

User's Manual

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## **Temperature Chamber /Industrial Oven**

PV(H)  
Basic Operation

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4022104013681



- Read this manual carefully before using the equipment.
- Familiarize yourself with all safety precautions before using the equipment.
- Keep this manual handy for future reference.

**ESPEC CORP.**

## **Liability**

ESPEC CORP. assumes NO responsibility whatsoever for accidents or equipment trouble arising from the failure to observe handling instructions contained herein. Do not perform any operation or handle the equipment in any way or form that is not described in this user's manual or which is herein specifically prohibited. Careless usage of the sort may result in unexpected damage to the equipment or accident.

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## **Notes**

- The contents of this manual are subject to change without notice.
- ESPEC CORP. will replace this manual if pages are missing or out of sequence.

# Introduction

This manual has been compiled to help you understand how to operate the equipment correctly. Read it thoroughly in order to obtain the maximum performance from the equipment.

How to read this manual

- The following safety symbols are used throughout this manual.

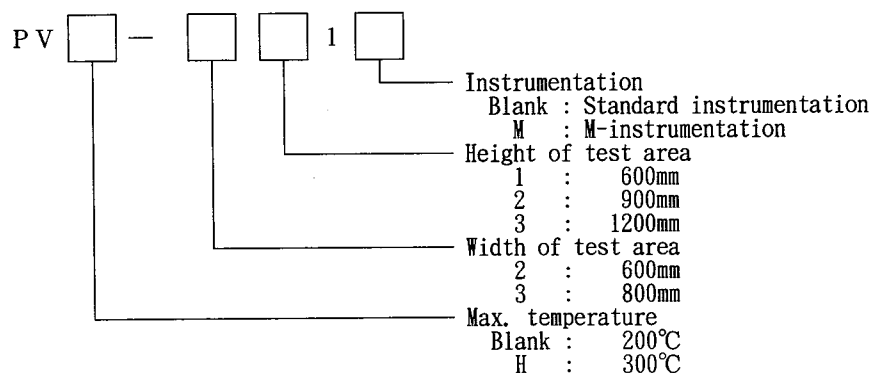
• Degree of DANGER

|                                                                                                         |                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Very dangerous</b> | This mark means extremely dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.                                 |
|  <b>Danger</b>         | This mark means dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.                                           |
|  <b>Caution</b>        | This mark means dangerous consequences may arise, with the possibility of somewhat serious injury to the user and/or damage to equipment and facilities, if the equipment is handled incorrectly. |

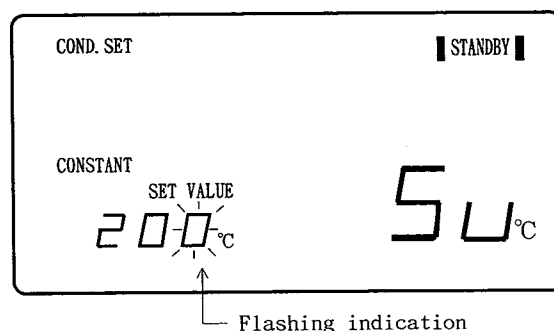
- The user's manual package that came with your chamber contains the following reference materials.

- Basic operation: ..... Describes the chamber's basic operation method.
- Standard/M : ..... Describes functions of the standard/M-instrumentation, function by function.
- Options : ..... Describes how to operate the concerned optional equipment (excluding the temperature recorder).
- Temperature Recorder : ..... Describes how to operate the temperature recorder (option).

- The PV (H) Series comes in 16 different models. This manual is applicable with all models. Confirm which model is yours by the below method of denomination.



- Displays referred to in this text will be as follows.



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Read this section before using the equipment.

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# 1



Read this section before using the equipment.

## Precautions in usage

This chapter explains precautions you should observe in order to safely operate the equipment. Be sure to read it carefully and follow instructions to the letter so as to prevent harm to you, anyone else, works or the equipment.

### 1.1 Substances which should not be placed inside the equipment

---



#### **DANGER**

**DO NOT** introduce the following explosives, combustibles or substances which contain them into the equipment. Moreover, keep these substances away from the equipment and immediate area.

When exposed to excessive heat, these substances may cause fires and/or explosions.

##### Explosive Substances



##### Explosive Substances

1. Nitroglycol, nitroglycerine, nitrocellulose, and other explosive ester nitrates.
2. Trinitro-benzene, trinitrotoluene, picric acid, and other explosive nitrocompounds.
3. Peracetic acid, methyl ethyl ketone peroxides, benzoyl peroxide, and other organic peroxides.



## DANGER

### Inflammable Substances



#### Combustible Substances

Metal lithium, metal potassium, metal sodium, yellow phosphor, phosphor sulfide, red phosphor, celluloids, calcium carbonate (also called carbide), calcium phosphate, magnesium powder, aluminum powder, metal powders other than magnesium powder and aluminum powder, hydrosulfite.



#### Oxides

1. Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates.
2. Potassium perchlorate, sodium perchlorate, ammonium-perchlorate, and other perchlorates.
3. Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides.
4. Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates.
5. Sodium chlorite and other chlorites.
6. Calcium hypochlorite and other hypochlorites.



#### Ignitable Substances

1. Ethyl ether, gasoline, acetaldehyde, propylene oxide, carbon disulfide and other substances with an ignition point of  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ).
2. Normal hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with an ignition point above  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ) and below  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ).
3. Methanol, ethanol, xylene, pentyl acetate amylacetate and other substances with an ignition point above  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) and below  $30^{\circ}\text{C}$  ( $85^{\circ}\text{F}$ ).
4. Kerosene, light oil, turpentine oil, isopentyl alcohol (also called isoamyl alcohol), acetic acid and other substance with an ignition point above  $30^{\circ}\text{C}$  ( $85^{\circ}\text{F}$ ) and below  $65^{\circ}\text{C}$  ( $150^{\circ}\text{F}$ ).



#### Combustible Gases

(Hydrogen, acetylene, ethylene, methane, ethane, propane, butane, and other combustible substances that are in a gaseous state at a temperature of  $15^{\circ}\text{C}$  ( $60^{\circ}\text{F}$ ) and at a pressure of 1 atmosphere.)

## 1.2 For user safety

---

Observe the following items of caution when using the equipment.



### **DANGER**

- **TRAPPED! NEVER** climb inside the equipment.

The door cannot be opened from the inside.

- **Ground the equipment WITHOUT FAIL.**

**ELECTRIC SHOCK!** Unless the equipment is grounded, the leakage breaker will not trip in the event current leaks, possibly resulting in electric shock. For grounding, see "3.5 Grounding and power supply work".

- **BEFORE** using the equipment, test the leakage breaker and make sure it is functioning properly.

**ELECTRIC SHOCK!** If the breaker is not functioning properly, shut OFF the primary power supply and contact the place of purchase or ESPEC CORP. Using the equipment in anything but good working condition could result in electric shock. For testing method, See "6.1 Leakage breaker trip test".

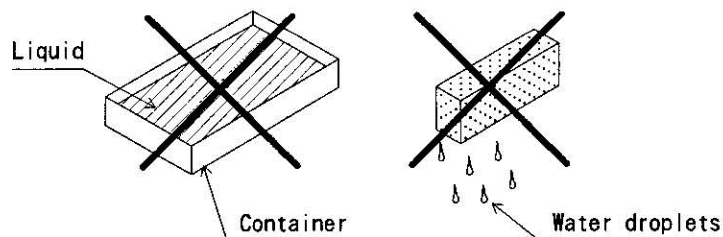
- **Detach the hinges and door lock** before disposing of the equipment.

The door cannot be opened from the inside. See "1.5 Disposing of the chamber".

- **DO NOT** introduce large volumes of liquid into the equipment.  
And, be careful not to spill liquids onto the equipment floor.

The equipment has electrical parts in its lower half. Contact with water can lead to electric shock or leaks.

Also, if introducing steam-generating specimens into the equipment, leave the damper open at all times.



Do not introduce liquid into the equipment as shown above.

- **DO NOT** leave specimens which contain liquids inside the equipment for long periods of time.

The equipment has electrical parts in its lower half. Contact with water can lead to electric shock or leaks.

- **Do not use or leave the equipment outdoors.**

Not only can outdoor environments adversely affect performance and functioning, but also electrical parts contact with water can lead to short-circuits, fire, electric shock and breakdown.

- **Do not disassemble, remodel or service the equipment.**

Unauthorized handling can lead to malfunction, fire, electric shock, personal injury and breakdown. For servicing, contact the place of purchase or ESPEC ENGINEERING CORP.



## CAUTION

- **HOT AIR BLAST WHEN OPEN!** Use caution when opening the door during and shortly after operation at high temperature.

Hot air is blown from inside the equipment when opened.

- **HOT ON THE INSIDE!** During and shortly after operation at high temperature the equipment is **HOT** on the inside (specimens, shelves, door gasket, inner chamber).

Direct contact may result in burns. Wear heat-resistant gloves.

- **Keep objects away from the exhaust port.**

Hot air is blown from the port when the damper is open (during operation only).

- **DO NOT** introduce electrically conductive specimens which might be thrown about by air currents inside the oven.

If specimens infiltrate the air conditioner, it could cause current leakage in the heater.

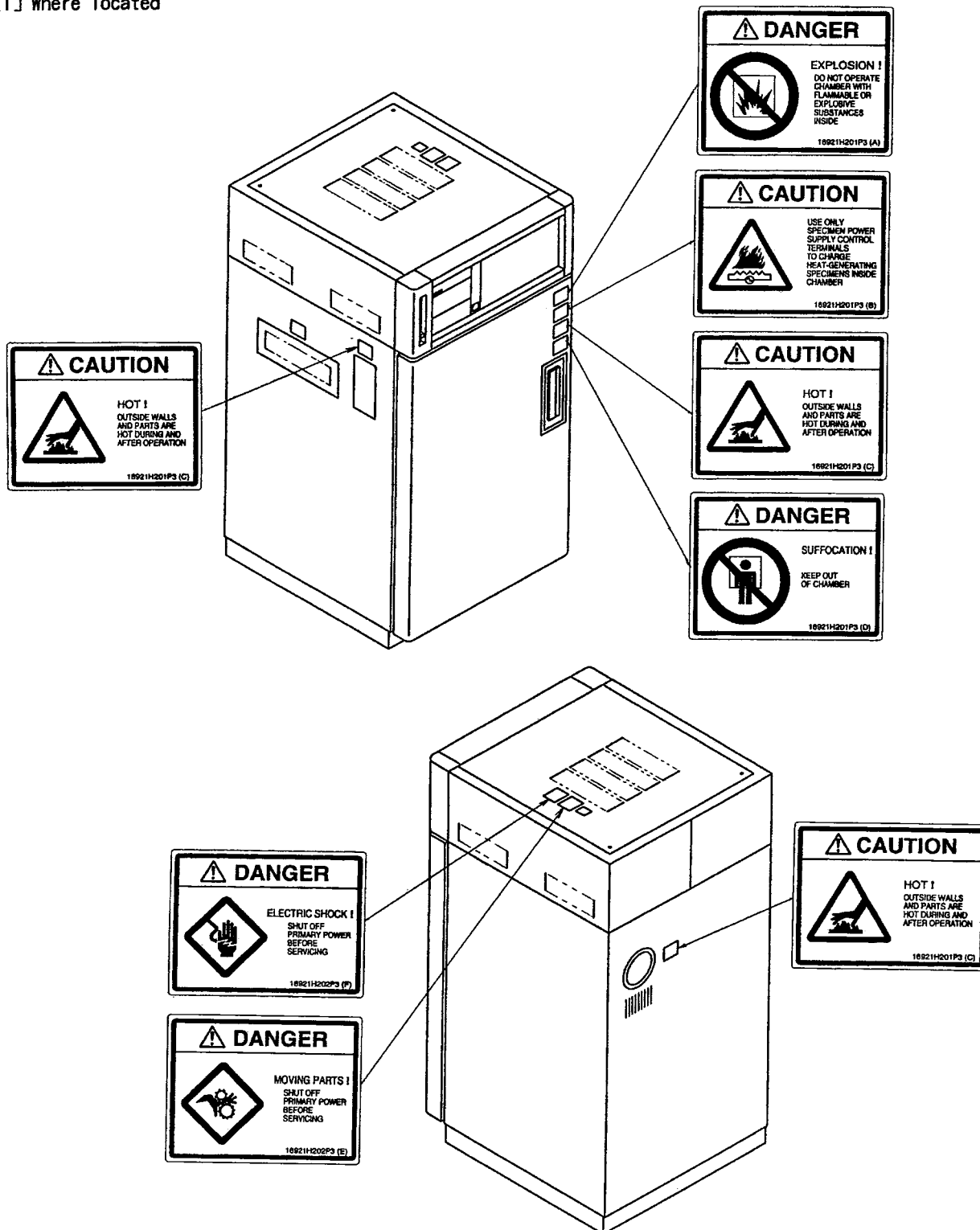
- **Do not** introduce corrosive substances into the test area.

Specimens that release corrosive substances (substances that corrode stainless steel and silicon rubber) may seriously shorten service-life of internal parts and packing.

Some corrosive substances are chlorine, chlorides and acids. This also applies to specimens that are not corrosive at ambient temperature but are so at high temperature.

## 1.3 Warning label

### [1] Where located



### [2] For additional labels

If labels are damaged, lost or become otherwise illegible, contact the place of purchase or ESPEC CORP. for replacement. (Replacements subject to billing.)

## 1.4 Protecting specimens

To prevent damage to specimens from overheating inside the chamber, the chamber is equipped with the following safety devices. Thoroughly understand how each device functions before using the chamber.

Table 1.1 Overheat protector list

| Safety devise                                                  | Trip temperature                 | How to set temperature                                                                                                                                                                                                                           | Action when tripped                                                                                                                                                                                                |
|----------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Automatic overheat protection function (Inside the controller) | (Set temperature + (10 to 49))°C | The temperature is set automatically in accordance with the environmental setting. Setting is determined to be the chamber set temperature + controller environmental setting (+10 to 49)°C. In normal operation, use the set temperature +10°C. | <ul style="list-style-type: none"> <li>• The heater is turned OFF.</li> <li>• An external alarm is sent.</li> </ul>                                                                                                |
| Overheat protector                                             | User-set                         | Set this value to within the below range.<br><br>Chamber set temperature < set temperature < Max. temperature allowed for specimens<br><br>* Use the (chamber set temperature + 15)°C as a yardstick for making your setting.                    | <ul style="list-style-type: none"> <li>• The heater is turned OFF.</li> <li>• Power supply to specimens is cut OFF at the specimen power supply control terminal.</li> <li>• An external alarm is sent.</li> </ul> |
| Upper temperature limit alarm function (Inside the controller) | User-set                         | Set this value to within the below range.<br><br>Chamber set temperature < set temperature < Max. temperature allowed for specimens<br><br>* Use the (max. chamber set temperature used daily + 15)°C as a yardstick for making your setting.    | <ul style="list-style-type: none"> <li>• The heater is turned OFF.</li> <li>• Power supply to specimens is cut OFF at the specimen power supply control terminal.</li> <li>• An external alarm is sent.</li> </ul> |
| Thermal fuse                                                   | 167°C(PV)<br>184°C(PVH)          | This setting is fixed and cannot be altered by the user.                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• The heater is turned OFF.</li> <li>• Power supply to specimens is cut OFF at the specimen power supply control terminal.</li> <li>• An external alarm is sent.</li> </ul> |

### (Setting example)

For a plastic material of an allowable maximum temperature of 200°C that is thermally tested at 150 °C, safety device trip temperatures are set as follows.

- Overheat protector: 170°C (A 30°C margin over the allowable maximum temperature of specimens is taken.)
- Upper temperature : 190°C (A 10°C margin over the allowable limit alarm maximum test temperature is taken.)

Under these conditions, if overheating occurs, the automatic overheat protection function, overheat protector and upper temperature limit alarm will trip in the said order. The chamber is equipped with multiple safety devices to assuredly detect overheating in the event one device malfunctions.

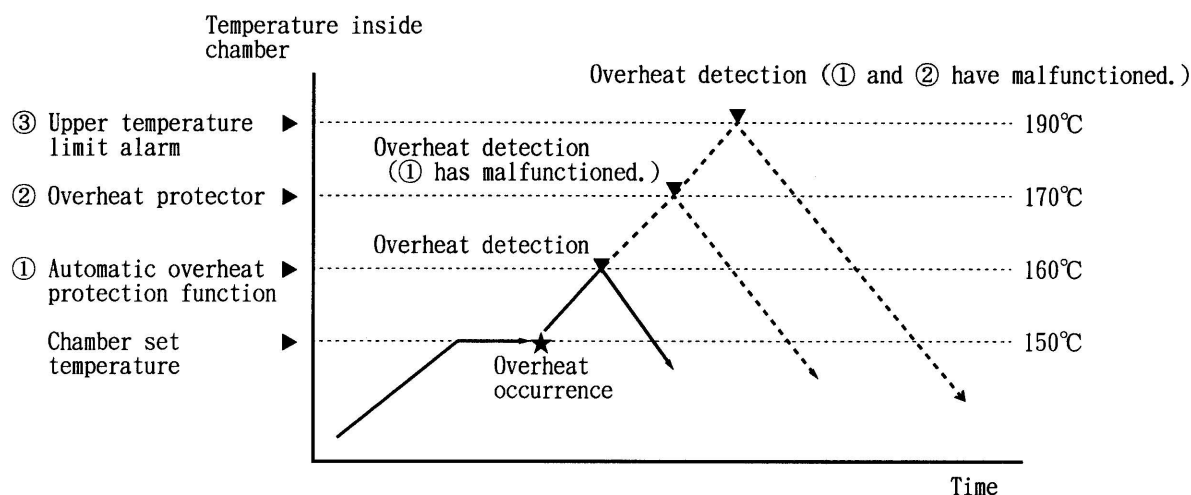
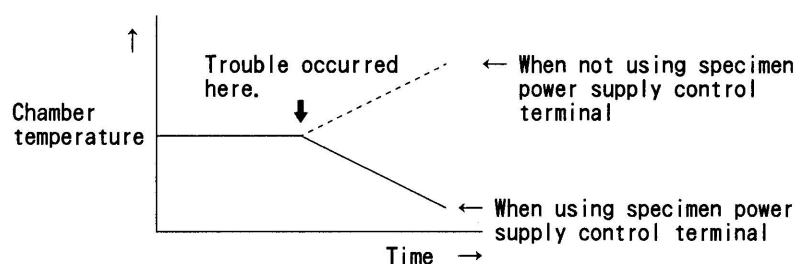


Fig. 1.1 Overheat protection tripping



## DANGER

- Use only the specimen power supply control terminals to apply voltage to specimens. Specimens generate heat as they are charged. The specimen power supply control terminals are interlocked with the chamber control circuit, so power to specimens is turned OFF when the chamber is not running. Using other means to charge specimens leaves the specimens charged in the event of chamber trouble. This can drive up temperature inside the chamber and damage specimens. See "4.4 Wiring specimen power supply control terminal".



Chamber temperature and specimen power supply control terminal

- Load specimens so that they are not thrown about by air currents inside the chamber. Small, lightweight specimens must be kept inside a closed basket when inside the chamber. Specimens wrapped in aluminum foil can be thrown about by air currents inside the chamber. If this happens, stop the chamber, shut OFF primary power supply and contact the place of purchase or ESPEC CORP. Make special note of the fact that aluminum foil can lead to trouble if it infiltrates the heater.

## 1.5 Disposing of the chamber

---



### **DANGER**

- Take the chamber door and inner door off their hinges before disposing of the chamber.

The chamber cannot be opened from the inside.

- Get help to detach doors.

Working alone, the door can slip unexpectedly out of place and injure you or someone else.

How to take the door off its hinges

- ① Turn OFF main power from the ON-OFF switch and check power is not being supplied to the chamber.
- ② Detach the damper unit.
  - 1) Remove the damper control knob.
  - 2) Remove the push-nut and pin from the link.
  - 3) Remove the damper unit installation screws.
- ③ Remove the bolts (×3 on top hinge) locking the door to the hinges (M5 box-head driver) and detach the door.

Have someone hold the door while you loosen the bolts, to keep it from slipping out of place.
- ④ Detach the door.



# 2

## Names and functions of parts

This chapter provides the names and functions of each individual part. During operation or while reading this manual, refer to this chapter, where necessary, for part names and function.

## 2.1 Outer appearance

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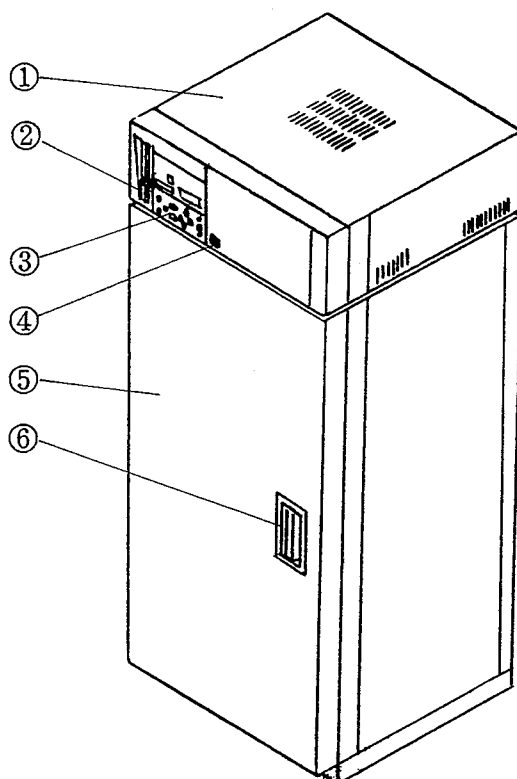


Fig. 2.1 Front side

- ① Electrical compartment door : Door for accessing the electrical compartment.
- ② Damper : Use for ventilated operation or to quickly drop temperature inside the chamber.
- ③ Operating panel : Used for chamber operation and equipment/test display.
- ④ Overheat protector : Stops chamber operation when temperature inside the chamber exceeds the set temperature.
- ⑤ Chamber door : Open/close to load/unload specimens.
- ⑥ Door handle : Use to open/close the chamber.

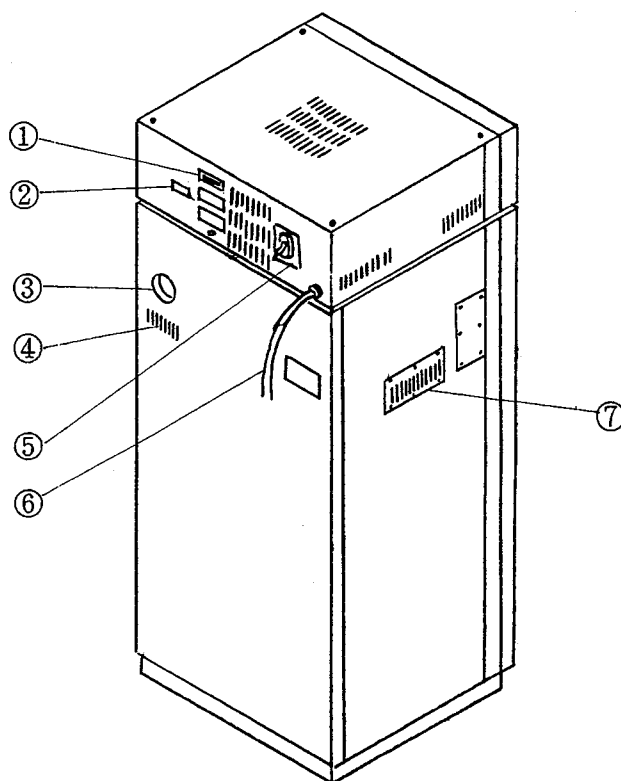


Fig. 2.2 Rear side

- ① Specimen power supply : Use to energize specimens. When the chamber stops operating because of control terminal an alarm, power supply to the specimens is cut off at this terminal.
- ② E-BUS connector : Connect to an external device for E-BUS transmission.
- ③ Exhaust port
- ④ Intake port
- ⑤ Main power switch : Switches power supply to the chamber ON/OFF. The switch incorporates a leakage breaker to protect against leakage, electric shock and overload.
- ⑥ Power cord : Connect to a power supply source.
- ⑦ Heater access port

## 2.2 Electrical compartment

---

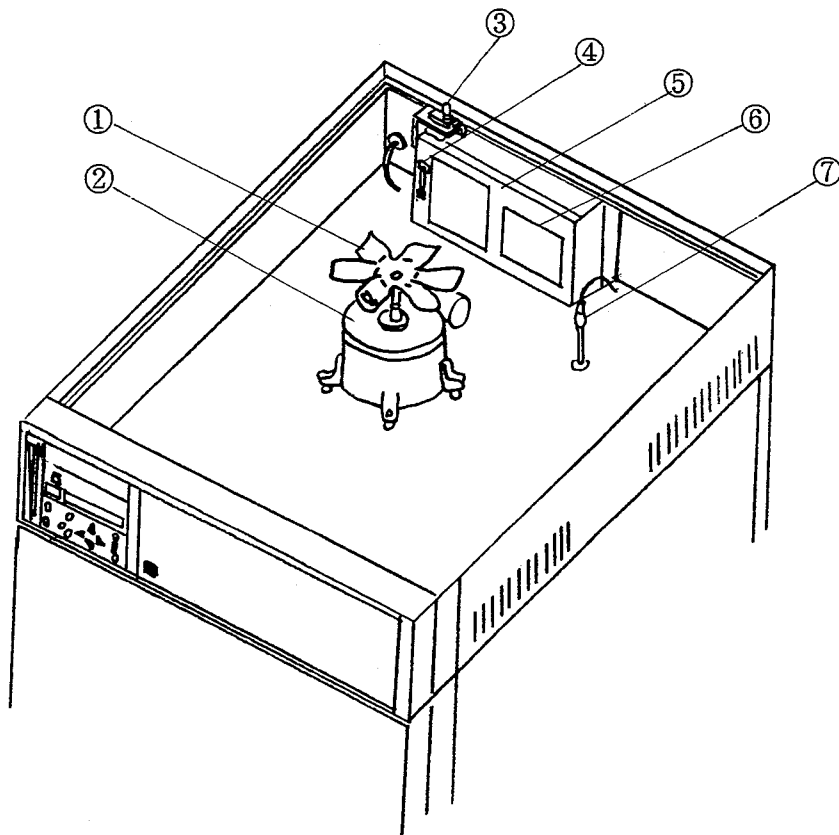
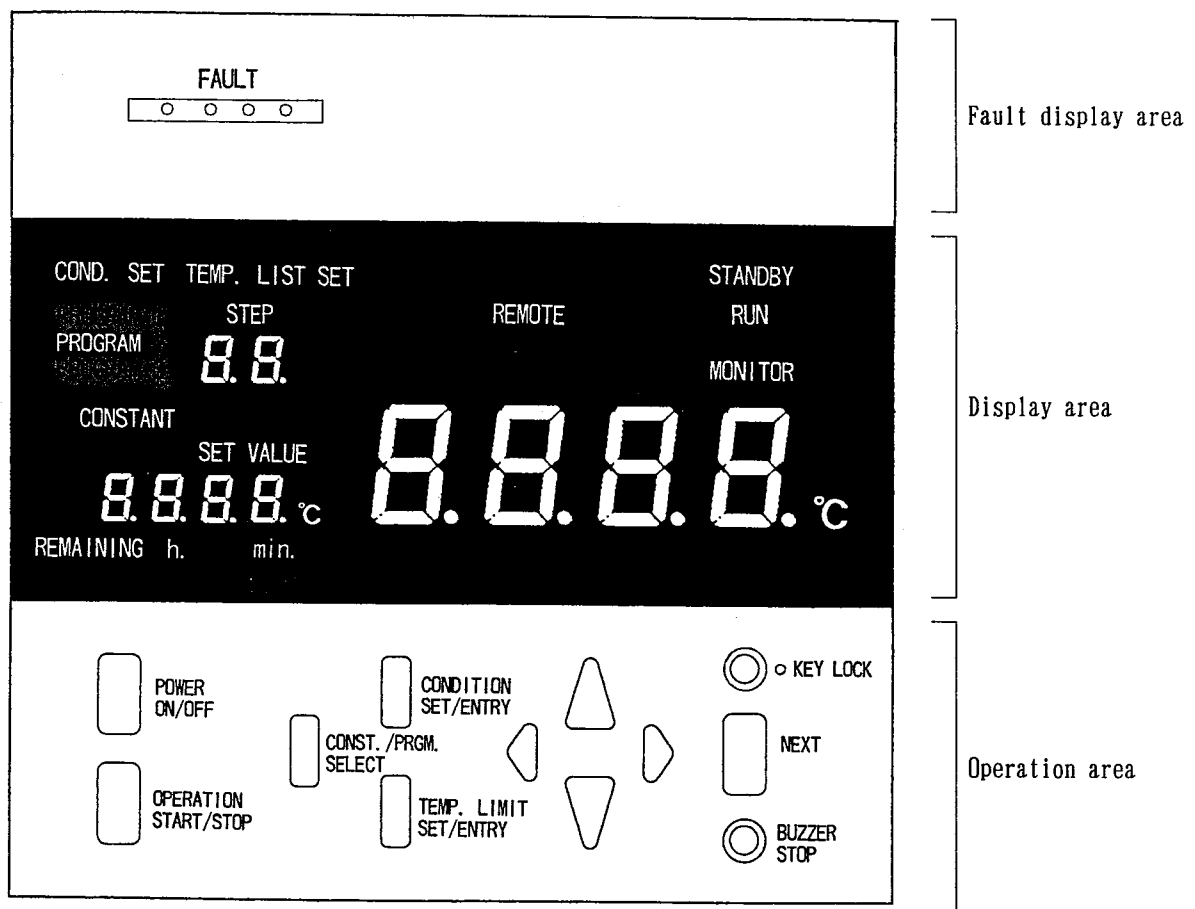


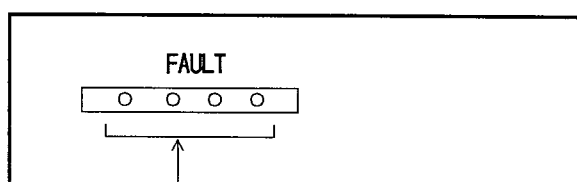
Fig. 2.3 Electrical compartment

- |                                      |                                                                      |
|--------------------------------------|----------------------------------------------------------------------|
| ① Electrical compartment cooling fan | : Cools inside the electrical compartment.                           |
| ② Air circulator                     | : Circulates air inside the chamber.                                 |
| ③ Door switch                        | : Detects whether the electrical compartment door is open or closed. |
| ④ Fuse                               | : Protects electric circuits from short-circuits and overcurrent.    |
| ⑤ Electrical chassis                 | : Distributes power to heater, air circulator, etc.                  |
| ⑥ Temperature controller             | : Controls equipment operation.                                      |
| ⑦ Temperature sensor                 | : Detects temperature inside the chamber.                            |

## 2.3 Controller



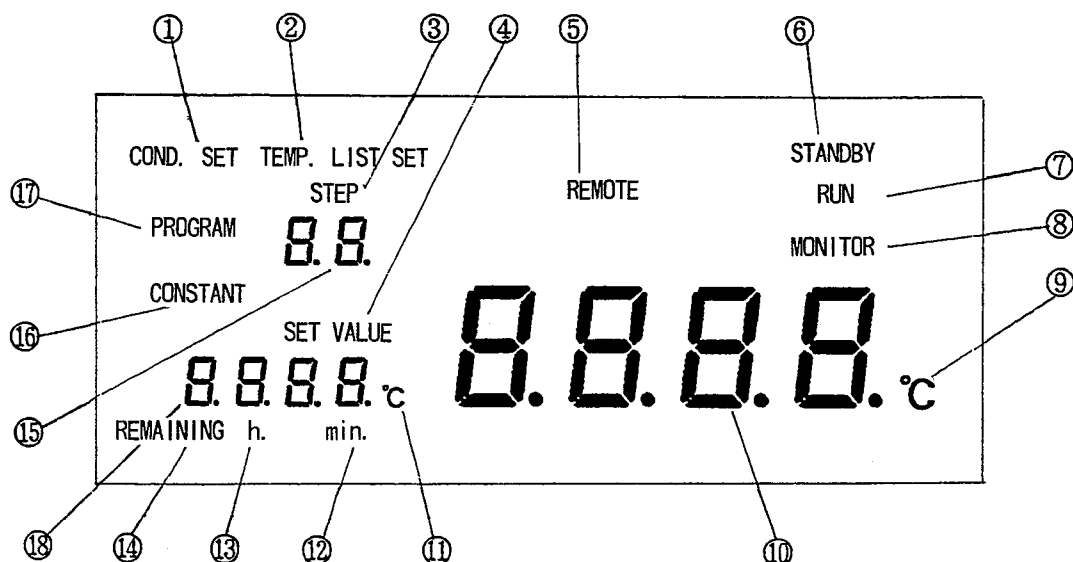
### (1) Fault display



Fault  
indication  
lamps

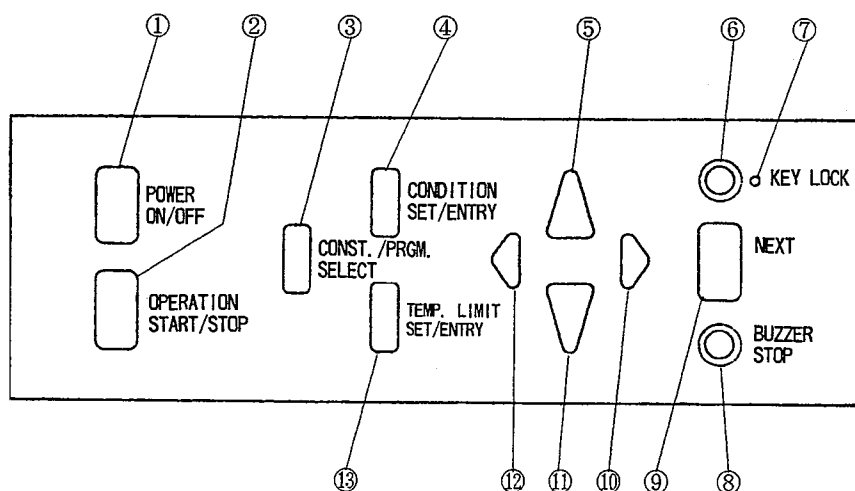
One or more of these lamps flash when a fault occurs.

(2) Display area



- ① COND. SET : Lit up while setting is enabled.
- ② TEMP. LIMIT SET : Lit up in the alarm setting mode.
- ③ STEP : Lit up in the program mode.
- ④ SET VALUE : Lit up while displaying the set temperature or time.
- ⑤ REMOTE : Lit up during E-BUS transmission.
- ⑥ STANDBY : Lit up when power is ON but the chamber is idle.
- ⑦ RUN : Lit up while the chamber is operating.
- ⑧ MONITOR : Lit up while displaying temperature inside the chamber.
- ⑨ °C : Lit up while displaying temperature inside the chamber.
- ⑩ Monitor display : Displays chamber state in each mode.
- ⑪ °C : Lit up while displaying set temperature
- ⑫ min. : Lit up while displaying time.
- ⑬ h : Lit up while displaying time.
- ⑭ REMAINING : Lit up while displaying time remaining until operation in course ends.
- ⑮ Digital display : Displays step No. in the program mode.
- ⑯ CONSTANT : Lit up in the constant mode.
- ⑰ PROGRAM : Lit up during program 1.
- ⑱ Setting display : For setting and displaying temperature and time.

### (3) Operation area



- |                             |                                                                |
|-----------------------------|----------------------------------------------------------------|
| ① POWER ON/OFF key          | Switches power to the controller ON/OFF.                       |
| ② OPERATION START/STOP key  | Starts/stops chamber operation.                                |
| ③ CONST./PRGM. SELECT key   | Switches operation mode between constant and programmed modes. |
| ④ CONDITION SET/ENTRY key   | Engages the setting mode.                                      |
| ⑤ Up key                    | Increases displayed numbers.                                   |
| ⑥ KEY LOCK key              | Locks/unlocks keys.                                            |
| ⑦ KEY LOCK lamp             | Lits up while keys are locked.                                 |
| ⑧ BUZZER STOP key           | Stops the buzzer when sounding.                                |
| ⑨ NEXT key                  | Switches the display according to mode.                        |
| ⑩ Right shift key           | Shifts the active column to the right.                         |
| ⑪ Down key                  | Decreases displayed numbers.                                   |
| ⑫ Left shift key            | Shifts the active column to the left.                          |
| ⑬ TEMP. LIMIT SET/ENTRY key | Engages the alarm setting mode.                                |

# 3

## Installation

This chapter explains how to install the chamber. If your chamber is being installed by ESPEC CORP. or the place of purchase, you need read only the necessary parts.

### 3.1 Removing from the pallet

---

The chamber is supported from underneath by a wooden pallet to make transport and usage easier. If unnecessary, loosen the anchoring bolts (M10) with a monkey wrench, spanner or other tool, and take the chamber off the pallet.



### 3.2 Installation site

---

Avoid the following when selecting an installation site.

- Unleveled or weak floors
- Direct exposure to sunlight
- Poorly ventilated rooms
- Rooms with an ambient temperature outside the range of 0 to 40°C
- Dusty places
- Damp places
- Flammable materials
- Combustible or corrosive gases
- Strong mechanical vibrations

### 3.3 Installation space

---



#### **CAUTION**

- When installing chambers back-to-back, make sure hot air discharged from the exhaust port does not enter the electrical compartment vent. The electrical compartment houses electric parts which are susceptible to damage if exposed to hot air currents. Provide an exhaust duct for channeling hot air away from the chamber if hot air currents unavoidably return inside the chamber because of limited installation space.

Keep the below indicated space when installing the chamber.  
(Min. required space for proper ventilation and access.)

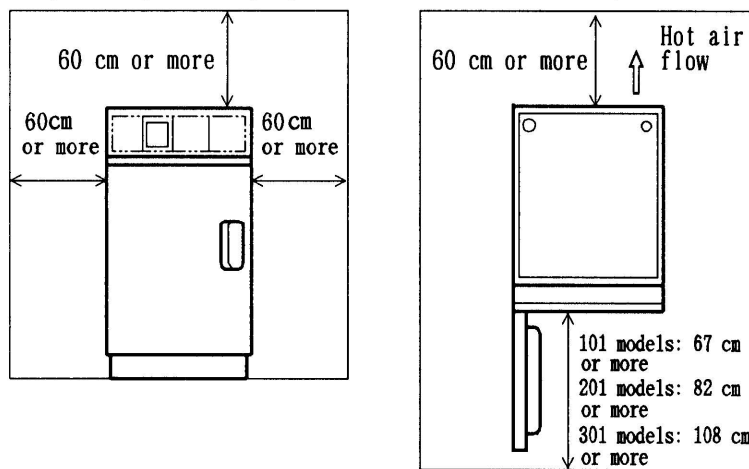


Fig. 3.1 Installation space

### 3.4 Connecting an exhaust duct

During operations that generate exhaust, unless the room is well ventilated, hot air exhausted from the exhaust port will cause ambient temperature near the chamber to rise and will fill the room with smoke generated from specimens. If much exhaust is generated during operations, provide an exhaust duct, as shown in Fig. 3.2, to channel smoke and exhaust out of the room.

A typical flexible material of a nominal diameter of 90 mm will suffice for exhaust duct. Draw the duct out of the room in such a way to avoid pressure loss inside the duct. Keep the duct as short as possible to minimize duct resistance. Resistance in the duct may hamper exhaust discharge.

- A chimney may be directly inserted into the exhaust port. A matching connection flange is available from ESPEC CORP. Consult ESPEC CORP. or the place of purchase.

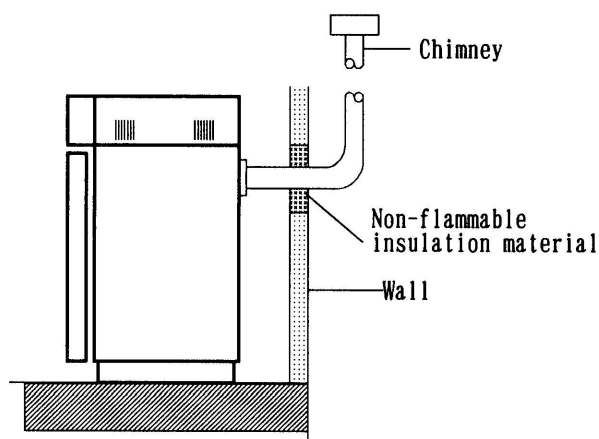


Fig. 3.2 Exhaust duct connection

### 3.5 Grounding and power supply work



#### **DANGER**

- **DO NOT** ground the equipment on gas pipes.  
Grounding of the sort could result in explosion.
- **Ground the equipment WITHOUT FAIL.**  
Unless the equipment is grounded, the leakage breaker will not trip in the event current leaks, possibly resulting in electric shock. Furthermore, this will leave the equipment unprotected against power supply noise. If a grounding terminal is not available, ensure a maximum 100Ω against ground.



#### **CAUTION**

- **DO NOT** share ground with equipment not fitted with a leakage breaker.  
The leakage breaker will not trip in the event of overcurrent, short-circuit or surge.
- **DO NOT** crossground between equipment.  
The leakage breaker will not trip in the event of overcurrent, short-circuit or surge.

① Check the power supply source satisfies the following conditions.

- (1) Voltage fluctuation is within  $\pm 10\%$ .
- (2) Minimum cable diameter and fuse capacity must satisfy conditions on the below table.

Table 3.1 Power supply source

| Model    | Max. current (A)             |                                |                                |                                | Min. conductors dia.<br>(Cabtyre cable) | Fuse capacity<br>(A) | Switch capacity |
|----------|------------------------------|--------------------------------|--------------------------------|--------------------------------|-----------------------------------------|----------------------|-----------------|
|          | Power supply voltage<br>200V | Power supply voltage<br>* 220V | Power supply voltage<br>* 230V | Power supply voltage<br>* 240V |                                         |                      |                 |
| P V -211 | 20.0                         | 18.5                           | 17.5                           | 17.0                           | 3.5mm <sup>2</sup> , 3                  | 30                   | 250V, 30A       |
| P V -221 | 24.0                         | 22.0                           | 21.0                           | 20.0                           |                                         |                      |                 |
| P V -231 | 17.0                         | 15.5                           | —                              | —                              | 3.5mm <sup>2</sup> , 4                  |                      |                 |
| P V -331 | 20.0                         | 18.0                           | —                              | —                              |                                         |                      |                 |
| PVH -211 | 20.0                         | 18.5                           | 17.5                           | 17.0                           | 3.5mm <sup>2</sup> , 3                  |                      |                 |
| PVH -221 | 17.0                         | 15.5                           | —                              | —                              | 3.5mm <sup>2</sup> , 4                  | 50                   | 250V, 60A       |
| PVH -231 | 18.0                         | 16.5                           | —                              | —                              |                                         |                      |                 |
| PVH -331 | 26.0                         | 23.5                           | —                              | —                              | 5.5mm <sup>2</sup> , 4                  |                      |                 |

\* Non-standard voltage specification

② Connect the primary power supply to the chamber.

# 4

## Operation

The chamber can be operated by constant operation or program operation. This chapter explains the basics of constant operation. Program operation is performed in the same manner.

For applied constant operations and program operations, refer to the reference manual for standard instrumentation or M-instrumentation.

### 4.1 Checking damper aperture

---

Check the damper is opened to the necessary aperture. Leave the damper shut if ventilation is unnecessary.

• For an explanation on how to use the damper, refer to Chapter 5.

### 4.2 Setting the shelf brackets and shelves

---

Determine shelf position based on the size and amount of specimens.

- ① Set the shelf brackets. Make sure they are securely clamped to the supports.
- ② Set the shelves.

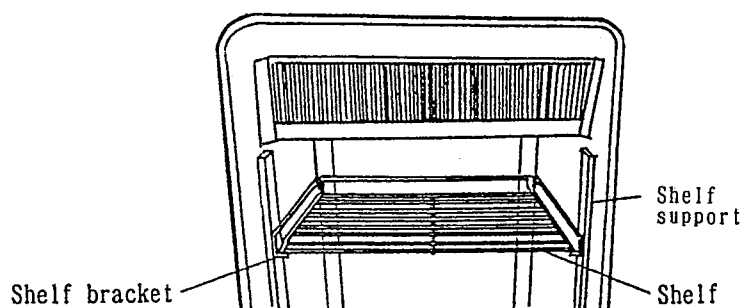


Fig. 4.1 Setting shelves and brackets

### 4.3 Loading specimens

---



#### CAUTION

- **HOT AIR BLAST WHEN OPEN!** Use caution when opening the door during and shortly after operation at high temperature.

HOT air is blown from inside the oven when opened.

- **Load specimens so that they are not thrown about by air currents inside the chamber.**

Small, lightweight specimens must be kept inside a closed basket when inside the chamber. Specimens wrapped in aluminum foil can be thrown about by air currents inside the chamber.

If this happens, stop the chamber, shut OFF primary power supply and contact the place of purchase or ESPEC CORP. Make special note of the fact that aluminum foil can lead to trouble if it infiltrates the heater.

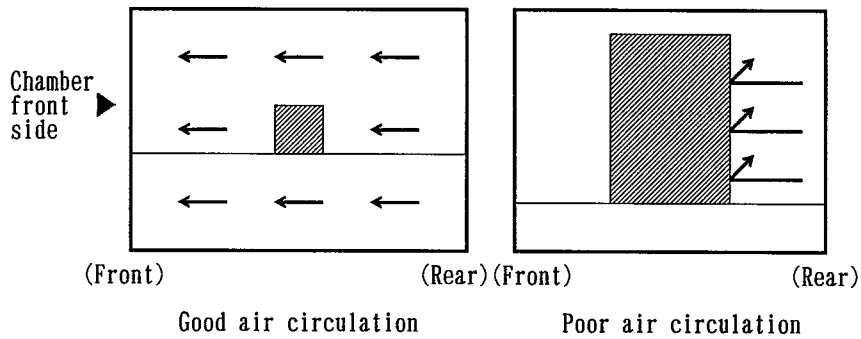
- **HOT ON THE INSIDE!** During and shortly after operation at high temperature, the chamber is HOT on the inside (specimens, shelves, door gasket, inner chamber).

Direct contact may result in burns. Wear heat resistant gloves.

#### <Note>

- Load capacity for shelves is a standard 25kg (PV[H]-211/221/231) or 45kg (PV[H]-331). Spread specimens across the entire shelf without bunching in any one area.
- Set specimens on the chamber floor up to the withstand load.  
Floor withstand load : 200kg
- The first time you use the chamber, oil adhering to shelves and shelf brackets will burn. This produces a burning odor and smoke. There is nothing wrong with the equipment.
- This occurs also with newly purchased shelves and shelf brackets.
- Fire alarms may trigger accidentally when the chamber door is opened during operation at high temperature. Hot wet air is blown from the chamber when the chamber door is opened.
- Use the velocity variable device to keep specimens from flying about inside the chamber. However, temperature uniformity performance drops when wind speed is lowered.

Keep specimens away from chamber walls and arrange them so that air circulation is not blocked. Temperature uniformity will be adversely effected if air inside the chamber does not circulate freely. This may also produce irregular test results.



For a large number of specimens, arrange the specimens as shown in the below figure, to keep air circulating freely.

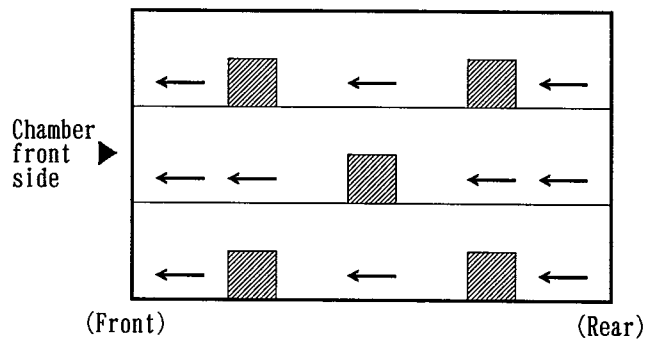
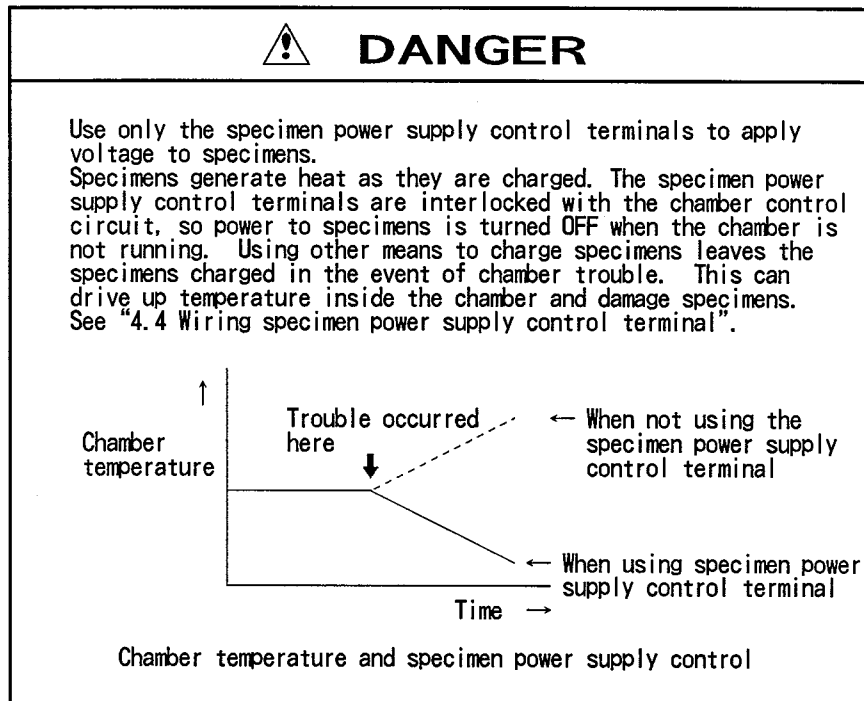


Fig. 4.3 Specimen distribution inside the chamber

#### 4.4 Wiring specimen power supply control terminal



The specimen power supply control terminal is located on the rear side of the distribution compartment. The rated electric capacity of the terminal is 250V AC, 3A.

- When the current conducted to the specimens is less than 3A, wire as shown in the below figure. Be sure to insert the fuse.

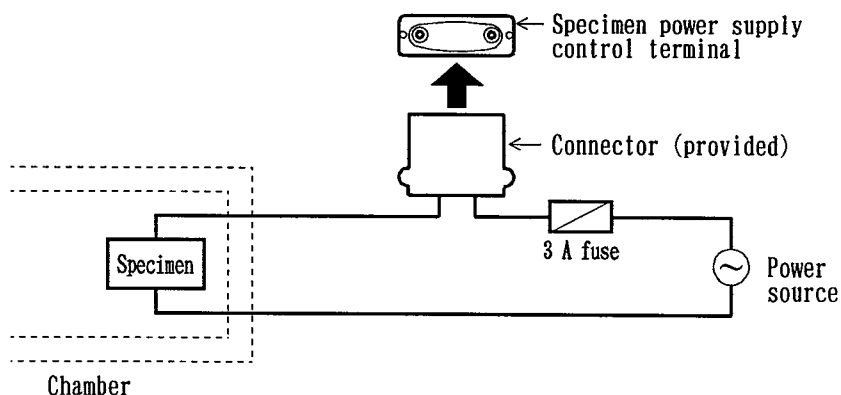


Fig. 4.4 Wiring specimen power supply control terminal (Less than 3A)

- When the current conducted to the specimens is 3A or more, wire as shown in the below figure. Be sure to insert a contactor and fuse that conform to specifications.

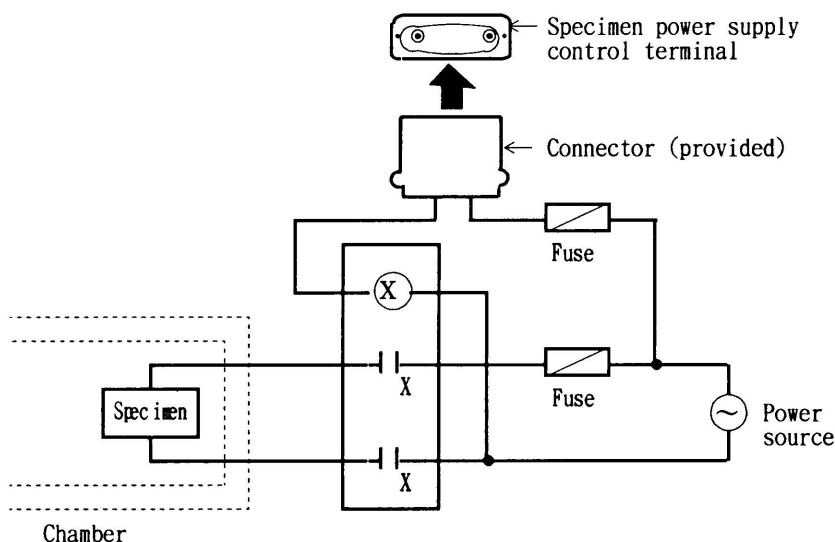


Fig. 4.5 Wiring specimen power supply control terminal (3A or more)

## 4.5 Setting the overheat protector

Set the overheat protector to prevent damage to specimens from overheating inside the chamber. Make the setting as described here following.

- ① Determine the set temperature. Set the overheat protector within the following range.

|                                                                                                       |
|-------------------------------------------------------------------------------------------------------|
| Chamber set temperature < Overheat protector set temperature < Max. temperature allowed for specimens |
|-------------------------------------------------------------------------------------------------------|

Use the (chamber set temperature +15)°C as a yardstick for making your setting.

- ② Set the desired temperature using the  $\Delta$  and  $\nabla$  keys.

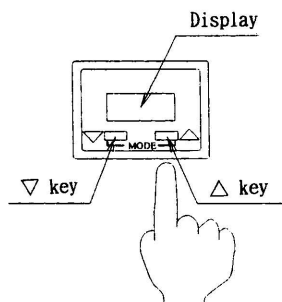


Fig. 4.6 Setting the overheat protector

- For a complete explanation on the overheat protector, refer to 1.3.

- Set the overheat protector before starting operation, as best allowed. Changing the temperature setting during a running test may mistakenly trigger an alarm.



(How to set)

1. While in the set value indication mode, press the  $\triangle$  or  $\nabla$  key.

The current alarm setting and "A" appear on the setting device display.

2. Set the desired temperature using the  $\triangle$  and  $\nabla$  keys.

Each press of a key (approx. 0.5 sec input) increases/decreases the setting by 1°C. Pressing and holding a key (approx. 2 sec or more) resets the lowest digit in the setting to "0" (provided the setting was not at "0" already) and then increases/decreases the setting in 10°C increments.

3. When approx. 5 sec or more elapse without key input, the setting is entered. Once the setting is entered, the display returns to the set value indication mode.

- If enter processing fails, "Err" appears and the display returns to the set value indication mode.

Note

- Do not change the thermocouple range, temperature range or alarm mode of the setting device.

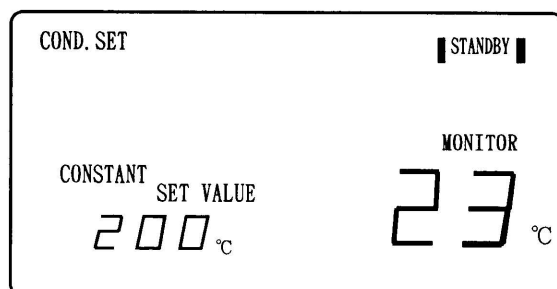
If settings are changed, the overheat protector may trigger mistakenly or not trigger at the set temperature.

## 4.6 Switching ON the power

- ① Turn ON the primary power supply.
- ② Turn ON the main power switch.
- ③ Press the **POWER** key on the controller.
- ④ The set temperature and temperature inside the chamber will be displayed and the chamber will enter the standby state.

- The chamber does not start operating when power is supplied to the controller, but when the POWER key is pressed.

- For a complete explanation on operating the controller, refer to the reference manuals for standard instrumentation or M-instrumentation.



## 4.7 Setting the upper/lower temperature limit alarms

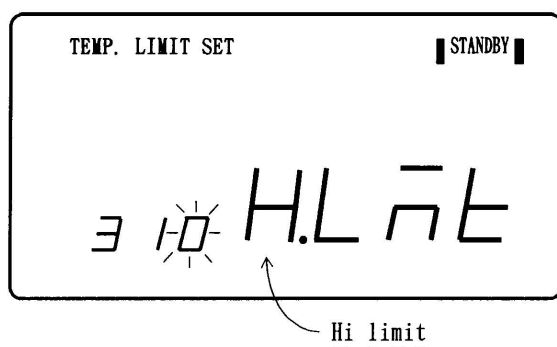
- ① Call up the alarm setting mode.

Press the **TEMP. LIMIT** key.

- ② Set the upper temperature limit.

Make the setting with the cursor keys.

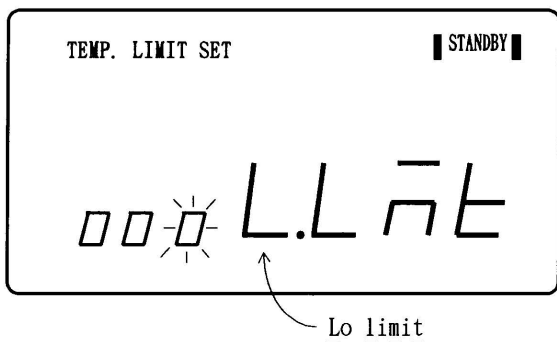
When setting is complete, press the **NEXT** key.



• The upper temperature limit can not be set below the constant operation temperature.

- ③ Set the lower temperature limit.

Make the setting with the cursor keys.



• The lower temperature limit is factory set to 0 °C. No alarm will be generated at this setting.

- ④ Return to the monitoring display.

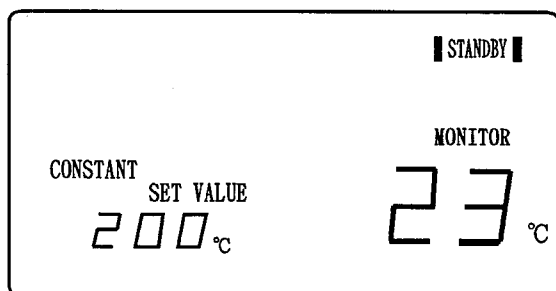
Press the **TEMP. LIMIT** key.

## 4.8 Recording temperature settings

---

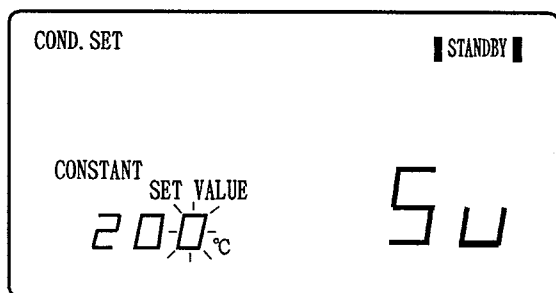
- ① Press the **CONST./PRGM. SELECT** key.

This calls up the constant operation mode.



- ② Press the **CONDITION** key.

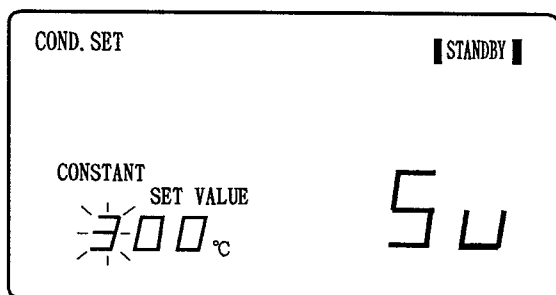
The lowest place digit will start flashing when the temperature setting is enabled.



- ③ Make the temperature setting.

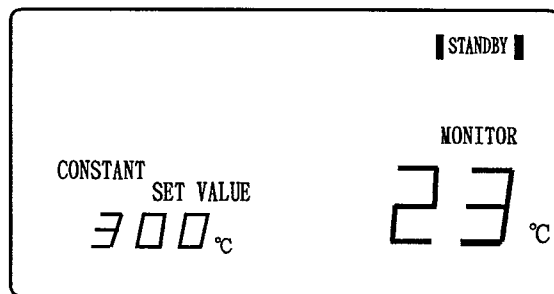
Make the setting with the cursor keys.

- Shift keys (**◀**, **▶**) : Each moves the active column.
- Up/Down keys (**▲**, **▼**) : Increases/decreases the active number.



- ④ Setting is complete, therefore return to the monitoring display.

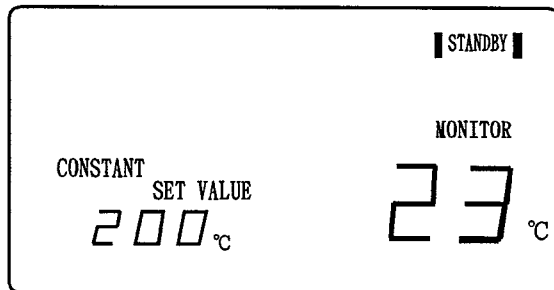
Press the **CONDITION** key.



## 4.9 Starting operation

---

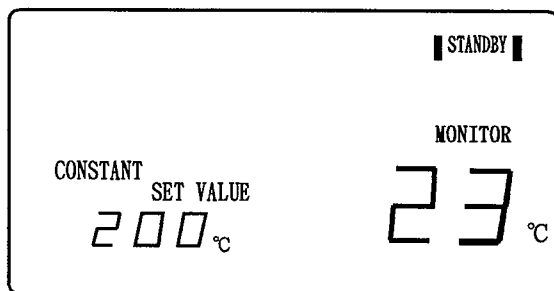
- ① Press the **CONST./PRGM. SELECT** key until "CONSTANT" is displayed.



- ② Check settings.

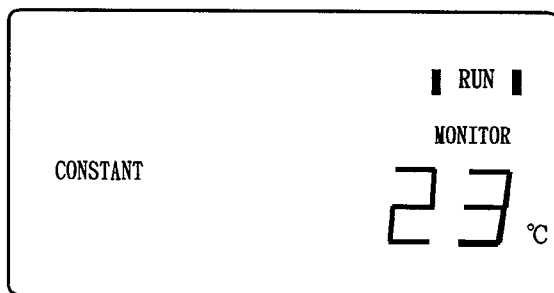
Refer to 4.8, to check settings.

When setting have been confirmed, press the **CONST./PRGM. SELECT** key again until "CONSTANT" is displayed.



- ③ Start the chamber.

Press the **OPERATION** key. This will start the chamber.

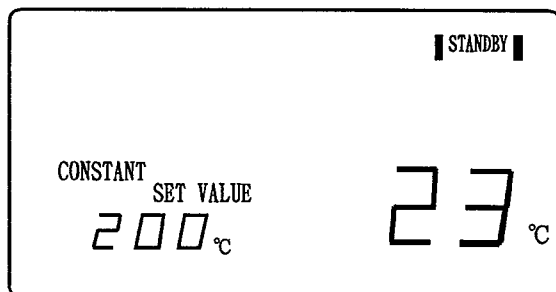


## 4.10 Ending operation

---

① Stop operation.

Press the **OPERATION** key.



② Press the **POWER** key on the controller.



### CAUTION

During and shortly after high temperature operation, the chamber is hot on the inside (specimens, shelves, inside panel of chamber door, inner chamber). Direct contact with hot spots may result in burns.

Wear heat resistant gloves when working under such conditions.

## 4.11 For long periods of disuse

---

Turn OFF the main power switch and primary power breaker.

# 5

## Convenient ways of usage

This chapter introduces some convenient ways of using the chamber, useful in becoming more familiar with its operation.

### 5.1 Open damper operation (ventilated operation)



#### DANGER

- Do not place flammable or combustible substances behind the chamber, especially in the vicinity of the exhaust port for no reason whatsoever.

When the chamber is operated with the damper open, hot air is exhausted from the chamber exhaust port.

To dry specimens, operate the chamber with the damper open. Efficient drying is possible because vapor pressure inside the chamber does not rise. Drying is also faster at high temperature, provided the specimens can withstand the heat. However, if the damper is opened too far, the chamber will be overly ventilated, making impossible to keep temperature inside the chamber constant.

- (1) Refer to the below charts for allowable damper aperture and temperature control range.

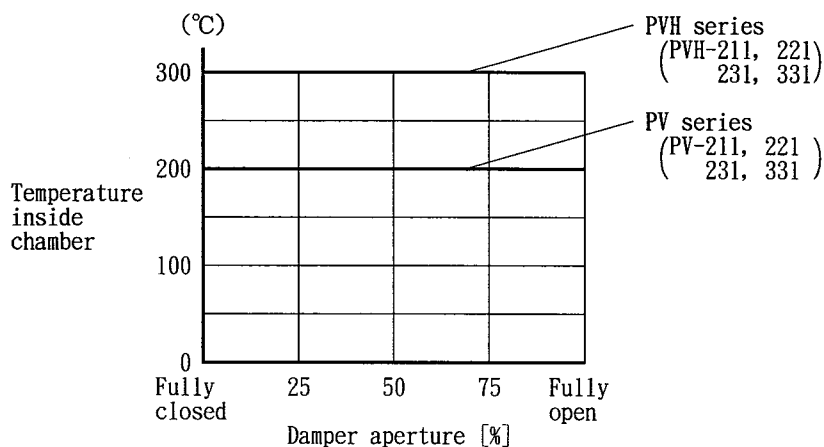


Fig. 5.1 Allowable temperature control range

(Conditions: No specimens, ambient temperature: 20°C, power supply: 200V AC)

\* Performance will vary slightly by model.

(2) Refer to the below table for the relations between damper aperture and ventilation rate.

• When the chamber is operated for a long period of time with the damper open, more time is required to pull up temperature inside the chamber. To quickly raise temperature, operate the chamber with the damper closed. When the set temperature is reached, open the damper.

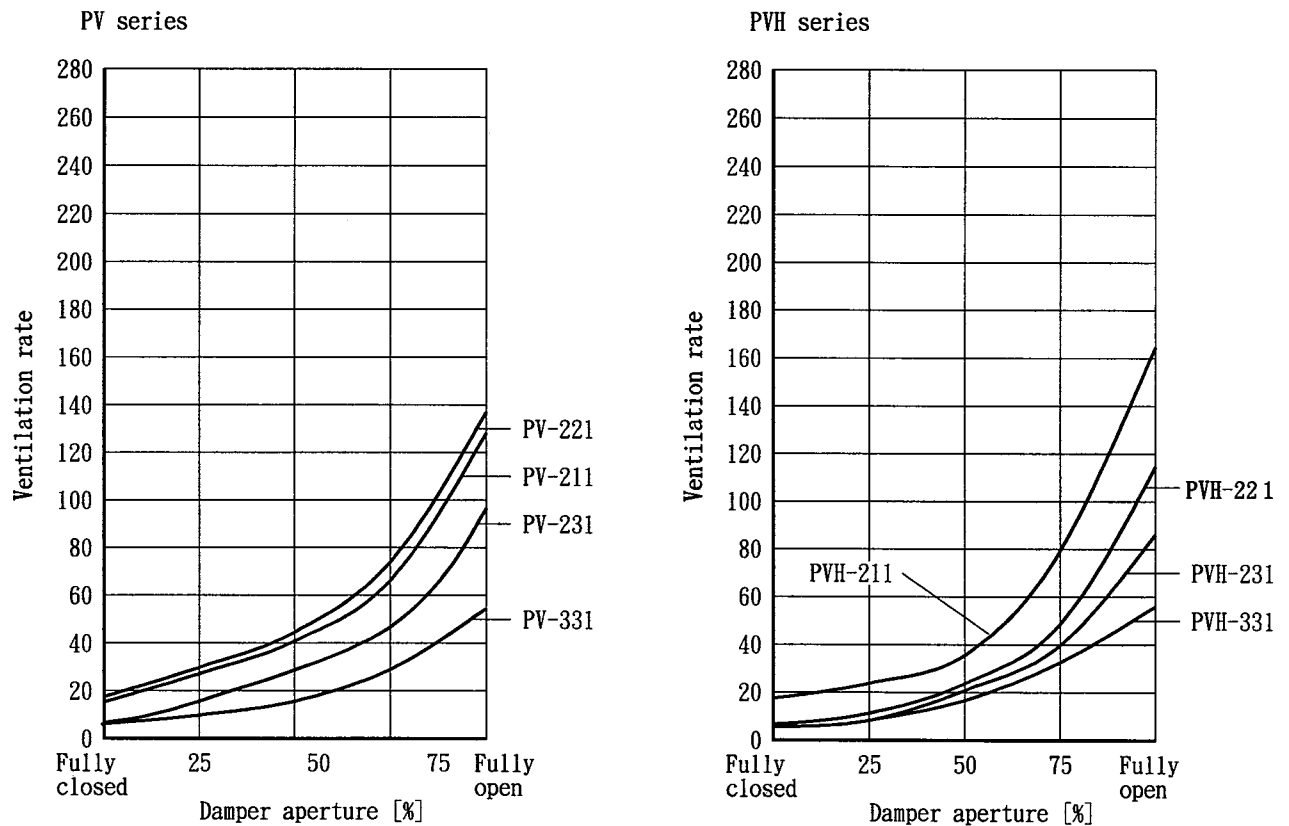


Fig. 5.2 Damper aperture and ventilation rate

(Conditions: No specimens, ambient temperature: 20°C, power supply: 200V AC)

\* Performance will vary slightly by model.



## 5.2 Rapid temperature pull-down

To rapidly pull down temperature inside the chamber, set the controller temperature setting to ambient temperature and fully open the damper. However, because the fan will stop operating depending on the controller environmental setting, do not set temperature to 0°C.

- The relationship between damper aperture and temperature pull-down rate is shown in the below charts.

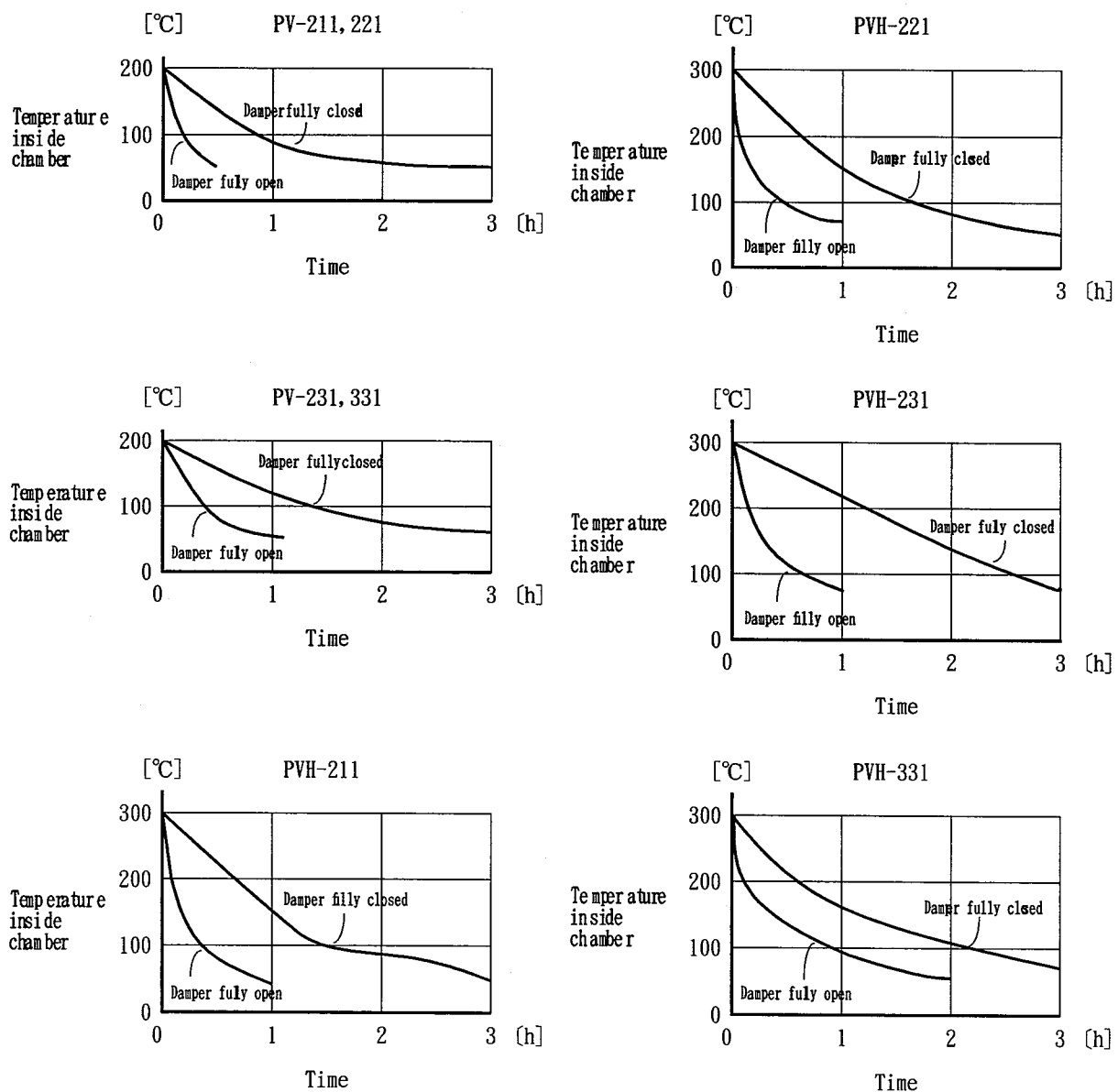


Fig. 5.3 Damper aperture and temperature pull-down rate (No specimens, ambient temperature: Conditions: 20°C, power supply: 200V AC)

\* Performance will vary slightly by model.

### 5.3 Allowable specimen heat generation

Specimens generate heat inside the chamber. Be careful that specimens do not generate more heat than allowed. Refer to the below charts.

Measuring conditions are below indicated. Data will change with any wide variation from these conditions. Performance will vary slightly by model.

Power supply ..... 200V AC, 1 $\phi$  or 3 $\phi$  60Hz

Ambient temperature ..... 23°C

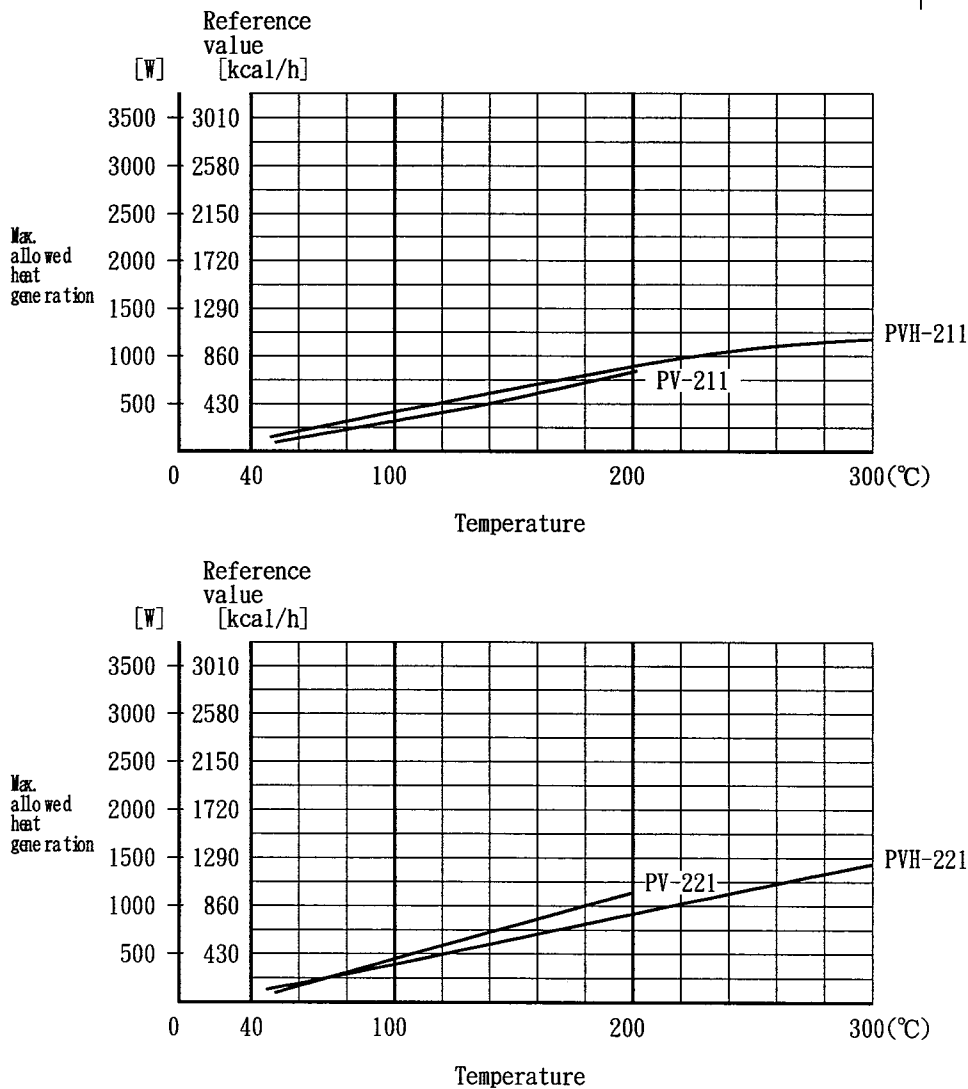


Fig. 5.4 Max. allowed heat generation by specimens inside chamber (PV(H)-211, 221)

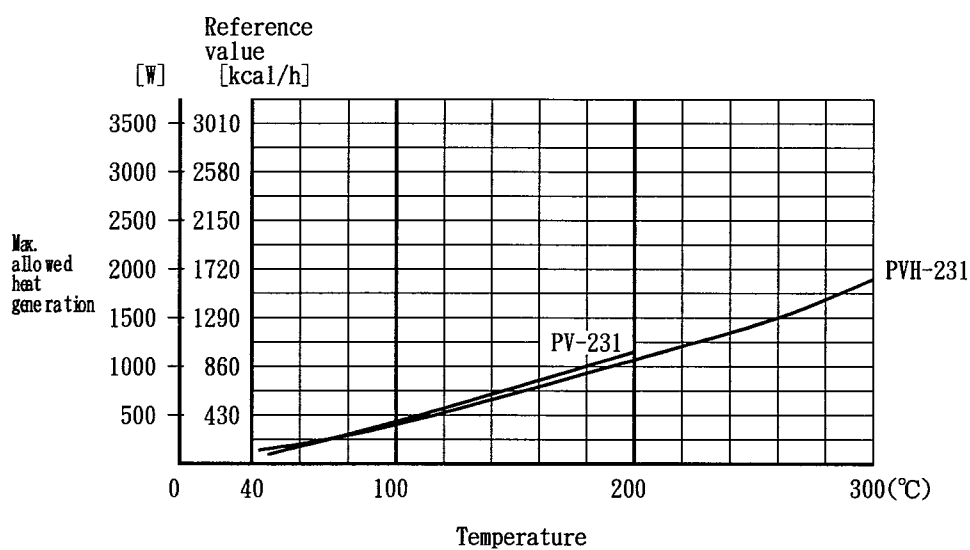


Fig. 5.5 Max. allowed heat generation by specimens  
inside chamber (PV(H)-231)

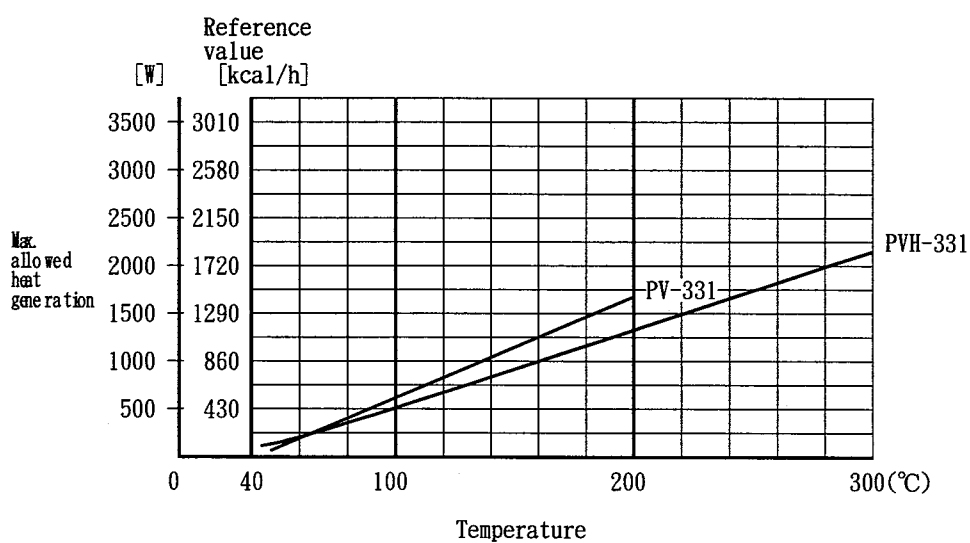


Fig. 5.6 Max. allowed heat generation by specimens  
inside chamber (PV(H)-331)

## 6.2 Overheat protector trip test

---

Before starting operation, test the overheat protector for proper tripping.

- ① Set the overheat protector temperature below the actual chamber temperature.

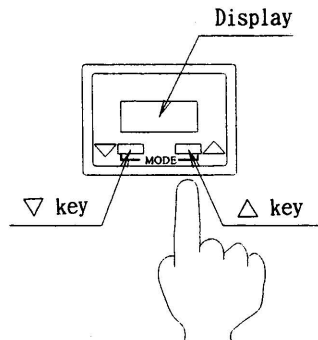


Fig. 6.2 Overheat protector trip test

- ② If the overheat protector is functioning properly, an alarm will be generated: a fault indication lamp will light up and the buzzer will sound. If an alarm is not generated, there is something wrong with the overheat protector. Contact the place of purchase or ESPEC CORP.

- If the overheat protector trips, all of the digits of the setting device display flash.



- ③ To clear the alarm, press the **POWER** key to shut OFF power to the chamber, and then reset the overheat protector.

## 6.3 Cleaning inside the chamber

---

After operation has ended, wipe away dirt from inside the chamber with a soft cloth.

## 6.2 Overheat protector trip test

---

Before starting operation, test the overheat protector for proper tripping.

- ① Set the overheat protector temperature below the actual chamber temperature.

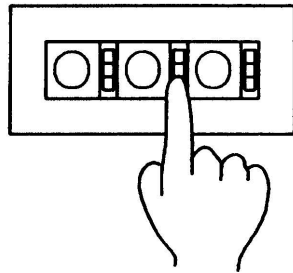


Fig. 6.2 Overheat protector trip test

- ② If the overheat protector is functioning properly, an alarm will be generated: A fault indication lamp will light up and the buzzer will sound. If an alarm is not generated, there is something wrong with the overheat protector. Contact the place of purchase or ESPEC CORP.



- ③ To clear the alarm, press the **POWER** key to shut OFF power to the chamber, and then reset the overheat protector.

## 6.3 Cleaning inside the chamber

---

After operation has ended, wipe away dirt from inside the chamber with a soft cloth.

## 6.4 Cleaning inside the electrical compartment

---

Because the electrical compartment is ventilated, dust easily accumulates inside. Dust accumulation may cause leakage and faulty contacts. Clean inside the electrical compartment once every 2 or 3 months with a vacuum cleaner.

## 6.5 Cleaning inside the exhaust duct

---



### **CAUTION**

Be sure to clean inside the exhaust duct, whether of our manufacture or installed by you, once every 2 or 3 months.

The vapor from specimens or airborne substances may settle inside the exhaust duct as sludge. Accumulated sludge may be ignited by the hot air of the exhaust.

# 7

## Troubleshooting

Major faults with this chamber are detected through equipment self-checks. The details of the fault are displayed and a buzzer sounded to notify the user. This function is referred to as an alarm. This chapter explains the causes and remedial action of alarms and other faults.

Contact the place of purchase or ESPEC CORP. in the following cases.

- When the equipment fails operate normally after taking the prescribed remedial action.
- Where "Call service." is indicated in this chapter.

### 7.1 Faults indicated by alarm

---

When an alarm has been generated, take the following action.

- ① Check the alarm code indicated on the display.



- ② Take the remedial action prescribed for the alarm code in the Alarm code list.
- ③ Reset the alarm. Press the **POWER** key on the controller.
- ④ To reactivate the chamber, press the **POWER** key again.

- For alarms AL-1 and 1-9, steps ③ and ④ are unnecessary. The chamber will reset automatically just by clearing the alarm state. However, the display will remain unchanged after alarm AL-9, therefore press the **POWER** key to clear the display.

Table 7.1 Alarm code list

| Alarm code  | Location                          | Symptom                                                                                                             | Probable cause                                           | Remedial action                                   |
|-------------|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------|
| <b>AL00</b> | Burn out                          | Temperature sensor fault                                                                                            | Temperature sensor disconnection                         | Reconnect the temperature sensor.                 |
| <b>AL01</b> | Automatic temperature overheat    | Temperature inside the chamber rose 10°C above the set temperature.                                                 | Specimens generated excessive heat.                      | Reduce specimen heat generation.                  |
|             |                                   |                                                                                                                     | Insufficient ventilation.                                | Open the damper.                                  |
|             |                                   |                                                                                                                     | Temperature setting is too low.                          | Set temperature (ambient temperature + 20)°C      |
| <b>AL02</b> | Upper temperature limit alarm     | Temperature inside the chamber rose above the upper temperature limit alarm setting.                                | Upper temperature limit alarm setting is too low.        | Change the upper temperature limit alarm setting. |
|             |                                   |                                                                                                                     | Specimens generated excessive heat.                      | Reduce specimen heat generation.                  |
| <b>AL03</b> | Lower temperature limit alarm     | Temperature inside the chamber dropped below the lower temperature limit alarm setting.                             | Lower temperature limit alarm setting is too high.       | Change the lower temperature limit alarm setting. |
|             |                                   |                                                                                                                     | Excessive ventilation.                                   | Close the damper.                                 |
| <b>AL06</b> | Overheat protector                | The overheat protector tripped.                                                                                     | Overheat protector setting is too low.                   | Raise the overheat protector setting.             |
|             |                                   | (All digits of setting device display are flashing.)                                                                | Specimens generated excessive heat.                      | Reduce specimen heat generation.                  |
|             |                                   | Trouble in the overheat protector temperature sensor ("----" burnout indication appears on setting device display.) | Faulty contact in overheat protector temperature sensor. | Reconnect the temperature sensor.                 |
|             | Circuit protector                 | The circuit protector tripped.                                                                                      | Short circuit or overcurrent of the heating circuit.     | Call service.                                     |
|             | Thermal fuse.                     | The thermal fuse blew.                                                                                              | Heater system fault                                      | Call service.                                     |
| <b>AL07</b> | Air circulator temperature switch | The air circulator temperature switch tripped.                                                                      | The air circulator shaft locked.                         | Call service.                                     |
| <b>AL09</b> | Door switch                       | The door was detected open for 3 sec. or more                                                                       | The door is open                                         | Close the door                                    |
| <b>AL82</b> | Time setting                      | The program is set to run at "0:00".                                                                                | Inappropriate time setting.                              | Remake the setting.                               |
|             | Temperature setting               | The program (step) temperature setting exceeds the upper (lower) temperature limit alarm.                           | Inappropriate temperature setting.                       | Remake the setting.                               |
| <b>E1</b>   | Memory error                      | Internal memory error                                                                                               | Internal memory error                                    | Call service.                                     |
| <b>E2</b>   | Memory error                      | External memory error                                                                                               | External memory error                                    | Call service.                                     |
| <b>2</b>    | CPU error                         | CPU malfunction                                                                                                     | Malfunction caused by noise                              | Improve the power supply environment              |



## 7.2 Other faults

The below table includes faults not detected by self-checks and operational mistakes that are easily mistaken as faults.

Note, also, that the fault symptoms listed in the below table can occur when the chamber is equipped with certain options even though there is nothing wrong with the equipment. For more information, contact the place of purchase or ESPEC CORP.

Table 7.2 Other faults

| Symptom                                                             | Probable cause                                                                                               | Remedial action                                                      | Reference |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------|
| The display does not light up even when the (POWER) key is pressed. | The primary power is OFF.                                                                                    | Turn ON the primary power.                                           | —         |
|                                                                     | The main power switch is OFF.                                                                                | Turn ON the main power switch.                                       | 4.6       |
|                                                                     | The fuse is blown.                                                                                           | Replace the fuse.                                                    | 7.3       |
| The temperature setting cannot be changed.                          | The keys are locked.                                                                                         | Unlock the keys.                                                     | 2.3       |
| Too much time is required to pull up/down temperature               | Heat load of specimens is large.                                                                             | Reduce the number of specimens.                                      | 4.3       |
|                                                                     | Ambient temperature is too low/high.                                                                         | Raise/lower the ambient temperature.                                 | —         |
|                                                                     | The damper is open/closed.                                                                                   | Close/open the damper.                                               | 5.1       |
| Temperature uniformity is uneven.                                   | Air circulation inside the chamber is poor.                                                                  | Improve air circulation.                                             | 4.3       |
|                                                                     | Specimens are generating too much heat.                                                                      | Reduce specimen heat generation.                                     | —         |
|                                                                     | Excessive ventilation.                                                                                       | Reduce damper aperture.                                              | —         |
| Temperature is unstable.                                            | Excessive ventilation.                                                                                       | Reduce damper aperture.                                              | —         |
|                                                                     | Ambient temperature changes at a rate faster than 5°C/hr.                                                    | Stabilize ambient temperature, then restart operation.               | —         |
|                                                                     | Power supply to high heat-generating specimens is turning ON and OFF.                                        | Reduce specimen heat generation.                                     | —         |
| Temperature gradually rises above the set temperature.              | Specimens are generating too much heat.                                                                      | Reduce specimen heat generation.                                     | —         |
| Strange odors or smoke is protruding from the chamber.              | Immediately after installation, the shelf brackets and shelves may burn, producing a strange odor and smoke. | No trouble has occurred with the chamber. Operate the chamber as is. | —         |

### 7.3 Replacing the fuse

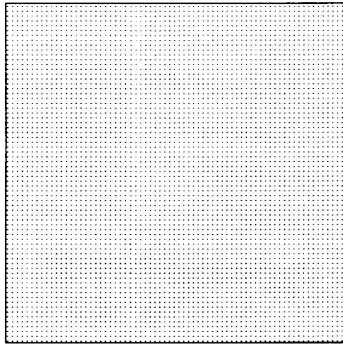
---

When the fuse blows, replace it by observing the following procedure.

The customer must keep a supply of spare fuses.

- ① Turn OFF the main power switch.
- ② Open the electrical compartment door.
- ③ Take out the fuse and check if it has blown or not.
- ④ Replace the fuse with a spare, if blown.

• If the fuse blows immediately after being replaced, contact the place of purchase or ESPEC CORP.



# Appendix

A. Operation principle

B. Main specifications

C. Consumable parts and replacement interval

D. Optional parts list

E. Temperature calibration

## A. Operation principle

---

This section explains the principle behind temperature controlled operation. Operation with the damper closed (circulated operation) and open (ventilated operation) are as follows.

(1) Circulated operation

When the damper is closed, the heater controls temperature inside the chamber to keep it constant.

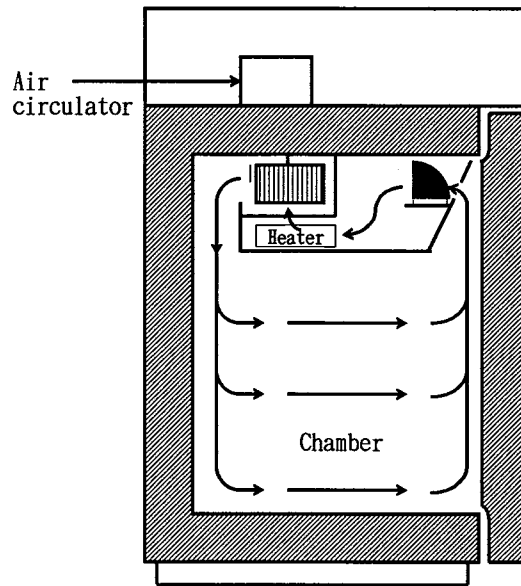


Fig. A.1 Circulated operation

(2) Ventilated operation

When the damper is open, outside air is forced inside the chamber through the air intake by the air circulator. Air heated by the heater is fed through the chamber and exhausted from the exhaust port. Also, except when the damper is fully open, part of the incoming air is circulated inside the chamber.

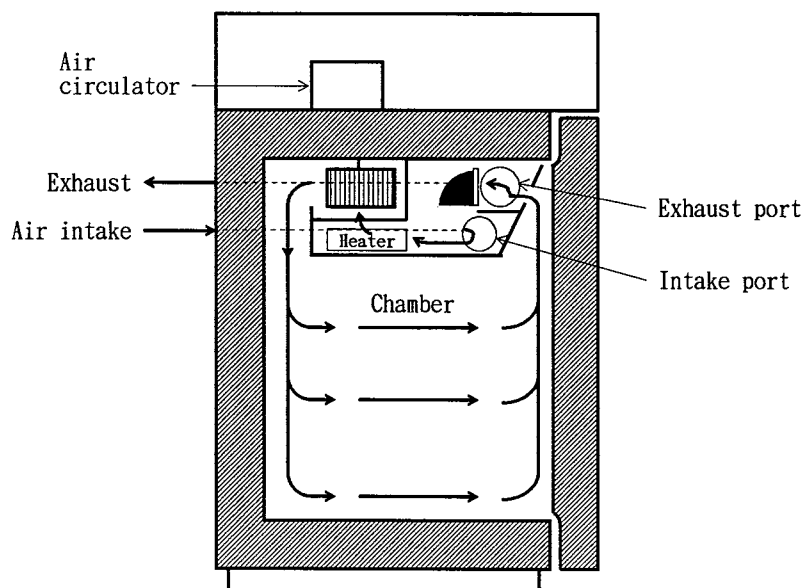


Fig. A.2 Ventilation operation

## B. Main specifications

| Product type           |                                   | Temperature chamber                                              |                 |                                      |                   | High temperature chamber                                   |                 |                                   |                   |
|------------------------|-----------------------------------|------------------------------------------------------------------|-----------------|--------------------------------------|-------------------|------------------------------------------------------------|-----------------|-----------------------------------|-------------------|
| Model                  |                                   | PV-211                                                           | PV-221          | PV-231                               | PV-331            | PVH-211                                                    | PVH-221         | PVH-231                           | PVH-331           |
| System                 |                                   | Forced hot air circulation and ventilation                       |                 |                                      |                   |                                                            |                 |                                   |                   |
| Power supply           |                                   | 200VAC }<br>220VAC } 1ϕ<br>230VAC } 50/60Hz<br>240VAC }          |                 | 200VAC }<br>220VAC } 3ϕ<br>50/60Hz } |                   | 200VAC }<br>220VAC } 1ϕ<br>230VAC } 50/<br>240VAC } 60Hz } |                 | 200VAC }<br>220VAC } 3ϕ 50/60Hz } |                   |
|                        |                                   | Allowed voltage fluctuation: Within ± 10%                        |                 |                                      |                   |                                                            |                 |                                   |                   |
| Max. power consumption |                                   | 4.0kVA                                                           | 4.8kVA          | 5.8kVA                               | 6.8kVA            | 4.0kVA                                                     | 5.8kVA          | 6.2kVA                            | 8.8kVA            |
| Performance<br>*1      | Temperature range                 | (Ambient temperature + 20)°C to 200°C                            |                 |                                      |                   | (Ambient temperature + 20)°C to 300°C                      |                 |                                   |                   |
|                        | Temperature uniformity            | ±0.2 °C at 100°C, 200°C                                          |                 |                                      |                   | ±0.2 °C at 100°C, 200°C<br>±0.3 °C at 300°C                |                 |                                   |                   |
|                        | Temperature uniformity            | ±1.0°C at 100°C, ± 2.0°C at 200°C                                |                 |                                      |                   | ±1.0°C at 100°C<br>±2.0°C at 200°C<br>±3.0°C at 300°C      |                 |                                   |                   |
|                        | Temperature pull-up rate          | Within 40 min. when between ambient temperature and 200°C        |                 |                                      |                   | Within 60 min. when between ambient temperature and 300°C  |                 |                                   |                   |
|                        | Ambient temperature               | Operatable range: 0 to 40°C                                      |                 |                                      |                   |                                                            |                 |                                   |                   |
| Dimensions<br>*2       | Outside dimensions (W × H × D cm) | 72×120<br>×92.5                                                  | 72×150<br>×92.5 | 72×180<br>×92.5                      | 103×180<br>×114.5 | 72×120<br>×92.5                                            | 72×150<br>×92.5 | 72×180<br>×92.5                   | 103×180<br>×114.5 |
|                        | Inside dimensions (W × H × D cm)  | 60×60<br>×60                                                     | 60×90<br>×60    | 60×120<br>×60                        | 80×120<br>×60     | 60×60<br>×60                                               | 60×90<br>×60    | 60×120<br>×60                     | 80×120<br>×60     |
|                        | Loading capacity (ℓ)              | 216                                                              | 324             | 432                                  | 768               | 216                                                        | 324             | 432                               | 768               |
|                        | Weight (kg)                       | 165                                                              | 190             | 210                                  | 325               | 165                                                        | 190             | 210                               | 325               |
| Accessories            | Shelf                             | Stainless steel × 2 Punched stainless steel sheet for PV (H)-331 |                 |                                      |                   |                                                            |                 |                                   |                   |
|                        | Shelf bracket                     | Stainless steel × 4                                              |                 |                                      |                   |                                                            |                 |                                   |                   |
|                        | Connector                         | For specimen power supply control terminal × 1                   |                 |                                      |                   |                                                            |                 |                                   |                   |
|                        | Fuse                              | Glass tube, 3A × 2 (5A for PV (H)-331)                           |                 |                                      |                   |                                                            |                 |                                   |                   |
|                        | User's Manual                     | For chamber and temperature indicator-controller 1 each          |                 |                                      |                   |                                                            |                 |                                   |                   |

\*1: Value determined in circulated operation, with no specimens and an ambient temperature of 20°C.

\*2: Excluding protrusions.

## C. Consumable parts and replacement interval

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The below parts must be replaced periodically. Promptly replace them at the specified interval if not sooner.

Maintenance service is also provided by ESPEC CORP.

For spare parts and servicing, contact the place of purchase or ESPEC CORP.

Table C.1 Consumable parts and replacement interval

| Part         | Replacement interval                                                                           | Replacement procedure                        |
|--------------|------------------------------------------------------------------------------------------------|----------------------------------------------|
| Door packing | Whenever the door packing cracks, tears or becomes hardened and the airtightness deteriorates. | Contact the place of purchase or ESPEC CORP. |

\* Replacement interval depends on the frequency of opening/closing of chamber door and the usage conditions.

## D. Optional parts list

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The following options are available for chambers of the PV (H) Series. These options are designed to expand the applications and performance of the chamber.

Contact the place of purchase or ESPEC CORP. for details on options and whether options are applicable or not with your chamber.

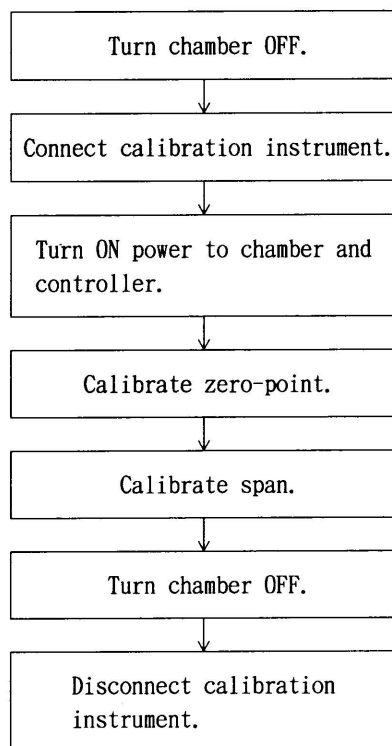
### 【Optional parts list】

- Stand (For PV (H)-211 and 221 only)
- Viewing window
- Cable port
- Temperature recorder
- Integrating hour meter
- Calendar timer
- External alarm terminal
- Exhaust port flange
- Automatic damper
- Velocity variable device (For air current control)
- Temperature sensor terminal
- Exhaust duct
- Color specification
- Basket type shelf
- Load resistance shelf and shelf bracket
- Time-up output terminal
- Shelf and shelf bracket
- N<sub>2</sub> gas injection

## E. Temperature calibration

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Temperature calibration is performed as indicated below.



Temperature calibration process flow

### E.1 Preparation

- ① Prepare the calibration instrument.

(Note)

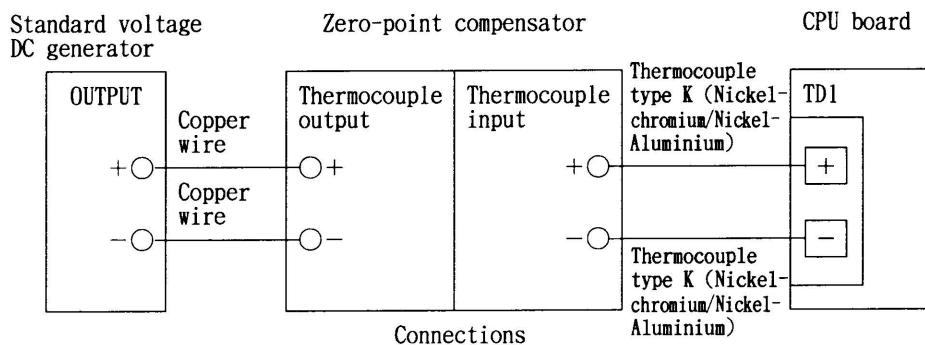
Make sure the recorder, thermometer and sensor of the calibration instrument have been calibrated.

- ② Set the temperature sensor of the calibration instrument near to the chamber's temperature sensor.

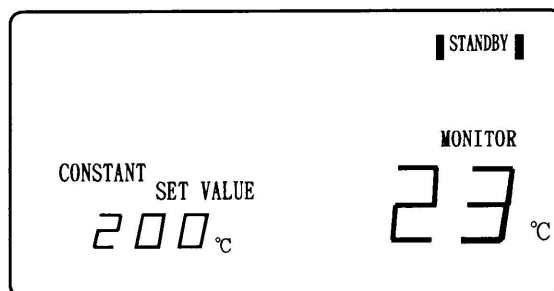


## E.2 Calibration

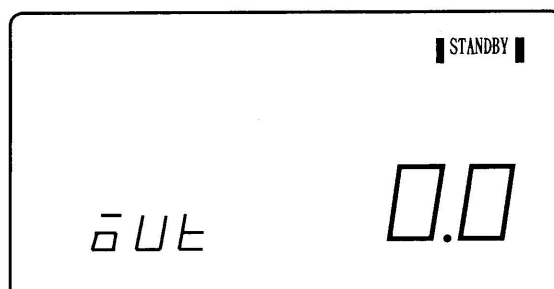
- ① Turn power to the chamber OFF from the ON-OFF switch.
- ② Connect a standard voltage DC generator and zero-point compensator as shown below. (Disconnect the temperature sensor from terminal board TD1.)



- ③ Turn power to the chamber back ON and press the **POWER** switch on the controller. Then, wait until the calibration instrument and CPU board stabilize.  
This usually takes about 1 hour.
- ④ While the temperature monitor is displayed, press the **NEXT** key.  
This will change the display to the heater output monitor.



- ⑤ Hold down both shift keys(◀ and ▶) for 3 seconds. This will engage the calibration mode.



⑥ Calibrate the zero-point

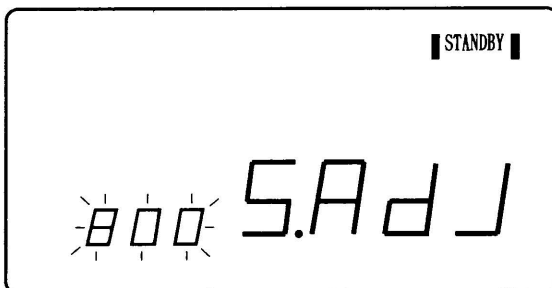
Input 0  $\mu\text{V}$  (equivalent to 0°C of the thermocouple type K (Nickel-chromium/Nickel-Aluminium)) from the voltage generator, through the zero-point compensator, and press the ▲ key. Zero-Point calibration is complete when the display reads "0".

Press the (NEXT) key.



⑦ Calibrate span

Input 33277  $\mu\text{V}$  (equivalent to 800°C of the thermocouple type K (Nickel-chromium/Nickel-Aluminium)) from the voltage generator, through the zero-point compensator, and press the ▲ key. Span calibration is complete when the display reads "800".



⑧ Return to the temperature monitor.

Press the (CONDITION) key.

⑨ Shut OFF power to the chamber and controller.

⑩ Disconnect the calibration instrument and reconnect the temperature sensor you disconnected in step ② to terminal board TD1.

User's Manual

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**Temperature Chamber  
/Industrial Oven**

PV(H)  
Basic Operation

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