

Glass Tube Oven

Model GTO-200

Operation Manual

Thank you very much for purchasing the SIBATA product.

Make sure to read this Instruction Manual before using the product.

Handle the equipment according to the instructions on the following pages.

After reading, keep this Instruction Manual with the warranty certificate for future reference.

If you have any questions, directly contact the SIBATA Sales Department or a sales office.



SIBATA SCIENTIFIC TECHNOLOGY LTD.

柴田科学株式会社

Notes for Safe, Correct Use

Read the entire Instruction Manual thoroughly and use the equipment correctly. Keep the Instruction Manual handy for future reference.

Before Use

(Make sure to read the below and handle the equipment carefully.)

The below are cautions for all SIBATA products so some items may not be applicable to this product.

- Install the equipment on a level, stable place.
- Make sure to ground the power cable.
- Supply water to prevent heating with no water.
- The equipment is not explosion-proof. Do not use it near flammable or combustible substances.
- [Do not remodel or disassemble] DO NOT disassemble or remodel the equipment. Remodeled or disassembled products are not covered under SIBATA's warranty.

Remodeling or disassembling the equipment may cause an unexpected failure or accident.

- In case of a failure, promptly make a request for service repair. DO NOT leave the equipment broken or use it after repairing it by yourself because it may cause an unexpected accident.
- To remove dirt, wipe it off using a soft cloth (soaked in a neutral detergent for severe dirt).
- If smoke is generated from the equipment, parts other than the heater are abnormally hot, or abnormal sound is heard, stop using the equipment immediately, turn OFF the power switch, unplug the power cable from the power outlet, and make a request for service repair.
- When unplugging the power cable, hold the power plug, instead of pulling the power cable. Do not touch the cable with wet hands because there is a danger of electric shock.
- Do not bend, pull, twist, or extend cables.
- In case of damage to the cable, disconnection, or poor contact of the plug, immediately stop using the equipment and make a request for service repair.

1. Overview

In general, vapor pressure of substances increases as temperature rises. "Glass tube oven" takes advantage of the phenomena in which volatile materials that evaporate at a pressure lower than air pressure (e.g. water) volatilize easily at a lower temperature.

Namely, the boiling point of a fluid contained in a substance is lowered by keeping the total pressure at a low level so that the fluid can be evaporated while keeping the substance's temperature at a low level. The substance can be heated at the same time.

1-1 Features of the Glass Tube Oven (small capacity vacuum heating equipment)

- In addition to quantitation of crystalline water, quantity of moisture, water, and occluded water can be determined separately by the indirect gravimetric method.
- The oven is suitable for drying samples that are easily decomposed or oxidized by heating because the necessary time is shorter as compared to drying at room temperature and heating temperature can be lower as compared to the normal pressure heating method.
- Since evaporated water is absorbed by the desiccant agent, samples can easily be almost completely dried.
- Heat transfer temperature difference is great because heating is performed by thermal radiation, which enables a higher heat transfer rate, namely drying rate. Samples can be dried two or three times faster as compared to drying methods under normal pressure.
- Negative effects of thermal decomposition are reduced and concentration can be performed under diminished pressure.

1-2 Use

- Concentration or desiccation of dyes, pharmaceuticals, organic industrial chemicals, foods, and substances that are easily oxidized or catch fire when in contact with air
- Desiccation of desiccant agents such as alumina and phosphorus oxide that are highly-hygroscopic

2. Notes

- The surface temperature of the outer tube (made of glass) reaches approximately 200 °C at the maximum under some setting conditions.

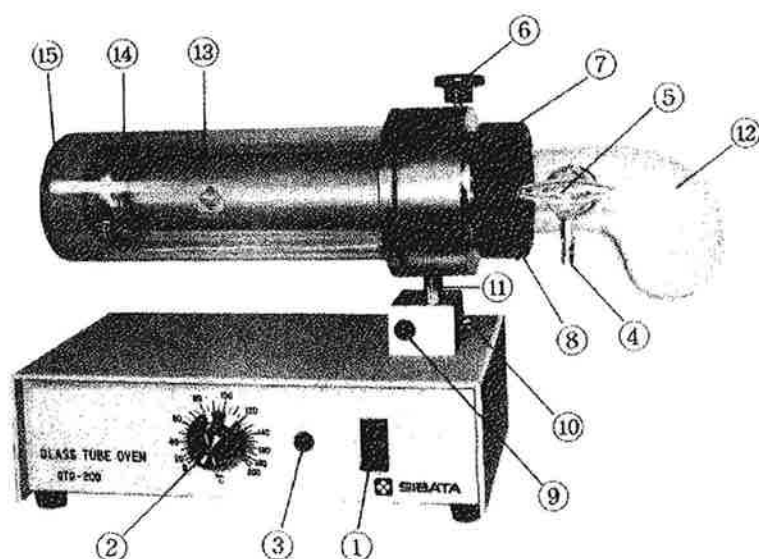
Directly touching it with your bare hand will result in a burn. Handle the tube with care.

- Do not raise the temperature over 200 °C.

It may cause a failure or other problems.

3. Configuration

3-1 Part Names



- (1) Main switch
- (2) Temperature adjustment knob
- (3) Pilot lamp for heater
- (4) Rubber stopper for vacuum
- (5) Three-way cock
- (6) Drying tube fixing screw
- (7) Screw cap
(internal flange seal)
- (8) Spring
- (9) Hole
- (10) Rod fixing screw
- (11) Rod
- (12) Hood
- (13) Drying cylinder
- (14) Heating tube
- (15) Outer tube

Fig. 1 Model GTO-200

4. Operation Procedure

1. Notes for Filling Desiccant Agent

Samples containing water can be dried quickly and efficiently with the help of desiccant agents such as silica gel, calcium chloride, and phosphorus pentaoxide. Put a desiccant agent in a cloth bag and place it back of the hood (12). When filling the desiccant agent, do not soil the cock (5) or inside of the hood (12).

If the inner wall is soiled, dirt gets carried by the air flow generated when exhausting the inside of the drying cylinder, contaminating the sample to be dried.

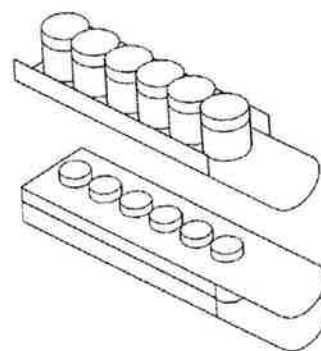
2. Filling Samples

Samples to be dried can be placed in the drying cylinder in a number of different ways. To select the best way, the amount of the sample to be dried is the most important point.

Some examples of using the Glass Tube Oven are described below.

Example 1 (Fig. 2)

Put the sample to be dried in weighing bottles (18 dia. × 25) and insert them into the drying cylinder using the holder (6 pieces can be held). (Keep the caps of the weighing bottles off.) Weighing bottles (18 dia. × 25, 30 dia. × 20) are available as an option. (Item code: 012750-1825A, 012750-3020A) This method is especially suitable for drying a small amount of sample.



Example 2 (Fig. 3)

When a large amount of sample needs to be dried, place it directly in the drying cylinder. However, this method is unsuitable for hygroscopic samples because they absorb moisture again while they are moved to a different container after being dried.



Fig. 3

Example 3 (Fig. 4)

Stand the tube oven vertically upright and put the sample to be dried directly in the drying cylinder. This method requires a longer drying time because the dried surface is smaller relative to the sample amount.



Fig. 4

3. Using in a Vertically Upright Position

As shown in the example, GTO-200 Glass Tube Oven can be used in a vertically upright position or tilted.

When using the GTO-200 in a vertically upright position, insert a 12 mm dia. rod into the hole (9) shown in Fig. 5 and use it as the axis for suspending the GTO-200. When using the GTO-200 tilted, fix the set screw during tilting.

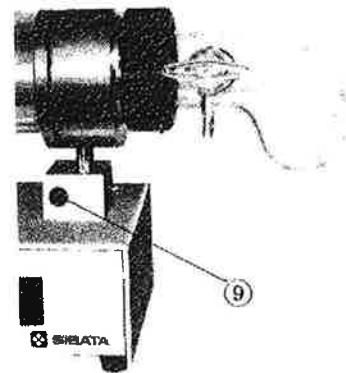


Fig. 5

4. Operation

Insert the drying cylinder into the glass tube oven and fix it at the correct position using the drying tube fixing screw (6).

Connect the vacuum pump to the rubber stop for the vacuum pump and reduce the pressure of the drying cylinder to a desired level.

During depressurizing, have the cock (5) in position A as shown in Fig. 6.

Set the temperature using the temperature adjustment knob (2) and turn ON the main switch (1). The pilot lamp (3) will light up, the heater will start working, and the drying cylinder will be heated.

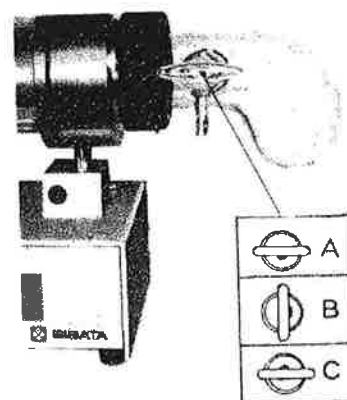


Fig. 6

When the desiccation of the sample is completed, stop the vacuum pump and turn OFF the main switch of the oven. Then, have the cock in position B to bleed the inside of the vacuum pump tubing or in position C to bleed the inside of the drying cylinder.

Chemical	Amount of air (in Liter) that 1 ml of each desiccant agent can dry (including 20 mg of water per liter)	Amount of water remaining in 1 liter of air after drying (mg)
Copper Sulfate (Anhydrous) *	0.45 to 0.7	2.7 to 2.9
Calcium Chloride (Granulated)	6.1 to 24.2	1.4 to 1.6
Calcium Chloride (Dehydrated)	4.0 to 5.8	1.23 to 1.29
Zinc Chloride (Rod State)	0.8 to 2.1	0.94 to 1.02
<u>Barium Perchlorate</u> (Anhydrous)	2.3 to 3.7	0.76 to 0.88
Caustic Soda (Rod State)	2.8 to 8.9	0.78 to 0.83
Magnesium Perchlorate (including trimolecular water)	4.0 to 7.2	0.028 to 0.003
Caustic Potash (Rod State)	3.2 to 7.2	0.010 to 0.017
Silica Gel *	2.1 to 5.2	0.002 to 0.010
Calcium Sulfate (Anhydrous) *	1.2 to 18.5	0.004 to 0.006
Lime	7.6 to 10.1	0.003 to 0.004
Magnesium Perchlorate (Anhydrous)	2.8 to 5.9	0.0016 to 0.0024
Alumina *	5.6 to 6.8	0.0008 to 0.0012
Barium Oxide	2.5 to 10.6	0.0006 to 0.0008
Phosphorus Pentaoxide		0.00005

Note: Chemicals with an * mark can be reused by heating to 100 °C min.

Table 1 Comparison of Desiccation Effects on Various Materials

Temperature (°C)	Vapor Pressure of Water (torr)	Moisture (mg/l)
100	760	
80	355	
60	150	
40	55.3	17.3
20	17.5	
0	4.6	4.8
-10	1.95	2.14
-20	0.77	0.88
-24	0.52	
-28	0.34	0.41
-30	0.28	0.33
-34	0.185	
-36	0.15	0.178
-38	0.119	
-40	0.093	0.117
-44	0.058	0.074
-50	0.029	0.038
-60	0.007	0.011
-70	0.0004	0.0008

Table 2 Moisture Contained in Water Vapor and Various States of Saturated Air

By comparing Tables 1 and 2, some interesting facts can be discerned. For example, you can see that the temperature where moisture in the air becomes equal to the water content remaining in 1 liter of dried air after using specific desiccant agents. The temperature is -60 °C for silica gel and anhydrous calcium sulfate, -70 °C for anhydrous magnesium perchlorate and alumina, and -80 °C for phosphorus pentaoxide.

When using a powder-state desiccant agent (e.g. phosphorus pentaoxide), a measure to prevent particulates from getting sucked into the vacuum system needs to be taken. If no measure is taken, phosphorus pentaoxide will become corrosive phosphoric acid and alumina and some other desiccant agents will become abrasives.

5. Warranty

This product shall be repaired free-of-charge should it malfunction within one year of purchase.

When making a request for service repair, be sure to directly contact the dealer of purchase or SIBATA's sales office.

When contacting, make sure to give the item code, product name, and model name or number and describe the problem.

Repair of the product shall fall outside of the scope of this Warranty and shall be charged for if any of the following causes it to malfunction:

- (1) Failures resulting from incorrect use
- (2) Failures or damage resulting from repairs or modifications implemented by parties other than SIBATA
- (3) Failures or damage resulting from unavoidable occurrences such as fires, earthquakes, or other natural disasters
- (4) Failures or damage occurred due to relocation, movement, falling, or vibration after purchase
- (5) Failures or damage resulting from the use of consumable items not specified by SIBATA
- (6) Warranty certificate with no date of purchase or seal of the store, or altered description
- (7) [Do not remodel or disassemble] DO NOT disassemble or remodel the equipment. Remodeled or disassembled products are not covered under SIBATA's warranty.

Remodeling or disassembling the equipment may cause an unexpected failure or accident.



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Note) Shape, dimensions, specifications, and other product information are subject to change without notice in the interest of product improvement to the extent that product functions and applications will not be impaired.