

WTVO-0.9	Model
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Vacuum Oven

User Manual



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1. Adaptable scope:

This vacuum drying oven is for various laboratories of factories, enterprises, mines, universities and research institutes to dry and heat objects in vacuum environment. To dry and heat objects in vacuum environment has following advantages:

- (1) Decrease dry temperature (low pressure and low temperature)
- (2) Avoid oxidation of objects when being heated and prevent objects from damage caused by dirt.
- (3) Avoid heated air killing biological cells.

2. Technical index (See Table 1)

3. Structure and working principles

Vacuum drying ovens (Hereafter referred as drying oven) are all desk-top type. Generally speaking, drying oven is made up of a cabinet, an internal bladder (working room), a vacuumizing system, and a temperature-control system.

The cabinet is made up of high-quality sheet with sprayed plastic surface. So the exterior surface is bright in color. Internal bladder is made up of galvanized armor plate or stainless steel armor plate with the shape of semi-arc. The space between the internal bladder and the out shell is filled with super-thin glass wool for insulating heat. In the middle of cabinet door, there is a view window made up of double-layer bulletproof glass. In the inner part beside the door, a thick safety glass and a long column like door pin are used. The distance between them is very convenient to adjust so that the door presses the rubber airproof enclosure after the cabinet is closed. Thus air leakage when vacuumizing is prevented. (Note: The rubber airproof enclosure is not oil-proof.)

The vacuumizing system is made up of vacuum pump, vacuum meter, vacuum valve and air-release valve (Pls ensure that the rubber suction exhaust port rotates 180deg). According to user's need, drying (cleaning) filter pot (equipment) or air-inlet valve can be equipped. Vacuum pump for other model is optional. (The velocity of vacuum pump you selected should not be less than 2L/S.)

Temperature-control system is made up of sensor (Pt100 platinum resistance), temperature controller, and heater. When receiving output resistance signal ($100\ \Omega$ for 0°C , 0°C) from sensor, temperature controller will display in PV screen real temperature tested from inside of working room. When input signal is less than set value, the power tube (bidirectional silicon controlled rectifier) is open and the heater gets enough electrical power to create heat. Otherwise, there is no power in the power tube and the heater does not heat. The temperature controller has the special function of adjusting output power with PID, testing and correcting temperature error and timing function. If the power is high than the set value, there will be a warning light and automatic cutting function will be effective.

Vacuum Drying oven Technical Index (Table 1)

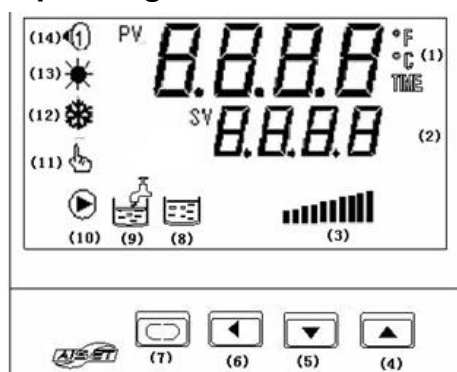
Index Name	Type	WTVO-0.9	WTVO-1.9
voltage		AC 220V 50Hz	
Input power (W)		400	600
Control scope (°F)		RT+10~65°C	RT+10~65°C
Attainable Vacuum degree		133Pa	
Shelf (layer)		4	6
Bladder Material		stainless steel	
Size of the Bladder (in)		11.8×11.6×10.8	16.3×14.7×13.6
Out size(in)		23×18.6×17.7	27.9×21.5×21.3

Note: 1. This product is produced according to Q/TIWY7-2004.

2. RT refers to environment temperature.

4. All technological indexes are get under the situation with environment temperature 25°C (77°F) , relative humidity \cong 85% and vacuum degree is \cong 0.1Mpa. And all data are tested with mercurial thermometer whose precision is $\pm 0.1^\circ\text{C}$ (°F) . The mercurial head of the thermometer should touch the surface of the shelf inside the cabinet well.

4. Operating method of the controller



4.1. Panel layout

1. PV: Measured temperature;
2. SV: Showing set temperature;
3. Light column display: Displays the percentage of the heating control output;
4. Add key: used for setting values, modifying control parameters or running time query

5. Decrease button: used for setting values, modification of control parameters or changes in operating status
6. Shift key: used for set value, shift of control parameters and start/stop auto-tuning;
7. Function key: used for setting value modification; parameter recall, parameter modification confirmation;
8. Water lever indicator: high/ low water lever (no function);
9. Replenishment indicator: When the water level is low, it will be on, and the rest will be off.
10. Running indicator: Lights up during operation and flashes when the curve is paused;
11. Self-tuning light: flashes when it is at auto-tuning.
12. Cooling lamp: It lights up when the cooling output;
13. Heating lamp: It lights up when the heating output;
14. Alarm lamp: It lights up when alarm light.

4.2. Description of each function

- 1) If the PV area displays "□□□□", the sensor is open or the input signal exceeds the upper limit of measurement; if the PV area displays "□□□□", the sensor is shorted or the input signal is lower than the lower limit of the range. When the input signal of the meter is not within the range, the buzzer will sound. , press any key to silence.
- 2) Change in set value and timing time:
Press the function key, the PV area displays SP, and the SV area is displayed as the required set temperature by pressing the shift, increase and decrease keys. The function key, the PV area displays St, and the SV area is displayed as the required timing time by pressing the shift, increase and decrease keys. Reset the button to return to the standard mode.
- 3) Timing function and restart after timing:
When ST is set to 0, the meter cancels the timing function, and the meter keeps running. When the ST setting is not 0, the meter has the timing function. When the running time of the meter arrives, the SV displays END, the buzzer sounds, and the meter stops working. Press any key to silence. Press the decrease button for more than 4 seconds to restart the run. Tap the increase button to query the run time and set time.
- 4) Self-tuning function:
If the temperature control effect is not ideal, please start auto-tuning. After pressing the shift button for 4 seconds in the standard state, the instrument will start self-tuning. At this time, the auto-tuning light will be on; after the auto-tuning is automatically finished, you will get the ideal temperature control effect.

4.3 Internal parameter setting

In the standard state, long press the SET button, the LCD displays the LK code, and the password can be entered into the parameter setting hierarchy interface.

1) Press hold SET key, when LCD screen displays LK=18, input the password, and click SET key to enter the setting;

Prompting character	Name	Setup scope	Description	Initial value
AL	Alarm setting	0~full range	When the measured temperature exceeds the value of "SP+ AL", the display character of overheating alarm is lit, cutting off the heating output	
CL	Cooling control setting	Full range	When the temperature exceeds "SP+ CL" and is in conformity to the cooling delay time of the compressor, the cooling indicator lamp is lit, cooling contact is connected to start the compressor	
Ct	Cooling control delay	0~3600 (s)	The delay time required for two adjacent starts of the compressor, Ct=0 cancels the function of compressor	
Pb	Zero adjustment (intercept)	-100.0~100.0	When the zero error of the instrument is greater and the full scale error is smaller, the value should be adjusted. As a rule with Pt100 the value is seldom adjusted	
PK	Adjustment of full scale (slope)	-1000~1000	When the zero error of the instrument is smaller and the full scale error is greater, the value should be adjusted. $PK=4000 \times (\text{specified value} - \text{actual display value}) / \text{actual display value}$ and as a rule with Pt100 the value is adjusted first.	

2) Press hold SET key, when the LCD screen displays LK=28, input the password and click SET key to enter the PID menu;

Prompting character	Name	Setup scope	Description	Initial value
P	Proportional band	2~100	Proportional regulation: the bigger P, the smaller the proportional effect is and the lower the system increase is, only for the heating side.	
I	Integration time	20~3600S	Constant of integration time: the bigger I, the weaker the integration is.	
d	Rate time	0~3600S	Constant of rate time: the bigger d, the stronger the rate effect, overcoming the over-regulation, (D=0 PI control)	
Ar	Overshooting control	0~100%	Ar overshoot suppression works when the set temperature is greater than SL	
t	Control period	1~100 S	The output of the thyristor is generally 2 to 3 seconds. For a device with a large residual power, the T can be adjusted to reduce the static difference of the PID control.	

※ 1. All products have passed strict test before delivery. When the technical index of the drying oven is in accordance with request and it works normally, generally there is no need to modify the parameters.

5. How to use

(1) Environment request

- a) Temperature 5~40°C (104°F)
- b) Relevant humidity: $\leq 85\%$
- c) Power: AC220V 50Hz
- d) There is no strong tremble around or corrosive air around.

(2) Vacuumizing debug

a) Close the cabinet door and turn the door pin to tight place. Close air-release valve (Make the hole in rubber stop is in 90° angle to the hole in air-release valve.) Open vacuum valve (turn 90° anticlockwise.) The vacuum valve may be tight in first use.

(2) Connect vacuum drying oven vacuumizing pipes (exterior diameter: $\Phi=16\text{mm}$) with vacuum pump (2XZ-2 model, exterior diameter for air entering mouth: $\Phi=16\text{mm}$) well through a vacuum connecting pipe (interior diameter: $\Phi=16\text{mm}$, thickness of the pipe wall=10mm) packaged with the machine. Switch on power of the vacuum pump and it begins to draw air. When the vacuum indicating meter points to -0.1Mp, **close vacuum vale first, and then switch off vacuum pump power to avoid oil of vacuum pump flowing back into the working room.** You can switch off power of the vacuum pump directly). Now the cabinet is in vacuum situation.

(3) Debug of the vacuum cabinet

Carry on the following operation after vacuum debugging:

(a) Switch on the power of the vacuum cabinet and now power indicating light is on. Now power of temperature controller is switched on and it begins self-inspection. PV displays testing temperature of the working room and SV displays the set value set when delivery. AT and HEAT light in temperature controller should be on. It shows that the apparatus is in heating situation.

(b) Modify set temperature value

First, press function key of temperature controller (SET). PV displays SP. You can modify the set value through press or .

Second, after finishing modifying, press SET again. PV displays ST. **(If you do not need the function of timing, let ST=0).** Press SET again to make PV display the temperature of the working room. SV will display the newly set value. Apparatus's AT and HEAT light should be on. Now the apparatus is in heating situation again.

(c) When the temperature inside the working room is close to the set value, HEAT light will blink. It shows that the apparatus is in PID adjusting phrase. Sometimes the testes temperature is higher than the set value and sometimes it is lower than the set value. These are normal situations. When testes temperature is close to or equals to the set value, after 1-2h, the working room is in constant temperature situation. And the object is in drying situation.

Note: When the temperature you need is very low, you can finish the setting of temperature in two times. For instance, if the temperature you want is 60°C, set the temperature as 50°C in the first time. Then set for the second time as 60°C so as to reduce or refuse temperature overshoot and enter constant temperature quickly.

(d) After finishing drying of the objects, switch off the power. If you want to decrease the temperature quickly, open air release valve to make the vacuum degree equals to 0. Wait for 5 minutes before open the cabinet door (Because it maybe impossible to open the door if you try to open it immediately.)

- (4) The humidity of the object inside the dry cabinet is relatively large. The steam generated when drying may affect the performance of the vacuum pump. It is suggested to add a desiccator/filter between the dry cabinet and the vacuum pump. Our company can equip a desiccator with the out shape of $\Phi 120 \times 300\text{mm}$ and the interface mouth diameter $\Phi 16$ (have indicated in the contract) according to request.
6. If in the procedure of drying goods, there is the need of adding nitrogen or other inert gas, it should be listed in the contract and we will add another air entering valve.

Note: (a). If the vacuum pump works normal and is in accordance with technical request, but it cannot draw air to make the room in vacuum situation, open the cabinet door and screw tight the door pin with plank we prepared for you in accessories box. Close the door and try again.

(b) This vacuum dry cabinet should not be used as electric heating and drying cabinet. Since the working room is not in vacuum situation, the tested temperature is much different from real temperature.

6. Precautions

- (1) The shell of the vacuum cabinet should be connected with the ground well to ensure safety.
- (2) The vacuum cabinet should be in the environment that its relative humidity is $\leq 85\%$, there is no corrective air, no strong shack source and strong electromagnetic field.
- (3) There is no anti explosive and anti corrosive equipment in the working room of the cabinet, so combustible, explosive objects or objects that easily create corrosive gas should not be put in the cabinet for drying.
- (4) The vacuum pump should not be working for a long time. So when the vacuum degree reaches the point you want, shut off the vacuum pump first and then switch off the power of the vacuum pump. When the vacuum degree cannot meet your need, switch on the vacuum pump again. So the lifespan of the pump is prolonged.
- (5) If the object for drying is damp, add a filter between the vacuum pump and the cabinet to avoid steam entering the pump and causing any problems.
- (6) If the object for drying is light and small in size (grains), a defending net should be added in the mouth for vacuum pump inside the working room to avoid absorbing any grains and damaging the pump (or electromagnetic valve).
- (7) After being used for several times, the cabinet may not able to be in vacuum situation. Now you have to replace the door airproof tool or adjust the door pin of the cabinet. When drying temperature of the cabinet is over 200°C , there may be air leakage (Except model WTVO-1.9). Now take off the back board of the cabinet body and screw loose heater seat with spanner, replace**

“0” shaped airproof enclosure or screw tight the heater seat.

(8) If the air release rubber stop is difficult to turn, wipe some fat (such as Vaseline).

(9) Except for repairing, the left cabinet cover should not be opened to avoid damaging of electric control system.

(10) The vacuum cabinet should be always clean. It is forbidden to clean the glass on the cabinet door with chemical solution. It should be cleaned with soft cotton cloth.

(11) If the cabinet is not in-use for a long time, clean exposed plated parts and coat them with neutral fat to avoid erosion. Cover it with plastic film to avoid dirt and place it in dry room to avoid damage to electric parts.

7 Failure treatment (See Table 2)

Failure phenomena	Possible reasons	Treatment
No power	The out power socket had no power,	Check whether the lines are connected well and whether the socket is well.
	The power plug is not inserted well in the socket or the line is cut off.	Re-insert the plug or repair the line.
	The fuse is broken or there is no fuse.	Check whether there is any short circuit; replace the fuse (short circuit for apparatus power transformer, short circuit for heater, short circuit for grounding and others short circuit all can cause breaking of fuse.
PV display "□□□□"	Temperature sensor Pt100 is damaged	Check Pt100, replace it
	Temperature sensor line is not connected well.	Connect lines again.
	Test scope of the apparatus is not correct	Re-set again.
The temperature does not increase	The set value is too low	Set temperature $SV \geq RT + 10^{\circ}\text{C}$ RT is environment temperature
	The output circuit of the apparatus is falling off.	Connect the lines again.
	Temperature controller has no output signal or is damaged or the controllable silicon is damaged,	Replace it.
	The heater is damaged(short circuit, or open circuit)	Replace it.
	Use timing function or the setting is not correct.	ST=0 or ST=(heating time +constant temperature time
The temperature is out of control or there is offset or overshoot because of the error between tested temperature and real temperature	The output of temperature controller is out of control.	3041 or BTA is damaged and replace it.
	Not qualified to use	$SV \geq RT + 10^{\circ}\text{C}$
	Pt sensor doest connects well.	Get rid off grounding resistance.
	Relevant parameters are not correctly set.	Re-set relevant parameters, such as Ar、P and so on.
There is big difference between tested temperature and real temperature.	No vacuum situation.	Vacuumizing.
	The mercurial thermometer head is not on the shelf.	Replace it.
	The apparatus or parameter is changing.	Re arrange Pb、Pk parameters.
The cabinet cannot be vacuumized.	The vacuum pump is not of the correct model and size.	The vacuumizing speed should not be less than 2 L/S.
	Various connecting pipe is too loose.	Replace it.
	The vacuum meter is damaged.	Replace it.
	The door is not closed well.	Adjust the door pin distance.
	The door airproof rubber is aged and lack of elasticity.	Replace it.
	Air release valve and vacuum vale is not in the correct place.	Adjust them.
Air leakage (the vacuum degree decrease to 0.092 Mpa from 0.1Mpa within 24 hours.	There is air leakage in various connect pipes.	Check and replace it.
	Except for model WTVO-1.9, the distortion of heater "O" shaped airproof circle causes air leakage.	Screw tight the heater seat (in the back of the inner bladder.) or replace "O" shaped airproof circle.
	The air release valve is not in the right place.	Place it in the right place.
	There is air leakage in vacuum valve.	Replace it

8 Packing list**Packing List**

Serial No	Type	Name	Unit	Quantity	Remark
1	File	User manual		1	
2	File	Packing list		1	
3	Fittings	spanner		2	

The articles listed here is in accordance with the articles packed in the box.

Packer2