



Freeze Dryer

DC801

Instruction Manual

- Fourth Edition -

- Thank you for choosing the DC801 freeze dryer from Yamato Scientific Co., Ltd.
- For proper equipment operation, please read this instruction manual thoroughly 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.

Yamato Scientific Co. Ltd.

Printed on recycled paper

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1. SAFETY PRECAUTIONS

Explanation of Safety 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. (Note 1) Serious injury is defined as bodily wounds,

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



General
Warning



Danger!: High
Voltage



Danger!:
Extremely Hot



Danger!: Moving
Parts



Danger!: Blast
Hazard

Caution



General Caution



Caution:
Shock Hazard!



Caution: Burn
Hazard!



Caution: Do Not
Heat Without
Water!



Caution: May
Leak Water!



Caution: Water
Only



Caution: Toxic
Chemicals

Restriction



General
Restriction



No Open Flame



Do Not
Disassemble



Do Not Touch

Action



General Action
Required



Connect Ground
Wire



Level Installation
Required



Disconnect Power



Inspect Regularly

1. SAFETY PRECAUTIONS

Warnings & Cautions

WARNING!



Never operate equipment near combustible gases/fumes.

Do not install or operate this unit near flammable or explosive gases/fumes. Unit is NOT fire or blast resistant. Negligent use could cause fire/explosion. Refer to "List of Hazardous Substances" (P.29).



Always ground equipment.

Always ground this unit properly to avoid electric shock.



DO NOT operate equipment when abnormalities are detected.

If smoke or unusual odors begin emitting from unit, or if any other abnormalities are detected, terminate operation immediately, turn off main power switch (Earth Leakage Breaker - "ELB") and disconnect power cable. Continued operation under such conditions may result in fire or electric shock.



DO NOT operate with bundled or tangled power cable.

Operating unit with the power cable bundled or otherwise tangled, may cause power cable to overheat and/or catch fire.



DO NOT damage power cable.

Damaging the power cable by forcibly bending, pulling or twisting may cause fire or electric shock to the operator.



DO NOT handle flammable substances without proper ventilation.

Be sure there is adequate ventilation when working with certain flammable substances (such as ethanol, etc.), which evaporate quickly at or below room temperature, and emit flammable fumes. Insufficient ventilation may cause a fire or explosion. Refer to "List of Hazardous Substances" (P.29).



DO NOT disassemble or modify equipment.

Attempting to dismantle or modify unit in any way, may cause malfunction, fire or electric shock.



Keep unit upright.

Never attempt to turn or place unit on its side while moving or transporting. Damage to refrigeration system may result. If briefly tilting unit to one side or the other is unavoidable during transport, refrain from turning power on for at least 24 hours after positioning unit upright.

1. SAFETY PRECAUTIONS

Warnings & Cautions

CAUTION!

 **DO NOT operate equipment during thunderstorms.**

In the event of a thunderstorm, terminate operation and turn off main power switch (ELB) immediately. A direct lightning strike may cause damage to equipment, or result in fire or electric shock.

 **DO NOT touch condensate in cold trap.**

Condensate and inner surfaces of cold trap may become extremely cold during operation or right after operation. Avoid contact with bare hands/fingers in order to prevent severe frostbite.

 **DO NOT touch cooling fins.**

Edges of cooling fins are very sharp. Do not contact with bare hands or skin. Laceration injuries may result.

2. PRE-OPERATION PROCEDURES

Installation Precautions & Preparations

WARNING!

1. Choose an appropriate installation site.

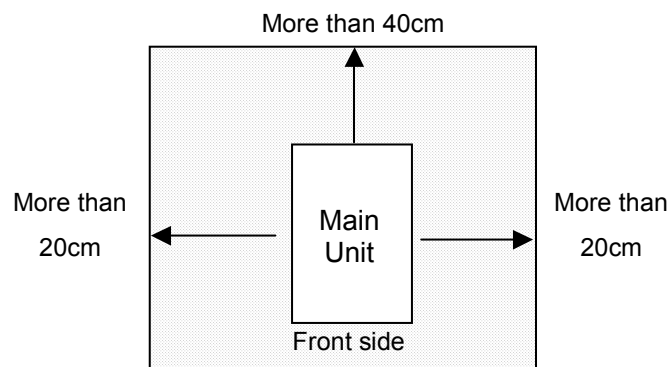


● Do not install unit:

- where installation surface is not completely level, not even or not clean.
- in excessively humid or dusty locations.
- where power supply is erratic.
- where ventilation is not sufficient
- where flammable or corrosive gases/fumes will be generated.
- where external temperature will exceed 30°C, will fall below 5°C or will fluctuate.
- where there is constant vibration.
- in direct sunlight or outdoors



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



2. Install unit in a safe, well-ventilated area.



In the event of an earthquake or other unforeseen incident, equipment may unexpectedly shift or fall, causing injury. Taking preventative steps to install unit in a safe location, away from room access doors and out of other danger is strongly recommended.

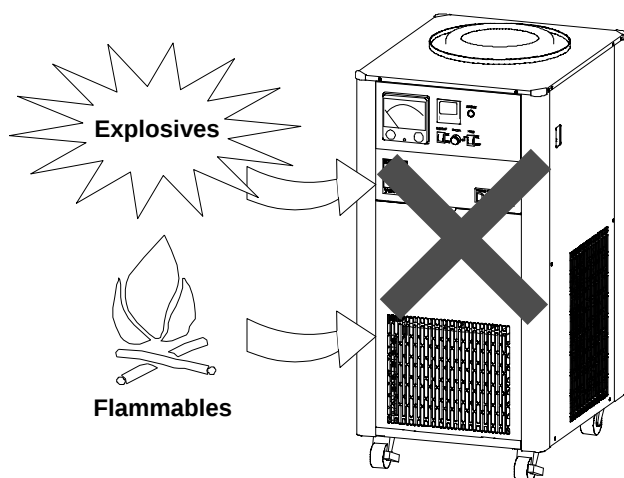
This unit is equipped with an air-cooled refrigerator. Install unit in a well-ventilated or air-conditioned place so that unit is allowed to sufficiently diffuse heat. Failure to do so may cause ambient temperature to rise, resulting in possible degraded cooling performance, overload on the refrigerator, or equipment malfunction.

3. Install in a location free of flammables and explosives.



● Never install near flammables or explosives. This unit is NOT fire or blast resistant. Simply switching the main power switch (ELB) "ON" or "OFF" can produce a spark, which can relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes.

- Refer to "List of Hazardous Substances" (P.29).



2. PRE-OPERATION PROCEDURES

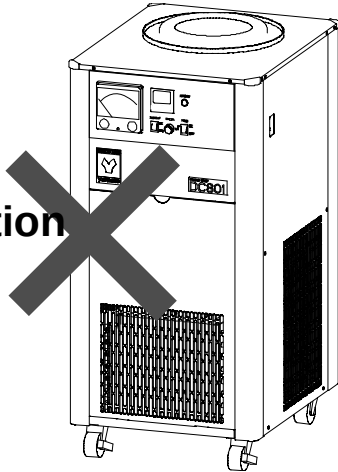
Installation Precautions & Preparations

4. Never disassemble or modify.



- Attempting to disassemble or modify this unit in any way may result in malfunction, fire or electric shock.

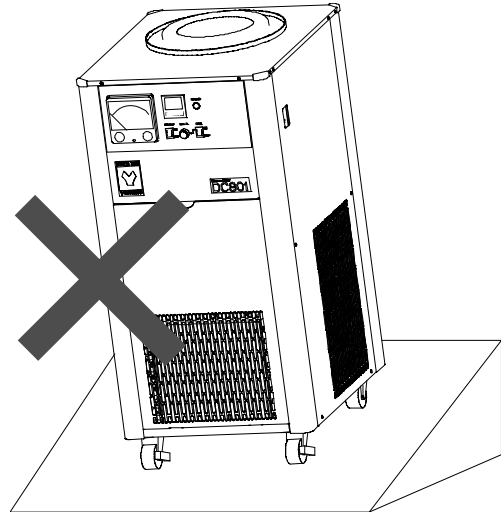
Modification



5. Install on a level surface.



- Install unit on a level and even surface. Failure to do so may result in abnormal vibrations or noise and damage to the refrigeration system.



Approximate unit weight is 65kg. Handle with care. Transport and installation should always be performed by two or more people.

6. Ensure adequate amount of unit ventilation.



- Do not operate unit with ventilating openings (front, side, rear) obstructed. Doing so may cause excessive temperatures inside unit, resulting in degraded performance, malfunction or fire.

7. Install in a dry location.



- Install unit where it will be free from fluid spray and other moisture. Failure to do so may result in malfunction, electrical shock and/or fire.

8. Connect to a proper power supply.



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

**Electrical
requirements:
(NOTE)**

AC100V±5% 7/6.5A 50/60Hz (15/14.5A when optional pump & heater is used)

- Check the line voltage on outlet or terminal to be used and properly evaluate whether to utilize a line being shared by other equipment. If unit is not activated by turning on the main power switch (ELB), take an appropriate course of action, such as connecting unit to a dedicated power source.
- If multiple power cables are connected to a single outlet, input voltage to unit may drop, causing degraded cooling and temperature control performance.

2. PRE-OPERATION PROCEDURE

Installation Precautions & Preparations

CAUTION!

9. Handle power cable with care.



- Never operate unit with power cable bundled or tangled; and do not modify, bend, forcibly twist or pull on power cable. Doing so may cause fire and/or electrical shock.
- Do not risk damage to power cable by positioning it under desks or chairs, or by pinching it between objects. Doing so may cause fire and/or electrical shock.
- 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 main power switch (ELB) immediately and disconnect from facility terminal or outlet, if power cable becomes partially severed or damaged in any way. Failure to do so may result in fire or electric shock.
Contact a local dealer or Yamato sales office for information about replacing power cable if it is damaged.
- Always connect power cable to appropriate facility outlet or terminal.

10. Equipment **MUST** always be grounded properly.



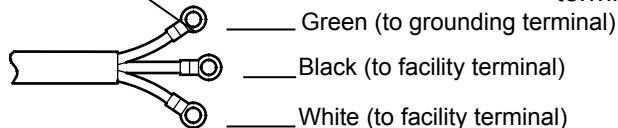
Where no grounding terminal is provided, contact a local dealer, electrician or Yamato sales office for location-specific electrical requirements.



- Connect terminals securely to facility terminal or to an appropriate connector.

Plugs and connectors are not included with this unit. Ground unit properly to facility outlet or terminal as required.

3(three) Round Terminal for M5 screws



Never connect ground wire to gas lines, water pipes, telephone grounding lines or lightening rods. Doing so may result in malfunction, fire or electrical shock.

11. Observe wire color designation. See table below.



Confirm that the facility main breaker is OFF before connecting the round terminals from the power cable. No power plugs or connectors of any kind are included with this unit. Where required, purchase an appropriate plug and properly connect using the round terminals.

Color	Facility
Black	Live/Hot side
White	Neutral side
Green	Ground

2. PRE-OPERATION PROCEDURES

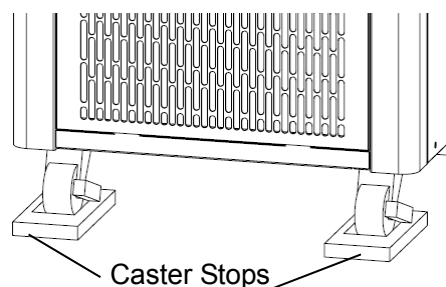
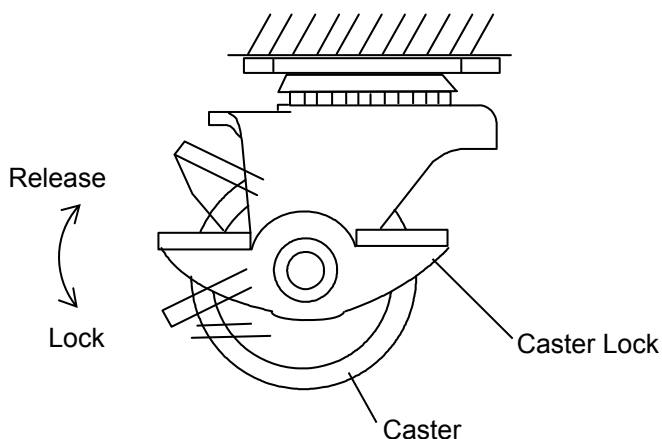
Installation Procedures

1. Unlock caster.

Pull up on lever to release caster lock (only two front casters are equipped with locks).

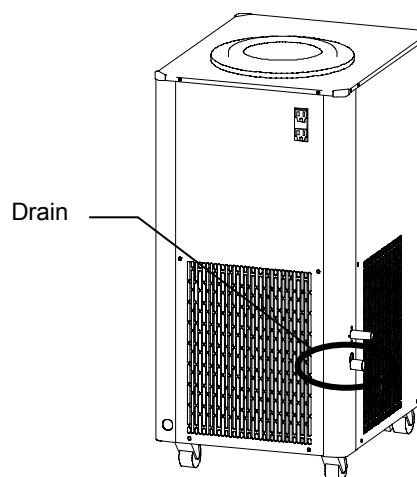
2. Move unit into place for installation.

- ❖ Wheeling unit over large bumps or crevices may cause excessive shock to unit or damage to casters. Use care when moving unit and obtain assistance, when necessary, to lift unit over bumps and crevices.
 - ❖ Do not turn or position unit on its side when lifting.
3. When unit is in place, place caster stops under casters and push down on lever to lock caster.



4. Check drain cap

- Check to make sure cap is installed on drain outlet hose.



5. Connect power cable

Be sure main power switch (ELB) is turned OFF. Connect power cable to grounded outlet.

6. Use a vacuum pump having a displacement of 50L/min or more, maximum pressure of 1.0×10^{-1} Pa and a current rating of 6A or less. Vacuum pump must have a check-valve.

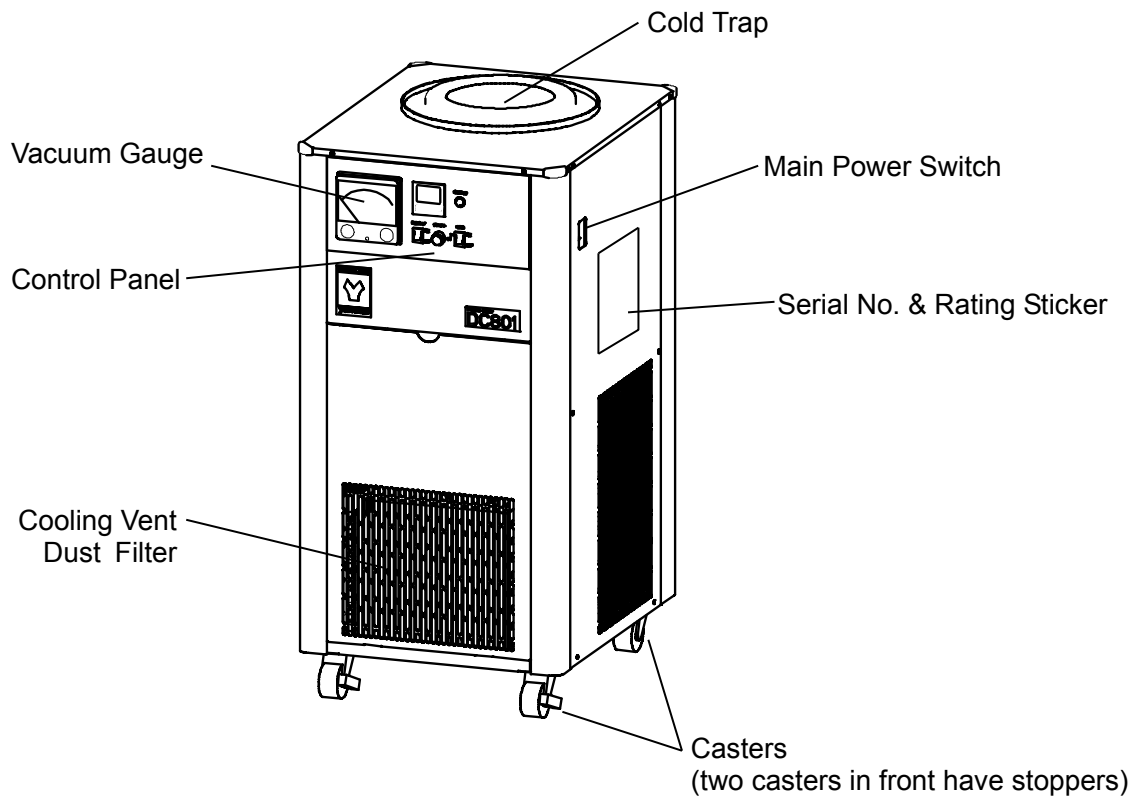
7. Install vacuum valves on all valve openings in the vacuum chamber.

8. Be sure a freezer is available which can maintain samples sufficiently below their eutectic (solidification) point. Refer to P.11 for explanation on eutectic point.

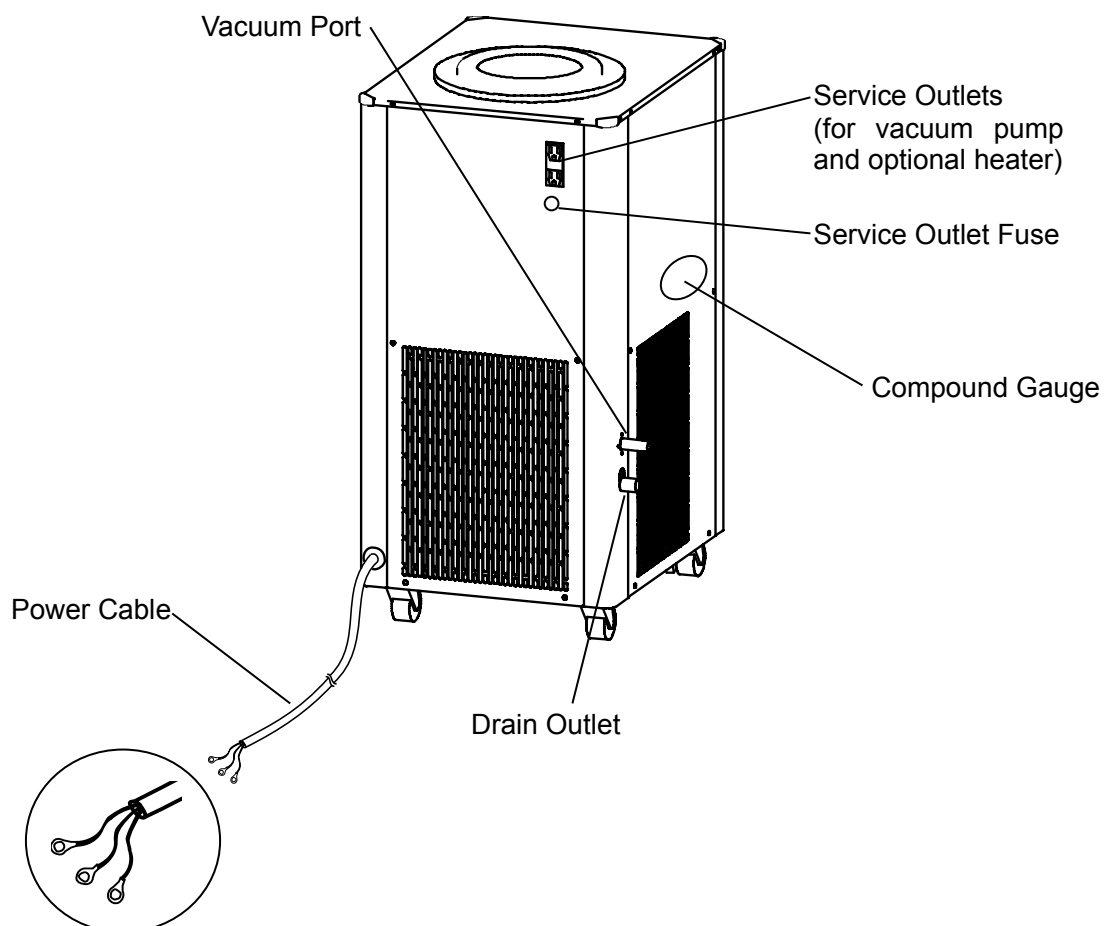
3. COMPONENT NAMES & FUNCTIONS

Unit Overview

Front View

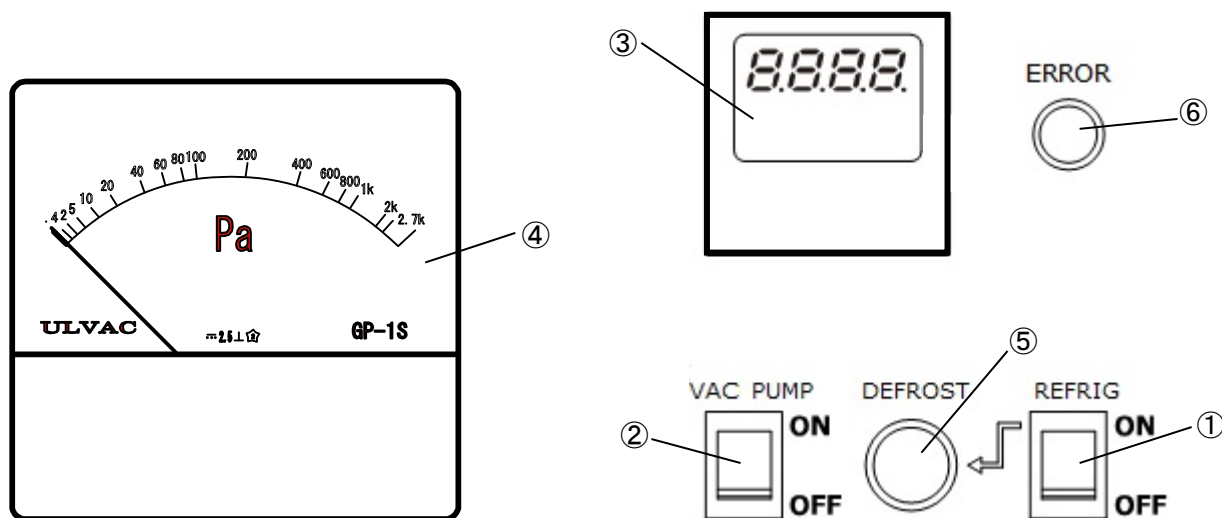


Rear View



3. COMPONENT NAMES & FUNCTIONS

Control Panel



Part Name		Function
①	Refrigeration Switch	Activates/deactivates refrigeration system. ❖ Protection delay timer activates system 3 minutes after switch is set to ON. ❖ May be used to stop defrost function mid-way through process
②	Vacuum Pump Switch	Activates service outlets, solenoid valve in vacuum line and vacuum gauge.
③	Temperature Display	Displays temperature of inner wall in cold trap.
④	Vacuum Gauge	Decompression (vacuum) strength meter.
⑤	Defrost Switch	Loosens ice buildup in cold trap. ❖ Operable only with REFRIGERATION switch ON.
⑥	Refrigeration Error Lamp	Lights when refrigeration system is in overload or when temperature sensor fails.

4. OPERATION PROCEDURES

Pre-freezing

For the pre-freezing process, freeze samples quickly and completely through, at a temperature sufficiently lower than sample eutectic (solidification) point*. Freeze as thinly as possible so that sample will not have a chance to melt before the drying process can dry it. Likewise, external heat may influence and begin melting samples with a low eutectic table, if it is frozen too thickly in the container.

Be advised that if throughput is too high, or if the eutectic point of samples is low, melting may give way to sudden boiling (bumping) which may scatter samples.

- When installing containers during a freeze-dry process, following pre-freeze, wait 3-4 minutes (varies with container and sample types) before installing the next container and opening the next valve for the next process, and so on until the whole process for all containers is complete. Making intervals shorter between each individual container process or attempting to install all containers at once, will cause samples to melt before vacuum pressure is able build again to dry them.

Eutectic (solidification) Point

- If pure water freezes at 0 degree Celsius, a mixed solution of water and other fluids may not freeze immediately below 0 degrees Celsius, and may simply become soft ice, or not freeze at all, because of being mixed with fluid(s) having a freezing point below 0. If temperature continues to fall, the value at which the entire solution uniformly freezes solid is called the "eutectic point" of that solution.

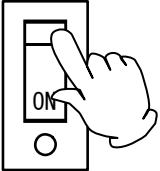
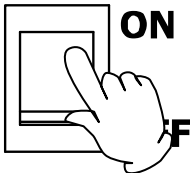
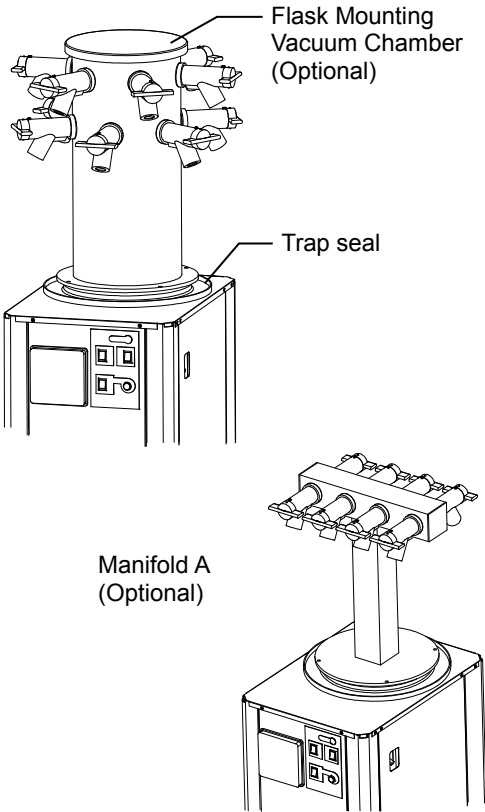
4. OPERATION PROCEDURES

Main Operation

Prepare dryer manifold, vacuum pump, vacuum hose, tandem tube, and other equipment necessary to operation process.

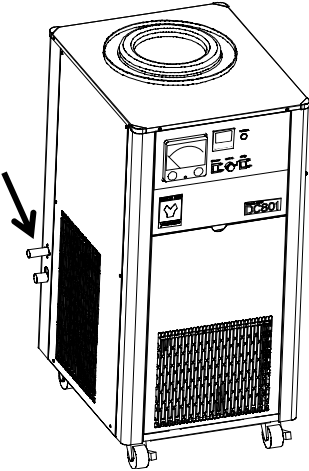
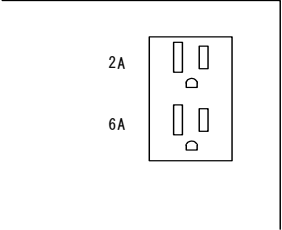
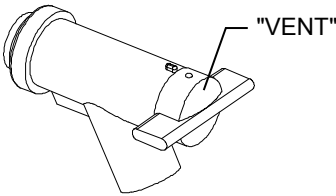
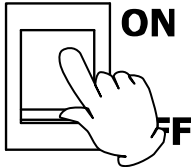
Example vacuum pump: PD52 (from YAMATO Scientific)

Displacement volume: 50L/min, maximum vacuum pressure: 6.7×10^{-2} Pa,
inlet pipe diameter: 18mm (or equivalent)

1. Turn power ON 	• Turn "ON" main power switch (ELB).
2. Start refrigeration REFRIG 	• Turn "ON" refrigeration switch. Refrigeration system activates after 3 minutes.
3. Install vacuum chamber.  Flask Mounting Vacuum Chamber (Optional) Trap seal Manifold A (Optional)	1. Be sure there is no dust or other contaminants on the trap seal or vacuum chamber before flask installation. ❖ Damage to or contaminants on chamber and seal weaken vacuum pressure. 2. Gently place flask mounting vacuum chamber on trap seal. ❖ If vacuum chamber does not sufficiently adhere to trap seal, a vacuum leak may result. ❖ The above holds true for Manifolds A & B, etc. as well

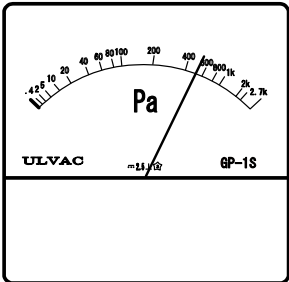
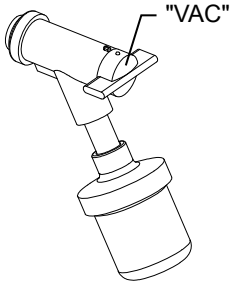
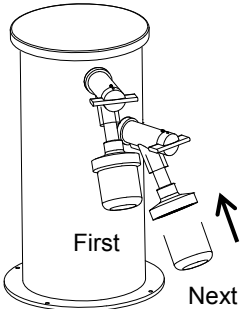
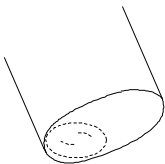
4. OPERATION PROCEDURES

Main Operation

4. Connect vacuum pump 	• Connect vacuum hose from pump to the vacuum port on left side of unit. (Vacuum port outer diameter: 17mm) (Inside dia. of applicable vacuum hose: 12mm X outer diameter 30mm) Connect the opposite end of the vacuum hose to vacuum pump inlet. ❖ Seal strength may be improved by applying vacuum seal grease (silicon grease compound manufactured by TORAY, H.V.G, etc) to the inside of vacuum hose opening.
5. Connect vacuum pump to power outlet on back of unit 	• Connect vacuum pump power cable to the 6A power outlet on back of DC unit. • Keep vacuum pump switch ON. ❖ Do not go above 8A total on 6A outlet.
6. Close valves. 	• Turn all valves so that surface reading "VENT" is in the top position, closing chamber side path.
7. Turn pump switch ON VAC PUMP 	• When the trap is sufficiently cooled (time required to reach minimum temp has passed), start the vacuum pump. • Time required to minimum temperature (-80°C): DC801: 60 minutes or less ❖ Base on external temperature of 20°C, no load ❖ This time is a guideline and may vary. (There will be condensation near the bottom of vacuum chamber when sufficient time has passed)

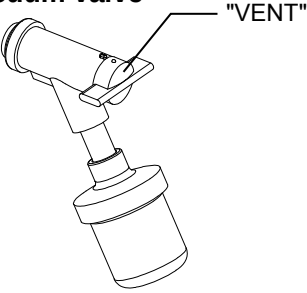
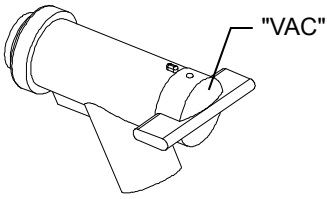
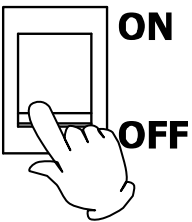
4. OPERATION PROCEDURES

Main Operation

8. Check vacuum gauge 	Confirm by looking at the vacuum gauge, that vacuum chamber has sufficiently decompressed. (20Pa or less)
9. Install sample container and open valve 	Install the pre-frozen sample container on the vacuum valve, turn the valve knob so that "VAC" is in the top position, opening the chamber side path. Sample container is decompressed and drying process begins.
10. Install the next container 	- When a vacuum valve is set from "VENT" to "VAC", the chamber interior is pressurized. To process multiple samples, wait (approx. 3-4 min.) until the pressure has returned before turning the next vacuum valve from "VENT" to "VAC". ❖ If multiple samples are processed at one time, decompression will decrease and pre-frozen samples will begin melting, possibly causing container to break.
11. End process 	Process may be ended after confirming sample status and making sure process has finished normally.

4. OPERATION PROCEDURES

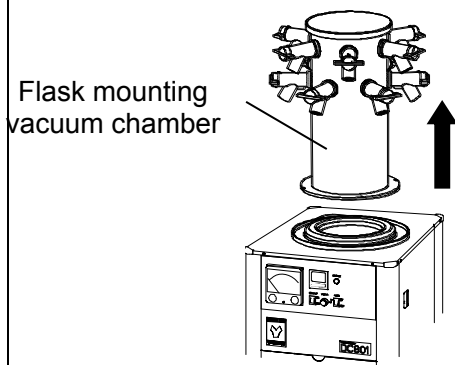
Main Operation

12. Close vacuum valve  The diagram shows a vacuum valve handle being turned to the "VENT" position, which is indicated by a line pointing to the top of the handle.	• When process has finished, turn valve from "VAC" to "VENT" ("VENT" in the top position) to normalize pressure in the sample container and remove the container. Hold container securely when removing, so that it is not dropped.
13. Normalize chamber pressure  The diagram shows a vacuum valve handle being turned to the "VAC" position, which is indicated by a line pointing to the bottom of the handle.	• When the drying process has completed for all samples, and all containers have been removed, turn one of the vacuum valves gradually until "VAC" is in the top position. This returns pressure inside the chamber to normal.
14. Turn vacuum pump OFF VAC PUMP  The diagram shows a vacuum pump switch being turned to the "OFF" position, which is indicated by a line pointing to the bottom of the switch. The switch is labeled "ON" and "OFF".	• Turn the vacuum pump switch OFF, after chamber pressure has normalized.

4. OPERATION PROCEDURES

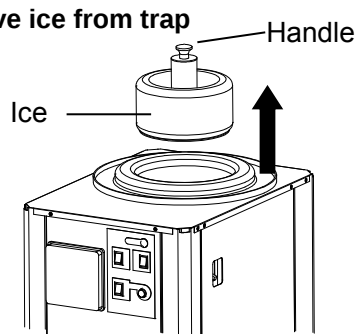
Defrost

1. Remove chamber



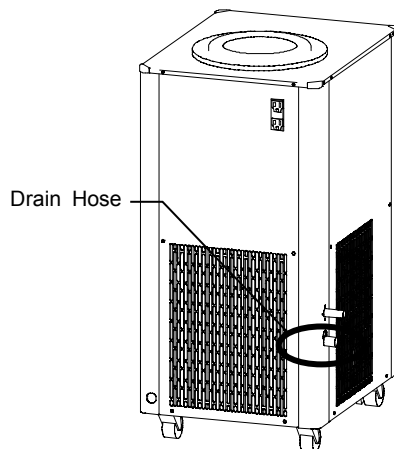
- Remove the flask mounting vacuum chamber from the trap.
If ice has formed on trap wall, press the defrost button with the REFRIG switch ON.

2. Remove ice from trap



- When ice has melted sufficiently to remove, do so by pulling up on handle and turn OFF the defrost switch.
- Defrost auto stop activates after approximately 45 minutes and the defrost lamp goes out.
- ❖ To terminate the defrost function mid-way, turn the REFRIG switch OFF.

3. Drain water

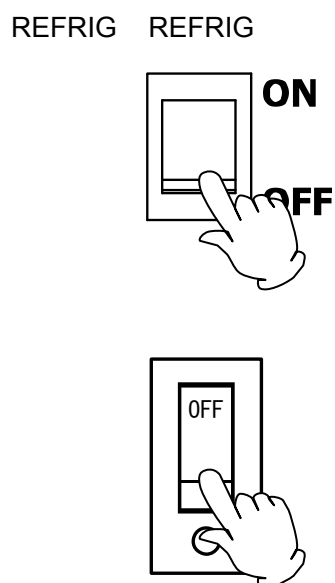


- Remove the drain hose cap, and drain remaining water from the trap into a drain basin or other receptacle.

5. HANDLING PRECAUTIONS

Defrost

4. Stop refrigeration system

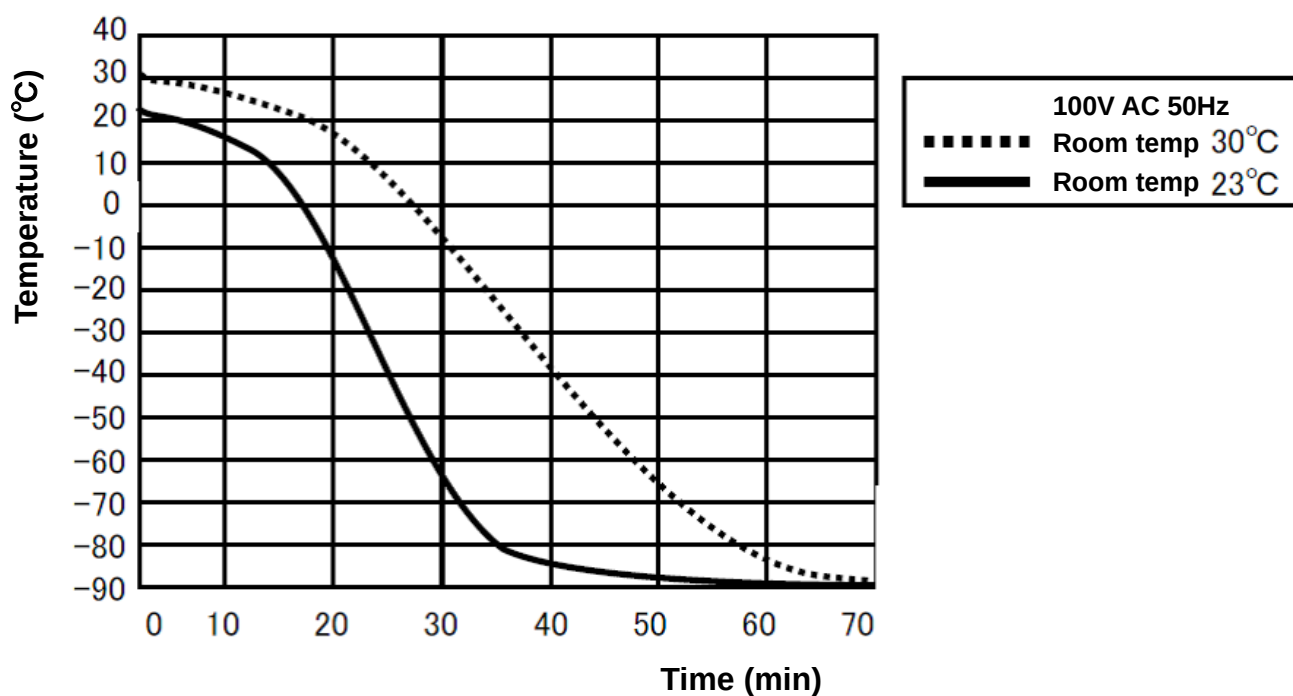


1. Turn "OFF" the refrigeration switch.

2. Turn "OFF" the main power switch (ELB).

Cooling curve (reference data)

Display temperature with the trap empty (no load)



5. HANDLING PRECAUTIONS

WARNING!

DO NOT operate equipment when abnormalities are detected.

-  If unit begins emitting smoke or abnormal odors for reasons unknown, turn off main power (ELB) immediately, disconnect power cable from power supply, and contact Yamato sales office 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 be always be performed by a certified technician.

DO NOT handle flammable substances without proper ventilation.

-  Be sure there is adequate ventilation when working with certain flammable substances (such as ethanol, etc.), which evaporate quickly at or below room temperature, and emit flammable fumes. Little or no ventilation may cause a fire or explosion resulting in serious injury or death. Refer to "List of Hazardous Substances" (P.29).

CAUTION!

Cold trap capacity.

-  Maximum cold trap capacity for DC801 is approximately 1.0L. Exceeding this capacity may severely degrade performance.

DO NOT climb on equipment.

-  Do not attempt to climb onto unit or substitute it for a proper step ladder. Units are not designed to support bodily weight and damage may result. In addition, unit may become unstable and tip over or fall resulting in equipment damage, serious injury or death.

DO NOT place objects on equipment.

-  Do not place any objects on unit, which may fall and cause personal injury.

DO NOT operate equipment during thunderstorms.

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

Overnight and extended storage.

-  Whenever unit is not in operation, stored overnight or placed in storage, always turn off main power switch and disconnect power cable. Drain any fluid collected in the cold trap if unit is going to be out of service for an extended period.

Power supply voltage.

-  Power supply voltage must be within +/-5% of the rated voltage.

DO NOT use solvents.

-  The seals contained in this unit is made from chloroprene rubber and may be damaged by acids, halogens, aromatics, esters, and oxo solvents. Do not use these compounds with unit.

Starting/restarting refrigeration

-  When the refrigeration switch is turned from OFF to ON or when refrigeration is resumed by turning ON the main power switch, a timer delays operation for three minutes to protect the refrigeration system. Note that this is NOT a failure.

5. HANDLING PRECAUTIONS

Power outage recovery.



DC801 units reset automatically to where operation halted before power loss and resumes operation when power is restored. When defrosting, the refrigeration system will turn back on after power is restored. Press the defrost button once again to resume defrosting.

If conditions for resuming operation are unfavorable, turn OFF the power switch (ELB) when power outage occurs.

Maximum cold trap temperature.



If an excessive amount of fluid is allowed to collect in the cold trap, internal temperature rises and may overload the refrigeration system.

Do not run successive operations when cold trap temperature is above -40°C.

Refrigeration pressure error



When excessive pressure builds in the refrigeration lines due to refrigeration system overload, a protection circuit activates the refrigeration error lamp and shuts down the refrigeration unit. When this happens, turn OFF the main power switch immediately and refer to "TROUBLESHOOTING" (P.23).

Refrigeration overload relay.



Operation of the refrigerator in the high temperature range may activate the refrigeration overload relay, which shuts down the refrigeration unit. When this happens, turn OFF the main power switch and refer to "TROUBLESHOOTING" (P.23).

Condensation.



Condensation may form on unit depending on operating conditions and/or environment. Wipe any undesired condensation away with a soft, dry cloth or rag.

Vacuum grease application.



Vacuum pressure is weakened and vacuum leaks may occur if any contaminants are allowed to build up on vacuum connection components. If contaminant buildup is found in any vacuum connection joints, clean and reapply vacuum grease as needed.

If vacuum valve stem tubes become difficult to rotate, remove the stem tube, apply vacuum grease, and reinstall.

Normalizing pressure.



Before turning OFF the vacuum pump, following an operation run, confirm that pressure in the vacuum chamber has returned to normal. If vacuum pump is turned OFF while chamber is decompressed, oil from the pump may back up into the chamber. Refer to "13. Normalize chamber pressure" (P.15).

Ampule neck size.



Ampule adapter inner diameter is 7mm. Use ampules with a connection neck size of 7-9mm.

Teardrop flask.



Use TS29 for teardrop flask fitting.

Transporting



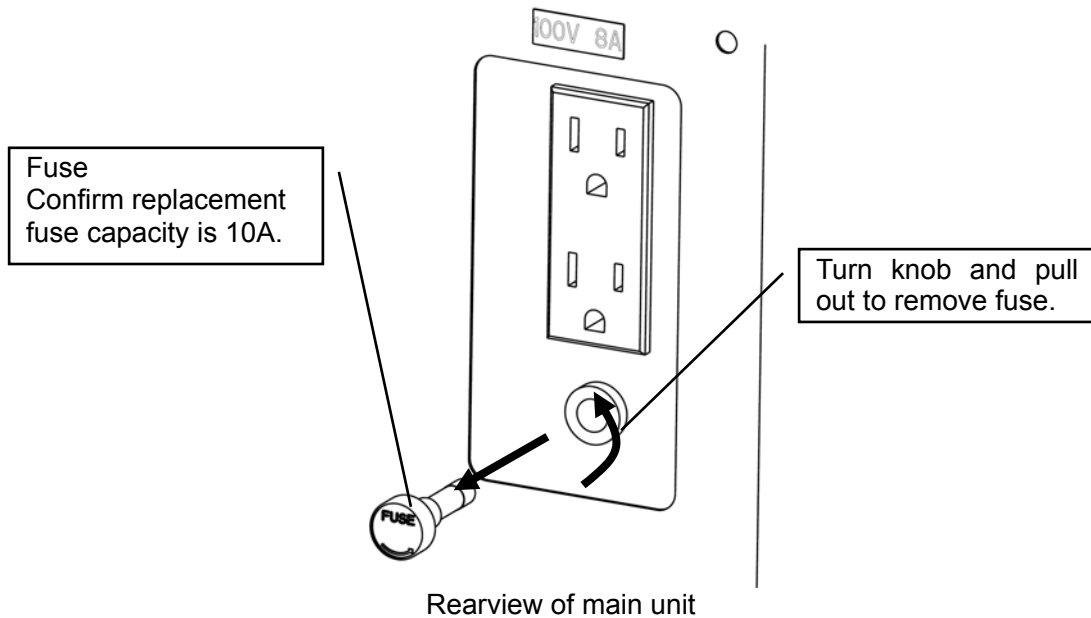
Do not tip unit on its side when lifting for transport.

Observe the installation precautions and procedures (P.5-8) when installing/reinstalling unit.

5. HANDLING PRECAUTIONS

Service outlet capacity.

- ! Load capacity for both service outlets is 8A. One is intended for an optional heater (2A) and the other for the vacuum pump (6A). Outlet fuse may be blown if service outlet is not in working order when power is supplied. Replace fuse with a capacity of 10A.



6. MAINTENANCE PROCEDURES

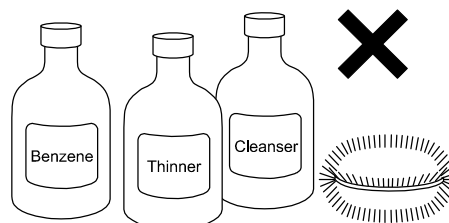
Inspection & Maintenance

WARNING!

- Always disconnect the power cable when performing inspection or maintenance, unless otherwise necessary.
- Perform daily inspection and maintenance after unit temperature has returned to normal (room temp).
- Do not disassemble unit.
- Do not touch cooling fins with bare hands or fingers.

CAUTION!

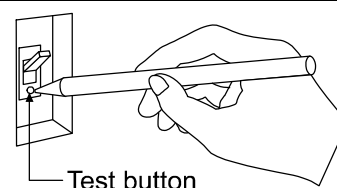
- Clean with a soft, damp cloth. Never use benzene, paint thinner, scouring powder, scrubbing brushes or other abrasives and solvents to clean unit. Superficial damage and/or discoloration, as well as deformity to some components may result.



Monthly maintenance

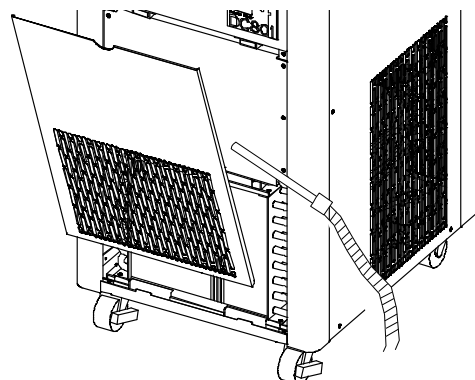
Inspect main power switch (ELB) ON and OFF function.

- Prepare unit for inspection by connecting power cable to a facility outlet or terminal.
- Confirm that main switch (ELB) is "OFF" then, turn main switch (ELB) back "ON".
- With the main switch "ON", press the test button on the main switch (ELB) using a ball-point pen or other fine-tipped object. If main switch (ELB) shuts off, it is functioning normally.



Cleaning cooling fins

- If cooling fins are allowed to become clogged with dust, degraded performance and refrigeration system malfunction may result. Inspect and clean cooling fins periodically.
- ❖ Remove filter cover by pulling out and up. Clean cover/filter using a vacuum cleaner.
- ❖ After cleaning the cooling fins in the same way, reinstall vent cover.



Be careful not to bend or crush the fins while cleaning.

Contact a local dealer or Yamato sales office for further assistance.



DO NOT touch cooling fins.

Edges of cooling fins are very sharp. Avoid direct contact with bare hands during maintenance work. Laceration injuries may result.

7. STORAGE & DISPOSAL

Extended storage & Unit disposal

CAUTION!

Extended storage

- Turn off power switch and disconnect power cable before placing unit in storage or out of service.
- Drain all fluid and wipe remaining remnants from cold trap.

WARNING!

Disposal

- Place out of reach of children.
- Dispose of main unit and cold trap as bulky or industrial waste.
- Refrigeration unit utilizes flammable refrigerant. Dispose of refrigerant by draining in small amounts at a time in a well-ventilated area, away from flames.

Disposal Considerations

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

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 DC801 units are listed in the table below:

Component	Material/Compound
Main	
Casing	Chromium-free electro-galvanized steel, baked-on melamine resin coating
Inner trap, Cover	Stainless steel SUS304
Name plate	Polyvinyl chloride (PVC), Polyester (PET) resin film
Corner protectors	Alkylbenzenesulfid (ABS) resin
Trap seal	Silicon rubber
Electrical	
Switches, Relays	Composite of resin and other
Power cable, wiring materials and other	Composite of synthetic rubber, copper, nickel and other
Refrigeration System	
Refrigeration unit	Iron, Synthetic oil and other
Cooling fins	Aluminum, Copper
Parts of Piping	
Drain hose	Natural rubber
Drain tap	Polyacetal resin
Refrigeration line covering	Polyurethane sponge
Refrigeration lines	Copper
Sealed Cooling Medium for Refrigerator	
Refrigerant	Isobutane, Ethylene, Methane

8. TROUBLESHOOTING

Troubleshooting Guide

Symptom	Possible Causes/Solutions
Unit will not power on.	- Power cable is not connected properly or securely. - Power failure in progress. - Main power switch (ELB) is "OFF" - Delay timer is actuated
Refrigeration system does not operate with the REFRIG switch ON	Confirm whether unit has just completed defrost function. If so, turn switch OFF and restart.
Temperature does not fall.	- Cooling fins are clogged with dust or debris. - Too many samples are being processed at once. - External temperature exceeds 30°C. - Cooling vent(s) are obstructed. - Voltage from power supply is insufficient. Refer to "8. Connect to a proper power supply" (P.6).
Ice in cold trap does not melt with DEFROST engaged.	- External temperature is too low (below 5°C). - DEFROST button pressed with REFRIG switch OFF. - Ice not melted entirely – defrost is an auxiliary function intended to separate ice from inner wall to facilitate removal. This function will not completely melt ice accumulated in cold trap.

Error lamps

Error Symptom	Cause	Remedy
Refrigeration error lamp on "----" in display	Refrigeration system overload	- Turn power off immediately, eliminate error source (refer to "temperature does not fall" above) and restart after approximately 5 minutes. - If lamp stays lit after restart, Contact a local dealer or Yamato sales office.
	Temperature sensor interruption or disconnection.	Contact a local dealer or Yamato sales office for assistance.

After power outage

	DC801 units reset automatically to where operation halted before power loss and resumes operation when power is restored. When defrosting, the refrigeration system will turn back on after power is restored. Press the defrost button once again to resume defrosting. If conditions for resuming operation are unfavorable, turn OFF the power switch (ELB) when power outage occurs.
---	--

If problem does not fall under any of errors above, turn off power immediately, disconnect power cable and contact a local dealer or Yamato sales office for assistance.

Requests for Repair

When a problem occurs, terminate operation immediately, turn off main power switch (ELB) and disconnect power cable.

Contact a local dealer or Yamato sales office for assistance.

The following information is required for all repairs.

- Model name
 - Serial Number
 - Date (year/month/day) of purchase
 - Description of problem in as much detail as possible
- } Refer to serial no. and rating label on unit.
See "3. COMPONENT NAMES & FUNCTIONS" (P.9) for label location.

Be sure to present the warranty card to Yamato service representative.

Keep warranty card with care. (attached separately)

- Keep warranty card with care.
Warranty card would be given by local dealer or one of Yamato sales offices.
Date of purchase of this equipment and other information should be filled in warranty card.
Please send warranty card to Yamato customer service center by facsimile described Fax number in the left top corner of it.
Then, keep the card with good care.
- Repair this Equipment for free of charge according to the contents on warranty card.
Warranty period is 1 (one) year from date of purchase.
- Consult with local dealer or Yamato sales office for any repair after warranty ended.
Charged repair service of this equipment will be available on customer's request when it can be maintained functional by its repair.

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for DC801 freeze dryers. "Repair parts" is defined as components which, when installed, allow for continued unit operation.

10. SPECIFICATIONS

Main Unit

Model		DC801
Method		Cooled container system
*1 Performance	Drying capacity	Max. 1.0L
	Minimum temperature *2,3	-85°C or less
Configuration	Refrigeration	Air cooling, 350W
	Refrigerant	Isobutane, Ethylene, Methane
	Temperature display *4	7-segment LCD
	Temperature sensor	Platinum resistance temperature detector Pt100Ω
	Pressure meter	Pirani gauge
	Defrost mechanism	Hot gas bypass type
	Vacuum port	φ17mm
	Chamber material	SUS304, Cylindrical
	Dimensions of chamber	φ153×H235mm
	Capacity	Approx. 4L
	Usable external temperature	5 to 30°C
Safety	Safety devices	Over-current (20A) earth leakage breaker, refrigeration system overload relay, high-voltage refrigeration error, refrigeration delay timer, sensor failure error
Standard measurements	External dimensions *5	W405×D500×H846 mm
	Weight	Approx. 65Kg
	Power requirements/capacity *6	AC100V±5% 7/6.5A (20A) Service outlet capacity AC100V Total 8A
Included items		Vacuum silicon grease (TORAY H.V.G), Vacuum hose (φ12 x φ30 x 1.5m), Instruction manual, Pirani gauge instruction manual, Guaranty card, Fuse (10A), Caster stop x 4

*1. Performance based on operation at 23°C±5°C, 65%RH±20% humidity, AC100V/50Hz rating, no load.

*2. Measured at 140mm from the top of trap wall seal.

*3. Value where the cold trap is used as an air reservoir

*4. Display temperature is a surface temperature of refrigeration piping and served as a guideline.

*5. Dimensions do not include protrusions.

*6. The current value in brackets represents breaker capacity

10. SPECIFICATIONS

Optional Accessories

Name	Specifications		Code №
Flask mounting vacuum chamber	Mounting valve	Inside dia. 18.5mm	212560
	Mounting valve pitch	96mm	
	No. of ports	12	
	Dimensions (mm)	φ195×H303	
Manifold A	Mounting valve	Inside dia. 18.5mm	212561
	Mounting valve pitch	80mm	
	No. of ports	8	
	Dimensions (mm)	W304×D60×H263	
Manifold B	Mounting valve	Inside dia. 18.5mm	212562
	Mounting valve pitch	80mm	
	No. of ports	16	
	Dimensions (mm)	W624×D60×H263	
Dry chamber	No. of shelves	1 pc	212563
	No. of 60mm petri dishes supplied	7 pcs	
	Temperature control	30°C±2°C *1	
	Dimensions (mm)	φ252×H240	
Stopper plug type dry chamber	No. of shelves	1 pc	212564
	No. of 60mm petri dishes supplied	7 pcs	
	Temperature control	30°C±2°C *1	
	Dimensions (mm)	φ252×H425	
Drying flask	120ml: 5 pcs		212820
	250ml: 5 pcs		212821
Drying flask cap (with glass joint)	Straight: 5 pcs		212570
	45-degree bent: 5 pcs		212571
Serum container (vial)	50ml: 10 pcs		212814
	30ml: 10 pcs		212815
	10ml: 10 pcs		212816
Ampule adaptor	Single: 5 pcs		212572
	Double: 5 pcs		212573
	Triple: 5 pcs		212574
Adaptor for test tube (with glass joint)	Straight		212590
	Angled 45-degrees		212591
Adaptor for measuring flask (female)	TS29 fitting or equivalent		212569
Adaptor for teardrop flask (male)	TS29 fitting		212597
Glass joint	Straight		212598
	Angled 45-degrees		212599
Micro tube holder	1.5ml × 16 pcs		212580

*1. Performance based on operation at 23°C±5°C, 65%RH±20% humidity, no load

12. REPLACEMENT PARTS

DC801

Symbol	Component	Code №	Specification	Manufacturer
ELB	Earth leakage breaker	LT00029776	NV-L22GR 20A	Mitsubishi
P	Terminal block	LT00031664	TFD250ABC-8P	Terminal
FM	Fan motor	3010060006	SANYO SE4-C041NP	Sanyo electric
TIC	Temperature indicator	LT00034914	TTM204-Q-RI-RUV	TOHO Electronics
Pt100	Temperature sensor	LT00009705	SB-6630-1A Pt100Ω	CHINO
Tr	Transformer 100→230V	LT00035654	100V-230V 1KW	Yamato Scientific
REF	Compressor	LT00035655	SC12CNX	Danfoss
X1	Relay: defrost start	LT00035664	LY4F AC100V	Omron
X2	Relay: defrost stop	LT00000993	LY3F AC100V	Omron
X3	Relay: refrigeration start	2050000035	LY2F AC100V	Omron
X4	Relay: pressure error monitor	2050000035	LY2F AC100V	Omron
X5	Relay: refrigeration stop	LT00000992	LY1F AC100V	Omron
X6	Relay: vacuum gauge, pump	LT00000992	LY1F AC100V	Omron
PATH1	Pirani gauge/sensor	LT00001004	GP-1S (with WP-02)	Ulbac
REFsw	Switch, refrigeration system	2550000011	CW-SB21NMKZMEF	Nikkai
DEFsw	Switch, defrost	LT00014520	AH164-LS11H1	Fuji electric
PS1sw/PS2 sw	Pressure switch	3180000006	VHP-F	Fujikoki
PS	Lamp, error	LT00021961	BN5665-AC100V Red	Sato parts
MV1/MV3	Electromagnetic valve, black	3020060004	NEV-603DXF	Saginomiya Sanki
MV2	Electromagnetic valve, green	3020060003	SEV-502DXF	Saginomiya Sanki
MV4	Three-way electromagnetic valve	3020010018	AG33022 100V	CKD
VACsw	Switch, vacuum gauge and pump	2550000017	CW-SB21NYKZYEF	Nikkai
CN	Service outlet	LT00035659	WCF1042B	Panasonic
	Fuse holder	LT00035660	MF-530H	Marushin
	Fuse	2100016008	F7161 10A	Sato parts
	Filter	DC80140050		Yamato Scientific
	Seal	LT00011815	DC400_3015_X	Yamato Scientific
	Drain plug	LT00000949	CA300-40200	Yamato Scientific
	Vacuum hose	W0040003	Φ6×Φ18×0.7m	Yamato Scientific
	Compound gauge	LT00007587	TA147W	TASCO
	Low-voltage container	DC80140000		Yamato Scientific
	Condenser	DC80130111		Yamato Scientific
	Dryer	3200036002	KC-10432	Meiko Kiki

13. LIST OF HAZARDOUS SUBSTANCES



Never use explosives, flammables or substances containing them for this device.

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 ⑦Celluloids ⑧Calcium 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)
Oxidizing substances	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
	⑤Sodium chlorite and other chlorites
	⑥Calcium hypochlorite and other hypochlorites
Flammable substances	①Ethyl ether, gasoline, acetaldehyde, propylene chloride, carbon disulfide, and other substances with ignition point at a degree 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 with ignition point between zero and less than 30 degrees.
	④Kerosene, light oil, terebinth oil, isopenthyll alcohol (a.k.a. isoamyl alcohol), acetic acid and other substances with ignition point between 30 degrees and less than 65 degrees.
Combustible gas	Hydrogen, acetylene, ethylene, methane, ethane, propane, butane and other gases combustible at 15°C at one air pressure.

14. STANDARD SETUP MANUAL

* Install this Equipment according to following format (Check the format for options or customized specifications)

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

No	Item	Implementation method	TOC No. Reference page of the instruction manual	Judgment
Delivery, installation place				
1	Accessories	Check for number of accessories on the basis of the column for accessories.	10. SPECIFICATIONS P.25	
2	Installation	• Visual check of environmental conditions Caution: Take care for environment	2. PRE-OPERATION PROCEDURES P.5	
		• Securing a space		
Operation-related matters				
1	Source voltage	• Measure the user side voltage (outlet, etc.) with a tester • Measure voltage during operation (shall meet the specifications) Caution: Always use a plug that meets the specification for attaching to the ELB.	2. PRE-OPERATION PROCEDURES • Equipment MUST ... P.7- • Connect to a ... P.6- 10.SPECIFICATIONS • Power requirements ... P.25	
2	Operation start	• Start operation.	2. PRE-OPERATION PROCEDURES P.9 4. OPERATION PROCEDURES P.12-15 • Main operation	
Description				
1	Operational descriptions	• Explain the customer about each operation according to the instruction manual.	4. OPERATION PROCEDURES P.12-15 • Main operation 1. SAFETY PRECAUTIONS P.1-29 13. LIST OF HAZARDOUS SUBSTANCES	
2	Error codes	Explain the customer about measures against troubles and procedures for recovery from errors according to the instruction manual.	8. TROUBLESHOOTING P.23	
3	Maintenance and inspection	Explain the customer about maintenance of each component according to the instruction manual.	7. MAINTENANCE PROCEDURES P.21 • inspection & maintenance	
4	Completion of installation Entries	• Fill in the installation date and the installation mgr. on the nameplate of the main unit • Fill in necessary information to the warranty card and hand it over to the customer • Explanation of the route for after-sales service	9. SERVICE & REPAIR P.24	

Limited Liability

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

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 DC801 unit which is not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Note

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

Instruction Manual

Freeze Dryer

Model DC801

Fourth Edition October 11, 2017

Revised

Yamato Scientific Co., Ltd

〒103-0022

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National holidays are excluded (Service also
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