FREEZE DRYERS
Models DC-41A/41B

Instruction Manual

Yamato Scientific Co., Ltd.

Tokyo, Japan
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1. PRECAUTION IN INSTALLING

(1) Please do not install the Freeze Dryer at the following places.

(1) Where flammable gas or corrosive gas is around.
(2) Humid places.
(3) Where the ambient temperature is at 35°C or more or the temperature difference is too big.
(4) Where the sunshine directly comes in.
(5) Where the wind from the airconditioners hits the sample containers directly.

(2) The vacuum pump for this Freeze Dryer should have the free air displacement of 50 l/min or more and the ultimate vacuum of 10⁻⁴ Torr.

(Suitable type for example: Yamato Model PD-52 Vacuum pump with free air displacement of 50 l/min.)

Please connect the hose nipple (outside diameter 18mm) at the left side and the suction port nipple of the vacuum pump tightly with a vacuum hose so that there is no air leakage.

If the hose differs from the suction port nipple in diameter, please use a proper reducer to connect securely.

(3) Connect the electric plug and the 3-wire grounded outlet.

If grounded outlet is not available, please use the grounding type adapter to ground the lead wire.
## 2. SPECIFICATIONS

<table>
<thead>
<tr>
<th>Models</th>
<th>DC-41A</th>
<th>DC-41B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample temperature*1</td>
<td>Below -30°C (when the number of sample is one.)</td>
<td>Below -20°C (when the number of sample is five.)</td>
</tr>
<tr>
<td>Max. freeze drying capacity</td>
<td>200g distilled water/batch*2</td>
<td></td>
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<tr>
<td>Max. freeze drying speed</td>
<td>approx. 30g of water/hr.</td>
<td></td>
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<tr>
<td><strong>Composition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condenser</td>
<td>Adsorption material (molecular sieve)</td>
<td></td>
</tr>
<tr>
<td>Dimension</td>
<td>Outside diameter 150mm x height 330mm</td>
<td></td>
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<tr>
<td>Material</td>
<td>Stainless steel SUS 304</td>
<td></td>
</tr>
<tr>
<td>Number of container to be set</td>
<td>5 pcs.</td>
<td></td>
</tr>
<tr>
<td>Vacuum gauge</td>
<td>Bourdon tube</td>
<td>Thermocouple</td>
</tr>
<tr>
<td>Measuring range (Indication)</td>
<td>0 ~ 76cmHg</td>
<td>200 ~ 10⁻¹ Pa/2~10⁻³ Torr</td>
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<tr>
<td><strong>Standard</strong></td>
<td><strong>DC-41A</strong></td>
<td><strong>DC-41B</strong></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Overall dimensions</td>
<td>340(W)X340(D)X446(H)mm (Protruding parts are</td>
<td></td>
</tr>
<tr>
<td></td>
<td>not included.)</td>
<td></td>
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<tr>
<td>Hose nipple</td>
<td>Outside diameter 18mm</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>AC 220V 50Hz, 1A</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 14kg (The weight of molecular sieve is</td>
<td></td>
</tr>
<tr>
<td></td>
<td>not included.)</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Accessories</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Vacuum valve</td>
<td>5 pcs.</td>
<td></td>
</tr>
<tr>
<td>Vacuum hose</td>
<td>Inside diameter 15mm X length 1m 1 pc.</td>
<td></td>
</tr>
<tr>
<td>Molecular sieve</td>
<td>2.5 kg</td>
<td></td>
</tr>
<tr>
<td>Grounding type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicone grease for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum</td>
<td>1 piece in cup</td>
<td></td>
</tr>
<tr>
<td>Fuse</td>
<td>1 pc.</td>
<td></td>
</tr>
<tr>
<td>Instruction manual</td>
<td>1 copy</td>
<td></td>
</tr>
</tbody>
</table>

*1  When 120ml flask of optional accessories is used and the amount of sample is 10g per flask.

Please note that performance varies depending on the amount of samples, kind of sample, shape and size of containers.

*2  This quantity of distilled water is processable when 2.5kg of molecular sieve is used.
1. Timer
2. Duzzm Switch
3. Purge Switch
4. Power Switch
5. Valve
6. Chamber cover
7. Chamber
8. Vacuum gauge
9. Fuse
10. Hose Nipple
11. DC-41A
12. DC-41B
4. ILLUSTRATION OF EACH PART OF THE PANEL

① Purge switch  ... It makes the circuit atmospheric and prevents oil from flowing backward when the vacuum pump stops.

② Buzzer switch  ... It informs that time is up by buzzer sound.

③ Timer  ......... It sets the freeze drying time. (Please adjust the time according to the amount and kind of the sample.)

④ Vacuum gauge  ... It indicates the vacuum degree in the circuit.
  (Type A  ......... Bourdon)
  (Type B  ......... Thermocouple)
5. ASSEMBLING

(1) How to attach the valve. (Fig. 1)

① Apply silicone grease to the groove of the valve body and the holes of the chamber. Then insert the end of the valve body straight into the holes of the chamber with turning it.

② Apply silicone grease to the external surface of the valve stem, then insert it into the valve body.

③ When you take off the valve, please do the above procedure conversely.

(2) How to attach the condenser. (Fig. 2)

① Charge the molecular sieve in the condenser. Open the lid at the top center of the condenser and charge the molecular sieve inside.

② After filling up, close the lid and fasten securely with the knurled screws.

③ Place the condenser in the chamber.
Molecular sieve

2.5Kg (dry)

Lid
Condenser

Fasten by knurled screw

Set

Fig. 2
6. OPERATION

(1) Preparation for the operation.

① Regenerate the molecular sieve in the condenser completely and cool it.

② Fasten the lid of the condenser securely with knurled screw.

③ Set the condenser in the chamber.

④ Connect the vacuum pump and the hose nipple of the main body with a vacuum hose.

⑤ Turn off the purge switch.

⑥ Turn the valve to " VENT " to close. (Fig. 3)

(2) Starting operation.

① Start up the vacuum pump.

② Please make sure that atmosphere is adequately vacuumed with the vacuum gauge.

③ Attach the samples which are prefrozen the valve and turn the valve to " VAC " to open.

This makes the pressure of the container reduced. (Fig. 4)

④ Set the timer. Timer should be adjusted according to the quantity and kind of the sample.

⑤ Turn the buzzer " ON ".
(3) Stopping operation.

① Check the condition of the sample before terminating the drying process.

② When the freeze drying is finished, turn the valve to "VENT" and take off the sample containers. (Fig. 3)

③ Turn the purge switch "ON" before you stop the vacuum pump.

④ Turn the buzzer switch "OFF" to stop the buzzer.

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Valve close

![Valve close](image1)

Fig. 3

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Valve open

![Valve open](image2)

Fig. 4
7. REGENERATION AND STORAGE OF THE MOLECULAR SIEVE

(1) When you finish the freeze drying, take out the condenser from the chamber and put it into the regeneration oven with opening the lid of the condenser stood for regeneration. (Fig. 5)

(2) Temperature for regeneration is 250°C.

(3) Regeneration time is approx. 12 hours after the chamber temperature of the oven gets 250°C.

(4) Once the regeneration is over, store the molecular sieve in the sealed container.

(5) Cooling should be done in the sealed container. Take out the condenser.

Unscrew the knurled screw and open the lid

Regeneration of molecular sieve

Oven

Temperature for regeneration 230~250 °C

Cooling and storage

Sealed container
8. CAUTION IN OPERATION

(1) Molecular sieve in accessories is adsorbent exclusive for water.
   Please note that solvent other than water can not be adsorbed and
   is absorbed in the vacuum pump.
(2) Please note that rubber packing and valve body can be corroded
   by acid and chloric solvents, benzene, toluene, and so on.
(3) Please use the containers for the samples we designate. As the
   inside diameter of the ampule adapter is 7mm, diameter of the
   connection tube for the ampule should be 7 ~ 9mm.
(4) After each batch of freeze drying, please be sure to regenerate
   the molecular sieve and keep it sealed up. If you leave it in the
   chamber after the operation it adsorbs the moisture in the
   air and becomes saturated. Please use the condenser storage
   container we designate.
(5) When you regenerate the molecular sieve, the temperature in the
   regeneration oven is very high. Please handle with care.
(6) Please note that the regeneration temperature for the molecular
   sieve should not be higher than necessary. The right temperature
   is 250 °C . If you make it higher than that the adsorbing capacity
   of the molecular sieve becomes weaker.
(7) Setting of the condenser into the chamber should be done immediately
   before the operation starts.
(8) To decide the sample quantity and the frequency of the operation,
   please refer to "9. REFERENCE DATA " . If the sample quantity is
   too large, the vapor sometimes cannot be adsorbed in the condenser
   and goes to the pump.
(9) After the operation, please let the air in the circuit open to the
   atmosphere. If you leave the vacuum pump evacuated, the oil in
   the pump might go back to the circuit.
(10) The timer is used for indicating the processing time merely as a reference. The freeze drying continues after the time elapses.

(11) If you do not use the timer, turn the buzzer switch "OFF". If it is turned "ON", the buzzer buzzes.

(12) Please make sure that the freeze dryer is grounded.

(13) It is impossible to warrant the freeze dryer against malfunction in case purchaser or user has made unauthorized remodeling or misused.

(14) If you find any malfunction, turn the power switch off and pull out the power supply cord and inform the sales agent.
9. REFERENCE DATA

When 120m£ flask (Yamato) is used.

When 500m£ eggplant shape flask is used.

Sample flask quantity

When one sample flask is repetively used.

When ampule (φ 5 x 2150mm) is used.

Sample ampule quantity

Sample quantity: 20g per flask

Sample container: 120m£ flask (Yamato)

Numbers of processing

* The above experimental data were given under the following conditions:

Sample: distilled water

Vacuum pump capacity: 50 l/ min.

Room temperature: 25 °C

Please note that the kind of the sample, the shape and size of the container, the capacity of the pump will make these data different a bit.
Check the followings if the product should have abnormality or trouble.

1. The vacuum degree is low.
   - Vacuum pump does not operate.
     - Check the vacuum pump.
       - Power plug is disconnected.
         - NO
           - Safety device is activated.
         - YES
           - Power switch is not ON.
             - NO
               - Oil is dirty.
                 - NO
                   - Oil is not enough.
                     - NO
                       - Filling the oil.
                         - YES
                         - Contact the nearest sales office.
                       - Replace the oil.
                         - YES
                         - Set the vacuum valve to VENT.
                           - YES
                           - Apply the grease.
                             - YES
                             - Contact the nearest sales office.
                       - It is not connected to the vacuum pump.
                         - NO
                           - Vacuum valve is set to VAC.
                             - NO
                               - U ring is dirty.
                                 - NO
                                 - Contact the nearest sales office.
                           - Check the main unit.
                             - NO
                               - Power plus is disconnected.
                                 - NO
                                   - Fuse is blown.
                                     - NO
                                     - Check the sample.
                                       - NO
                                         - Sublimation rate is large.
                                           - NO
                                             - Processing amount is large.
                                               - NO
                                                 - Eutectic point is low.
                                                   - YES
                                                   - Processing is not possible.
                                                 - YES
                                                 - Use the specified container.
                                                   - YES
                                                   - Reduce the processing amount.
                                                     - YES
                                                     - Reproduce the molecular sieve.
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### 11. REPLACING PARTS LIST

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Part No.</th>
<th>Specification</th>
<th>Manufacturer</th>
</tr>
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<tbody>
<tr>
<td>Power switch</td>
<td>212514-105</td>
<td>AJ921002B3</td>
<td>Matsushita Denko</td>
</tr>
<tr>
<td>Purge switch</td>
<td>212514-106</td>
<td>HLS112A (BLACK)</td>
<td>Fujisoku</td>
</tr>
<tr>
<td>Buzzer switch</td>
<td>212514-106</td>
<td>HLS112A (BLACK)</td>
<td>Fujisoku</td>
</tr>
<tr>
<td>Purge valve</td>
<td>212514-141</td>
<td>AG31-02-1-AC100V</td>
<td>CKD</td>
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<tr>
<td>Timer</td>
<td>212514-111</td>
<td>STMN-111</td>
<td>Tateishi Denki</td>
</tr>
<tr>
<td>Buzzer</td>
<td>212514-112</td>
<td>EA4201</td>
<td>Matsushita Denko</td>
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<tr>
<td>Fuse</td>
<td>212514-103</td>
<td>6.4 x 30 mm 1A 125V</td>
<td>On the market</td>
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<td>U ring</td>
<td>224181-105</td>
<td>CR</td>
<td>Yamato Scientific</td>
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<tr>
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<td>P24 (NBR)</td>
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<td>Molecular sieve</td>
<td>212514-200</td>
<td>3A-3.2 Pellet</td>
<td>Union Showa</td>
</tr>
<tr>
<td>Vacuum valve main unit</td>
<td>212514-300</td>
<td>CR</td>
<td>Yamato Scientific</td>
</tr>
<tr>
<td>Vacuum valve stem</td>
<td>212514-301</td>
<td>PP</td>
<td>Yamato Scientific</td>
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<tr>
<td>Bourdon's tube vacuum meter*1</td>
<td>212514-121</td>
<td>AA15-221</td>
<td>Nagano Keiki</td>
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<tr>
<td>Thermocouple vacuum meter*2</td>
<td>212515-123</td>
<td>MTG-011</td>
<td>Nichiden Aneruba</td>
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<tr>
<td>Measurement ball*2</td>
<td>212515-124</td>
<td>TG-550</td>
<td>Nichiden Aneruba</td>
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The part marked with *1 is only for the model DC-41A.
The parts marked with *2 are only for the model DC-41B.