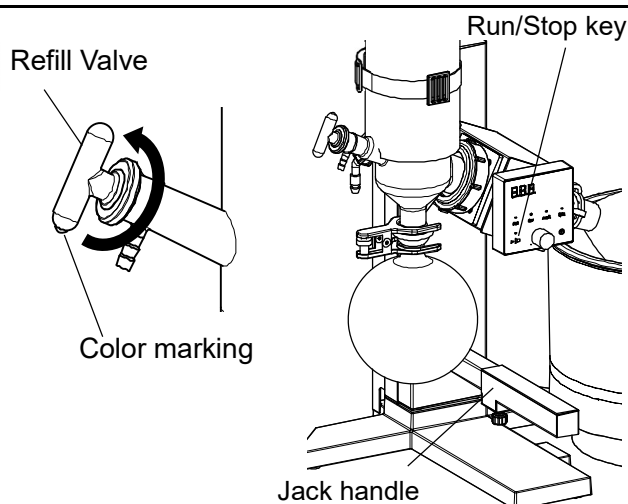
Operation Stop

(1) Press the Run/Stop key to stop rotation.

(2) Turn jack handle counterclockwise to release the jack. Lift slide panel slowly so that evaporation flask comes out of the bath.

(3) Stop the pressure reducing device. Gently rotate Refill Valve so that the color marking on the stopcock comes upside. Return unit to atmospheric pressure.

(4) Stop cooling water circulator and water/oil bath to end the operation.



(5) Remove flask clip from evaporation flask.

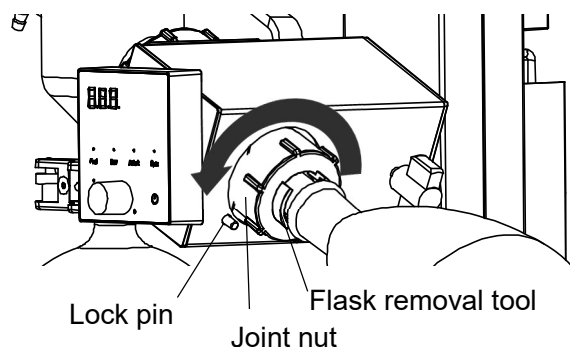
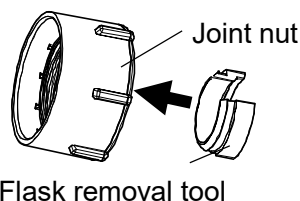
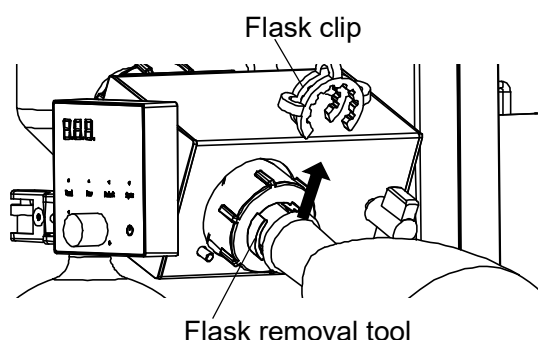
(6) Take evaporation flask off Vapor Tube. When it is hard to remove evaporation flask by hand, follow the steps below.

① Attach flask removal tool to joint nut. (See P.14)

② Hold evaporation flask with one hand, and turn joint nut counterclockwise. Flask removal tool pushes evaporation flask from the joint.

(7) press in the lock pin with the thumb to lock the rotary part. Turn joint nut counterclockwise with the other hand. Flask removal tool will now push the neck of Vapor Tube. Pull out Vapor Tube.

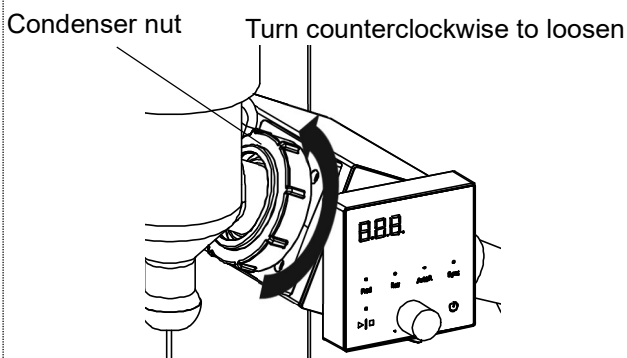
(8) Support receiving flask on the bottom, and turn the dial inside ball joint clamp with the other hand to release the lock. Remove the clamp and receiving flask.



(9) Remove condenser fixing band.

* Only for vertical condenser (type F)

(10) Hold cooling condenser by hand and turn condenser nut counterclockwise, then remove cooling condenser.



5. HANDLING PRECAUTIONS

Warnings and Cautions



WARNING



Exercise caution when handling flammable chemicals.

Unit is NOT fire or blast resistant. When processing flammable samples, be sure to provide adequate ventilation and not to allow anything that may be a source of fire or ignition (static electricity, etc.) approached. Do not use this unit in an atmosphere of substances shown in LIST OF HAZARDOUS SUBSTANCES (P.44). Never vaporize explosive substances.



Turn OFF (○) power immediately when an abnormality occurs.

If unit begins emitting smoke or abnormal odours for reasons unknown, turn OFF (○) power immediately, disconnect power cable from power supply, and contact original dealer of purchase for assistance. Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should always be performed by a certified technician.



CAUTION



Select appropriate gasket for organic solvents



Although included standard vacuum seal has tolerance to chemicals, it may swell or become deteriorated depending on the types of solvents and conditions of use. In such cases, use of optional PTFE vacuum seal is recommended.

(See "Fehler! Verweisquelle konnte nicht gefunden werden." P.Fehler! Textmarke nicht definiert.)



Use caution not to spill samples on equipment

When sample spilled over RE unit, wipe it dry with a clean dry cloth. Failure to do so may cause coating to peel or corrode.



Inspect regularly.

Regular inspection and maintenance are highly recommended to ensure proper operation. See "Inspection and Maintenance" (P.30)



Power loss recovery

When a power loss occurs during operation and then restored, unit may resume operation or remain on standby. These actions can be selected through user setting. See "Auto-resume Function" (P.25) for setting procedure; default setting is "OFF".

6. MAINTENANCE PROCEDURES

Precautions before Inspection



WARNING

- Be sure to disconnect power cable before conducting inspection and maintenance.
- Never attempt to disassemble unit.

Precautions in Daily Maintenance



CAUTION

- Clean unit using soft damp cloth. Never use benzene, paint thinner, scouring powder, scrubbing brush or other abrasives and solvents to clean unit. Superficial damage and/or discoloration, as well as deformity to some components may result.



Maintenance and Inspection

- Check power plug for damage
 - Check power plug for dust or dirt on its prongs, and clear off if any accretions found.
 - Confirm that the prongs of power plug are not bent or damaged. Replace if bent or damaged.
 - Check the power plug for discoloration or abnormal heat generation. If there is discoloration or abnormal heating, the internal contact of the outlet may be faulty.
- Pay attention to the sound of motor
 - If there is an unusual noise comes from motor, contact original dealer of purchase.

- ◆ Contact original dealer of purchase if further questions arise concerning maintenance procedures.

7. EXTENDED STORAGE AND DISPOSAL

Extended Storage

 WARNING	 CAUTION
Extended storage ● Turn OFF (○) power and disconnect power cable. ● Remove all the glass components.	Unit disposal ● Do not leave unit in a location where children may have access.

Disposal Considerations

Dispose of or recycle this unit in a responsible and environmentally friendly manner.

KNF and Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

Major components and materials, comprising RE unit are listed in the table below

Component Name	Material
Main Unit Components	
Exterior	Chromium-free electrogalvanized steel sheet, baked-on finish Aluminum, baked-on finish/anodized Polybutylene terephthalate resin (with fiber glass)
Interior	Stainless steel, aluminum
Electrical Parts	
Motor	Composite of resin, aluminum, copper and other materials
Control panel	Polybutylene terephthalate resin (with fiber glass) Polycarbonate resin
Circuit boards	Composite of fiber glass and other materials
Power cable	Composite of synthesized rubber coating, copper, nickel and other compounds
Wiring material	Composites of fiberglass, fire-retardant vinyl, copper, nickel and other compounds
Seals	Resin material
Spring	Stainless steel
Roller	Polyacetal resin
Jack handle	Polyurethane, aluminum

8. TROUBLESHOOTING

Reading Error Codes

Unit has a self-diagnostic function built into the CPU board. The table below shows possible causes and measures to take when safety function is performed.

[Error Codes]

When an operational error or malfunction occurs, an error code is displayed on the control panel. When an error occurs, confirm the error code and terminate operation immediately.

EN

Display code	Description	Possible causes and measures
E 72	Motor failure (E72)	<ul style="list-style-type: none"> ● Motor overload ● Overvoltage ● Voltage drop ● Rotary sensor failure Turn OFF (○) power and restart. If unit does not reset, contact original dealer of purchase.
E 15	EEPROM failure (E15)	<ul style="list-style-type: none"> ● Error in a storage element EEPROM on the controller board Turn OFF (○) power and restart. If unit does not reset, contact original dealer of purchase.

Other warnings (displayed alternately with rpm reading)

Display alert	Alert description	Possible causes and measures
"Pon" displayed after power loss	Power failure notification	<ul style="list-style-type: none"> ● When a power failure occurs during operation, rpm reading and "Pon" are displayed alternately on the control panel to indicate that a power failure has occurred Turn OFF (○) power and restart.
"oPn" blinking display	Interlock operation	<ul style="list-style-type: none"> ● With auto-resume function "ON", unit resumes operation. Remain standby when set to "OFF". ● When the interlock setting is ON, opening the lid of the optional protection cover during operation will stop the operation of this unit and display "oPn" on the display. If the interlock setting is OFF, you can operate even if you open the lid of the optional protection cover.

8. TROUBLESHOOTING

Troubleshooting Guide

Symptom	Possible causes	Possible measures
RPM display remains blank when the Power key is pressed.	● Power supply failure	Check supply voltage must be 90-250V AC
	● AC adapter failure ● Power cable failure ● Controller failure	● Replace relevant parts ● Replace relevant parts ● Replace relevant parts
Evaporation flask does not rotate when the Run/Stop key is ON	● External temperature is below 5 °C ● Motor failure ● Bearing failure ● Drive belt failure ● Circuit board failure	● Operating ambient temperature range is 5 to 35 °C ● Replace relevant parts ● Replace relevant parts ● Replace relevant parts ● Replace relevant parts
Rotation speed is not stable	● Sample volume is excessive ● Circuit board failure ● Motor failure ● Pulley/belt failure	● Reduce sample Lower speed setting ● Replace relevant parts ● Replace relevant parts ● Replace relevant parts
Unusual noise comes from unit during rotation	● Vacuum seal is worn ● Joint nut is loose ● Motor failure ● Bearing failure ● Pulley/belt failure	● Replace relevant parts ● Re-tighten joint nut ● Replace relevant parts ● Replace relevant parts ● Replace relevant parts
Weak or no decompression (vacuum)	● Vacuum seal is worn ● Vapor Tube is worn ● Vapor Tube is not set up properly ● Nozzle gasket is worn ● Vacuum hose is deteriorated	● Replace relevant parts ● Replace relevant parts ● Check that Vapor Tube is installed properly (P.14) ● Replace relevant parts ● Replace relevant parts
Jack does not work properly	● Jack handle is deteriorated ● Spring is deteriorated ● Bearing is worn	● Replace relevant parts ● Replace relevant parts ● Replace relevant parts
Jack does not lock	● Components in lock mechanism are worn or deteriorated	● Replace relevant parts
Vapor Tube cannot be inserted	● Vapor Tube lock mechanism is worn or deteriorated	● Replace relevant parts
Vapor Tube cannot be pulled out	● Vapor Tube lock mechanism is worn or deteriorated	● Gentle tap Vapor Tube with plastic head hammer to remove ● Replace relevant parts
Motor box angle cannot be adjusted	● Rotary part is worn ● Rotary part grease dry-out	● Replace relevant parts ● Replace relevant parts
Control panel cannot rotate	● Gasket is worn	● Replace relevant parts


8. TROUBLESHOOTING

Troubleshooting Guide

The "OPN" display on the RE212-G does not disappear even when the BC102-G lid is closed.	<ul style="list-style-type: none">● Connection cable is disconnected.● The Protection Cover lid is not completely closed.	<ul style="list-style-type: none">● Check if the connection cable is disconnected.● Please close it completely.
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If problem persists, turn OFF (○) power immediately, disconnect power cable from outlet or terminal and contact original dealer of purchase for assistance.

9. SPECIFICATIONS

Model		RE212-G	
Performance *1	Operating ambient temperature range	5-35 °C	
	Speed range	5-315 rpm *3	
	Evaporation capacity	Up to 23 mL/min	
Functions	RPM display	Digital display/ Control knob setting	
	Rotation mode	Forward/Reverse/Auto inversion	
	Spring-loaded jack	Manual balance (Max. height 200 mm, stepless regulation, one-touch lock)	
Configuration	Rotary motor	DC brushless (simple servo)	
	Condenser retention	Retaining bracket for vertical condenser	
Safety functions		[DC motor] Motor overload protection, overvoltage, low voltage, rotation speed sensor error [AC adapter] Short circuit in internal circuit, overcurrent protection, overvoltage protection	
Standard	Cooling condenser	Double corrugated tube (cooling surface: 0.143 m ²)	
		Suction Port: GL-14 (upper), Φ10 nozzle	
		Cooling port: GL14 (two places in lower part), two φ10 nozzles	
	Compatible evaporation flask	50-2000ml for NS 29	
	Compatible receiving flask	100-2000 mL	
	External dimensions *2	529W×324D×745H	
	Overall dimensions *2 (Including bath)	554W×365D×745H	
	Power rating	RE212-G: 200-230 VAC single phase 1 A – 50/60 Hz	
	Power cable	Approx. 0.7m with inlet plug	
	Weight	Approx. 9.0 kg (including RE unit)	
Conformance standard			
Accessories	[Main unit] Instruction manual (1), AC adapter (1), power cable (1), bath guide (1) rear cover (1), double-sided tape fastener roll (1), Condenser bracket (1), Handle extension adapter (1)		
	[Glass set] Cooling condenser (type F)(1), Vapor Tube (1), evaporation flask (1), receiving flask (1), ball joint clamp (1), flask clip (1), vacuum seal (1), condenser insulation kit (1), flask removal tool, single-sided tape fastener roll (1), hex wrench (1) condenser bracket (1),		

*1 Performance data above based on 23 ±5 °C room temperature, 65%RH ±20% humidity, and no process load.

*2 Dimensions do not include protrusions.

*3 Applicable rotation speed range and sample volume depend on the capacity of evaporation flask.

Evaporation flask capacity	Liquid samples		Powdery samples	
	Sample volume (mL)	Rotation speed (rpm)	Sample volume (mL)	Rotation speed (rpm)
50-500 mL	Flask capacity ÷ 2	315	Flask capacity ÷ 2	315
1000 mL				150
2000 mL		150	Not available	

10. Accessories/Spare Parts

EN

Spare Parts

ID Number	Name
345304	Vapor Tube NS29/32
345305	Refill valve (Glass + PTFE Tube)
345306	Vacuum Seal FKM/PTFE, 2 pieces
375308	Condenser Set, with monting
345311	Power Adaptor (Base Frame)

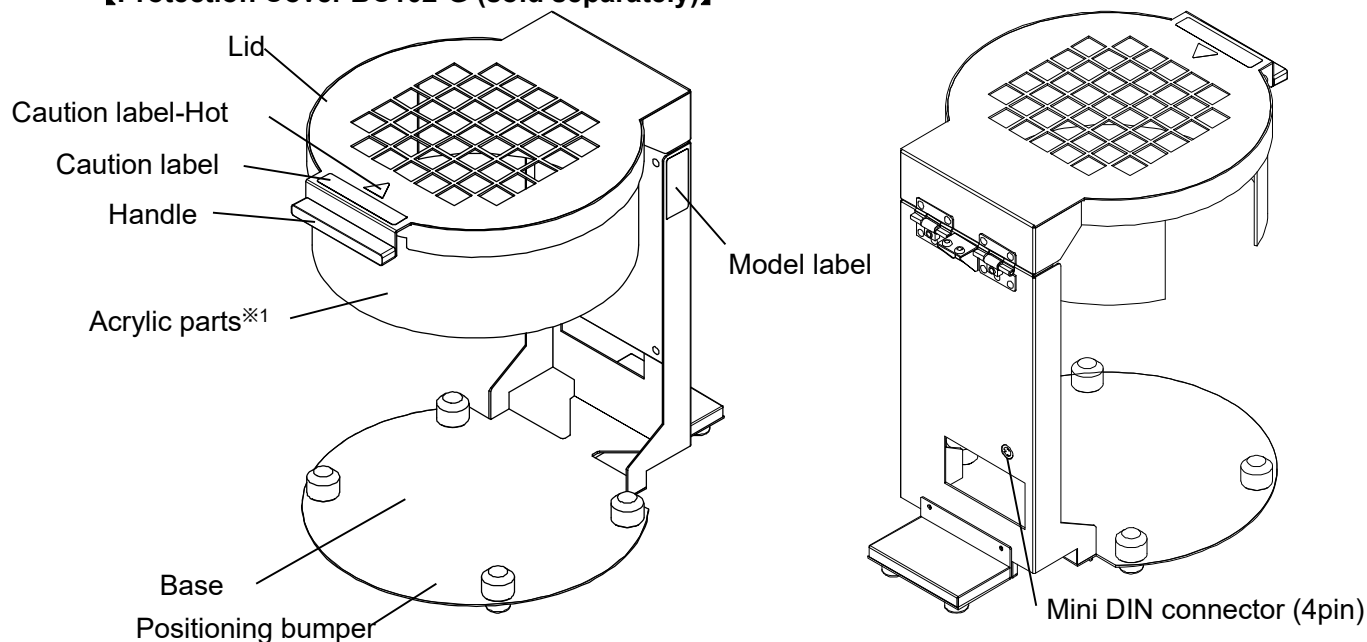
Accessories

ID Number	Name
340996	Protection Cover Heating Bath
On request	Heating bath BO312-G (Oil)

11. BC102-G Instruction manual

Appearance

【Protection Cover BC102-G (sold separately)】

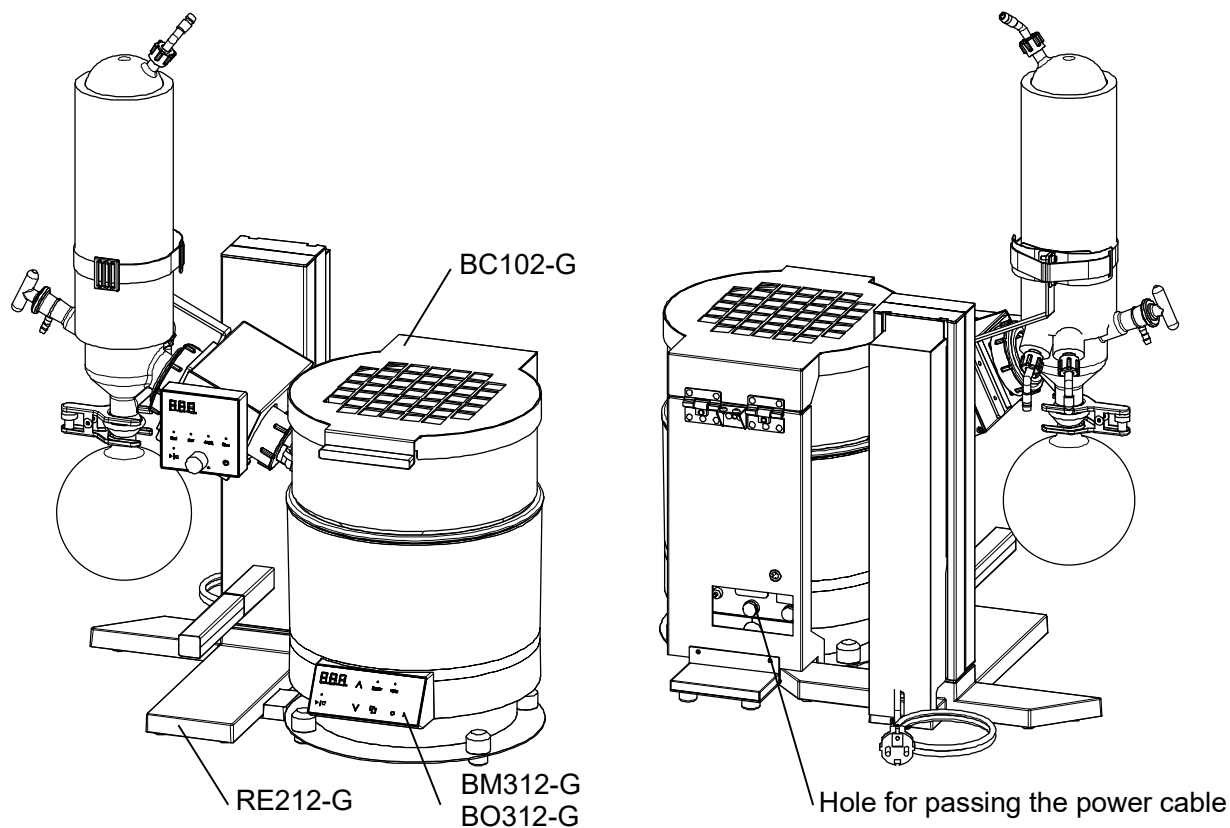


**※1 : Do not wipe acrylic parts with an organic solvent such as ethanol.
There is a risk of damage such as cracks.**

【RE212-G、BM312-G(BO312-G) Combination diagram】

This unit is equipped with BM312-G and BO312-G, and is distilled with RE212-G.

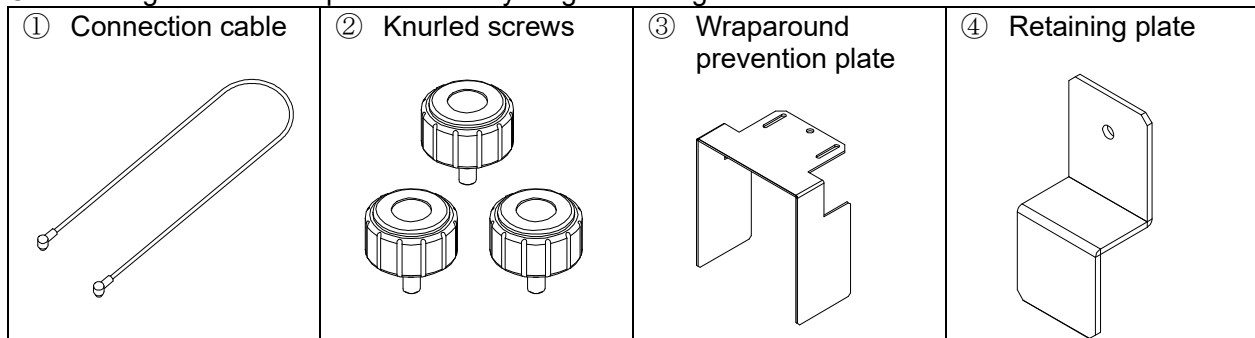
By installing BC102-G, it is possible to suppress the splashing of liquid in the bath chamber due to the rotation of the flask.



12. BC102-G Instruction manual

Accessories

Check before operation that all the accessories are complete.
Contact original dealer of purchase if anything is missing.



WARNING



DO NOT touch hot surfaces.

Do not touch anything other than the handle during or immediately after operation. Burn injury may result.

CAUTION



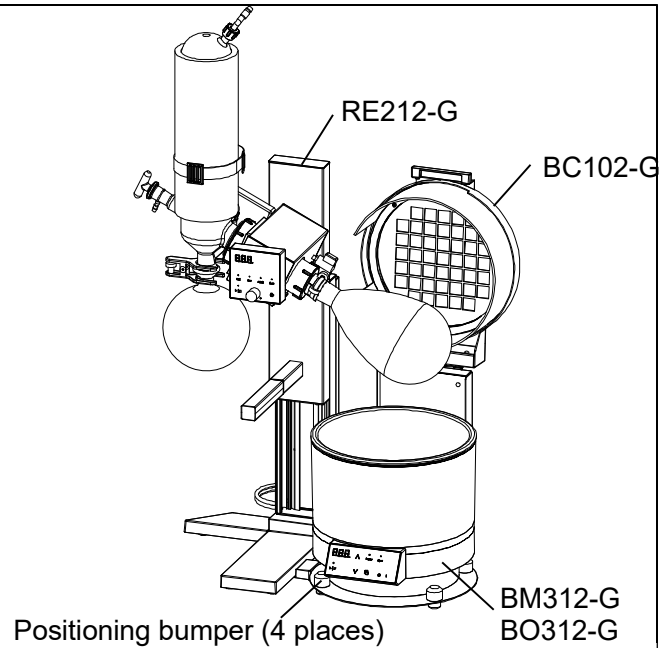
Do not use organic solvents for wiping.

Do not wipe acrylic parts with an organic solvent such as ethanol. There is a risk of damage such as cracks.

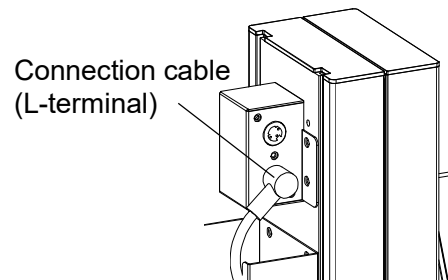
12. BC102-G Instruction manual

Installation Procedure

- ① Place this unit on the right side of the RE212-G and place the BM312-G (BO312-G) so that it fits inside the positioning bumper on the base.

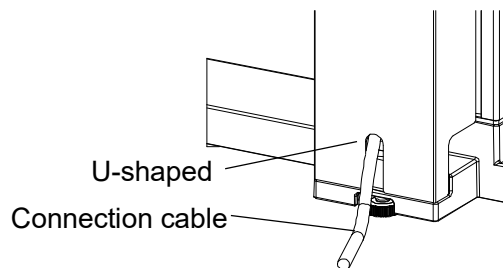


- ② Connect L-terminal of the connection cable to the Mini DIN connector (4pin) of RE212-G.



- ③ Slide the rear cover over the post along its groove. Draw connection cable through the U-notch in the bottom of the rear cover.

※Exercise caution not to pinch connection cable and power cable in the rear cover when attaching it.

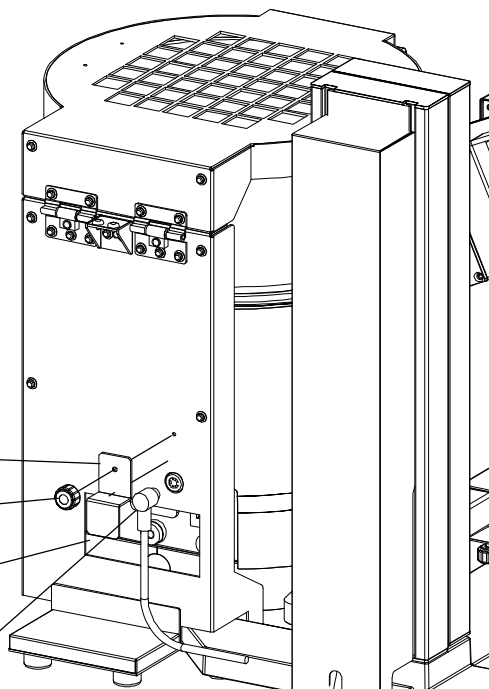


12. BC102-G Instruction manual

Installation Procedure

- ④ Connect to the Mini DIN connector (4pin) on the back of this unit. Let the cable hang down.
- ⑤ Secure the supplied retaining plate with the supplied knurled screw to prevent the connection cord from coming off.
- ⑥ Connect the power cable of BM312-G (BO312-G) or RE212-G from the hole for passing the power cable.

Retaining plate
Knurled screw
Hole for passing the power cable
Connection cable (L-terminal)

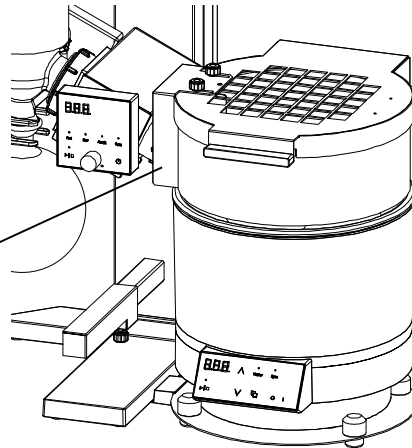


12. BC102-G Instruction manual

Installation Procedure (Accessories)

By attaching the accessory wraparound prevention plate to this unit, you can cover the drive part of RE212-G and suppress the wraparounds of operators hair. Install it if necessary.

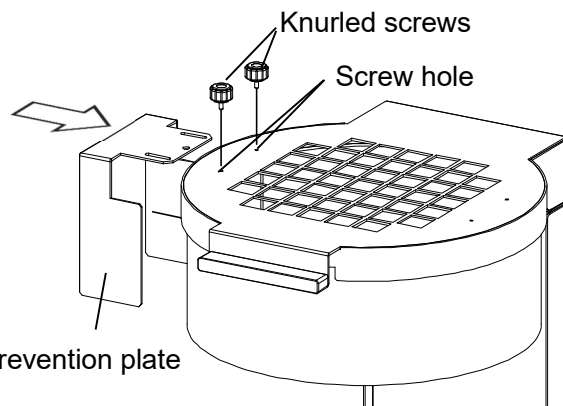
Wraparound prevention plate



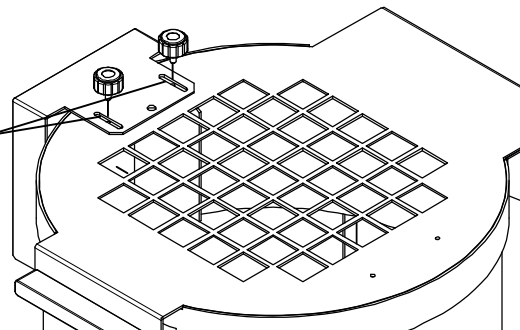
Slide the wraparound prevention plate from the RE212-G side, align the slotted hole of the wraparound prevention plate with the screw hole in the lid, and fix it with the knurled screw.

If you loosen the knurled screw, you can slide the wraparound prevention plate by about 15 mm. Determine the fixing position in consideration of the distance from RE212-G.

Wraparound prevention plate



Slotted hole

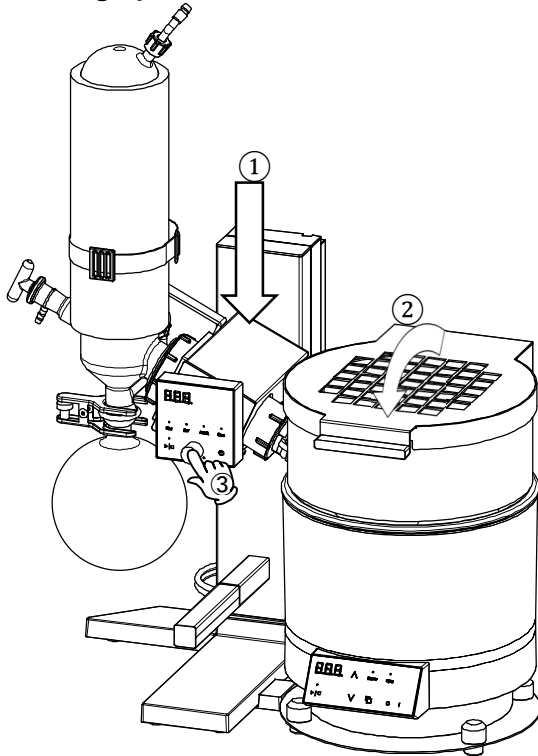


12. BC102-G Instruction manual

Operation Procedure

EN

1. Starting operation



① Immerse the flask of RE212-G in the water chamber of BM312-G (BO312-G).

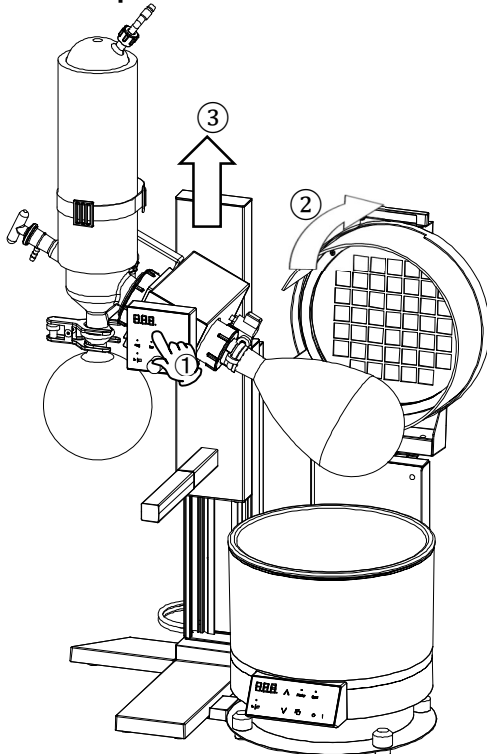
② Please close the lid.

③ Always start operation at atmospheric pressure.

※ Follow the respective instruction manuals to use RE212-G and BM312-G (BO312-G).

※ When opening and closing the lid, be careful not to touch anything other than the handle as the main unit may be hot.

2. End of operation



① Stop operation of RE212.

② Open the lid of this unit.

③ Please raise the flask.

※ When lifting the BM312-G (BO312-G), be careful not to forget to unplug the cable on the back side. If you lift it while it is connected, it may cause a fall and it is dangerous.

12. REFERENCE DATA

Solvent Boiling Point

Substance	Chemical formula	Molecular weight	Density (g/cm ³) (20 °C)	Latent heat of vaporization (cal/g) (1013 hPa)	Boiling point (°C) (1013 hPa)	Degree of vacuum at each boiling point (hPa)		
						Boiling Point		
						25 °C	30 °C	40 °C
Diethyl ether	C ₄ H ₁₀ O	74.1	0.736	89.8	34.6	712	859	Atm. pressure
n-pentane	C ₅ H ₁₂	72.7	0.626	92.6	36.1	678	931	Atm. pressure
Ethyl bromide	C ₂ H ₅ Br	109.0	1.451	549.7	38.4	625	753	Atm. pressure
Dichloromethane	CH ₂ Cl ₂	84.9	1.326	78.7	39.8	580	706	Atm. pressure
1,2 Dichloroethylene	C ₂ H ₂ Cl ₂	97.0	1.284	75.0	48.0	532	452	798
Cyclopentane	C ₅ H ₁₀	70.1	0.745	97.2	49.0	423	514	740
Acetone	C ₃ H ₆ O	58.1	0.788	125.0	56.3	307	378	562
1-1 Dichloroethane	C ₂ H ₄ Cl ₂	99.0	1.175	69.0	57.4	306	359	539
Methyl acetate	C ₃ H ₆ O ₂	74.1	0.934	98.1	57.8	289	359	541
Chloroform	CHCl ₃	119.4	1.486	58.8	61.3	260	320	474
Methanol	CH ₄ O	32.0	0.794	264.0	64.7	169	218	354
n-hexane	C ₆ H ₁₄	86.2	0.659	91.8	68.7	202	249	373
Carbon tetrachloride	CCl ₄	153.8	1.595	46.6	76.8	152	173	284
Ethyl acetate	C ₄ H ₈ O ₂	88.1	0.901	88.2	77.1	129	163	254
Ethanol	C ₂ H ₆ O	46.0	0.785	204.0	78.4	79	105	179
Benzene	C ₆ H ₆	78.1	0.874	94.2	80.1	127	159	244
2-propanol	C ₃ H ₈ O	74.1	0.786	159.2	82.0	60	81	142
1-2 Dichloroethane	C ₂ H ₄ Cl ₂	99.0	1.257	77.3	83.5	111	146	199
1-propanol	C ₃ H ₈ O	60.1	0.804	162.6	97.8	27	38	70
2-butanol	C ₄ H ₁₀ O	74.1	0.807	134.4	99.5	24	34	63
Water	H₂O	18.0	0.997	540.0	100.0	32	43	74
Formic acid	CH ₂ O ₂	46.0	1.214	120.4	100.6	57	73	114
Propyl acetate	C ₅ H ₁₀ O ₂	102.1	0.889	80.3	101.8	44	57	94
Toluene	C ₇ H ₈	92.2	0.866	98.6	110.6	38	49	79
1, 1, 2-trichloroethane	C ₂ H ₃ Cl ₃	133.4	1.442	68.7	113.5	33	40	68
1-butanol	C ₄ H ₁₀ O	74.1	0.810	141.3	117.7	8	12	24
Acetic acid	C ₂ H ₄ O ₂	60.0	1.050	4.8	118.0	20	27	46
2-pentanol	C ₅ H ₁₂ O	88.2	0.810	97.8	119.3	8	12	21
Tetrachloroethylene	C ₂ Cl ₄	165.8	1.623	50.0	121.0	24	31	53
Isoamyl alcohol	C ₅ H ₁₂ O	88.1	0.809	116.0	130.8	4	7	12
Chlorobenzene	C ₆ H ₅ Cl	112.6	1.106	77.4	131.7	16	21	35
1-pentanol	C ₅ H ₁₂ O	88.2	0.814	120.6	138.0	4	5	9
m-Xylene	C ₈ H ₁₀	106.2	0.860	81.9	139.1	13	15	25
o-Xylene	C ₈ H ₁₀	106.2	0.876	82.9	144.4	9	13	20
Styrene	C ₈ H ₈	104.2	0.901	100.8	145.2	10	13	19
						Degree of vacuum at each boiling point (hPa)		
						Boiling Point		
						70 °C	90 °C	120 °C
Styrene	C ₈ H ₈	104.2	0.901	100.8	145.2	81	180	494
1-hexanol	C ₆ H ₁₄ O	102.2	0.819	107.2	157.1	24	69	265
Butyric acid	C ₄ H ₈ O ₂	88.1	0.958	113.9	163.5	20	57	199
1-heptanol	C ₇ H ₁₆ O	116.2	0.822	438.9	176.3	9	33	133
1-octanol	C ₈ H ₁₈ O	130.2	0.824	98.2	195.2	4	13	67
Ethylene glycol	C ₂ H ₆ O ₂	62.1	1.116	219.8	197.4	4	12	53
Capric acid	C ₆ H ₁₂ O	116.2	0.927	133.0	205.8	3	8	40
1-nonanol	C ₉ H ₂₀ O	114.3	0.827	134.0	213.5	3	8	37
Glycerin	C ₃ H ₈ O ₃	92.1	1.262	158.4	290.0	5 hPa/150		

13. LIST OF HAZARDOUS SUBSTANCES



Never attempt to process explosives, flammables or any items which contain explosives or flammables.

EN

Explosive substances	①Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	②Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④Metallic Azide, including Sodium Azide, etc.
Combustible substances	①Metal "Lithium" ②Metal "Potassium" ③Metal "Natrium" ④Yellow Phosphorus ⑤Phosphorus Sulfide ⑥Red Phosphorus ⑦Phosphorus Sulfide ⑧Celluloids, Calcium Carbide (a.k.a, Carbide) ⑨Lime Phosphide ⑩Magnesium Powder ⑪Aluminum Powder ⑫Metal Powder other than Magnesium and Aluminum Powder ⑬Sodium Dithionous Acid (a.k.a., Hydrosulphite)
	①Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	②Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
Oxidizing substances	⑤Sodium Chlorite and other chlorites
	⑥Calcium Hypochlorite and other hypochlorites
	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances having ignition point of 30 or more degrees below zero. ②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero. ③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a. amyl n-acetate) and other substances having ignition point of between zero and less than 30 degrees. ④Kerosene, Light Oil, Terebinth Oil, Isopenthyll Alcohol (a.k.a. Isoamyl Alcohol), Acetic Acid and other substances having ignition point of between 30 degrees and less than 65 degrees.
Flammable substances	①Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances having ignition point of 30 or more degrees below zero.
	②n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a. amyl n-acetate) and other substances having ignition point of between zero and less than 30 degrees.
	④Kerosene, Light Oil, Terebinth Oil, Isopenthyll Alcohol (a.k.a. Isoamyl Alcohol), Acetic Acid and other substances having ignition point of between 30 degrees and less than 65 degrees.
Combustible gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°C, ambient air pressure.

14. STANDARD INSTALLATION MANUAL

Install this equipment according to following format (check options and special specifications separately).

Model	Serial Number	Installation Date	Charged Personnel or Company Name for Installation	Installation proved by	Judgment

No	Item	Implementation method	Chapter No. & Reference page of instruction manual	Judgment
Specifications				
1	Accessories	Quantity check according to the accessories column	10. SPECIFICATIONS P.9	
2	Installation	- Visual check of surrounding conditions Caution: Take care for environment - Securing a space	3. PRE-OPERATION PROCEDURES -Choose an appropriate ... P.11	
Operation-related matters				
1	Power supply voltage	- Measure line voltage (power distribution board of facilities, outlet etc.) with a tester. - Measure line voltage during operation (must meet required voltage) Caution: Use a compliant plug to install	3. PRE-OPERATION PROCEDURES -Always connect ... P.12 10. SPECIFICATIONS -Power supply P.35	
2	Confirmation on operation	- Explain name and function of each component. - Perform operation set at 100 rpm	2. COMPONENT NAMES AND FUNCTIONS P. 8 4. OPERATION PROCEDURES P.21	
Description				
1	Operational descriptions	- Explain operations of each component and handling precautions according to instruction manual.	4. OPERATION PROCEDURES P.21 5. HANDLING PRECAUTIONS -Warnings and Cautions P.29 14. LIST OF HAZARDOUS SUBSTANCES -Table 14.1 List of ... P.44	
2	Error Codes	- Explain about error codes and procedures for reset according to instruction manual.	8. TROUBLESHOOTING -[Error Codes] P.32 -Troubleshooting Guide P.33	
3	Maintenance and Inspection	- Explain about maintenance of equipment and each component according to instruction manual.	6. MAINTENANCE PROCEDURES -Inspection and Maintenance P.30	
4	Completion of installation Matters to be Stated	- Enter the date of installation and name of the charged personnel in the main unit nameplate.		

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death, resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure on RE units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- **Instruction manual descriptions and specifications are subject to change without notice.**
- **KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

Instruction Manual
Rotary Evaporator
RE212-G
First Edition: November 8, 2022

Sales Organisation:

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Manufacturer

**Yamato Scientific Co., Ltd.
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1-8-11 Harumi, Chuo-ku, Tokyo 104-6136, JAPAN**



**Water Bath
BM312-G
Oil Bath
BO312-G**

Instruction Manual

First Edition

- Thank you for choosing BM/BO series Baths from KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd.
- For equipment operation, please read and become thoroughly familiar with this instruction manual before use. Always keep equipment documentation safe and close at hand for convenient future reference.



Warning: Read instruction manual warnings and cautions carefully and completely before proceeding.

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1. SAFETY PRECAUTIONS


Explanation of Symbols

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A Word Regarding Symbols

Various symbols are provided throughout this text and on equipment to ensure safe operation. Failure to comprehend the operational hazards and risks associated with these symbols may lead to adverse results as explained below. Become thoroughly familiar with all symbols and their meanings by carefully reading the following text regarding symbols before proceeding

 **Warning** Signifies a situation which may result in serious injury or death (Note 1.)

 **Caution** Signifies a situation which may result in minor injury (Note 2) and/or property damage (Note 3.)

(Note 1) Serious injury is defined as bodily wounds, electrocution, bone breaks/fractures or poisoning, which may cause debilitation requiring extended hospitalization and/or outpatient treatment.

(Note 2) Minor injury is defined as bodily wounds or electrocution, which will not require extended hospitalization or outpatient treatment.

(Note 3) Property damage is defined as damage to facilities, equipment, buildings or other property.

Symbol Meanings



Signifies warning or caution.
Specific explanation will follow symbol.



Signifies restriction.
Specific restrictions will follow symbol.



Signifies an action or actions which operator must undertake.
Specific instructions will follow symbol.

1. SAFETY PRECAUTIONS

Symbol Glossary

WARNING / CAUTION



General



Danger!
Blast Hazard



Caution: Indoor
Use Only

RESTRICTION



General
Restriction



Do Not
Disassemble

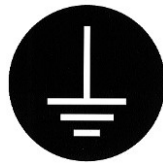


Do Not Touch

ACTION



General Action
Required



Connect Ground
Wire



Level Installation



Disconnect Power



Inspect
Regularly

1. SAFETY PRECAUTIONS

Warnings and Cautions



WARNING



Install in a location free of flammables and explosives.



Never install or operate unit in a flammable or explosive gas atmosphere. Unit is NOT fire or blast resistant. Simply switching the Power switch "ON (I)" or "OFF (o)" can produce a spark, which can then be relayed during operation, causing fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes.

See "11. LIST OF HAZARDOUS SUBSTANCES" (P. 31) for information on flammable and explosive gases.



Implement proper fire extinguishing and ventilation measures.



【BO312-G】

The oily smoke and steam generated from heating silicon oil is flammable and may cause a fire hazard. Silicon oil also emits harmful gas when heated to high temperatures.

A ventilation hood must be installed above unit, with a fire extinguisher in close proximity.



Ground wire **MUST** be connected properly.



- Connect power cable to a grounded outlet in order to avoid electric shock.
- Never connect ground wire to gas lines or water pipes. Fire, accident or equipment malfunction may result.
- Never connect ground wire to telephone grounding lines or to lightning conductor rods. Fire or electric shock may result.
- Never insert multiple plugs into a single outlet. Doing so may result in power cable overheating, fire or drop in voltage.



Turn OFF (o) the Power switch immediately when an abnormality occurs.



If unit begins emitting smoke or abnormal odours for reasons unknown, turn OFF (o) the Power switch immediately, disconnect power cable from power supply, and contact original dealer of purchase for assistance. Continuing to operate without addressing abnormalities may cause fire or electric shock, resulting in serious injury or death. Never attempt to disassemble or repair unit. Repairs should always be performed by a certified technician.

1. SAFETY PRECAUTIONS

Warnings and Cautions



Handle power cable with care.



- Do not operate equipment with power cable bundled or tangled. Operating unit with power cable bundled or otherwise tangled, may cause power cable to overheat and catch fire.
- Do not modify, bend, forcibly twist or pull on power cable. Fire or electric shock may result.
- Do not risk damage to power cable by positioning it under desks or chairs, or by allowing it to be pinched in between objects. Fire or electric shock may result.
- Do not place power cable near kerosene/electric heaters or other heat-generating devices. Doing so may cause power cable insulation to overheat, melt and/or catch fire, which may result in electric shock.
- Turn off the Power switch immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Contact original dealer of purchase for information about replacing power cable. Failure to do so may result in fire or electric shock.
- Always connect power cable to appropriate facility outlet or terminal.



DO NOT disassemble or modify equipment.

Never attempt to disassemble or modify unit. Doing so may cause malfunction, fire, electric shock, or personal injury. Note that any malfunction resulting from unauthorized modifications or customizations to unit will void the warranty.



DO NOT touch hot surfaces.

Do not touch the reservoir around the brim during operation or immediately after operation. Burn injury may result.



CAUTION



DO NOT operate equipment during thunderstorms.

In the event of a thunderstorm, turn OFF (○) the Power switch and disconnect power cable immediately. A direct lightning strike may cause equipment damage, fire or electric shock, resulting in serious injury or death.



Turn OFF (○) the Power switch in case of power failure.

Operation stops when power failures occur. For added safety however, turn OFF (○) the Power switch in the event of a power failure.

1. SAFETY PRECAUTIONS

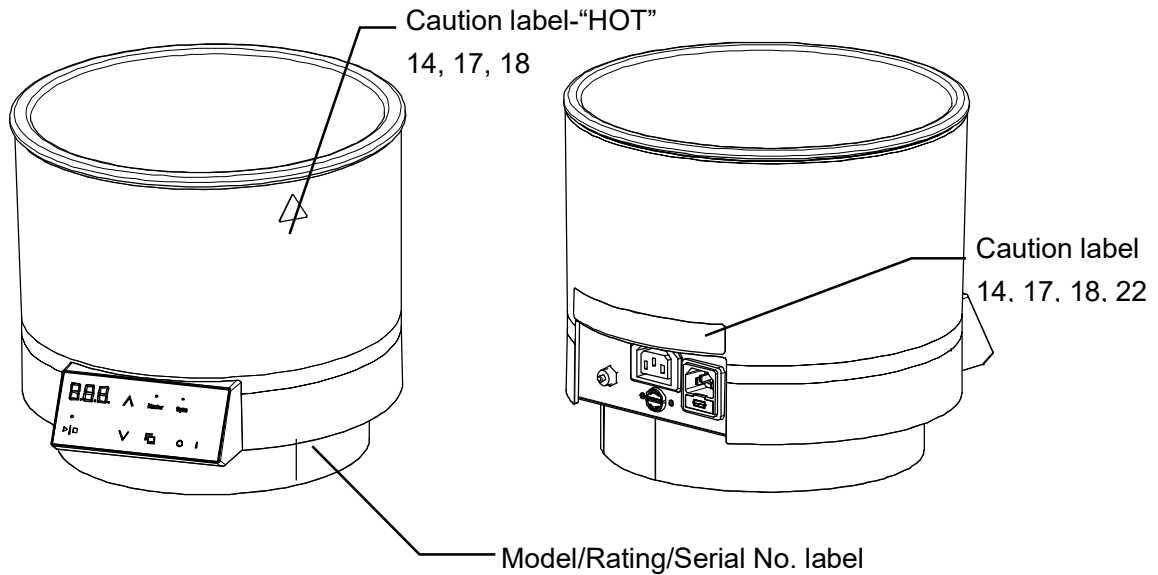
Residual Risk Map

These figures indicate positions of caution labels.

The numbers shown in the figure indicate the numbers listed in the "List of Residual Risks" in this manual.

For details of individual residual risks, see the List of Residual Risks.

【BM312-G/BO312-G】



***Contact us if the caution signs are no longer visible because the nameplate has peeled off or the texts is no longer legible. We will send you a new nameplate. (Chargeable)**

1. SAFETY PRECAUTIONS

List of Residual Risks

List of residual risks (instructions for risk avoidance)

This list summarizes residual risks to avoid personal injuries or damages to properties during or related to the use of equipment.

Be sure to fully understand or receive instructions on how to use, maintain and inspect equipment before starting operation.

Loading/Installation				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page(s)
1	WARNING	Fire/ Electric shock	Choose an appropriate installation site.	P.10
2	CAUTION	Injury	Install unit on a level surface.	P.10
3	CAUTION	Electric shock	Make power connection properly.	P.11
4	WARNING	Fire/Electric shock	Always connect power cable to appropriate facility outlet or terminal.	P.11
5	WARNING	Fire/Electric shock	Install in a dry location.	P.11
6	WARNING	Injury	Use unit in fume hood whenever processing harmful solvents.	P.12
7	WARNING	Explosion/fire	Install in a location free of flammables and explosives.	P.3
8	WARNING	Fire/ Electric shock	Handle power cable with care.	P.4
9	WARNING	Fire/ Electric shock	Ground wire MUST be connected properly	P.3
10	WARNING	Fire/ Electric shock	DO NOT disassemble or modify equipment.	P.4
11	WARNING	Fire/Injury	Implement proper fire extinguishing and ventilation measures. (BO312-G)	P.3

1. SAFETY PRECAUTIONS

List of Residual Risks

Use				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page(s)
11	WARNING	Explosion/fire	DO NOT process explosive or flammable substances	P.22
12	WARNING	Fire/ Electric shock	Turn OFF (○) the Power switch immediately when an abnormality occurs.	P.3
13	CAUTION	Fire	When unit stops operation due to power failure etc., be sure to confirm the state of unit at the time of power recovery.	P.4
14	WARNING	Burn	DO NOT touch hot surfaces	P.22
15	WARNING	Fire	Be acquainted with property of heating medium in use.	P.12
16	WARNING	Fire	DO NOT operate equipment during thunderstorms.	P.4
17	CAUTION	Burn Injury	ALWAYS run equipment within specified temperature range.	P.23
18	WARNING	Burn	Exercise caution in handling heating medium after operation.	P.22
19	WARNING	Fire/ Electric shock	Do not use silicone oil mixed with any moisture. (BO312-G)	P.22
20	WARNING	Electric shock	Air-dry unit completely after using water below room temperature.	P.13
21	WARNING	Fire	DO NOT insert foreign objects into unit openings.	P.22
22	WARNING	Fire	When unit is not in operation during the night or for extended period of time, be sure to turn OFF (○) the Power switch and disconnect power cable.	P.23

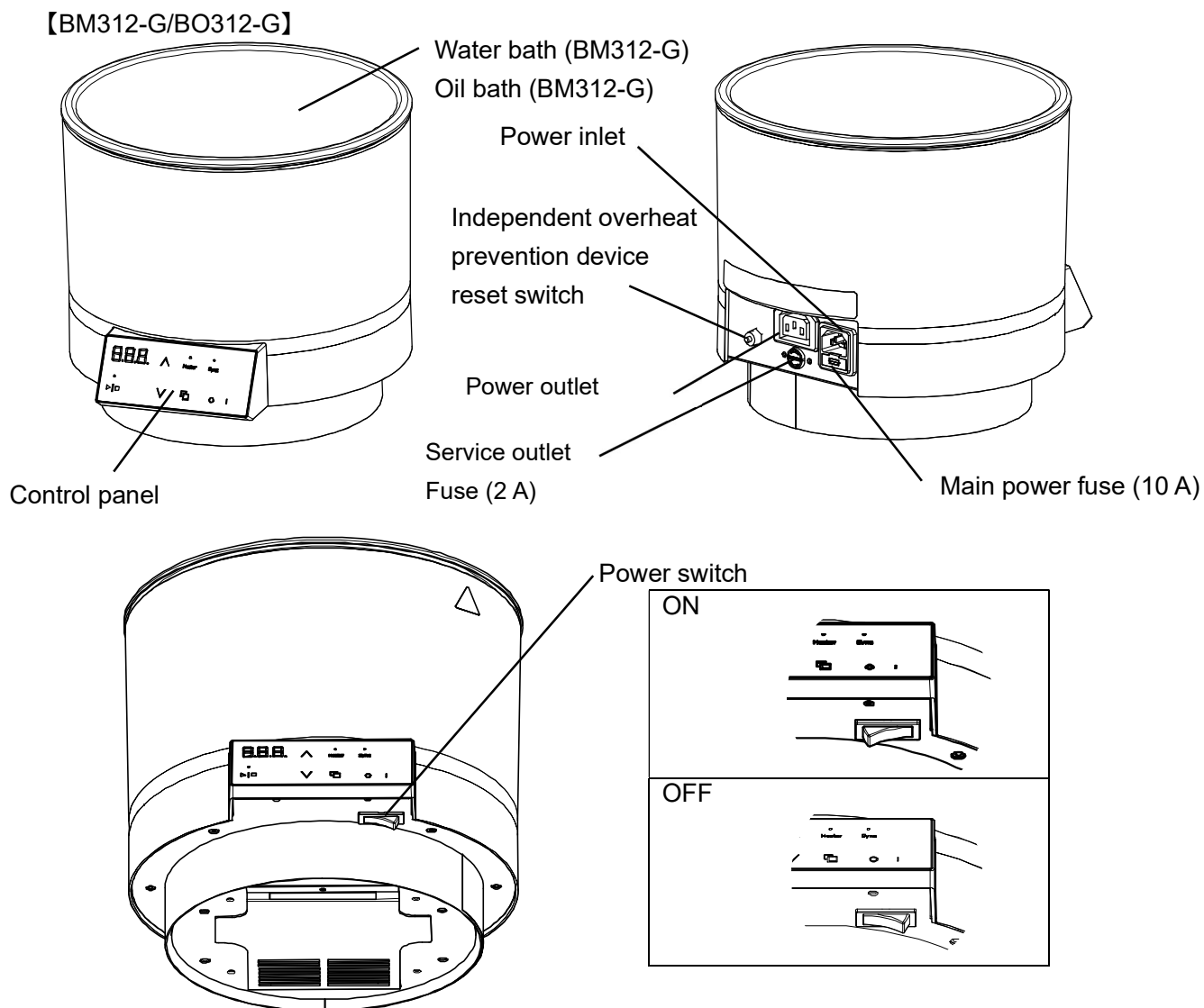
Daily inspection/maintenance				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page(s)
23	WARNING	Fire/ Electric shock	Remove the power cable for inspection and maintenance.	P.24
24	WARNING	Burn	Perform inspections and maintenance when unit is at room temperature.	P.24
25	WARNING	Fire/Electric shock	NEVER disassemble or modify unit	P.24

Extended storage/disposal				
No.	Degree of risks	Risk description	Protective measures taken by the user	Relevant page(s)
27	WARNING	Fire/ Electric shock	Turn off the Power switch and disconnect power cable from facility outlet or terminal.	P.26
28	CAUTION	Injury	Do not leave unit in a location where children may have access	P.26

EN

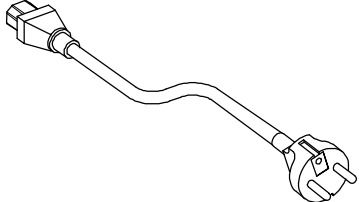
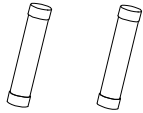
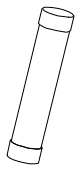
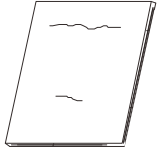
2. COMPONENT NAMES AND FUNCTIONS

Main Unit



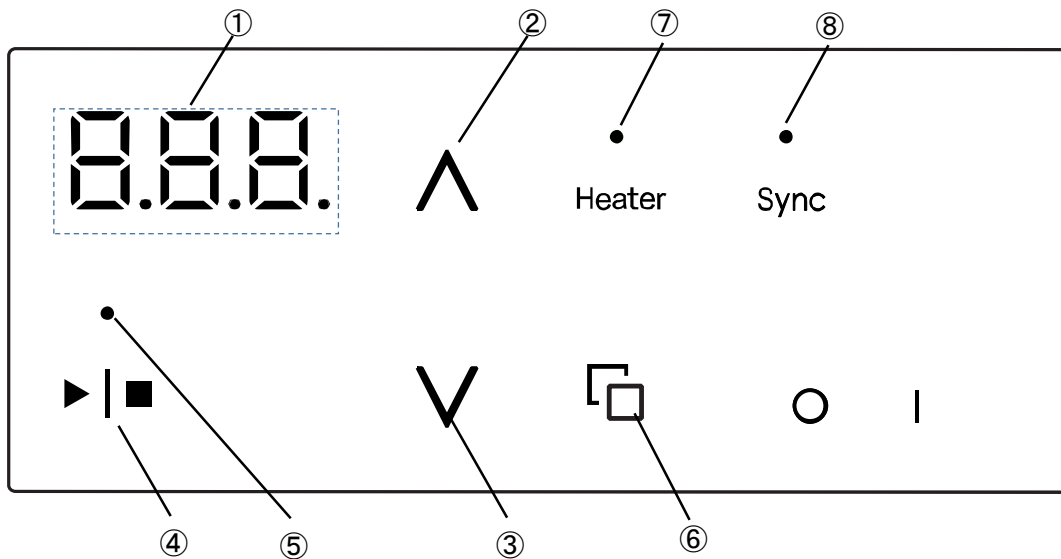
Accessories

Check before operation that all the accessories are complete. Contact original dealer of purchase if anything is missing.

<p>(1) Power cable (3 m)</p> 	<p>(2) Spare fuse for main power 10A 2pcs</p> 	<p>(3) Spare fuse for service outlet 2 A 1pc</p> 
<p>(4) Instruction manual</p> 		

2. COMPONENT NAMES AND FUNCTIONS

Control Panel



EN

No.	Panel item	Description
①	Temperature display	Shows current temperature, temperature setting, and items in user setting.
②	Up key	Press to increase or decrease set value, scroll items in user setting, and switch settings.
③	Down key	
④	Run/Stop key	Press to start or stop an operation. Press one second to start operation, pressing it while unit is running will stop operation.
⑤	Run/Stop lamp	Illuminates during operation.
⑥	Set key	Press to switch screen between temperature reading and temperature setting. Press and hold to switch screen to user setting.
⑦	Heater lamp	Illuminates when heater is on and drawing power.
⑧	Syncro lamp	Not used for this unit.

Display Characters

All characters displayed when making settings and during operation are defined as follows:

Character	Letters	Description
CAL	CAL	Appears while entering offset temperature values. See "Calibration Offset" (P.17)
Pon	Pon	Appears when setting Auto-resume function. See "Auto-resume Function" (P.18)
tAH	tAH	Overshoot alert See "Overshoot Alert" (P.19)
dSP	dSP	Appears when setting LED brightness. See "LED Brightness Setting" (P.20)

3. PRE-OPERATION PROCEDURES

Installation Precautions



Choose an appropriate installation site.



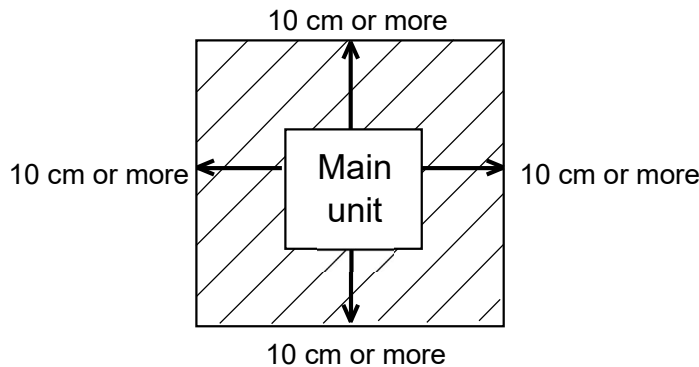
DO NOT install unit:

- where installation surface is not completely level, not even or not clean.
- where flammable or corrosive gases/fumes may be present
- where external temperature will exceed 35°C, will fall below 5°C or will fluctuate largely.
- where liquid is assumed to splash on unit
- in excessively humid or dusty locations.
- in direct sunlight or outdoors.
- where there is constant vibration.
- in direct contact with the outside air
- where power supply is erratic.
- where there is combustible material nearby.
- in the proximity of, particularly below a fire alarm.
- where there is a risk of freezing or condensation.



Install unit in a location with sufficient space, as specified below.

【BM312-G, BO312-G】



Install unit on a level surface.

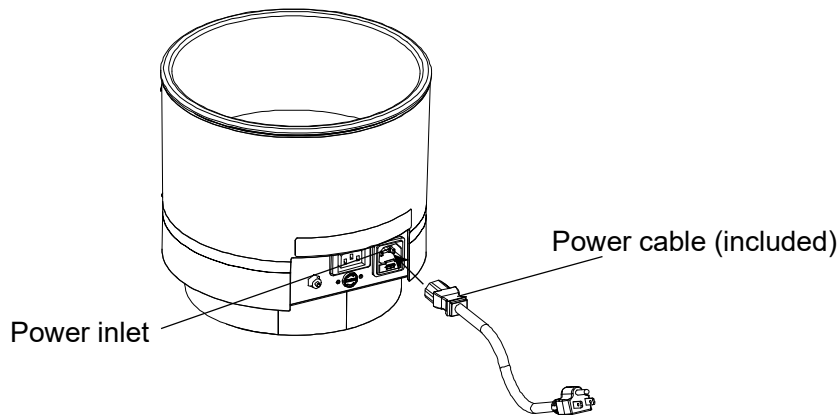
Install unit on level and even surface. Failure to do so may cause abnormal vibrations or noise, possibly resulting in complications and/or malfunction.

3. PRE-OPERATION PROCEDURES

Installation Precautions

EN

! Make power connection properly.



Insert supplied power cable into the power inlet.

! Always connect power cable to appropriate facility outlet or terminal.

Connect power cable to a suitable facility outlet or terminal, according to the electrical requirements.

Power BM312-G/BO312-G: 200-230 V AC single phase 50/60 Hz 5-6 A (fuse 10 requirements A)

Operational voltage range is 180-250 V, performance guarantee voltage range is 190-241 V, and frequency is $\pm 1\%$

* Check the line voltage on distribution board and properly evaluate whether to utilize a line being shared by other equipment. If unit is not activated by turning the Power switch ON (!) take an appropriate course of action, such as connecting unit to a dedicated power source. Inserting multiple cords into a single outlet, using branch outlets or extension cords, may cause a drop in voltage, which may affect performance, resulting in failure to control or maintain proper temperature.

Power cable

Power supply	Standard	Cable end processing
220 V AC	3-core 1.0 mm ²	Type SE electrical plug (2-pin plug with grounding contact)

⊘ Install in a dry location.

Install unit where it will be free from liquid spray and other moisture. Failure to do so may result in control mechanisms becoming wet, causing malfunction, electrical shock and/or fire.

3. PRE-OPERATION PROCEDURES

Installation Precautions



Use unit in fume hood whenever processing harmful solvents.

A ventilation hood must be installed for processing harmful solvents at constant temperature.

Also obtain the safety data sheet (SDS) for safe use, and handle with extreme care.

【BO312-G】

Silicon oil when heated at more than 150°C will gradually generate trace amount of formaldehyde. Place unit in fume hood or provide good ventilation for safe operation.



Heating medium

【BM312-G】

For water only * Using a fluid other than water may result in fire or equipment malfunction.

【BO312-G】

For water and oil * Maximum operating temperature is up to 90 °C for water, and 180°C for oil. Use heat-resistant dimethyl silicon oil for open system heat transfer only, and kinematic viscosity of 50mm²/s (cSt) or less.

Recommended: KF-96-50cs silicon oil by Shinetsu Science Industries Co., Ltd.

Silicone oil characteristics	Appearance	Clear and colorless
	Kinematic viscosity (25°C)	50 mm ² /s
	Specific gravity (25°C)	0.960
	Volatile content (150 °C/24 h)	0.5% or less
	Viscosity temperature coefficient (V.T.C)	0.59
	Pour point	-50 °C or less
	Flash point	310 °C or more
	Specific Heat (25 °C)	1.5 J/g·°C
	Thermal conductivity (25 °C)	0.15 W/m·°C
	Expansion coefficient (25-150°C)	0.00096 cc/°C

- ❖ Deterioration rate of silicone oil varies depending on the operating temperature. For more information on the silicone oil characteristics, contact silicone oil maker at the time of purchase.
- ❖ Use KF-96-50cs from Shinetsu Science Industries Co., Ltd. or its equivalent oils. KF-96 series silicone oil includes various types of viscosity. Note that low-viscosity oils have low heat-resistance, and high-viscosity oils may cause local heating, possibly resulting in fire.

3. PRE-OPERATION PROCEDURES

Installation Precautions



Air-dry unit completely after using low-temperature water.

When using cold water below room temperature, operate unit under the condition of room temperature 20 ± 5 °C, humidity 60 % RH. After operating with low-temperature water, condensations may have formed inside unit. Leave unit in a well-ventilated place until it dries completely to prevent the possibility of electrical leakage.

EN

Safety Functions

1	Independent overheat prevention (fixed temperature)	Unit has a separate overheat prevention device, independent of the CPU board for added safety. However, this is not designed to prevent empty heating. Do not run unit without sufficient amount of fluid. Bath reservoir is hot when the device is activated. Turn OFF (○) the Power switch and disconnect power cable. Avoid touching the reservoir until it cools. See "Independent Overheat Prevention Device Reset" (P.21) for procedure for resetting overheat prevention device.
2	Automatic overheat prevention	This function shuts off heater circuit when temperature reading exceeds set temperature to a certain degree. (Operation continues)
3	Temperature upper limit error (E06)	This function shuts off heater circuit when temperature reading exceeds maximum operating temperature. Activation temperature: approx. 105 °C (BM312-G) approx. 220 °C (BO312-G) Bath reservoir is hot when the device is activated. Turn OFF (○) the Power switch and disconnect power cable. Avoid touching the reservoir until it cools. Wait until the temperature of the reservoir falls below 60°C, then turn the Power switch back ON (I). Unit will restart.
4	Overcurrent protection fuse	Unit is equipped with overcurrent protection fuse on the rear. The fuse blows when overcurrent occurs during operation. Check the fuse if unit does not turn on by turning the Power switch ON (I) while independent overheat prevention device is not activated. Replace the fuse by referring to "Maintenance and Inspection" (P.25).

* If overheat prevention device activation and temperature upper limit error frequently occurs, contact original dealer of purchase for inspection.

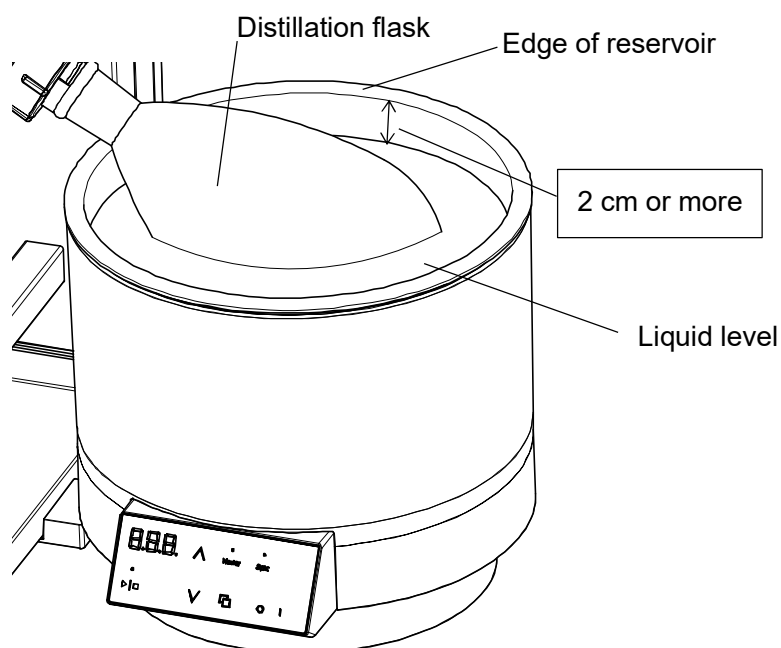
* Main function of overheat prevention function and temperature upper limit is to keep this unit from overheating, NOT to protect test samples from damage. Likewise, it is NOT intended for protection against accident or injury resulting from the negligent use of explosives and flammables.

3. PRE-OPERATION PROCEDURES

Installation Precautions



Supply of water/oil



Maximum fluid level should be 2 cm from the edge of the reservoir with a flask or other container is placed in the bath. Use caution not to overflow the bath when supplying fluid. Pour at least 2 L of fluid in the reservoir.

【BO312-G】

Silicon oil has a broad thermal expansion capacity and may overflow from bath when heated.

Expansion should be subtracted prior to supply silicone oil to the reservoir.

(Example) Supply amount of KF-96-50cs to the reservoir can be calculated based on the following formula.

Oil increment = (set temperature - temperature reading) × amount of silicone oil × 0.00096

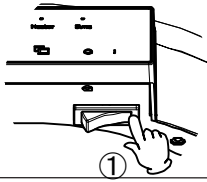
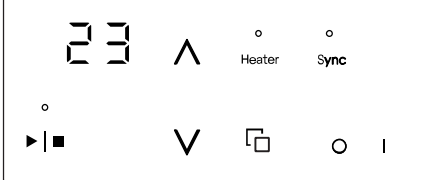
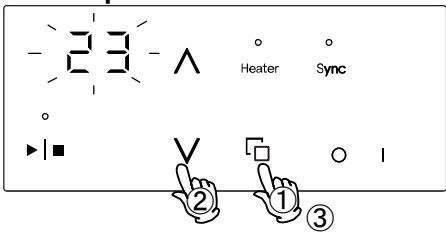


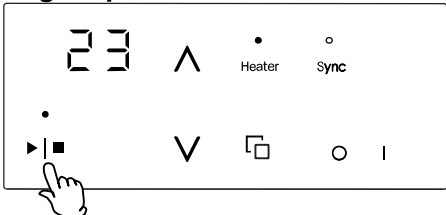


With set temperature 180 °C, current temperature reading 23 °C, and required amount of silicone oil 4.5 L, increase amount of the oil will be: (180 °C-23 °C) × 4.5 L × 0.00096 = 0.68 L.

Thus, 3.8 L of silicone oil needs to be prepared in the case of example above.

4. OPERATION PROCEDURES

Operation Procedure




EN

<p>1. Turn power on.</p>	 	<p>1. Turn ON (I) the Power switch on the lower right of the control panel.</p> <p>Temperature display: Temperature reading will show following firm ware version "V. o. o".</p>
<p>2. Set temperature</p>	 <p>☀ indicates flashing.</p>	<p>1. Press  key. Temperature display: Current set temperature flashes.</p> <p>2. Enter desired value by using the \wedge \vee keys. [BM312-G] Temperature setting range: 0-90 °C [BO312-G] Temperature setting range: 0-180 °C (oil) 0-90 °C (water) ❖ Operate BO312-G unit below 90 °C when using water.</p> <p>3. Press  key. Temperature display: Temperature reading will show</p>
<p>3. Begin operation</p>	 <p>Press 1 sec.</p>	<p>Press and hold  key for one second.</p> <p>Run/Stop lamp : ON Heater lamp : On/Flashing</p> <p><To stop> Press  again.</p> <p>Run/Stop lamp : OFF Heater lamp : OFF</p>

4. OPERATION PROCEDURES

User Setting

List of user setting items

- Press and hold  key for four seconds to show user setting. Select an item by using \wedge / \vee keys. Press  key again to make setting on the selected item.
- Holding down  key for two seconds while the user setting item is displayed or leaving unit without key operation for about two minutes, will discard the changes, and the display returns to previous screen.
- Only calibration offset function "CAL" can be set or altered during operation (Run/Stop lamp ON). The other items must be set during standby.

Panel item	Description	Page
Calibration offset	Calibration offset is a function which can correct for any differences discovered between actual liquid temperature and the temperature displayed on the control panel. Offset function can correct to either the positive or negative side of the entire unit temperature range. Setting range: -5.0 to +5.0 °C Default setting is "0.0 °C"	P.17
Auto-resume function	Select operation for the time power is restored. OFF: Unit goes into idle at power recovery. ON: Unit automatically reverts to status just before power loss and begin operation once again from that point. Default setting is "OFF"	P.18
Overshoot alert	When temperature reading goes over "set temperature + alert setting value (°C)", the readout begins flashing to alert an overshoot. Alert setting range: 1-50 °C Default setting is "50 °C"	P.19
LED brightness setting	Change the LED brightness of the control panel. The brightness can be set in 8 levels from 0 to 7. Setting range: 0-7 Default setting is "3"	P.20

4. OPERATION PROCEDURES

Calibration Offset

EN

Calibration offset is a function which can correct for any differences discovered between actual liquid temperature and the temperature displayed on the control panel.

Offset function can correct to either the positive or negative side of the entire unit temperature range.

- Run unit at desired temperature. Once temperature has risen and stabilized, gauge liquid temperature with a thermograph.

- Check the difference between the set temperature and the actual liquid temperature.

Setting range: -5.0 to +5.0 °C

Default setting is "0.0 °C"

❖ Setting change can also be made during operation.

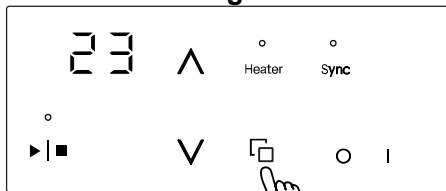
Example

Actual temperature is 2 °C lower than control panel temperature reading of 60 °C.


Temperature reading can be calibrated by entering a calibration offset value of -2.0 to compensate against the actual temperature deficiency of 2 °C.

If the initial temperature reading was 60°C, it will read 58°C after offset calibration, and be brought into agreement with actual liquid temperature.

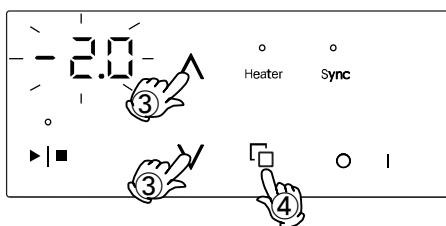
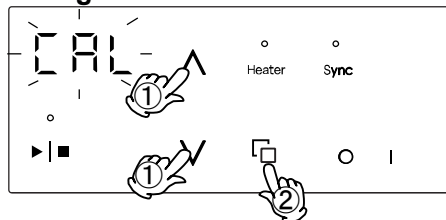
1. Enter user setting



Press 4 sec.


Turn power ON (I) and press  key for four seconds while temperature reading is on the screen. Unit enters user setting.

2. Change offset value



1. Select "CAL" using the \wedge \vee keys.

Temperature display: "CAL" flashes.

2. Press  key.

Temperature display: Current set value flashes.

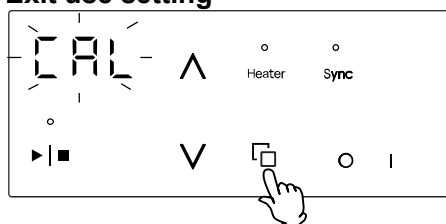
3. Enter a value that brings set temperature and liquid temperature into agreement, using the \wedge \vee keys.

4. Press  key to finalize.


Temperature display: Set value is shown for about one second.

After completion, the screen returns to step 1.

3. Exit use setting



Press 2 sec.

After completing the setting, press and hold  key for two seconds. Display reverts to initial screen and shows temperature reading.

4. OPERATION PROCEDURES

Auto-resume Function

Select recovery mode for the event of a power failure.

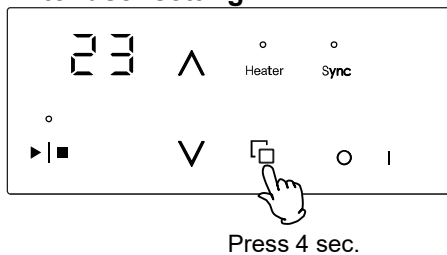
OFF: Unit goes into idle at power recovery.

ON: Unit automatically reverts to status just before power loss and begin operation once again from that point.

Default setting is "OFF"

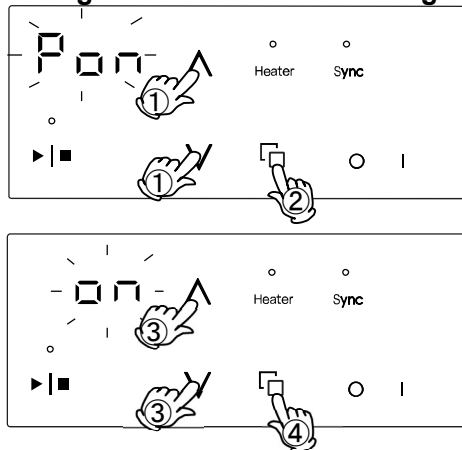
❖ Setting change can be made during standby only.

1 Enter user setting



Turn power ON (I) and press key for four seconds while temperature reading is on the screen. Unit enters user setting.

2 Change the Auto-resume setting



1. Select "Pon" using the \wedge \vee keys.
Temperature display: "Pon" flashes.

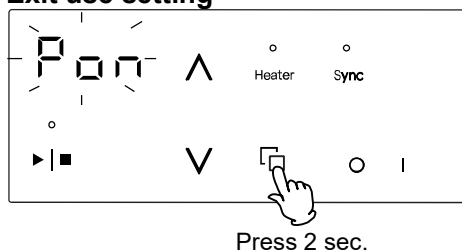
2. Press key.
Temperature display: Current setting flashes.

3. Use the \wedge \vee keys to alter the setting.

4. Press key to finalize.
Temperature display: New setting is shown for about one second.

After completion, the screen returns to step 1.

3 Exit use setting



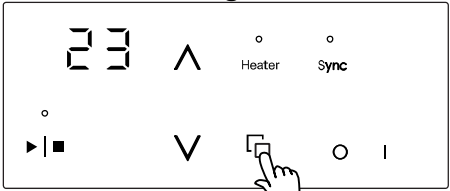

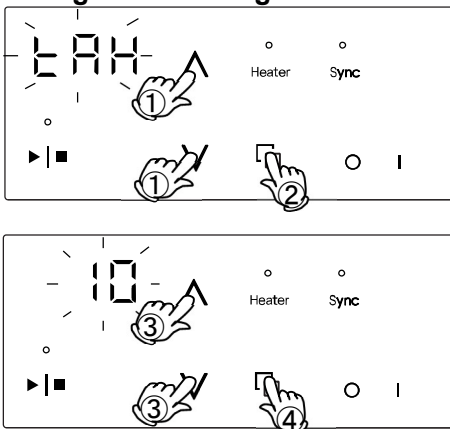


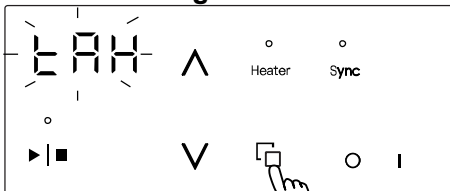

After completing the setting, press and hold key for two seconds. Display reverts to initial screen and shows temperature reading.

4. OPERATION PROCEDURES

Overshoot Alert

EN

When temperature reading goes over “set temperature + alert setting value (°C)”, the readout begins flashing to alert an overshoot.
 Alert setting range: 1 to 50°C
 Default setting is “50 °C”
 ❖ Setting change can be made during standby only.

<p>1 Enter user setting</p>	 <p>Press 4 sec.</p>	<p>Turn power ON (I) and press  key for four seconds while temperature reading is on the screen. Unit enters user setting.</p>
<p>2 Change alert setting value</p>		<ol style="list-style-type: none"> 1. Select "tAH" using the $\wedge \vee$ keys. Temperature display: "tAH" flashes. 2. Press  key. Temperature display: Current set value flashes. 3. Use the $\wedge \vee$ keys to alter the setting. 4. Press  key to finalize. Temperature display: Set value is shown for about one second. <p>After completion, the screen returns to step 1.</p>
<p>3 Exit use setting</p>	 <p>Press 2 sec.</p>	<p>After completing the setting, press and hold  key for two seconds. Display reverts to initial screen and shows temperature reading.</p>

4. OPERATION PROCEDURES

LED Brightness Setting

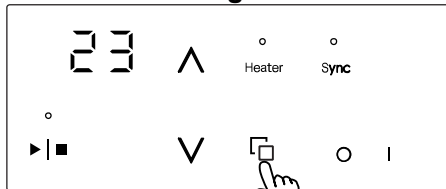
Change the LED brightness of the control panel.

The brightness can be set in 8 levels from 0 to 7.


Default setting is "3"

❖ Setting change can be made during standby only.

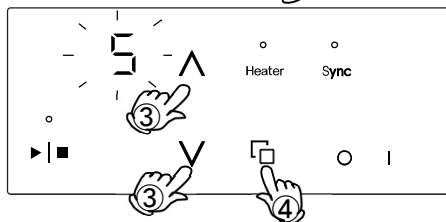
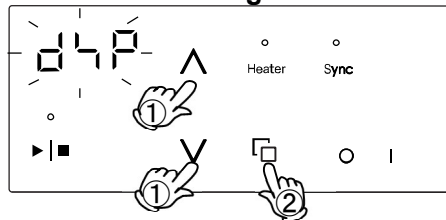
1 Enter user setting



Press 4 sec.

Turn power ON (I) and press  key for four seconds while temperature reading is on the screen. Unit enters user setting.

2 Select the LED brightness level




1. Select "dSP" using the \wedge \vee keys.

Temperature display: "dSP" flashes.

2. Press  key.

Temperature display: Current set value flashes.

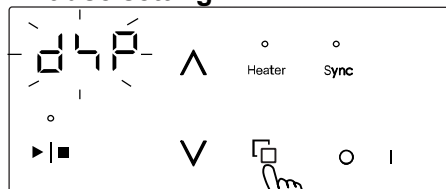
3. Use the \wedge \vee keys to alter the setting.

4. Press  key to finalize.


Temperature display: Set value is shown for about one second.

After completion, the screen returns to step 1.

3 Exit use setting



Press 2 sec.

After completing the setting, press and hold  key for two seconds. Display reverts to initial screen and shows temperature reading.

4. OPERATION PROCEDURES

Independent Overheat Prevention Device Reset



Be sure to reset independent overheat prevention device after confirming that temperature of the bath reservoir has become room temperature.

Unit is hot when the device is activated. Exercise vigilance in order to avoid getting burnt.

EN

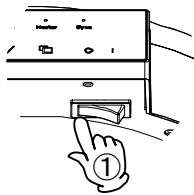
Resetting independent overheat prevention device

Independent overheat prevention device shuts off power supply to the controller when bath temperature has risen beyond the device activation temperature (fixed).

When independent overheat prevention device activates, the display will be blank despite the Power switch in the ON (I) position.

1 Turn power off

1. Turn the Power switch OFF (O).

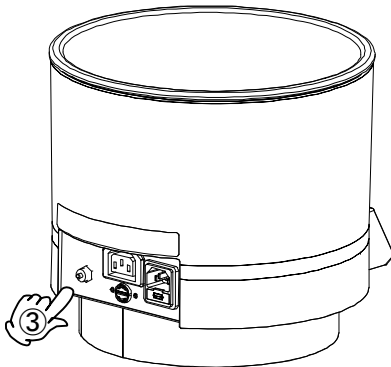


2 Reset independent overheat prevention device

2. Address the cause of independent overheat prevention device activation; low water/oil, ambient temperature exceeds 36 °C, etc.

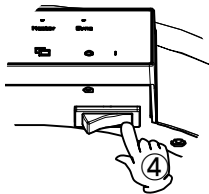
3. Check that unit is cooled to room temperature and press the reset switch of independent overheat prevention device.

❖ The device cannot be reset while unit is hot. Wait until bath temperature falls below 60 °C.



3 Turn power on

Turn the Power switch ON (I).
Control panel display will turn on.



◆ Contact original dealer of purchase if unit will not restart.

5. HANDLING PRECAUTIONS

Warnings and Cautions



CAUTION



NEVER process explosive or flammable substances



Never attempt to process explosives, flammables or any items which contain explosives or flammables. Fire or explosion may result. See "11. LIST OF HAZARDOUS SUBSTANCES" (P.31)



Resin container advisory.

When using resin containers for processing, confirm that they conform to the heating specifications of this unit. Heating resin beyond capacity to withstand temperature will cause resin to melt and may result in fire or explosion.



DO NOT insert foreign objects into unit openings.

In the event that a foreign object accidentally falls inside, turn off the Power switch immediately, disconnect power cable and contact original dealer of purchase for assistance. Failure to do so may result in fire or electric shock.



DO NOT use silicone oil mixed with any moisture.

【BO312-G】

Moisture in oil evaporates explosively when heated to high temperatures, possibly resulting in fire or burn injury.

When changing the fluid between water and silicone oil, thoroughly wipe the moisture or oil content off the reservoir.



DO NOT touch bath reservoir while operating at high temperatures.



Bath reservoir becomes hot during high temperature operation.

When necessity dictates that you need to touch/be in contact with hot surfaces, be sure to wear protective equipment against burn injury. Pay due attention not to spill heated medium.



Use extreme caution in handling fluids and samples following high temperature operation.

Bath reservoir, water/oil, and sample/process items are hot during operation or for some time after operation. Be careful with hot items in order to avoid burn injury. Dispose of heating medium after it comes below 45 °C.



DO NOT process corrosive items.

Do not process items containing corrosive chemicals of any kind. Potent acids may corrode the reservoir despite stainless steel construction.

5. HANDLING PRECAUTIONS

Warnings and Cautions



ALWAYS run equipment within specified temperature range.

Never attempt to operate unit outside of specification range. Equipment malfunction or damage may result.



Overnight and extended storage.

When unit is not in operation during the night or for extended period of time, be sure to turn OFF (○) the Power switch and disconnect power cable.

Discharge water/oil and clean the reservoir if unit will be in storage for a long period of time. See "6. MAINTENANCE PROCEDURES" (P.24). Failure to do so may lead to buildup of scale, or malfunction due to corrosion.



Power loss recovery.

When a power loss occurs during operation and then restored, unit may resume operation or remain on standby. These actions can be selected through user setting. See "Auto-resume Function" (P.18) for setting procedure; default setting is "OFF".



Exercise caution when processing heat-generating substances.

Note that temperature reading may not be consistent when processing heat-generating samples.



Use calibration offset function to correct temperature reading.

If there is a discrepancy between temperature reading and actual liquid temperature, see "Calibration Offset" (P.17) to make a correction.



Inspect regularly.

Regular inspection and maintenance are highly recommended to ensure proper operation. See "6. MAINTENANCE PROCEDURES" (P.25) for detailed instructions.

6. MAINTENANCE PROCEDURES

Precautions before Inspection



WARNING

- Be sure to disconnect power cable before conducting inspection and maintenance.
- Perform inspections and maintenance when unit is at room temperature.
- Never attempt to disassemble unit.

Precautions in Daily Maintenance



CAUTION

- Clean unit using soft damp cloth. Never use benzene, paint thinner, scouring powder, scrubbing brush or other abrasives and solvents to clean unit. Superficial damage and/or discoloration, as well as deformity to some components may result.

Maintenance and Inspection

- Bath reservoir maintenance
 - Wash the reservoir regularly, operating unit with scale formed on the reservoir may cause abnormal temperature rise, leading to equipment damage.
- Check power plug for damage
 - Check power plug for dust or dirt on its prongs and clear off if any accretions found.
 - Confirm that the prongs of power plug are not bent or damaged. Replace if bent or damaged.
 - Check the power plug for discoloration or abnormal heat generation. If there is discoloration or abnormal heating, the internal contact of the outlet may be faulty.

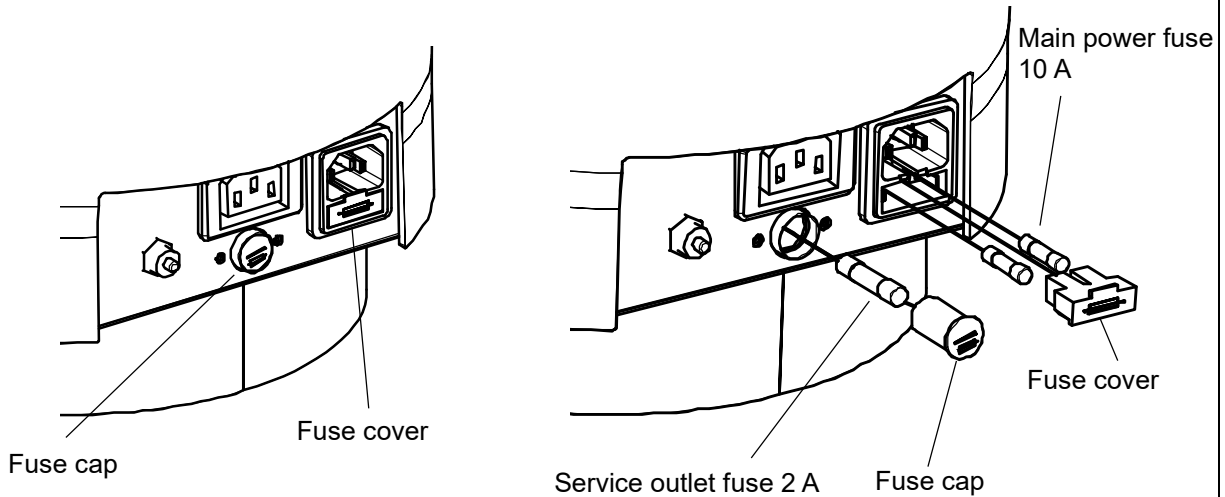
6. MAINTENANCE PROCEDURES

Maintenance and Inspection

EN

● Fuse replacement

- If overcurrent protection fuse has blown, eliminate the cause and replace with a spare.



● Fuse for inlet

- ① Turn OFF (○) the Power switch and disconnect power cable.
- ② Hook a slotted screwdriver, etc. on the tab on top of the fuse cover and pull it out.
- ③ Replace the blown fuse with a spare (10 A) and put the fuse cover back into the main fuse slot.
- ④ Plug power cable into an outlet and turn ON (|) the Power switch to make sure unit starts up.

● Fuse for outlet

- ① Turn OFF (○) the Power switch and disconnect power cable.
- ② Set the flat-blade screwdriver?? to "OFF (○)" and unplug the power cord from the outlet.
- ③ Turn the fuse cap counterclockwise with a slotted screwdriver.
- ④ Replace the blown fuse



VR connection terminal (mini-DIN 8P)
with a spare (2 A).

- ⑤ Put the cap back and turn it all the way clockwise.
- ⑥ Plug power cable into an outlet and turn ON (|) the Power switch to make sure unit starts up.

Contact original dealer of purchase for further assistance.

7. EXTENDED STORAGE AND DISPOSAL

Extended Storage/Disposal

 WARNING	 CAUTION
Extended storage Turn OFF (○) the Power switch and disconnect power cable.	Disposal Do not leave unit in a location where children may have access.

Disposal Considerations

Dispose of or recycle this unit in a responsible and environmentally friendly manner.

KNF and Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible in order to separate parts and recycle them in contribution to preserving the global environment. Major components and materials, comprising BM/BO units are listed in the table below

Component Name	Material
Main Unit Components	
Exterior	Polybutylene terephthalate resin (with fiber glass), chromium-free electrogalvanized steel sheets, stainless steel, aluminum
Bath reservoir	Stainless steel, aluminum
Heat insulator	Glass wool
Electrical Parts	
Switches and relays	Composite of resin, copper and other materials
Control panel	Polybutylene terephthalate resin (with fiber glass) Polycarbonate resin
Printed circuit boards	Composite of fiber glass and other materials
Heater	Aluminum tube heater
Power cable	Composite of synthesized rubber coating, copper, nickel and other compounds
Wiring materials	Composites of fiber glass, fire-retardant vinyl, copper, nickel and other compounds
Seals	Resin material
Sensor	Stainless steel etc.

8. TROUBLESHOOTING

Reading Error Codes

This unit has a self-diagnostic function built into the CPU board and a separate safety function, independent of the CPU board. The table below shows possible causes and measures to take when a safety function is performed.

[Error Codes]

When an operational error or malfunction occurs, error code and temperature reading are alternately displayed on the control panel, and operation stops. When an error occurs, confirm the error code and turn OFF (○) the Power switch immediately.

Display code	Description	Possible causes and measures
E 0 1	Temperature sensor failure (E01)	<ul style="list-style-type: none"> ● Controller failure ● Defective temperature sensor (interrupted or short circuited) ● Temperature out of specification range. Contact original dealer of purchase for assistance.
E 0 6	Temperature upper limit error (E06)	<ul style="list-style-type: none"> ● When temperature reading rises beyond the limits specified below, operation will be terminated. BM312-G: approx. 105 °C BO312-G: approx. 220 °C ● Turn OFF (○) power supply and wait until the liquid temperature comes below 60 °C, and restart operation. If unit does not reset, contact original dealer of purchase
E 1 5	EEPROM failure (E15)	<ul style="list-style-type: none"> ● Error in a storage element EEPROM on the controller board ● Turn OFF (○) power and restart unit. If unit does not reset, contact original dealer of purchase

Other warnings

Display alert	Description	Possible causes and measures
Temperature reading flashes (only in operation)	Overshoot alert	<ul style="list-style-type: none"> ● When temperature reading goes over “set temperature + alert setting value (°C)”, the readout begins flashing to alert an overshoot. (Operation continues) Contact original dealer of purchase if temperature continues to significantly decrease after alert occurs.

When independent overheat prevention device is activated.

Display alert	Description	Possible causes and measures
Lamps on the control panel went out	Independent overheat prevention	<ul style="list-style-type: none"> ● Independent overheat prevention device shuts off power supply to the controller when bath temperature has risen beyond the device activation temperature (fixed). ● See “Independent Overheat Prevention Device Reset” (P.21) for procedure for resetting the device. If unit does not reset, contact original dealer of purchase

8. TROUBLESHOOTING

Troubleshooting Guide

Symptom	Possible causes	Possible measures
Unit does not turn on when the Power switch is turned ON (I).	<ul style="list-style-type: none"> ● Power supply failure ● Power cable disconnection 	<ul style="list-style-type: none"> ● Check power supply voltage Must be 180-250 V AC ● Insert power cable firmly deep into the power inlet. See "Make power connection properly." (P.11)
	<ul style="list-style-type: none"> ● Power switch failure ● Controller failure ● Independent overheat prevention device is activated ● Overcurrent protection fuse (15 A) is blown 	<ul style="list-style-type: none"> ● Replace relevant parts ● Replace relevant parts ● Press the reset switch. See "Independent Overheat Prevention Device Reset" (P.21) ● Replace relevant parts
Temperature does not rise when the Run/Stop key is ON	<ul style="list-style-type: none"> ● External temperature is below 5 °C ● Independent overheat prevention device is activated 	<ul style="list-style-type: none"> ● Operating ambient temperature range is 5 to 35 °C ● Press the reset switch. See "Independent Overheat Prevention Device Reset" (P.21)
	<ul style="list-style-type: none"> ● Temperature sensor failure ● Controller failure ● Heater failure ● Power supply failure 	<ul style="list-style-type: none"> ● Replace relevant parts ● Replace relevant parts ● Replace relevant parts ● Check power supply voltage Must be 180-250 V AC

9. SPECIFICATIONS

BM312/BO312

Model		BM312-G	BO312-G
Product Name		Water Bath	Oil Bath
Performance * 1	Operating ambient temperature range	5 to 35 °C	
	Temperature control range	Room temp +10°C to 90°C	Room temp +10°C to 180°C
	Temperature control accuracy	±1.0 °C	±1.5 °C
	Temp. control accuracy (w/ oil, stirring)		±2.0 °C
Configuration	Temperature control system	PID control	
	Controller	White LED digital display, key entry, minimum digit of 1 °C	
	Temperature sensor	Pt100 Ω	
	Heater	1000 W aluminum sheathed heater	
	Exterior	PBT (with fiber glass)	
	Bath reservoir	Stainless steel	
Safety functions		Automatic overheat prevention, independent overheat prevention (fixed temp.), temperature upper limit error Overcurrent protection fuse	
Other functions		Overshoot alert, Auto-resume (selectable) Calibration Offset	
Standard	External dimensions *2	φ262 (max. D286) x H240 mm	
	Reservoir capacity	Approx. 5 L	
	Power supply (Fuse capacity)	200-230 V AC 5-6 A (10 A)	
	Power cable	3 m long with electrical plug, C14 coupler	
	Weight	Approx. 4.5 kg	
Conformance standard		CE	
Accessories		C14 inlet power cable (1), Spare fuse for main power 10 A (2), spare fuse for service outlet 2 A (1)	

*1 Performance data above based on 190-241 V AC supplied power, 23 ±5 °C room temperature, 65%RH ±20% humidity, and no process load.

Operating temperature range for BM/BO series unit is between 5°C and 35°C. Be advised that maximum operating temperature may not be reached under low ambient temperatures, if source voltage is below 190 V.

Temperature control accuracy is measured based on JTM K05

*2 Dimensions do not include protrusions.

Temperature Rise Curve (reference data)

Analysis provisions

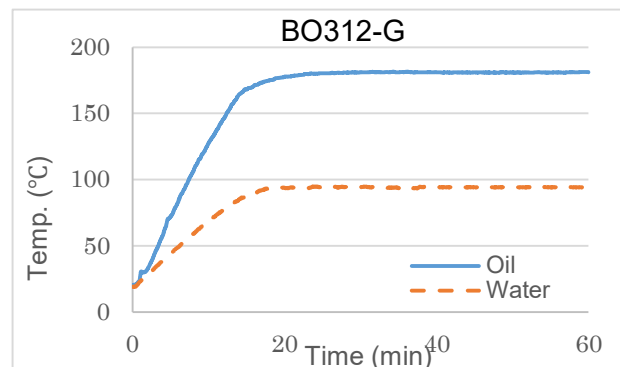
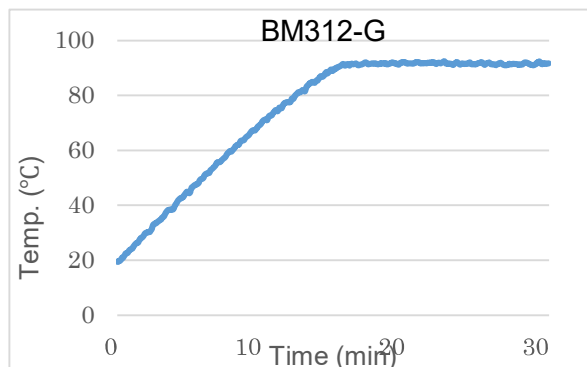
Room temperature: 23±5 °C

Power supply: 220 V AC ±5 %


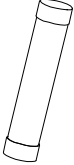
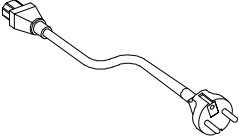
Measurement: reservoir center,

Fluid volume: 3 L, no load

Set temperature: BM312-G 90 °C, BO312-G 180 °C (oil) / 90 °C (water)



10. REPLACEMENT PARTS LIST

Part name	Part code	Standard	Manufacturer
Main power fuse 10 A 2pcs		LT00040473	250 V 10 A Yamato Scientific
Service outlet fuse 2 A 1pc		LT00040474	250 V 10 A Yamato Scientific
Power cable		LT00040738	With a plug, 3 m Yamato Scientific

11. LIST OF HAZARDOUS SUBSTANCES



Never attempt to process explosives, flammables or any items which contain explosives or flammables.

Explosive substances	① Nitroglycol, Glycerine trinitrate, Cellulose Nitrate and other explosive nitrate esters
	② Trinitrobenzen, Trinitrotoluene, Picric Acid and other explosive nitro compounds
	③ Acetyl Hydroperoxide, Methyl Ethyl Ketone Peroxide, Benzoyl Peroxide and other organic peroxides
	④ Metallic Azide, including Sodium Azide, etc.
Combustible substances	① Metal "Lithium" ② Metal "Potassium" ③ Metal "Natrium" ④ Yellow Phosphorus
	⑤ Phosphorus Sulfide ⑥ Red Phosphorus ⑦ Phosphorus Sulfide
	⑧ Celluloids, Calcium Carbide (a.k.a, Carbide) ⑨ Lime Phosphide ⑩ Magnesium Powder
	⑪ Aluminum Powder ⑫ Metal Powder other than Magnesium and Aluminum Powder
	⑬ Sodium Dithionous Acid (a.k.a., Hydrosulphite)
Oxidizing substances	① Potassium Chlorate, Sodium Chlorate, Ammonium Chlorate, and other chlorates
	② Potassium Perchlorate, Sodium Perchlorate, Ammonium Perchlorate, and other perchlorates
	③ Potassium Peroxide, Sodium Peroxide, Barium Peroxide, and other inorganic peroxides
	④ Potassium Nitrate, Sodium Nitrate, Ammonium Nitrate, and other nitrates
	⑤ Sodium Chlorite and other chlorites
	⑥ Calcium Hypochlorite and other hypochlorites
Flammable substances	① Ethyl Ether, Gasoline, Acetaldehyde, Propylene Chloride, Carbon Disulfide, and other substances having ignition point of 30 or more degrees below zero.
	② n-hexane, Ethylene Oxide, Acetone, Benzene, Methyl Ethyl Ketone and other substances with ignition point between 30 degrees below zero and less than zero.
	③ Methanol, Ethanol, Xylene, Pentyl n-acetate, (a.k.a. amyl n-acetate) and other substances having ignition point of between zero and less than 30 degrees.
	④ Kerosene, Light Oil, Terebinth Oil, Isopentyl Alcohol (a.k.a. Isoamyl Alcohol), Acetic Acid and other substances having ignition point of between 30 degrees and less than 65 degrees.
Combustible gas	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°C, ambient air pressure.

12. STANDARD INSTALLATION MANUAL

* Install this equipment according to following format (check options and special specifications separately)

Model	Serial Number	Installation Date	Charged Personnel or Company Name for Installation	Installation proved by	Judgment

No	Item	Implementation method	Chapter No. & Reference page of instruction manual	Judgment
Specifications				
1	Accessories	Quantity check according to the accessories column	9. SPECIFICATIONS P.29	
2	Installation	- Visual check of surrounding conditions Caution: Take care for environment - Securing a space	3. PRE-OPERATION PROCEDURES -Choose an appropriate... P.10	
		Put water/oil into the reservoir	3. PRE-OPERATION PROCEDURES -Heating medium P.12 -Supply of water/oil P.14	
Operation-related matters				
1	Power supply voltage	- Measure line voltage (power distribution board of facilities, outlet etc.) with a tester. - Measure line voltage during operation (must meet required voltage). Caution: Use a compliant device to install	1. SAFETY PRECAUTIONS -Ground wire MUST be ... P.3 -Handle power cable ... P.4 3. PRE-OPERATION PROCEDURES -Always connect ... P.11 9. SPECIFICATIONS -Power supply P.29	
2	Confirmation on operation	-Explain name and function of each component. -Implement an operation set temperature: 50°C	3. COMPONENT NAMES AND FUNCTIONS -Main Unit P.8-9 4. OPERATION PROCEDURES P.15-21	
Description				
1	Operational descriptions	Explain operations of each component and handling precautions according to instruction manual.	4. OPERATION PROCEDURES P.15-21 5. HANDLING PRECAUTIONS -Warnings and Cautions P.22 12. LIST OF HAZARDOUS SUBSTANCES -Table 15.1 List of ... P.31	
2	Error Codes	Explain about error codes and procedures for reset according to instruction manual.	8. TROUBLESHOOTING -Reading Error Codes P.27 -Troubleshooting Guide P.28	
3	Maintenance and Inspection	Explain about maintenance of equipment and each component according to instruction manual.	6. MAINTENANCE PROCEDURES -Inspection and Maintenance P.25	

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death, resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure on BM/BO units which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- **Instruction manual descriptions and specifications are subject to change without notice.**
- **KNF NEUBERGER GmbH / Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

Instruction Manual
Water Bath / Oil Bath
model BM312-G/BO312-G
First Edition: ○○

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