# 英文取説納付時の注意事項

本書に含まれる以下の要素は、案件毎に修正が必要となる可能性があります。
納付時には対象製品の仕様を確認の上、必要に応じて修正を加えてください。

1) P.7 “Use specified receptacle for power source”中、電源仕様に関する表記。

| | |
|---|---|
| **Electric capacity:** | DC401: 100V AC, 50/60Hz, 6A (When using the pump, heater: 14A)<br>DC800: 100V AC, 50/60Hz, 11A (When using the pump, heater: 17A) |

2) P. 23 "Specification”中、電源仕様に関する表記。

3) P. 25～ "Wiring Diagram”の結線図中、入力電源表記。

4) P. 27 "Replacement Parts Table”中、各種交換部品の電圧・電気容量に関する表記。

以上

# Freeze Dryer

**Model**

# DC401/800

## Instruction Manual

- First Edition -

- Thank you for purchasing "Freeze Dryer, DC Series" of Yamato Scientific Co., Ltd.
- To use this unit properly, read this "Instruction Manual" thoroughly before using this unit.
  Keep this instruction manual around this unit for referring at anytime.

⚠WARNING!:
Carefully read and thoroughly understand the important warning items described in this manual before using this unit.

**Yamato Scientific Co. LTD.**

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# Contents

## Explanation

### MEANING OF ILLUSTRATED SYMBOLS

#### Illustrated Symbols

Various symbols are used in this safety manual in order to use the unit without danger of injury and damage of the unit. A list of problems caused by ignoring the warnings and improper handling is divided as shown below.Be sure that you understand the warnings and cautions in this manual before operating the unit.

**⚠ WARNING!** If the warning is ignored, there is the danger of a problem that may cause a serious accident or even fatality.

**⚠ CAUTION!** If the caution is ignored, there is the danger of a problem that may cause injury/damage to property or the unit itself.

#### Meaning of Symbols

This symbol indicates items that urge the warning (including the caution).
A detailed warning message is shown adjacent to the symbol.

This symbol indicates items that are strictly prohibited.
A detailed message is shown adjacent to the symbol with specific actions not to perform.

This symbol indicates items that should be always performed.
A detailed message with instructions is shown adjacent to the symbol.

## Table of Illustrated Symbols

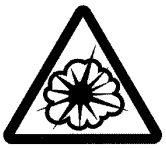
### Warning


Warning,
generally


Warning,
high voltage


Warning,
high temperature


Warning,
drive train


Warning,
explosive

### Caution


Caution,
generally


Caution,
electrical shock


Caution,
scald


Caution,
no road heating


Caution,
not to drench

Caution,
water only


Caution,
deadly poison

### Prohibit


Prohibit,
generally


Prohibit,
inflammable


Prohibit,
to disassemble


Prohibit,
to touch

### Compulsion


Compulsion,
generally


Compulsion,
connect to the
grounding
terminal

Compulsion,
install on a flat
surface


Compulsion,
disconnect the
power plug


Compulsion,
periodical
inspection

## Fundamental Matters of “WARNING!” and “CAUTION!”

# WARNING!

### Do not use this unit in an area where there is flammable or explosive gas

Never use this unit in an area where there is flammable or explosive gas.
This unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result. (Refer to page28 “List of Dangerous Substances”.)

### Always ground this unit

Always ground this unit on the power equipment side in order to avoid electrical shock due to a power surge.

### If a problem occurs

If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result. Never perform repair work yourself, since it is dangerous and not recommended.

### Do not use the power cord if it is bundled or tangled

Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

### Do not process, bend, wring, or stretch the power cord forcibly

Do not process, bend, wring, or stretch the power cord forcibly. Fire or electrical shock may result.

### Pay special attention to the measure for flammability and handling of flammable solvent

Leaving at the temperature higher than the room temperature may vaporize the flammable material (ethanol, etc.). There might be the case that some flammable liquid might be vaporized at the temperature lower than the room temperature. The result of such careless handling could cause the fire or explosion. Do provide the vaporization with enough during the operation.

### Do not disassemble or modify this unit

Do not disassemble or modify this unit. Fire or electrical shock or failure may be caused.

## Fundamental Matters of “WARNING!” and “CAUTION!”

### ⚠CAUTION!

| | |
|---|---|
| | **During a thunder storm** |
| During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused. | |

| | |
|---|---|
| | **Do not touch ice in the trap bath** |
| If touch the ice in the trap bath during operation or just after operation, the frostbite might be resulted from low temperature. Therefore, do not touch the ice in the trap bath. | |

| | |
|---|---|
| | **Do not touch the cooling fin with bare hands** |
| Do not touch the cooling fin with bare hands during maintenance, for the edge of the cooling fin is too sharp to cut your hand. | |

## Requirements for Installation

# WARNING!

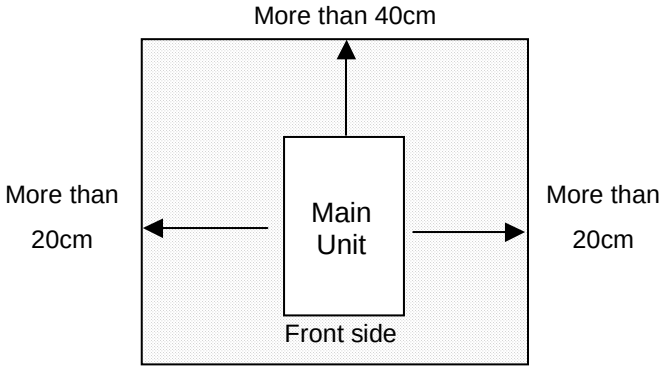
### 1. Always ground this unit

- Connect the power plug to a receptacle with grounding connectors.
- Do not forget to ground this unit, to protect you and the unit from electrical shock in case of power surge. Choose a receptacle with grounding connectors as often as possible.
- Do not connect the grounding wire to a gas pipe, or by means of a lightning rod or telephone line. A fire or electrical shock will occur.
- Do not use a branching receptacle, which may cause the heat generation.

### 2. Choose a proper place for installation

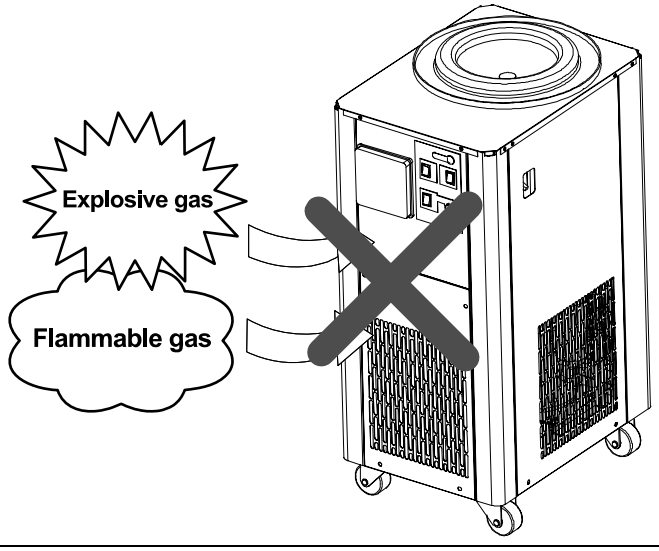
- Do not install this unit in a place where:
  - Rough or dirty surface.
  - Flammable gas or corrosive gas is generated.
  - Ambient temperature bellow 5℃ or above 30°C.
  - Ambient temperature fluctuates violently.
  - There is direct sunlight.
  - There is excessive humidity and dust.
  - There is a constant vibration.
  - Winds from the air conditioner, etc. hit the sample container directly.

- Install this unit on a stable place with the space as shown below.




### 3. Do not use this unit in an area where there is flammable or explosive gas

- Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned ON or OFF, and fire/explosion may result.
- To know about flammable or explosive gas refer to page28 “List of Dangerous Substances”.

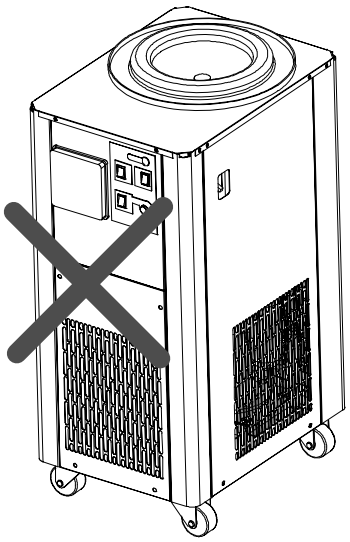


## Requirements for Installation

### 4. Do not modify

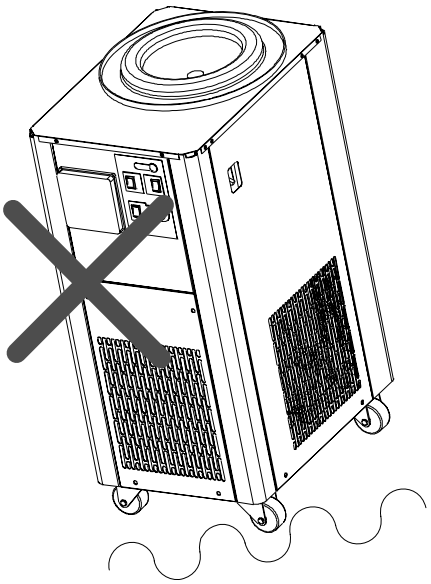
- Modification of this unit is strictly prohibited. This could cause a failure.

**Modification**



### 5. Do not topple or tilt this unit


- Set this unit to the flattest place. This unit incorporates the refrigerator. Do not topple or tilt it. Setting this unit on rough or slope place could cause the vibration or noise, or cause the unexpectible trouble or malfunction.



## Requirements for Installation

# ⚠CAUTION!

### 6. Use specified receptacle for power source

- Choose a correct power distribution board or receptacle that meets the unit's rated electric capacity.

**Electric capacity:** DC401: 100V AC, 50/60Hz, 6A (When using the pump, heater: 14A)
DC800: 100V AC, 50/60Hz, 11A (When using the pump, heater: 17A)

**NOTE)**

- ❖ There could be the case that the unit does not run even after turning ON the power. Inspect whether the voltage of the main power is lowered than the specified value, or whether other device(s) uses the same power line of this unit. If the phenomena might be found, change the power line of this unit to the other power line.
- ❖ Starburst connection with a branching receptacle or extended wiring with a cord reel lowers electrical power voltage, which may cause the degradation of refrigeration capability.

### 7. Before/after installing

- It may cause injure to a person if this unit falls down or moves by the earthquake and the impact. etc..To prevent, take measures that the unit cannot fall down, and not install to busy place.
- Though this unit has the air-cooled refrigerator, the device exhausts the heat. Do provide the vaporization with enough so as not to raise the ambient temperature caused by the exhaust of the heat, or install this unit with its air controlled completely. If the ambient temperature becomes high, the operation efficiency becomes worse, and could cause the malfunction of the device by high temperature and humidity.

### 8. Handling of power code

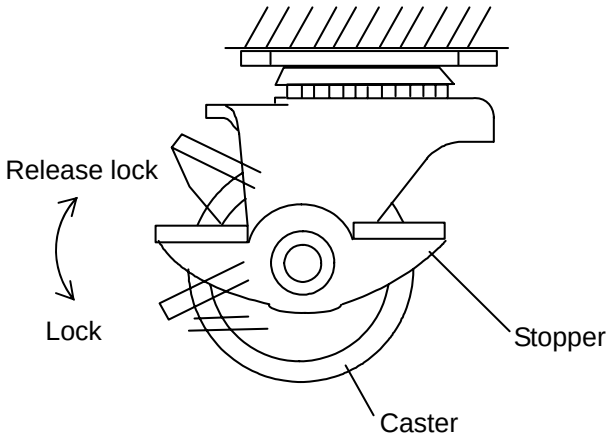
- Do not entangle the power cord. This will cause overheating and possibly a fire.
- Do not bend or twist the power cord, or apply excessive tension to it. This may cause a fire and electrical shock.
- Do not lay the power cord under a desk or chair, and do not allow it to be pinched in order to prevent it from being damaged and to avoid a fire or electrical shock.
- Keep the power cord away from any heating equipment such as a room heater. The cord's insulation may melt and cause a fire or electrical shock.
- If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.
- Connect the power plug to the receptacl which is supplied appropriate power and voltage.

## Installation Method

1. Unlock the stopper of the caster.
   Pulling up the lever of the stopper for caster releases the lock.
   (Only the two casters in front of the unit are attached the stopped.)
2. Move the device to the place to be installed.

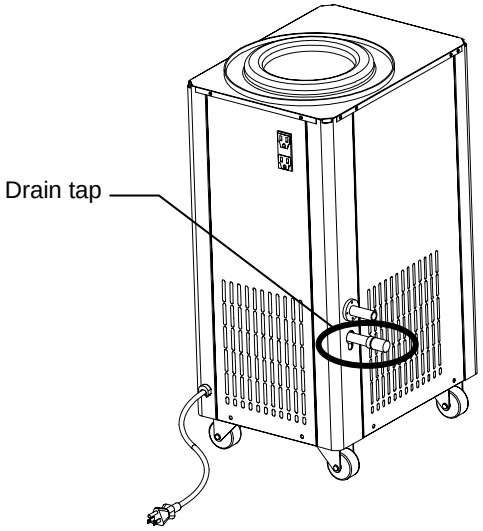
❖ If there is a step on the floor, the too strong impact is given to the caster, and could give the damage. In that case, move the device by lifting at the step.

3. When the installation place is determined, pull down the lever of the stopped for caster, and lock them.




4. Drain Tap Check

- Check whether the drain tap is detached or not.




5. Power Plug Connection
   Check the power of the earth leakage breaker is turned "OFF", and plug the power cord in the receptacle.

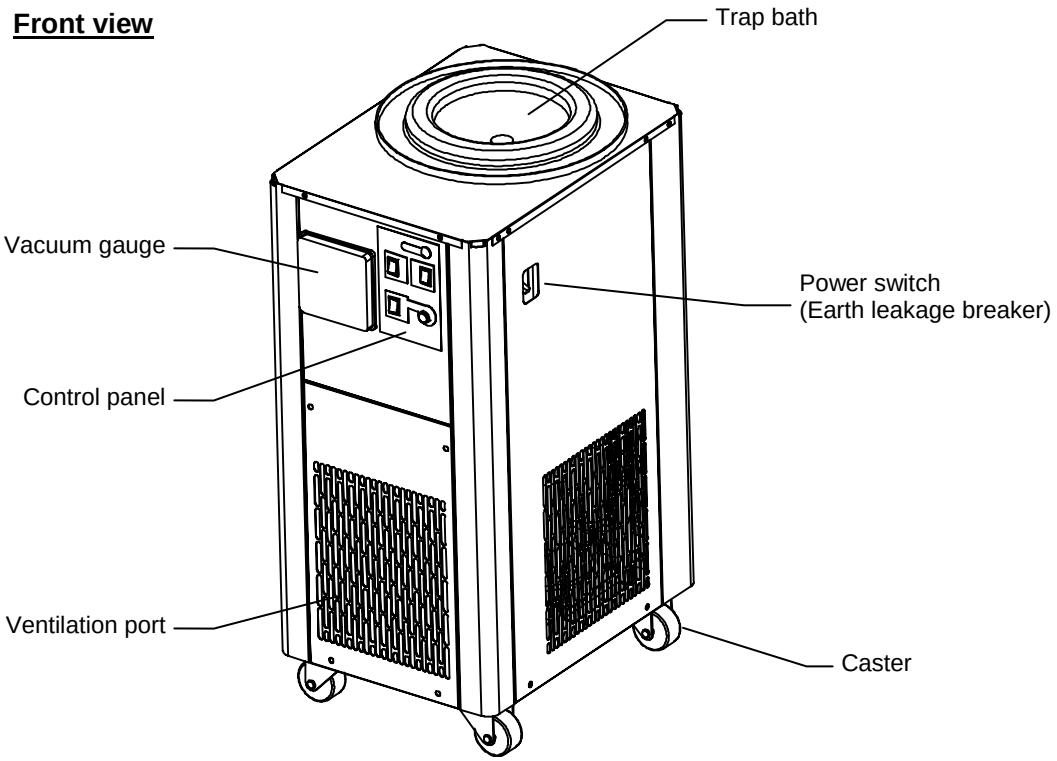
6. Prepare the vacuum pump that the exhaust amount is 50ℓ /min or more, and the ultimate pressure is $1.0X10^{-1}$Pa. This pump must also have a check-valve.

7. Install the vacuum valve to all of the valve mounting holes on the chamber.

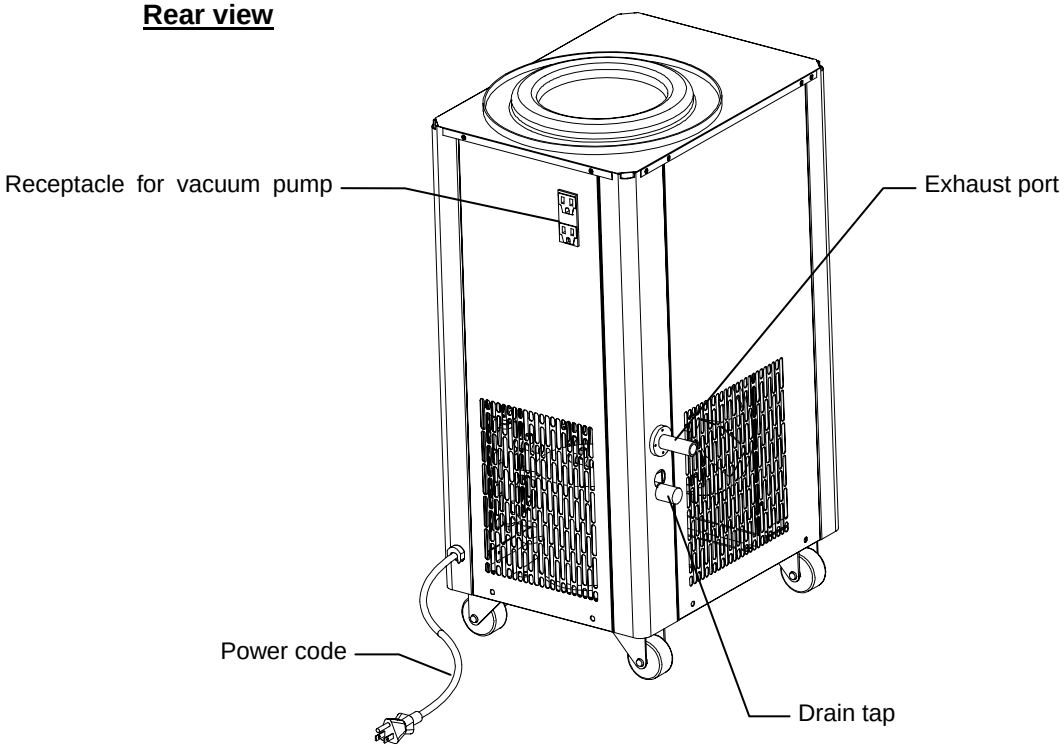
8. Prepare a spare freeze dryer that can retain temperature sufficiently lower than the eutectic (crystal) point of the sample.

## Main Unit

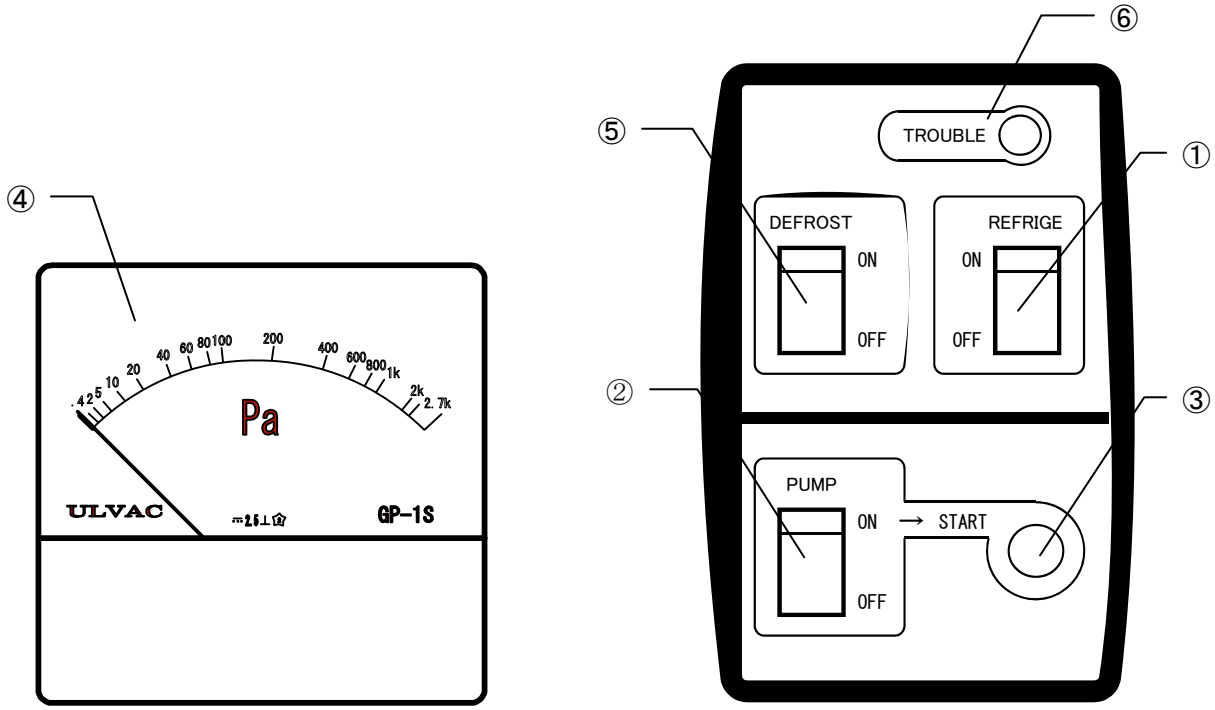
**Front view**




**Rear view**



## Control Panel




| Part Name | | Function |
|---|---|---|
| ① | Refrigerator Switch : | The refrigerator activates by pressing “ON” of this switch. |
| ② | Vacuum Pump Switch : | Enables pump operative. |
| ③ | Pump Start Switch : | Starts pump operation. |
| ④ | Pirani Gauge : | Displays degree of vacuum. |
| ⑤ | Defrost Switch : | Melts frozen ice in the trap bath. |
| ⑥ | Refrigerator Trouble Lamp : | This lamp lights on when the refrigerator is in overload. |

## Pre-freezing

At pre-freezing process, quickly and completely freeze to the inside at sufficient lower temperature than the eutectic (crystal) point* of the sample. Make the ice layer as thin as possible because thick ice layer might be easily melted by drying. Moreover, keep in mind that it becomes easy to receive the heat of external temperature, and it may cause melting-ice if it freezes widely on the container surface when the eutectic point of the sample is low.

Keep in mind that if there are too many throughput, or if the eutectic point of the sample is low, a melting-ice phenomenon arises and this may cause bumping or scattering of the sample.

When installing the container and starting freeze-drying after pre-freezing process, set 3-4 minutes' interval till next sample drying starts. (This differs depending on the container and sample types.)

Melting-ice may be caused if the interval is too short.

### Eutectic (Crystal) Point

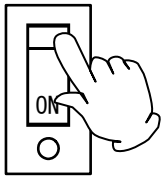
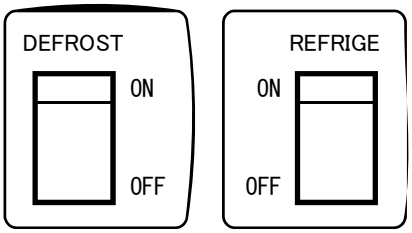
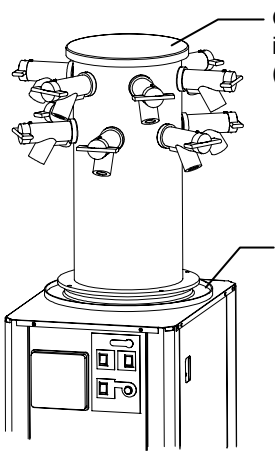
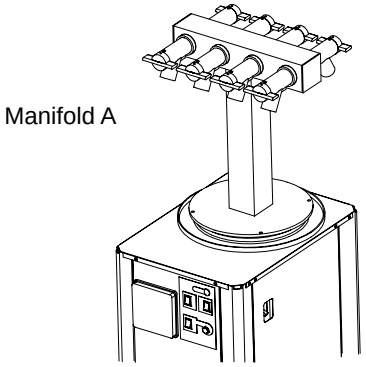
- Although pure water is frozen at 0 Celsius degree, solution is not frozen immediately below 0 Celsius degree, and the solution becomes soft ice condition because the frozen pure water and the concentration solution that is not frozen are mixed.
  Furthermore, if freezing is continued, all the solution will freeze uniformly under containing its solutes, and will become solid ice in whole.
  This temperature is called as the eutectic (crystal) point of the solution.

## Procedure of Operation

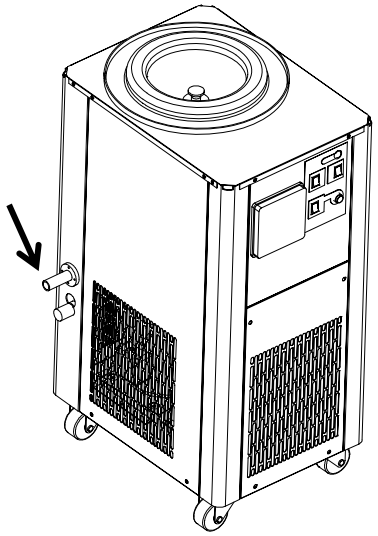
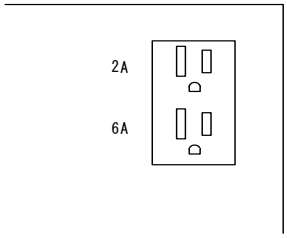
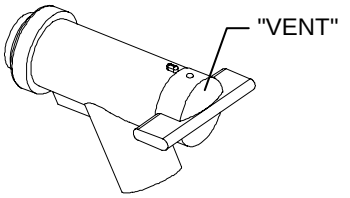
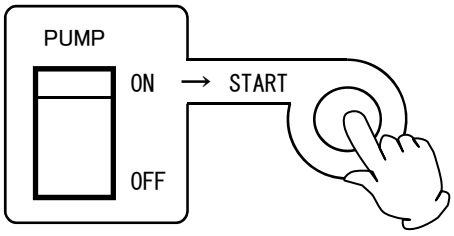
Before operation, prepare a drying chamber, a vacuum pump, a vacuum hose, a tandem tube, etc.

Vacuum Pump: PD52 (YAMATO Product)

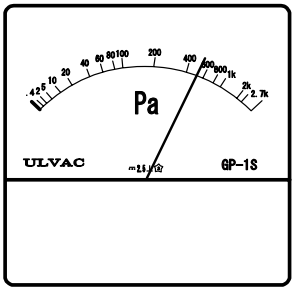
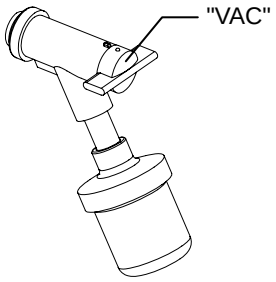
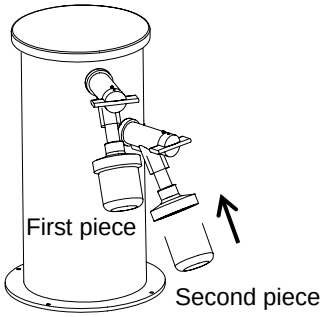
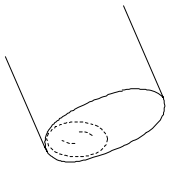
Exhaust amount: 50ℓ /min, Ultimate pressure: $6.7 \times 10^{-2}$Pa,
Diameter of inlet pipe: 18mm (or equivalent)

| | |
|---|---|
| **1. Supply the power**<br>  | • Turn "ON" the earth leakage breaker. |
| **2. Operation of the refrigerator**<br>  | • Turn "ON" the refrigerator switch. The refrigerator activates.<br>❖ There is the case that the starting sound of the refrigerator might become higher depending on the operation initial status and ambient temperature. However, this phenomenon is not abnormal. |
| **3. Installation of chamber**<br>  <br>  | 1. Make sure that there is no dust adhered to the trap packing or the chamber for flask installation.<br>❖ If any dent or dust is existed, degree of vacuum in the trap bath becomes low.<br>2. Gently put the chamber for flask installation etc. on trap packing.<br>❖ If it has not stuck to trap packing enough, it will become the cause of a vacuum leak.<br>❖ The same is said of the case of a manifold etc. |

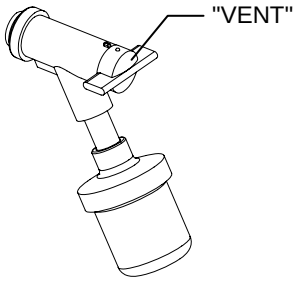
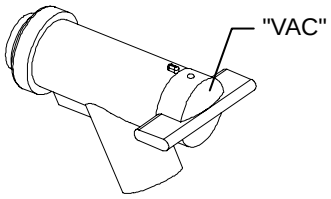
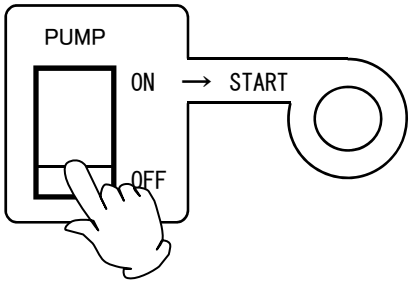
## Procedure of Operation

| | |
|---|---|
| **4. Connection with the vacuum pump**<br>  | • Connect the vacuum hose to the exhaust port on the left side.<br>(Exhaust port: outer shape 17 ㎜)<br>(Inside dia. of applicable vacuum hose: 12 X outer shape 30 ㎜)<br>Connect the opposite side of the vacuum hose to the inlet of the vacuum pump.<br>❖ The vacuum hose is not included.<br>❖ Seal strength shall be improved by applying the vacuum seal (silicon grease compound manufactured by TORAY, H.V.G, etc) inside of the vacuum hose at connecting. |
| **5. Connect the vacuum pump with the rear receptacle**<br>  | • Insert the power code of the vacuum pump into the 6A receptacle of the rear side.<br>• Keep the switch of the vacuum pump ON.<br>❖ Use the receptacle below 8A in total. |
| **6. Make all valves for "VENT" to turn up**<br>  | • Make all valves for “VENT” face to turn up, and close the path of the chamber side. |
| **7. Turn ON the vacuum pump switch. Then, press Start switch once**<br>  | • After the trap bath becomes cold enough (if the lowest temperature attainment time is over), start the vacuum pump operation.<br>• The Lowest temperature attainment time:<br>(Outside temperature: 20℃, no load)<br>**DC401: 50min., DC800: 80min.**<br>This is guideline. (Condensation might be caused at the bottom of the chamber.) |

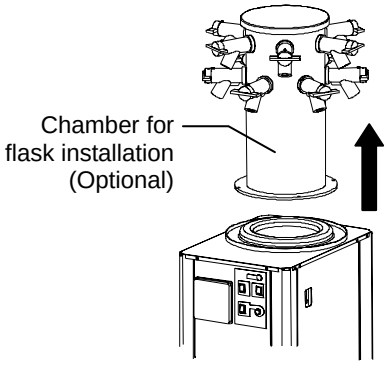
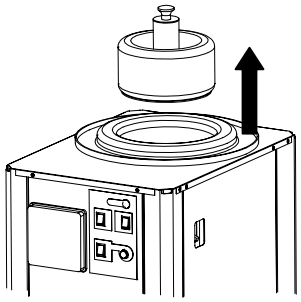
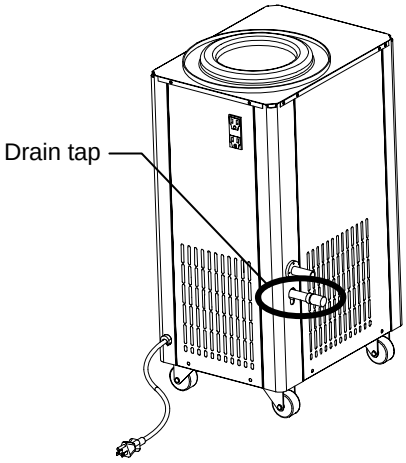
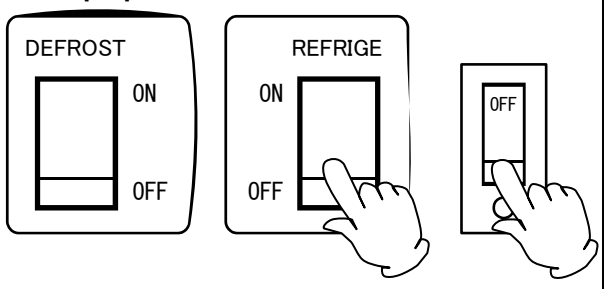
## Procedure of Operation

| | |
|---|---|
| **8. Check the vacuum gauge**<br>  | • Make sure that inside of the chamber attains vacuum with the vacuum gauge. (10Pa-20Pa) |
| **9. Install a sample container, then, turn up "VAC" face of the vacuum valve**<br>  | • Install the pre-frozen sample container to the vacuum valve, then, turn up "VAC" face of the vacuum valve, and open the path of the chamber side.<br>The sample container is decompressed and drying process starts. |
| **10. Container installation after second piece**<br>  | • When switching the vacuum valve setting from "VENT" to "VAC", inside of the chamber is pressurized. In case of multiple samples processing at one time, wait (approx. 3-4 min.) till the pressure is returned, and then, switch the next vacuum valve from "VENT" to "VAC".<br>❖ If installing multiple samples at one time, the degree of vacuum decreases and the pre-frozen sample is melted. This may cause the sample container broken. |
| **11. End of freeze-drying**<br>  | • Finish the freeze-drying process after checking the sample condition. |

## Procedure of Operation

| | |
|---|---|
| **12. After freeze-drying process finished, turn "VENT" face of the vacuum valve upward**<br>  | • Turn "VENT" face of the vacuum valve upward in order to return the inside of the sample container to normal atmosphere pressure. Then, remove the container. Keep the container securely by hands so as not to fall. |
| **13. Return inside of the chamber to normal atmosphere pressure**<br>  | • When drying of all samples are completed, and the container is removed, turn one of the vacuum valves gradually so that "VAC" face turns upward, and return the inside of the chamber to normal atmosphere pressure. |
| **14. Turn OFF the vacuum pump**<br>  | • Switch OFF the vacuum pump switch after the inside of the chamber is returned to normal atmosphere pressure. |

## Defrost Operation

| | |
|---|---|
| **1. Remove the chamber for flask installation**<br>  | • Remove the chamber for flask installation.<br>If ice coating is formed on trap bath wall, turn ON the defrost switch. |
| **2. Remove ice**<br>  | • If the ice of the ice coating side is melted by defrosting, take out the ice and turn OFF the defrost switch.<br>• Defrosting is auto-stopped.<br>DC401: Approx. 20min.<br>DC800: Approx. 45min.<br>❖ Switch OFF the defrost switch by manual. |
| **3. Drain water**<br>  | • Remove the drain tap, and drain the water remained in the bath with the drainage hose. |
| **4. Stop operation**<br>  | 1. Turn "OFF" the refrigerator switch.<br>2. Turn "OFF" the earth leakage breaker. |

# WARNING!

### If a problem occurs

If smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result. Never perform repair work yourself, since it is dangerous and not recommended.

### Measure for flammability and handling of flammable solvent

This unit is not designed as the explosion-proof construction. Pay special attention to the handling of the sample to be handled with this unit on the consumption with the explosive material, flammable material, and similar ones. The flammable material may be vaporized by leaving it at the temperature higher than room temperature, and could cause the fire or explosion. When handling such material, provide ventilation with enough before the operation. (Refer to page 28 “List of Dangerous Substances”.)

# CAUTION!

### Maximum trap capacity

The max. trap capacity of the bath in this DC401/800 is approx. 0.6ℓ /1.0ℓ . Excessive amount shall cause significant unit performance degradation.

### Do not step on this unit

Do not step on this unit. It will cause injury if this unit fall down or break.

### Do not put anything on this unit

Do not put anything on this unit. It will cause injury if fall.

### During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

### Countermeasure for stop operation during night or long-term stop

In case of stopping operation during night or long-term, toggle the power switch to "OFF".

### Power supply voltage

The power supply voltage must be within +/-10% of the rated voltage.

### Do not use solutions

The rubber packing of the unit and U-ring on the chamber cap for the vacuum valve and the flask are made of chloroprene rubber. Keep in mind that they may be immersed by acid, halogen, aromatic series, ester, and the oxo solvent.

### Restarting

Stop operation and wait over 5 minutes, and then, restart operation.

### Upper limit of inside bath temperature

Do not operate continuously when the temperature of the bath is higher than -20℃.

### Vacuum grease application

If there is any dirt adhered to each connecting part of the vacuum system, the degree of vacuum might be degreased. In this case, wipe the dirt off, and then, apply the vacuum grease.
In case that the stem tube of the vacuum valve is hard to rotate, remove the stem tube once and apply the vacuum grease, and then install the stem tube again.

### When returning to normal atmosphere pressure

Before turning OFF the vacuum pump, make sure that inside of the chamber is returned to normal atmosphere pressure after operation finished. If turning OFF the vacuum pump under vacuum condition, the oil inside of the pump might be flown back in the chamber. (Refer to “12. After freeze-drying process finished, turn “VENT” face of the vacuum valve upward” in P.15 for the procedure of vacuum relief.)

### Dimension of ampoule

Use an ampoule that diameter of the connecting hole is approx. 7-9mm since the inner diameter of the ampoule adapter is 7mm.

### Eggplant flask

Use TS29 for grinding eggplant flask.

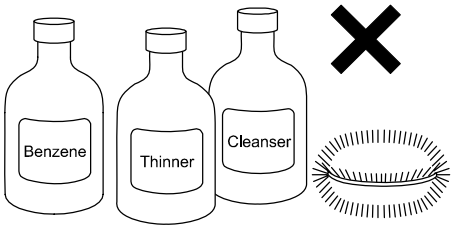
## Daily Inspection and Maintenance

### ⚠WARNING!

- Disconnect the power cable from the power source when doing an inspection or maintenance unless needed.
- Perform the daily inspection and maintenance after returning the temperature of this unit to the normal one.
- Do not disassemble this unit.
- Do not touch the cooling fin with bare hands.

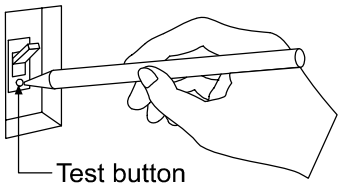
### ⚠CAUTION!

- Use a well-drained soft cloth to wipe dirt on this unit. Do not use benzene, thinner or cleanser for wiping. Do not scrub this unit. Deformation, deterioration or color change may result in.




### Monthly maintenance

- Check the earth leakage breaker function.
  1. Connect the power cord.
  2. Turn the breaker on.
  3. Push the red test switch by a ballpoint pen etc.
  4. If there is no problem, the earth leakage breaker will be turned off.



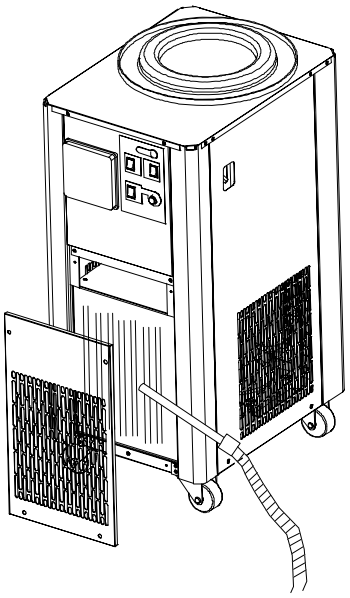

### Cleaning of cooling fin

- Clogging of the cooling fin could cause the deterioration of the cooling performance, and also cause the malfunction of the refrigerator. The clogged status differs depending on the surrounding condition or operation time. Clean the cooling fin periodically.

❖ Loosen the mounting screws (4 screws) of the ventilation port cover, remove the cover of the ventilation port, and remove the dust attached to the surface of the cover using the vacuum cleaner.

❖ After cleaning the cooling fin, attach it in inverse procedure.

⚠ Take care not to crush the fin during cleaning.



**For any questions, contact the dealer who you purchased this unit from, or the nearest sales division in our company.**

## When not using this unit for long term / When disposing

### ⚠CAUTION!

**When not using this unit for long term…**

- Turn off the power and disconnect the power cord.

### ⚠WARNING!

**When disposing…**

- Keep out of reach of children.

***Environmental protection should be considered***

We request you to disassemble this unit as possible and recycle the reusable parts considering to the environmental protection. The feature components of this unit and materials used are listed below.

| Component Name | Material |
|---|---|
| **Parts of Main Unit** | |
| Casing | Bonderizing steel plate baked with melamine resin coating |
| Inner bath, Cover | Stainless steel SUS304, Acryl |
| Production plates | Polyester (PET) resin film |
| Corner | Alkylbenzenesulfied (ABS) resin |
| Trap packing | Silicon rubber |
| **Electrical Parts** | |
| Switches, Relays | Composites with resin and others |
| Power cord & wiring materials and others | Composites with synthetic rubber, copper, nickel and others |
| **Parts of Refrigeration System** | |
| Refrigerator unit | Iron, Synthetic oil and others |
| Cooling fin | Aluminum, Copper |
| **Parts of Piping** | |
| Drain hose | Natural rubber |
| Drain tap | Polyacetal resin |
| Drain tap holder | Bonderizing steel plate baked with melamine resin coating |
| Pipe cover | Polyurethane sponge |
| Pipe | Copper |
| **Sealed Cooling Medium for Refrigerator** | |

| | | | | |
|---|---|---|---|---|
| Cooling medium | | DC401 | DC800 | Ask the specialist for the dealing of cooling medium. |
| | R404A | 225g | 450g | |
| | R23 | - | 53ℓ | |

## Trouble Shooting

| Condition | Possible Causes |
|---|---|
| The device does not start when turning on the power switch. | • Power plug is not connected to the receptacle correctly.<br>• Power failure.<br>• Earth leakage breaker is turned to “OFF” |
| Not fallen the temperature. | • The cooling fin is clogged.<br>• The cooling sample is overheated.<br>• The ambient temperature is exceeding 30℃.<br>• The peripheral of the ventilating port is shut down. |

## In lighting on the lamp,

| Error Sign | Cause | Remedy |
|---|---|---|
| Turned on the refrigerator trouble lamp | Overload of refrigerator | • Immediately turn off the power, remove the cause of the error referring to the "Trouble Shooting" (Not fallen the temperature) above, and turn on the power again after passing the certain time.<br>• In case of lighting the alarm lamp again, make a call to the service office. |

**In the case if the error other than listed above occurred, turn off the power switch and primary power source immediately. Contact the shop of your purchase or nearest Yamato Scientific Service Office.**

## In Case of Request for Repair

If the failure occurs, stop the operation, turn OFF the power switch, and unplug the power plug. Please contact the sales agency that this unit was purchased, or the Yamato Scientific's sales office.

**< Check following items before contact >**

- ◆ Model Name of Product
- ◆ Production Number
- ◆ Purchase Date

} See the production plate attached to this unit.

- ◆ About Trouble (in detail as possible)

## Minimum Retention Period of Performance Parts for Repair

The minimum retention period of performance parts for repair of this unit is 7 years after discontinuance of this unit.
The "performance part for repair" is the part that is required to maintain this unit.

## Main Unit

| Model | | DC401 | DC800 |
|---|---|---|---|
| Method | | Storage water heater body cooling method | |
| Performance | Dehumidifying capacity | Max. 0.6kg | Max. 1.0kg |
| | Lowest reached temperature ※ | -45℃ | -80℃ |
| | Time required to reach lowest temperature ※ | 50min. (20℃ to -45℃) | 80min. (20℃ to -80℃) |
| Configuration | Refrigerator | Air cooling, 400W | Air cooling, 350W×2 |
| | Cooling medium | R404a | R404a/R23 |
| | Pressure indication gauge | Pirani gauge | |
| | Exhaust port | ϕ17mm | |
| | Chamber material | SUS304, Cylindrical | |
| | Dimensions of chamber | ϕ153×H235mm | |
| | Capacity | Approx. 4L | |
| | Usable ambient temperature | 5 to 30℃ | |
| Standards | External dimensions | W340×D450×H720 mm | W405×D455×H850 mm |
| | Weight | Approx. 43Kg | Approx. 54Kg |
| | Power supply | 100V AC, 50/60Hz, 6A | 100V AC, 50/60Hz, 11A |
| Accessories | | Vacuum silicon grease (TORAY H.V.G), Vacuum hose (ϕ12×ϕ30×1.5m), Instruction manual for main unit, Instruction manual for Pirani gauge | |

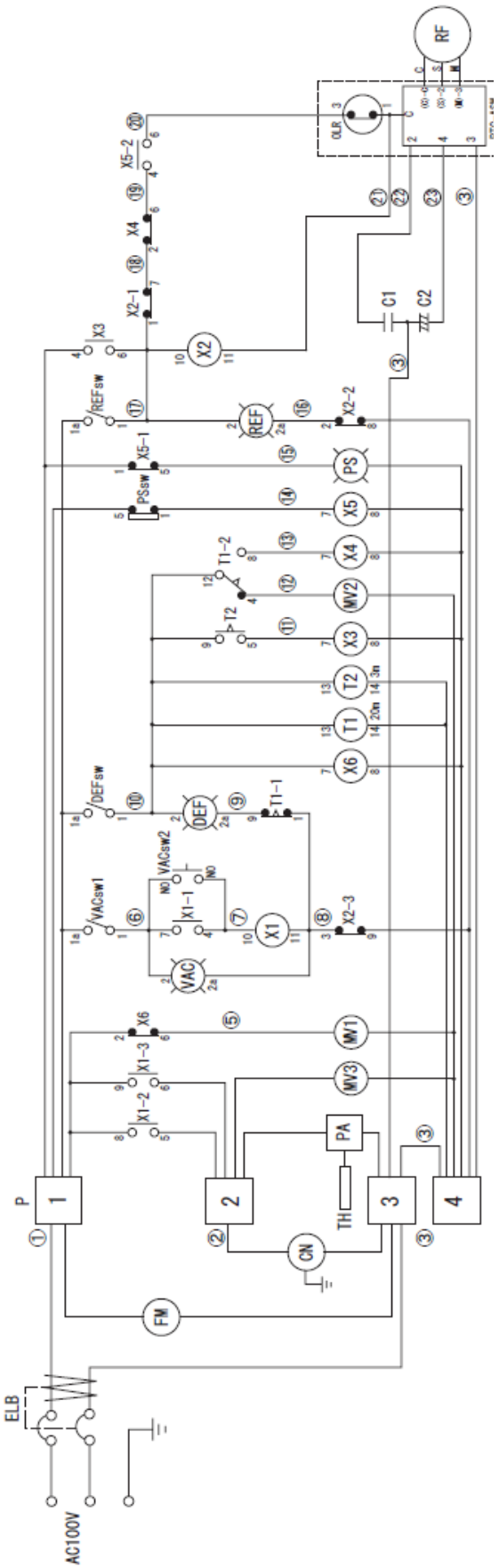
※**:** Operation conditions: Outside air temperature = 20℃, no load

## Optional Accessories

| Name | Specification | | Product code |
|---|---|---|---|
| Chamber for flask installation | Mounting cock | Inner dia.: 18.5mm | 212560 |
| | Mounting cock pitch | 96mm | |
| | Number of port | 12 | |
| | Dimensions | ϕ195×H303 mm | |
| Manifold A | Mounting cock | Inner dia.: 18.5mm | 212561 |
| | Mounting cock pitch | 80mm | |
| | Number of port | 8 | |
| | Dimensions | W304×D60×H263 mm | |
| Manifold B | Mounting cock | Inner dia.: 18.5mm | 212562 |
| | Mounting cock pitch | 80mm | |
| | Number of port | 16 | |
| | Dimensions | W624×D60×H263 mm | |
| Dry chamber | Number of shelves | 1 | 212563 |
| | 60mm dish, Number of falls | 7 | |
| | Temperature adjustment | 30℃±2℃ ※ | |
| | Dimensions | ϕ252×H240 mm | |
| Stopper type dry chamber | Number of shelves | 1 | 212564 |
| | 60mm dish, Number of falls | 7 | |
| | Temperature adjustment | 30℃±2℃ ※ | |
| | Dimensions | ϕ252×H425 mm | |
| Dry flask | 120mℓ ・5 pcs. | | 212820 |
| | 250mℓ ・5 pcs. | | 212821 |
| Dry flask cap (with glass joint) | Straight・5 pcs. | | 212570 |
| | 45° bent・5 pcs. | | 212571 |
| Serum bottle (Vial bottle) | 50mℓ ・10 pcs. | | 212814 |
| | 30mℓ ・10 pcs. | | 212815 |
| | 10mℓ ・10 pcs. | | 212816 |
| Adapter for ampoule | Single・5 pcs. | | 212572 |
| | Double・5 pcs. | | 212573 |
| | Triple・5 pcs. | | 212574 |
| Adapter for test tube (with glass joint) | Straight | | 212590 |
| | 45° bent | | 212591 |
| Adapter for egg plant flask (female) | TS29 grinding or equivalent | | 212569 |
| Adapter for egg plant flask (male) | TS29 grinding | | 212597 |
| Glass joint | Straight | | 212598 |
| | 45° bent | | 212599 |
| Micro tube holder | 1.5mℓ ×24 pcs. mountable | | 212580 |

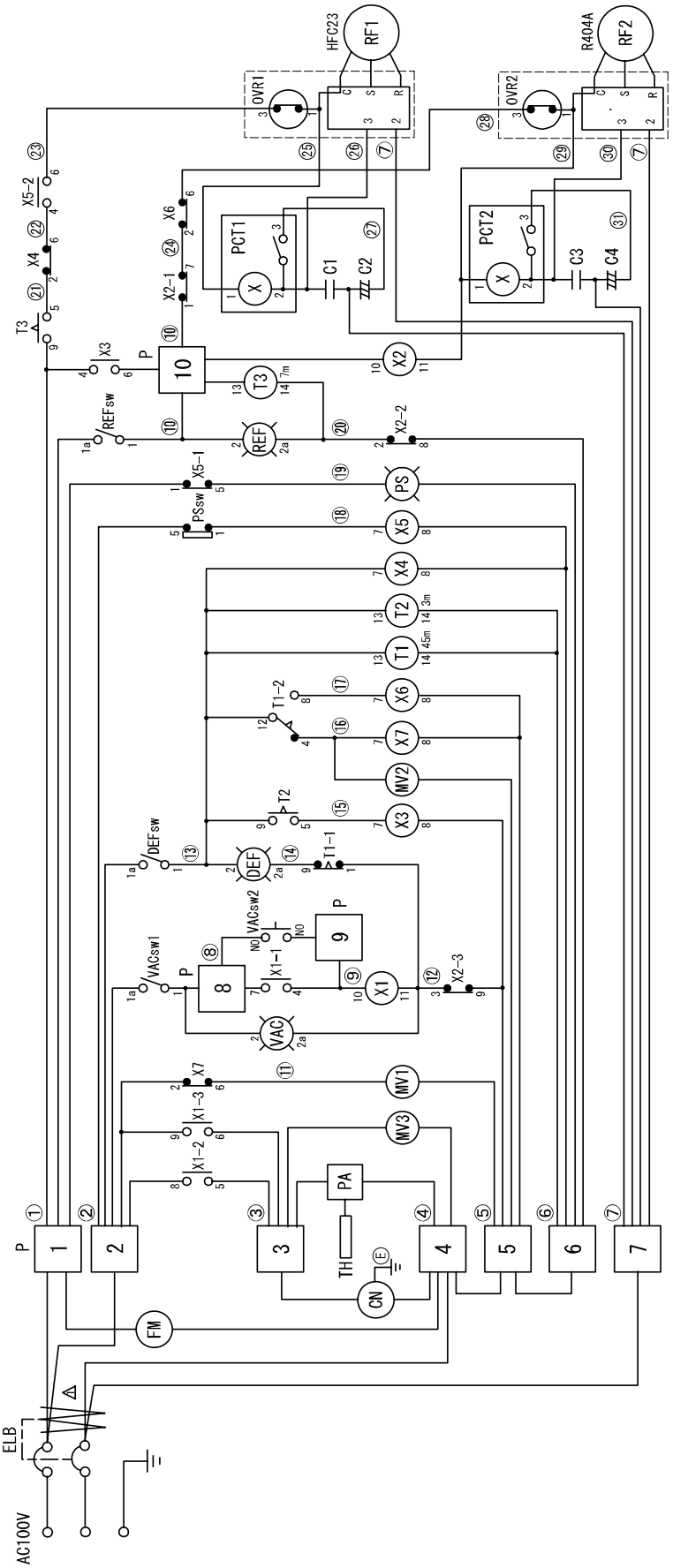
※: Conditions: Room temperature = 20℃, no load

## DC401




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ELB | Earth leakage breaker | X3 | Relay (Refrigerator) | PAsw | Switch (Vacuum gauge) | CN | Receptacle |
| P | Terminal block | X4 | Relay (Refrigerator stop) | PSsw | Pressure switch | T1 | Timer (Auto defrost) |
| FM | Fan motor (Refrigerator) | X5 | Relay (Pressure error) | VAC | Lamp (VACsw built-in) | T2 | Timer |
| MV1 | Solenoid valve (Refrigerator) | X6 | Relay (Solenoid valve) | DEF | Lamp (DEFsw built-in) | PTC-ASM | Start relay |
| Mv2 | Solenoid valve (Defrost) | VACsw1 | Switch (Pump) | REF | Lamp (REFsw built-in) | OVR | Overload relay |
| Mv3 | Solenoid valve (VAC) | VACsw2 | Switch (Pump start) | PS | Lamp (Pressure) | C1 | Operation condenser |
| X1 | Relay (VAC) | DEFsw | Switch (Defrost) | PA | Pirani gauge | C2 | Start condenser |
| X2 | Relay (Refrigerator, Pump stop) | REFsw | Switch (Refrigerator) | TH | Sensor (Vacuum gauge) | RF | Refrigerator |

## DC800




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ELB | Earth leakage breaker | X4 | Relay (Refrigerator stop) | VAC | Lamp (VACsw built-in) | T3 | Timer (Refrigerator delay) |
| P | Terminal block | X5 | Relay (Pressure error) | DEF | Lamp (DEFsw built-in) | PTC | Start relay |
| FM | Fan motor (Refrigerator) | X6 | Relay (Solenoid valve) | REF | Lamp (REFsw built-in) | OVR1, 2 | Overload relay |
| MV1 | Solenoid valve (Refrigerator) | VACsw1 | Switch (Pump) | PS | Lamp (Pressure) | C1, 3 | Operation condenser |
| Mv2 | Solenoid valve (Defrost) | VACsw2 | Switch (Pump start) | PA | Pirani gauge | C2, 4 | Start condenser |
| Mv3 | Solenoid valve (VAC) | DEFsw | Switch (Defrost) | TH | Sensor (Vacuum gauge) | RF1, 2 | Refrigerator |
| X1 | Relay (VAC) | REFsw | Switch (Refrigerator) | CN | Receptacle | | |
| X2 | Relay (Refrigerator, Pump stop) | Pasw | Switch (Vacuum gauge) | T1 | Timer (Auto defrost) | | |
| X3 | Relay (Refrigerator) | PSsw | Pressure switch | T2 | Timer | | |

# Replacement Parts Table

## Common Parts

| Symbol | Part Name | Specification | Manufacturer | Code No. |
|---|---|---|---|---|
| MV1 | Solenoid valve (Refrigerator) | NEV-603DXF | Saginomiya | 3-02-006-0004 |
| MV2 | Solenoid valve (Defrost) | SEV-502DXF | Saginomiya | 3-02-006-0003 |
| MV3 | Solenoid valve (VAC) | AG33022 AC100V | CKD | 3-20-001-0018 |
| ELB | Earth leakage breaker | NV-L22GR 20A | Mitsubisi | LT00029776 |
| X3, 4, 6 | Relay | LY1F AC100V | OMRON | LT-00000992 |
| X1, 2 | Relay | LY3F AC100V | OMRON | LT00000993 |
| T2, 3 | Timer (Auto defrost) | ADX11134 | Matsushita | 2-05-000-0053 |
| T1 | Timer | ADX11184 | Matsushita | LT00000994 |
| DEFsw<br>PEFsw | Switch | CW-SB21NMKZMEF | Nihon Kaiheiki | 2-55-000-0011 |
| VACsw2 | Switch | CW-SB21NYKZYEF | Nihon Kaiheiki | 2-55-000-0017 |
| VACsw1 | Switch | A3CT-90A0-Y | OMRON | LT00000995 |
| PS | Lamp (Pressure) | BN5665L AC100V | Satoh Parts | LT00021961 |
| CN | Receptacle | AC-R02MB12 | ECHO | LT00033205 |
| PA | Pirani gauge | GP-1 (WP-02 with sensor) | ULVAC | LT00001004 |
| PSsw | Pressure switch | VHP-F | Fuji Kohki | 3-18-000-0006 |

## For DC401

| Symbol | Part Name | Specification | Manufacturer | Code No. |
|---|---|---|---|---|
| RF | Compressor | RL4075HA | Hitachi | LT00028782 |
| FM | Fan motor | SE4-C041NP | Sanyo C&C | 3-01-006-0006 |
| P | Terminal block | MKH-250ABC-4P | Terminal | LT00035672 |
| X5 | Relay | LY2F AC100V | OMRON | 2-05-000-0035 |

## For DC800

| Symbol | Part Name | Specification | Manufacturer | Code No. |
|---|---|---|---|---|
| RF1 | Compressor | C-2SN350LOU | Sanyo C&C | 3-01-006-0005 |
| RF2 | Compressor | C-2SN350LOU (oil less) | Sanyo C&C | 3-01-006-0008 |
| FM | Fan motor | SE4-D11LP | Sanyo C&C | 3-01-006-0014 |
| P | Terminal block | MKH-250ABC-10P | Terminal | LT00035676 |
| X5 | Relay | LY3F AC100V | OMRON | LT00000993 |

## List of Dangerous Substances

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit.

### EXPLOSIVE

| | |
|---|---|
| **EXPLOSIVE:** | Ethylene glycol dinitrate (nitro glycol), Glycerin trinitrate (nitroglycerine), Cellulose nitrate (nitrocellulose), and other explosive nitrate esters |
| | Trinitrobenzene, Trinitrotoluene, Trinitrophenol (picric acid), and other explosive nitro compounds |
| | Acetyl hidroperoxide (peracetic acid), Methyl ethyl ketone peroxide, Benzyl peroxide, and other organic peroxides |

### FLAMMABLE

| | |
|---|---|
| **IGNITING:** | Lithium (metal), Potassium (metal), Sodium (metal), Yellow phosphorus, Phosphorus sulfide, Red phosphorus, Celluloid compounds, Calcium carbide, Lime phosphate, Magnesium (powder), Aluminum (powder), Powder of metals other than magnesium and aluminum, Sodium hydrosulfite |
| **OXIDIZING:** | Potassium chlorate, Sodium chlorate, Ammonium chlorate, and other chlorate |
| | Potassium perchlorate, Sodium perchlorate, Ammonium perchlorate, and other perchlorate |
| | Potassium peroxide, Sodium peroxide, Barium peroxide, and other inorganic peroxide |
| | Potassium nitrate, Sodium nitrate, Ammonium nitrate, and other nitrate |
| | Sodium chlorite and other chlorites |
| | Calcium hypochlorite and other hypochlorites |
| **INFLAMMABLE LIQUID:** | Ethyl ether, Gasoline, Acetaldehyde, Propylene chloride, Carbon disulfide, and other flammable substances having a flash point of lower than -30℃ |
| | Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone, and other flammable substances having a flash point of -30℃ or higher but lower than 0℃ |
| | Methanol, Ethanol, Xylene, Pentyl acetate (amyl acetate), and other flammable substances having a flash point of 0℃ or higher but lower than 30℃ |
| | Kerosene, Light oil (gas oil), Oil of turpentine, Isopentyl alcohol (isoamyl alcohol), Acetic acid, and other flammable substances having a flash point of 30℃ or higher but lower than 65℃ |
| **FLAMMABLE GAS:** | Hydrogen, Acetylene, Ethylene, Methane, Propane, Butane, and other flammable substances which assume a gaseous state at 15℃ and 1 atm |

(Source: Appendix Table 1 of Article 6 of the Industrial Safety and Health Order in Japan)

## Responsibility

Please follow the instructions in this document when using this unit. Yamato Scientific has no responsibility for the accidents or breakdown of device if it is used with a failure to comply.
Never conduct what this document forbids. Unexpected accidents or breakdown may result in.

## Note

- The contents of this document may be changed in future without notice.
- Any books with missing pages or disorderly binding may be replaced.

Instruction Manual for

**Freeze Dryer**
**Model DC401/800**

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