

Tabletop Freeze Dryer

DC41A/B

Instruction Manual

Second Edition

- Thank you for choosing DC41 series tabletop freeze dryers 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.

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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.

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:
Electrical 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 DC41 unit near flammable or explosive gases/fumes. Unit is NOT fire or blast resistant. Negligent use could cause a fire/explosion.
See "List of Hazardous Substances (P.20).

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 power switch 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.

NEVER process explosive or combustible substances.

Attempting to process/use explosive or combustible substances in/near unit may cause explosion or fire. See "List of Hazardous Substances" (P.20)

NEVER disassemble or modify equipment.

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

Caution

DO NOT operate equipment during thunderstorms.

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

2. PRE-OPERATION PRODEDURES

Precautions & Preparations



Warning

1. Ground wire **MUST** be connected properly.

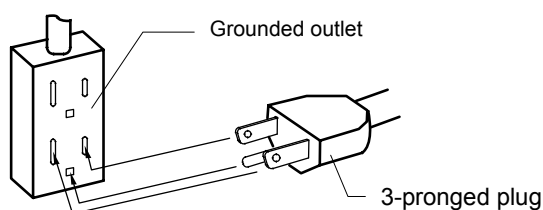


- Ground wire must be connected to a proper grounding line or teminal in order to avoid electrical shock.

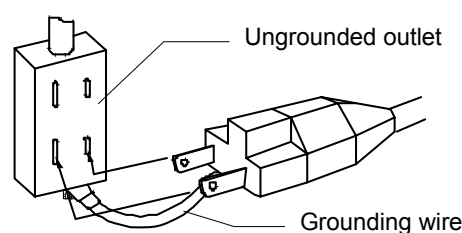


- Never connect ground wire to gas lines or water pipes.
- Never connect ground wire to telephone grounding lines or lightening rods. Doing so may result in fire or electric shock.
- Never insert multiple plugs into a single outlet. Doing so may result in power cable overheating, fire or drop in voltage.

Connect to grounded outlet.



Use grounded adapter for ungrounded outlets.



When no grounding terminal is found:

Grounding to Electrical Equipment Technical Standards, Section 19, class D (Grounding Resistance Max. 100Ω) is required in Japan. Contact a local dealer, electrician, or Yamato Sales office for location-specific electrical requirements.

↑ Insert grounded power plug into ground adapter. Connect grounding wire (green) from ground adapter to a ground terminal.

2. Choose an appropriate placement area.

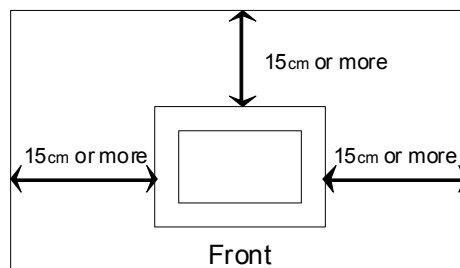


Do not install DC41 unit:

- ◆ where flammable or corrosive gases/fumes will be generated.
- ◆ where exterior temperature will exceed 35°C, will fall below 5°C or will fluctuate.
- ◆ in excessively humid or dusty locations.
- ◆ where sample containers may be directly affected by breeze from air conditioning units.
- ◆ where there is constant vibration.
- ◆ in direct sunlight or outdoors.



Place DC41 unit in a location with sufficient space and ventilation as specified as below.



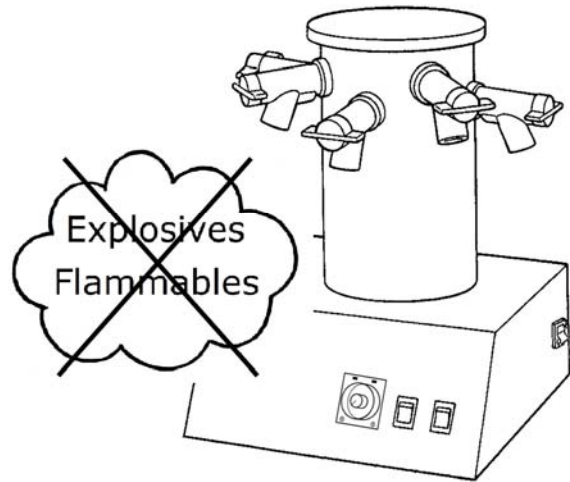
2. PRE-OPERATION PROCEDURES

Precautions & Preparations

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



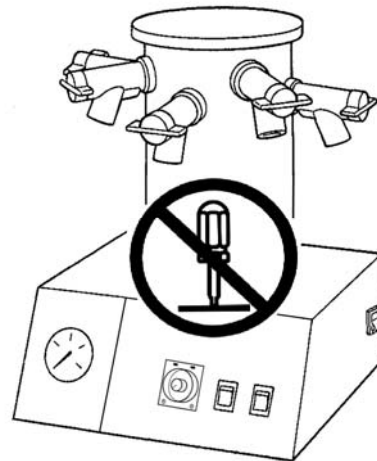
Never place near flammables or explosives. Unit is NOT fire or blast resistant. Simply switching the power "ON" or "OFF" can produce a spark, which could relay during operation, causing a fire or explosion when near flammable or explosive fluids, chemicals or gases/fumes. See "List of Hazardous Substances" (P.20).



4. DO NOT disassemble or modify.



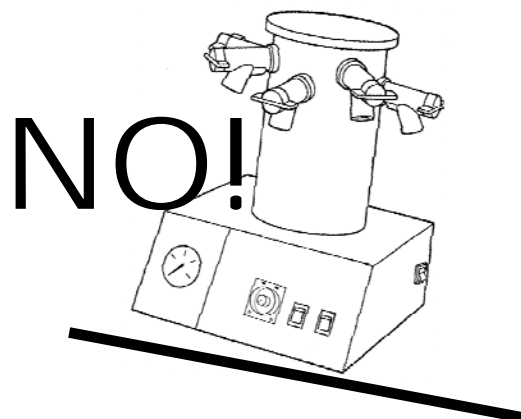
Attempting to disassemble or modify unit in any way may result in malfunction, fire or electric shock.



5. Place on a level surface.



Place unit on a level and even surface. Failure to do so may result in abnormal vibrations or noise, possibly causing complications and/or malfunction.



2. PRE-OPERATION PROCEDURES

Precautions & Preparations



Caution

6. Connect to power supply.



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

Power requirements: single phase 100V AC 50/60Hz 0.5A

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 the unit is not activated by turning on the power switch, take an appropriate course of action, such as connecting the unit to a dedicated power source.

7. 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 having it pinched 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 power switch 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.



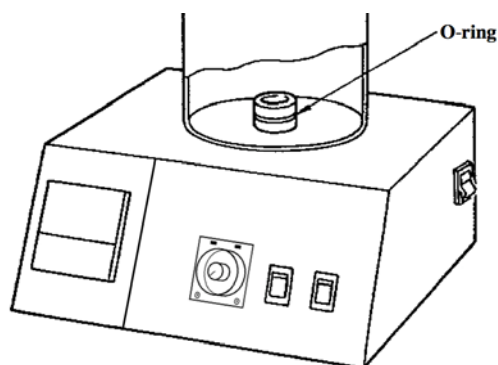
- Contact a local dealer or Yamato sales office for information about replacing power cable if it is damaged.
- Always connect power cable to appropriate facility outlet or terminal.

2. PRE-OPERATION PROCEDURES

Assembly & Operation Prep

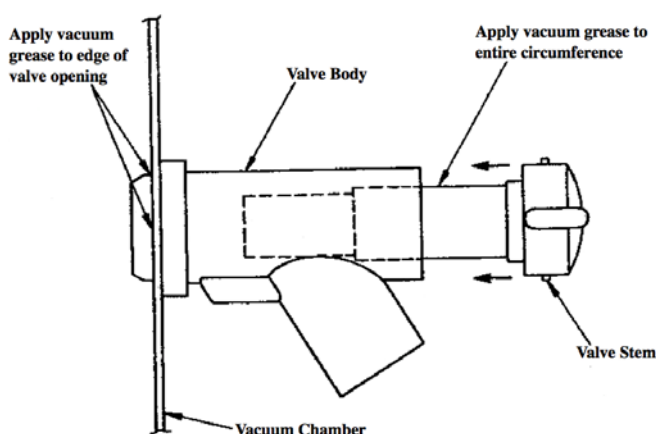
1. Install o-ring:

Install the supplied o-ring onto the receptacle at the bottom of the chamber.



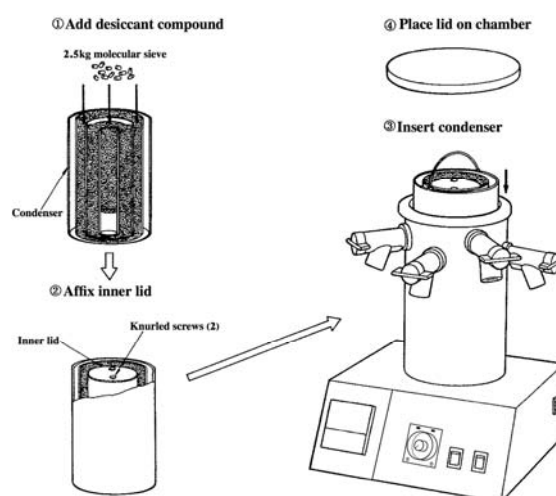
2. Install vacuum valves:

- Apply silicon vacuum grease to seating groove on valve and to chamber opening.
- Insert valve end straight into chamber opening while turning.
- Apply silicon vacuum grease to valve stem and insert into valve body.
- Install the remaining 4 valves as above.



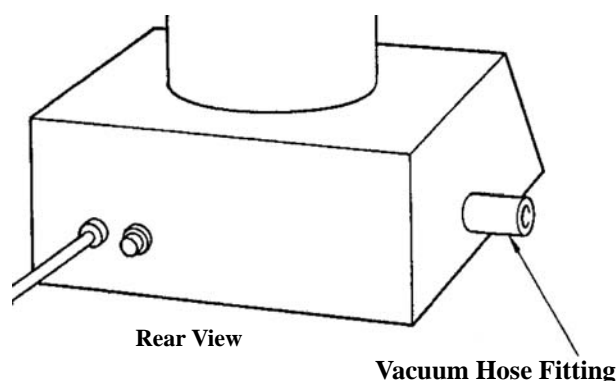
3. Install condenser:

- Loosen knurled screws and remove lid from condenser.
- Fill with the supplied 2.5kg desiccant compound (molecular sieve) or other re-dried desiccant compound.
- Replace cover and knurled screws.
- Insert condenser into vacuum chamber.



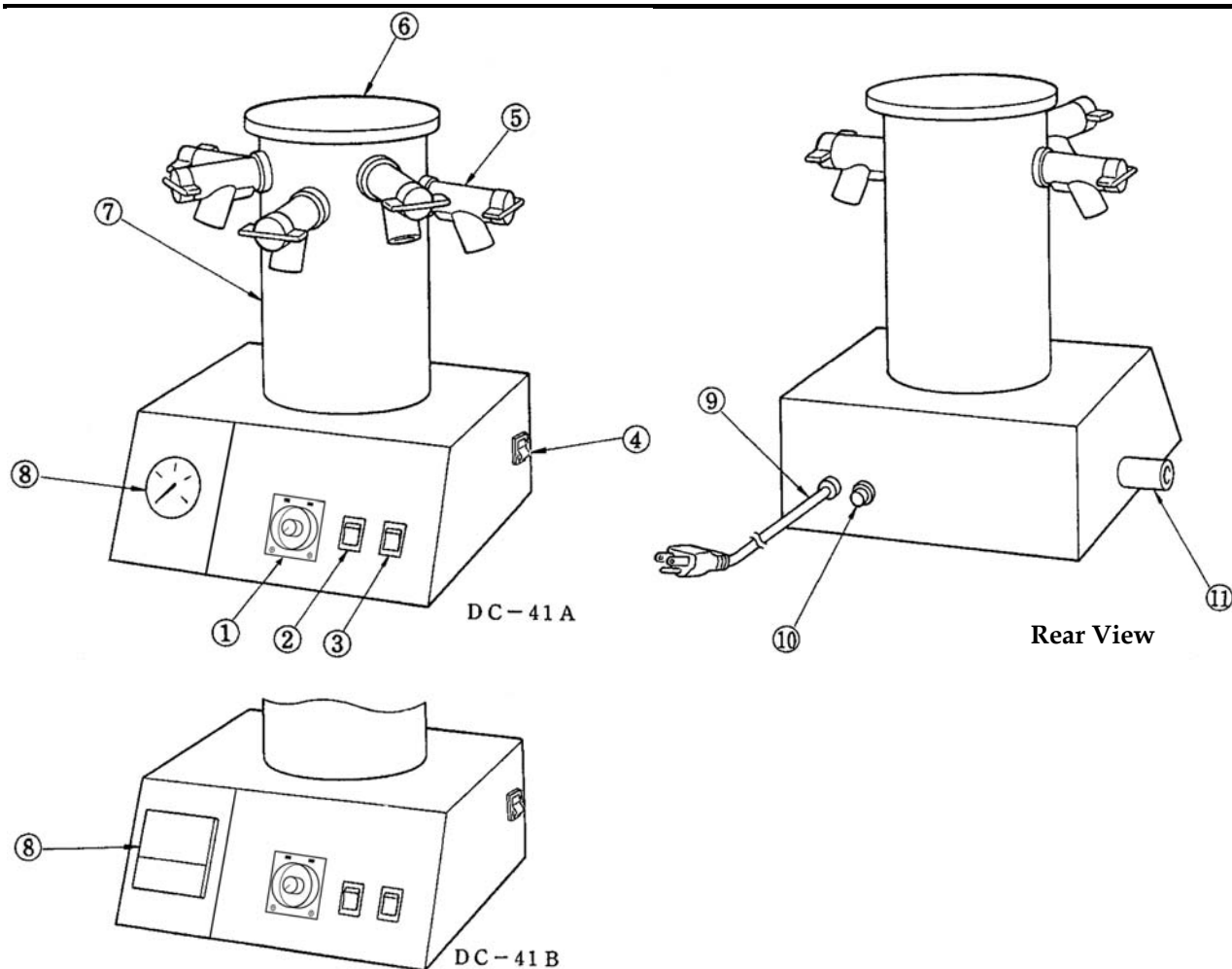
4. Connect vacuum pump:

- Connect hose from vacuum pump to vacuum fitting on unit.
- ☞ Use a vacuum pump having a displacement of 50/min or more and maximum pressure of 1.0×10^{-1} Pa.
- ☞ Recommended vacuum pump:
PD52 (from YAMATO Scientific)
Displacement volume: 50/min
Maximum vacuum pressure: 6.7×10^{-2} Pa
Inlet pipe diameter: 18mm (or equivalent)



3. COMPONENT NAMES & FUNCTIONS

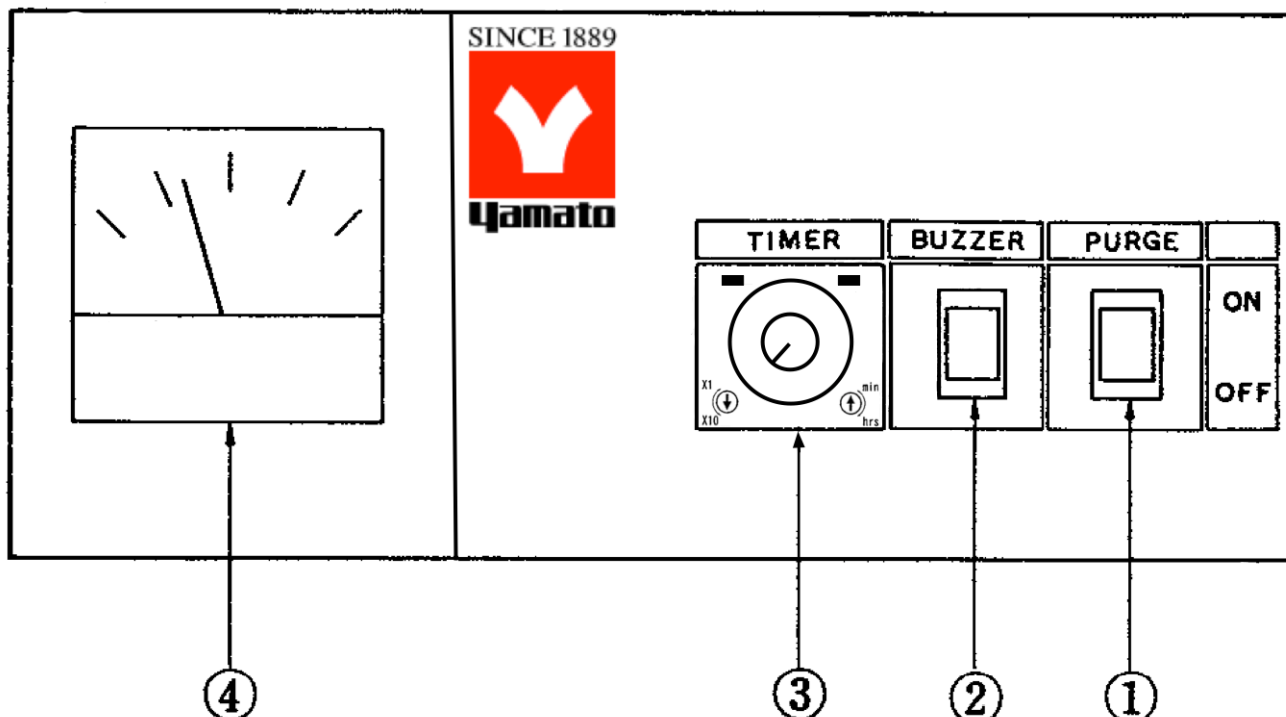
Main Unit Overview



- ① Timer
- ② Buzzer Switch
- ③ Purge Switch
- ④ Power Switch
- ⑤ Vacuum Valve
- ⑥ Chamber Lid
- ⑦ Vacuum Chamber
- ⑧ Vacuum Gauge
- ⑨ Power Cable
- ⑩ Fuse
- ⑪ Vacuum Hose Fitting

3. COMPONENT NAMES & FUNCTIONS

Control Panel



- ① Purge Switch: normalizes pressure in chamber and vacuum lines. Prevents vacuum pump oil from backing up into vacuum system.
- ② Buzzer Switch: sounds an alert when timer is up, if set in the ON position.
- ③ Timer: Sets a time on the freeze-dry process. Set according to sample/container size and type.
- ④ Vacuum Gauge: measures decompression in vacuum path and displays reading in MPa (DC41A) or Pa (DC41B).

Setting Timer

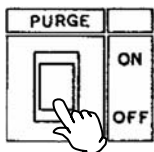
DC41 units feature a timer with two transition switches which allow the timer to be set in four different time ranges. Set the transition switches to the desired range as follows:

Transition Switch Position				
Time Ranges	0. 3min~3min	3min~30min	0. 3h~3h	3h~30h

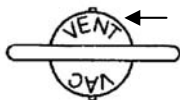
4. OPERATION PROCEDURE

Main Operation

1. Close purge valve

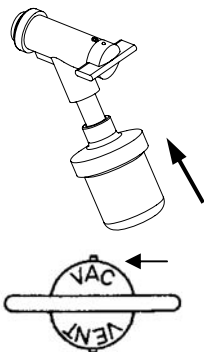


2. Close vacuum valve(s)

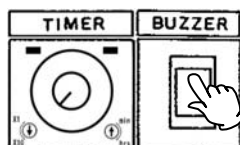


3. Start vacuum pump

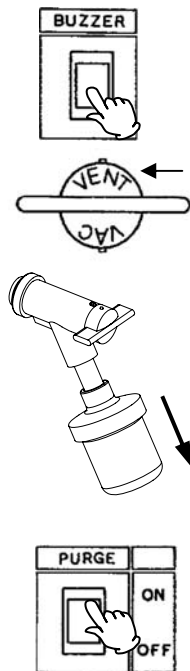
4. Install sample container(s)



5. Set timer and buzzer



6. End operation



- Turn purge switch OFF.
- Rotate valve knob so that "VENT" is in the top position.
- Turn vacuum pump ON.
- Confirm that chamber is sufficiently decompressed by checking the vacuum gauge (10Pa-20Pa).
- Install sample container(s) with pre-frozen sample.
- Open valve by rotating knob so that "VAC" is in the top position. Container decompresses and drying process starts.
 - ☞ When processing multiple samples wait 3-4 minutes (depending on sample and container type) before installing the next container and opening the next valve, so that decompression has a chance to build again in the chamber. Otherwise, samples will begin thawing before they can dry.
- Set the timer (time will depend on sample/container size and type).
- Turn buzzer ON.
- When buzzer sounds, check sample status to confirm that process has finished normally.
- Turn buzzer OFF.
- Close valve by rotating knob to "VENT".
- Remove sample container.
- Turn purge switch ON **before** turning off the vacuum pump.
- Shut down vacuum pump.
 - ☞ If vacuum pump is turned off with chamber still decompressed (purge switch off), oil from the pump may back up into the vacuum lines and chamber.
- Remove condenser from chamber.
- Re-dry and properly store desiccant compound according to P.11 below.

4. OPERATION PROCEDURE

Desiccant Compound (Molecular Sieve) Re-dry / Storage Procedure

(1) If desiccant compound is not entirely spent:

- A) Remove condenser from chamber and store condenser with compound in a sealed container, such as the condenser storage container from Yamato Scientific P/N 212576, or empty compound into an airtight container and store.

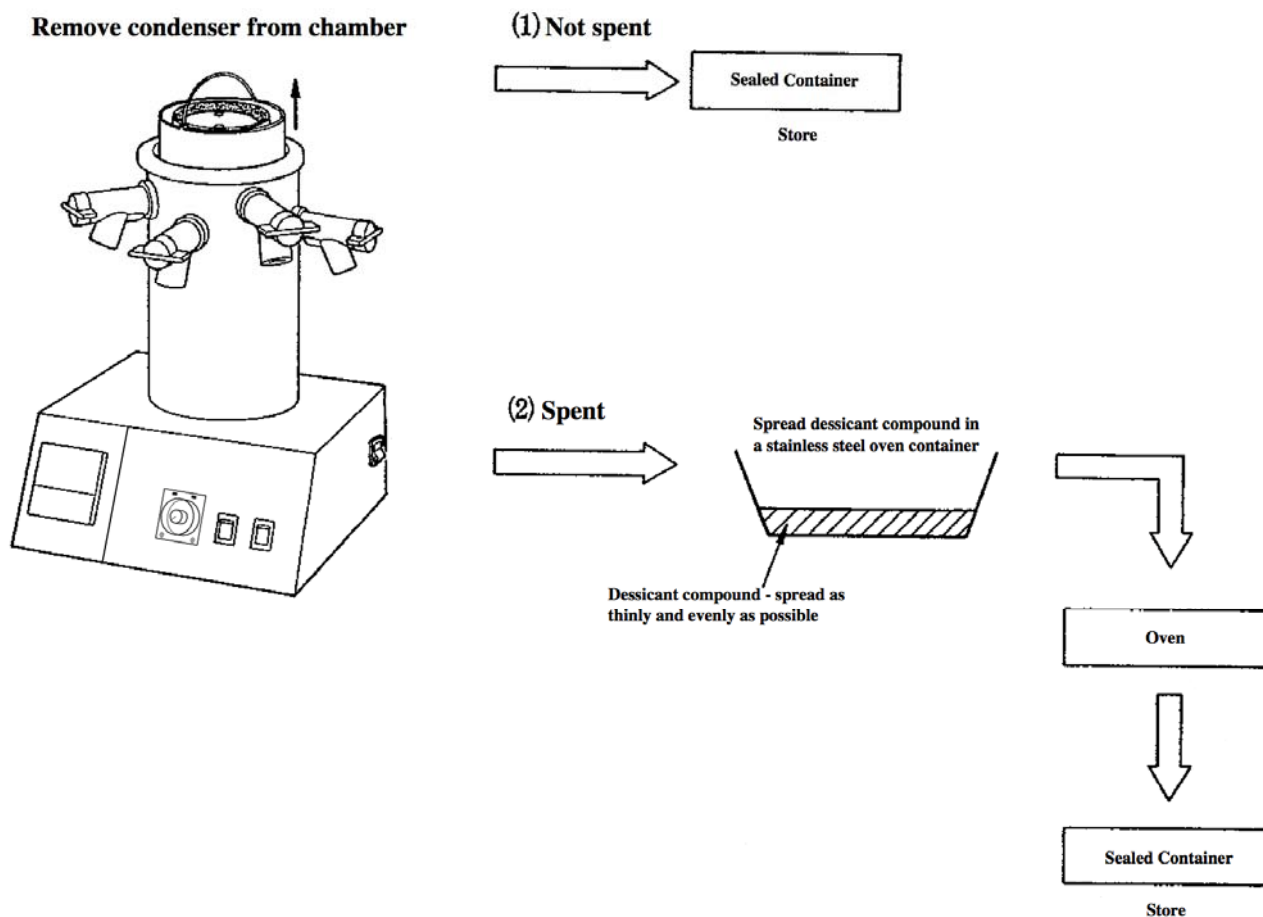
(2) If desiccant compound is spent:

- A) Place compound in a stainless steel oven container, spreading as thinly as possible.
B) Re-dry at 250°C for 12 hours from the time oven reaches temperature.
C) Place dried compound into an airtight container as soon as possible after drying and allow it to cool in container.



Caution:


Do not cool molecular sieve by leaving exposed. This will cause moisture from the air to be absorbed, rendering molecular sieve unusable without once again re-drying.




5. HANDLING PRECAUTIONS

Warning

1. DO NOT process hazardous or harmful substances.


 Never process explosive or flammable items. Fire or explosion causing serious injury or death may result. See "List of Hazardous Substances" (P.20) for more information on these items.

2. DO NOT operate equipment when abnormalities are detected.


 If unit begins emitting smoke or abnormal odors for reasons unknown, turn off power switch immediately, disconnect power cable from power supply, and contact a local dealer or 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 always be performed by a certified technician.

Caution


1. DO NOT place items on top of equipment.

 Placing items on top of unit may cause unit to become unstable and tip over, resulting in possible equipment damage, injury or death.


2. DO NOT operate equipment during thunderstorms.

 In the event of a thunderstorm, turn off 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.


3. DO NOT use solvents.

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


4. Vacuum grease application.

 Vacuum pressure may be weakened and vacuum leaks may occur if any contaminants are allowed to build 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, clean thoroughly, apply vacuum grease, and reinstall.


5. Pressure normalization.

 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 vacuum lines and chamber. See "end operation" (P.10) for pressure normalization procedure.


6. Timer.

 The timer on DC 41 units should be used as a rough guideline. Be sure to check sample status before and after timer is up. When timer is at 0, be sure that the buzzer is OFF. Buzzer will sound whenever timer is at 0 (zero), if buzzer switch is ON.

7. Ampule neck size.

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

8. Desiccant compound for water absorption only

 The supplied molecular sieve desiccant compound is intended for water absorption applications only. All other solvents and chemical compounds may bypass the molecular sieve compound and be drawn into the vacuum pump.

5. HANDLING PRECAUTIONS

9. DO NOT leave desiccant compound exposed.

- ! Re-dry or store molecular sieve desiccant compound in an airtight container immediately following use. Leaving compound inside of unit, unsealed (purge switch ON), for any amount of time will allow moisture from the air to be absorbed, saturating compound and rendering it unusable until it is re-dried. Using the optional condenser storage container from Yamato Scientific, P/N 212576 is recommended. Likewise, place condenser with desiccant compound into chamber and begin operations as quickly as possible.

10. Dry desiccant compound as directed.

- ! Do not dry molecular sieve compound at a temperature higher than 250°C. Doing so will result in degraded moisture absorption capacity.

11. Use proper sample sizes and process accordingly.

- ! Size test samples properly and use appropriate times and process frequency. See reference data on P.19. Processing too many or too large a sample size may overwhelm condenser, causing excess moisture to be drawn into the vacuum pump.

12. Prepare test samples appropriately.

- ! When pre-freezing, samples should be spread into containers as thinly and as broadly as possible to prevent them from thawing before the process can dry them.

13. Power failures.

- ! In the event of a power failure, decompression in the chamber will fall causing samples to begin thawing. Implement prevention measures as needed.

14. Use as directed.

- ! Operate DC41 unit only as directed in this text. Utilizing equipment for anything other than that which it is intended may cause malfunction, damage, serious personal injury or death. Read instruction manual thoroughly before use. Likewise, using non-Yamato components to modify, customize or to otherwise attempt to improve unit design is not recommended and may void warranty.

6. MAINTENANCE & DISPOSAL PROCEDURES

Inspection & Maintenance

Warning

Conduct daily general inspections to assure optimal performance.

- Be sure that power switch is OFF before daily inspection and maintenance of DC41 units.
- Never attempt to disassemble unit.

Caution

Cleaning.

- 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.

Extended Storage / Unit Disposal

Caution

Extended periods of nonuse.

Turn off power and disconnect power cable during periods nonuse or extended storage.

Warning

Disposal.

- Place out of reach of children.
- Remove power cable.
- Dispose as bulky or industrial waste.

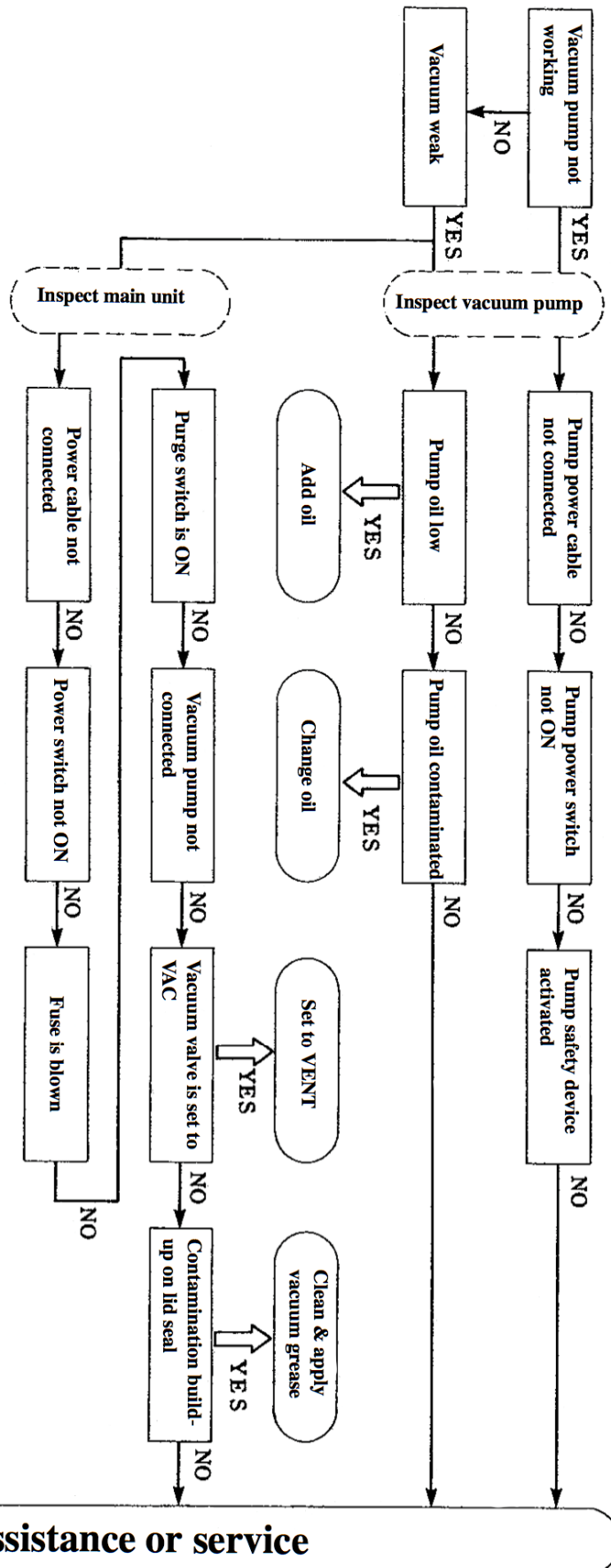
Disposal Considerations

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

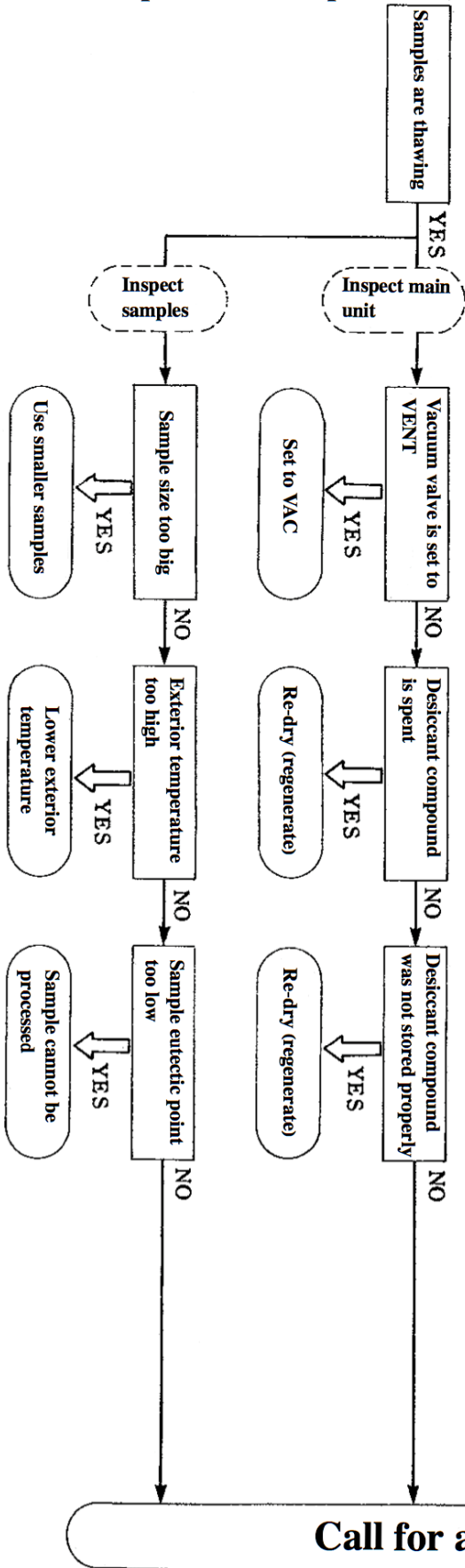
Yamato Scientific Co., Ltd. strongly recommends disassembling unit, as far as is possible, in order to separate parts and recycle them in contribution to preserving the global environment.

Troubleshooting Chart

1) Vacuum suction weak



2) Test samples cannot be processed



Requests for Repair

When a problem occurs, terminate operation immediately, turn off power switch 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

Guaranteed Supply Period for Repair Parts

Guaranteed maximum supply period for repair parts is 7 (seven) years from date of discontinuation for DC41A/B tabletop freeze dryers. "Repair parts" is defined as components which, when installed, allow for continued unit operation.

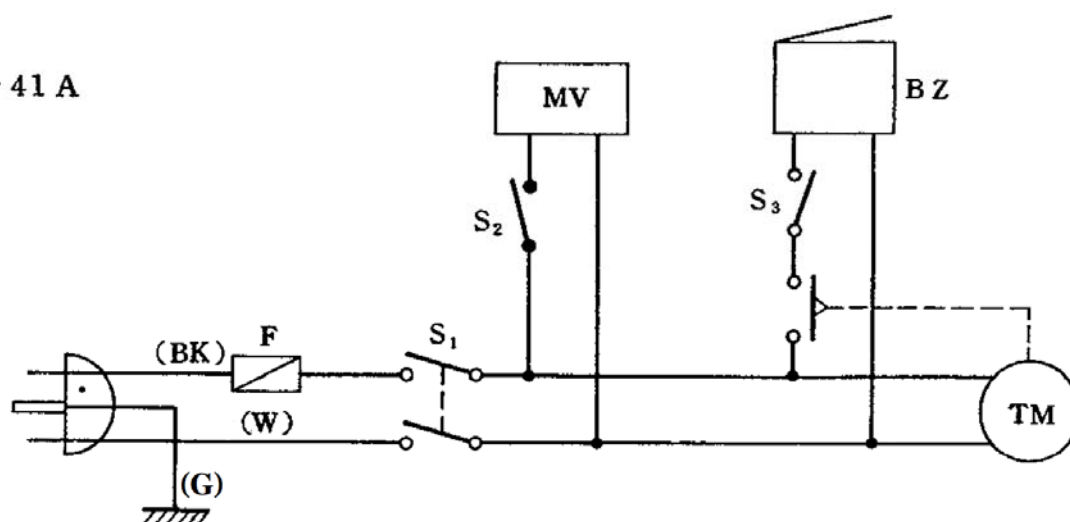
9. SPECIFICATIONS

Model		DC41A	DC41B
Performance	Max. drying capacity	200g evaporated moisture	
	Max. drying speed ※1	Approx. 30g/hr	
	Sample temperature ※2	Below -30°C (one sample) Below -20°C (five samples)	
Configuration	Condenser type	Desiccant moisture absorption compound (molecular sieve)	
	Condenser dimensions	φ 150mm x height 330mm	
	Condenser material	SUS304 stainless steel	
	Vacuum gauge	Bourdon type	Thermocouple type
	Vacuum gauge range	0 ~ -0.1MPa	200 ~ 10 ⁻¹ Pa
	No. of containers attachable	5	
Standard measurements	Overall dimensions	W340 x D340 x H446mm	
	Vacuum port	φ 18mm	
	Power requirements	100V AC, 50/60Hz, 1A	
	Weight	Approx. 14kg (dry)	
Included items	Vacuum valves	5	
	Vacuum hose	(φ 15 × φ 30 × 1.5m) 1	
	Silicon vacuum grease	1	
	Desiccant compound	(molecular sieve) 2.5kg	
	Fuse	1	
	Instruction manual	1	

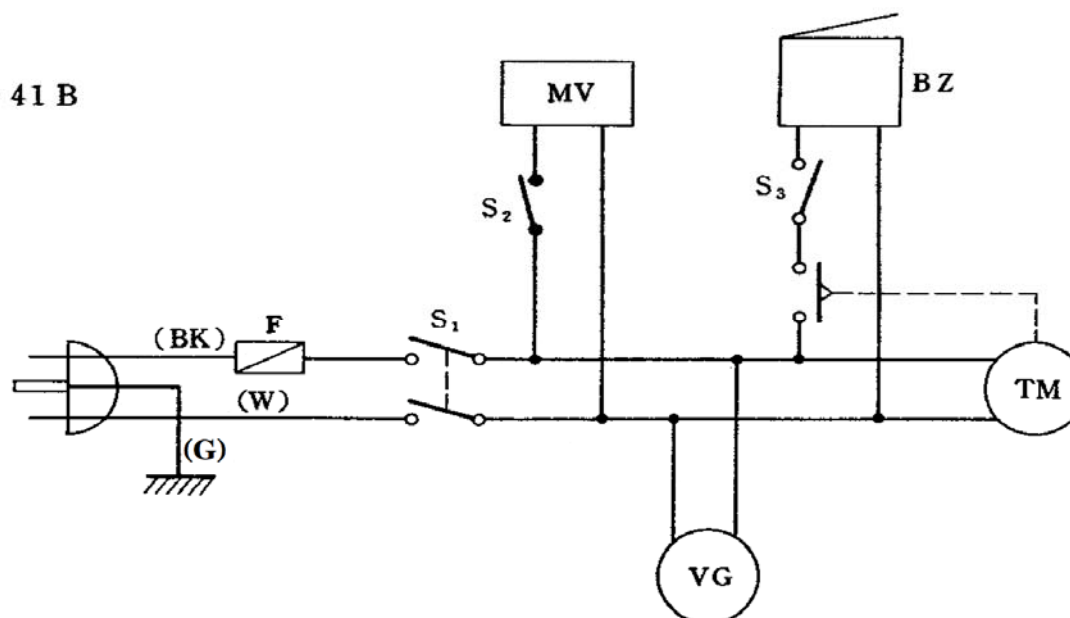
※1 Max possible with 2.5kg molecular sieve compound added.

※2 Performance based on using Yamato Scientific 120mm flasks with 10ml of sample in each container. Results may vary depending on sample type/size and container type/size.

DC-41 A



DC-41 B



Wiring Diagram Component List

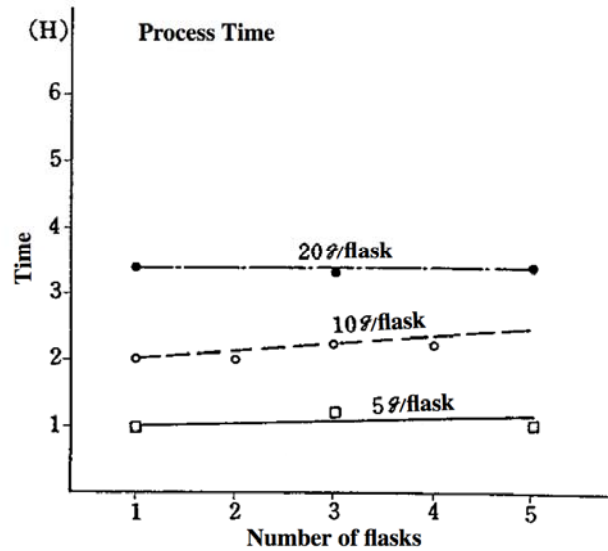
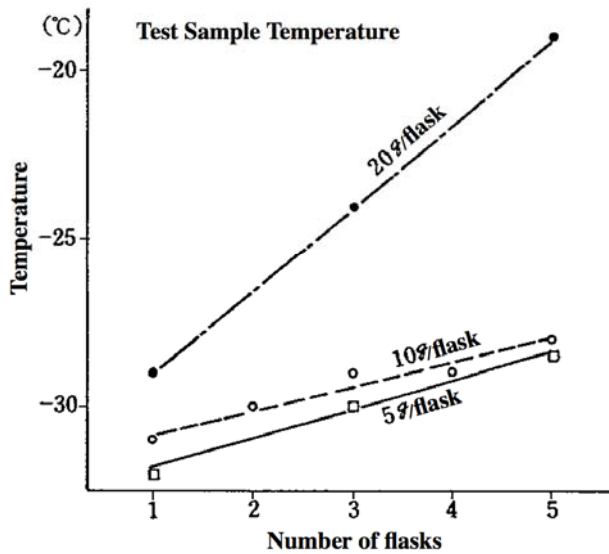
Symbol	Component Name
BZ	Buzzer
F	Fuse
MV	Purge Valve
S ₁	Power Switch
S ₂	Purge Switch
S ₃	Buzzer Switch
TM	Timer
VG*	Thermocouple Vacuum Gauge

*DC41B only.

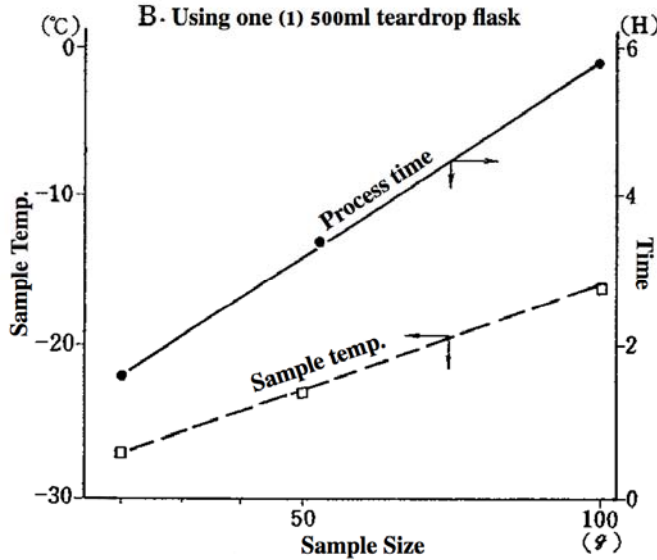
11. REFERENCE DATA

Freeze Dry Process Data

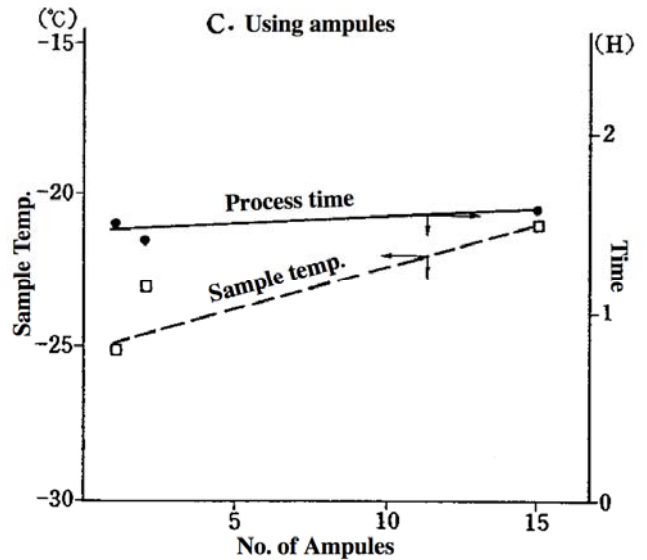
A. Using 120ml Yamato flasks



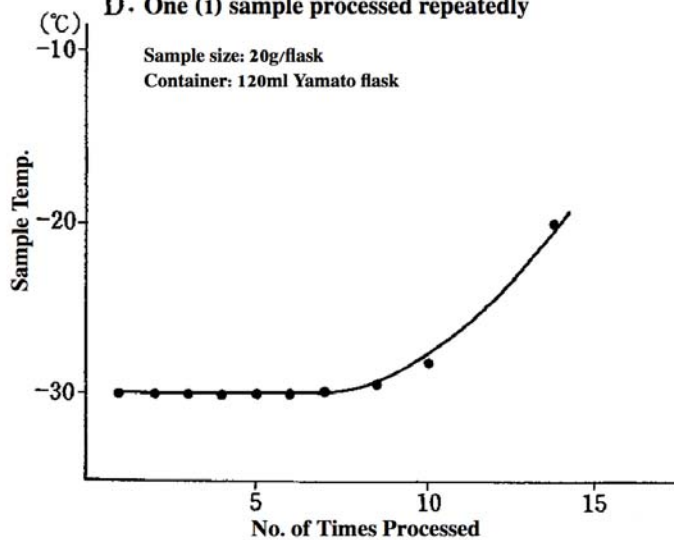
B. Using one (1) 500ml teardrop flask



C. Using ampoules



D. One (1) sample processed repeatedly



Sample size: 20g/flask
Container: 120ml Yamato flask

12. LIST OF HAZARDOUS SUBSTANCES



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

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.
Explosive Substances	①Metal "Lithium" ②Metal "Potassium" ③Metal "Natrium" ④Yellow Phosphorus
	⑤Phosphorus Sulfide ⑥Red Phosphorus⑦Phosphorus Sulfide
	⑧Celluloids, Calcium Carbide (a.k.a, Carbide)⑨Lime Phosphide□Magnesium Powder
	⑩Aluminum Powder ⑪Metal 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	① Ethyl 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 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 Gases	Hydrogen, Acetylene, Ethylene, Methane, Ethane, Propane, Butane and other gases combustible at 15°C under air pressure.

Excerpt from Table 1, Hazardous Substances, in Cabinet Order from Occupational Safety and Health Law (substances related to Articles 1, 6, and 9)

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 DC41 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.**
- **Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.**

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Tabletop Freeze Dryer
DC41A/B
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