

Service Manual

Temperature Chamber (Vertical type)

PV(H)-212, 222, 232, 332

4022205000200



This Service Manual has been compiled specifically for servicepeople trained or certified by ESPEC CORP. Because of the dangers involved, service described herein should not be performed by other persons.

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Introduction

This Service Manual explains how to service Temperature Chamber (Vertical type) in the event of trouble during usage. In particular, it provides check lists with criterion for making decisions at every step to help you locate and correct troubles. It also contains precise procedures on replacing parts. If troubles cannot be corrected as explained herein, contact the place of purchase or ESPEC CORP.

Make note of the following conventions used in this manual before reading it.

Safety Indications

The following safety Indications are used throughout this manual.

■ Degree of DANGER

 VERY DANGEROUS	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.
 DANGER	This mark means dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.
 CAUTION	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.

Keywords

The following keywords are used in this manual.

Note : Provides information necessary for gaining full performance from the chamber or to prevent damage to equipment.

Procedure : Explains how to operate the chamber on a step-by-step basis.

Reference : Offers supplementary information.

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Introduction



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Read this section BEFORE servicing the equipment.

Chapter 1 For Your Safety

This chapter explains safety precautions to be observed when servicing the equipment. Read this section BEFORE servicing the equipment to prevent accidents to you, users, specimens or the user's equipment. For other explanations, such as how to operate the equipment, refer to the User's Manual in separated volume.

1.1 Who May Service the Equipment



DANGER

- **This Service Manual was written for persons trained and certified by ESPEC CORP. or service people with the same knowledge and skill. Because of the dangers involved, persons untrained in service procedures should never perform servicing described herein.**
- **ESPEC CORP. assumes no responsibility whatsoever for accidents or trouble incurred because of usage outside of the information contained in this manual.**

1.2 Being Prepared



VERY DANGEROUS

- **Anyone servicing the equipment as explained in this manual is exposed to various forms of danger.**

For your safety and that of others, read this chapter thoroughly BEFORE servicing the equipment. The first dangers that come to mind are as follows. In all cases, the servicepeople can be killed or seriously injured.

- Electric shock → Always ground the equipment when servicing the equipment.
- Toxic gas poisoning → Always wear a safety mask when servicing the equipment.
- Mechanical dangers → Always wear protective gear when servicing the equipment.

In servicing the equipment, always remember the safety first principle, follow procedures to the letter, and use tools as specified.

1.3 Clothing and Safety Gear to Be Worn during Service Work

DANGER

Dress and prepare appropriately for the specific type of work to be performed. With the exception of clean room work, work clothes may be the same for service jobs.

Type of work	Servicepeople clothing requirements
Regular work	Work-specific clothes and safety shoes
Wiring & circuit checks	No metallic objects exposed on the side facing the equipment
Welding	Shaded safety goggles, gloves and long sleeve shirt
Solvent use (refrigeration water circuit cleaning, etc.)	Dust-proof mask, safety goggles, gloves and long sleeve shirt
Glass wool insulating	Dust-proof mask and gloves
Piercing	Dust-proof goggles
Quick-bonding agent use	Dust-proof goggles and vinyl gloves (or of similar material)
Work in high places	Helmet and safety belt
Lifting or handling metallic parts	Leather gloves
Inside clean rooms	Clean room suit

1.4 Reporting Accidents and Trouble

If personnel is lost, property is damaged or work is shut down (more specifically, if a life-endangering accident, damaged specimens, fire, water pollution, or other serious situation occurs) because of trouble attributable to the product itself or service thereto or if the possibility thereof is foreseen; contact the personnel of the place of purchase.

1.5 Precautions in Service Work

Before Starting



DANGER

- To prevent electric shock, check the equipment is properly and effectively grounded.
- Test the leakage breaker and check it is functioning properly.

Troubleshooting, Checks and Adjustments



DANGER

Because the chamber is in running status (power is ON) when troubleshooting or when making checks and adjustments, precautions are listed separate of those for repair work.

(1) Prerun checks

- [1] Check no inflammables or explosives have been loaded inside the chamber as specimens.
- [2] If the customer charges specimens in testing, check specimen power supply control terminals are properly wired.
- [3] Have the customer remove specimens and wiring from inside the chamber before starting it.

(2) Precautions in usage

- [1] Do not touch exposed live terminals.
- [2] Watch out for rotating parts such as fans.
- [3] Do not disable safety circuits when running the chamber.
If however unavoidable, restore the safety circuit and check tripping after servicing the chamber.
- [4] Door opening-closing during high temperature operations
Do not open the door during high temperature operations

Repair Work

DANGER

Turn power to the chamber OFF before replacing parts or making other repairs. Also, take measures to prevent power from being turned ON accidentally.

- (1) Precautions in electric wiring work
 - Use spring washers with screw-locked load circuits and coat with locking agent to prevent loosening.
- (2) Precautions in using solvents
 - Perform work that requires handling of solvents outdoors where possible or in a well-ventilated place.
- (3) Precautions in working in high places
 - [1] Take measures to prevent tools and supplies from dropping to below.
 - [2] Wear a helmet and safety belts, and use adequate stepladders or other means for climbing to high places.
- (4) Precautions in moving heavy objects
 - Have other persons help you as needed. Also, wear leather gloves to keep your hands from slipping.
- (5) Precautions in using quick-bonding agents
 - [1] Wear dust-proof goggles and vinyl (or similar material) gloves.
 - [2] Be careful not to touch bonding agents with hands when oozing from applied areas.
- (6) Other
 - [1] Take measures to keep the door from accidentally closing when working inside the chamber.
 - [2] Wear leather gloves when handling sheet metal.

After Servicing the Equipment

DANGER

- (1) Clean and tidy up the work area. Especially, check inside the chamber to make sure you haven't forgotten tools, rags, etc.
- (2) Restore the customer's operation pattern. Check the overheat protector is properly set.
- (3) Check screw-locked terminals of load circuits are tight.

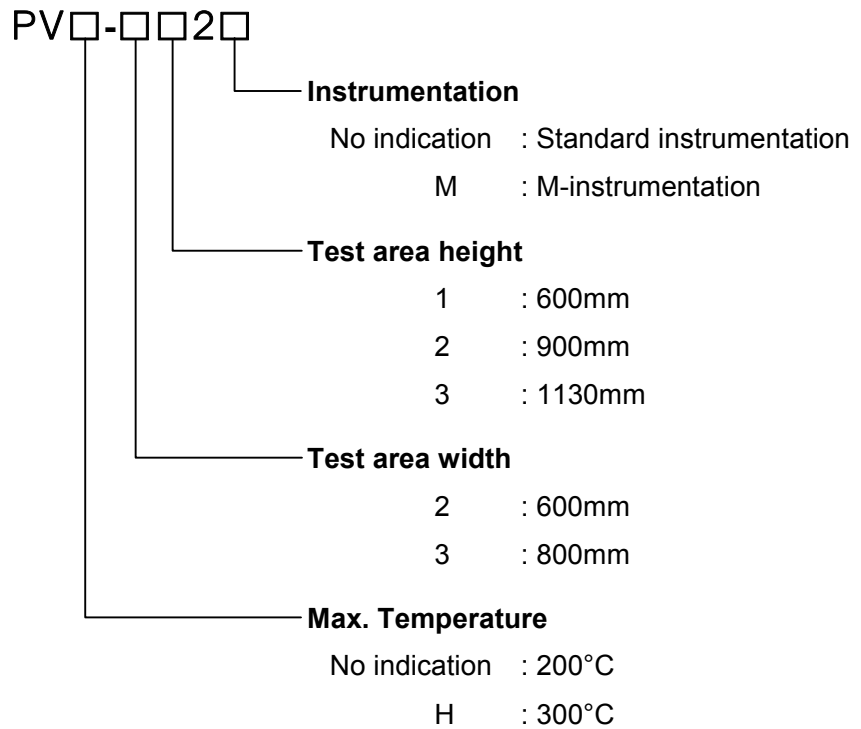
Chapter 2

Chamber Configuration

This chapter explains chamber configuration. Read this section BEFORE checking the trouble and making correction trouble.

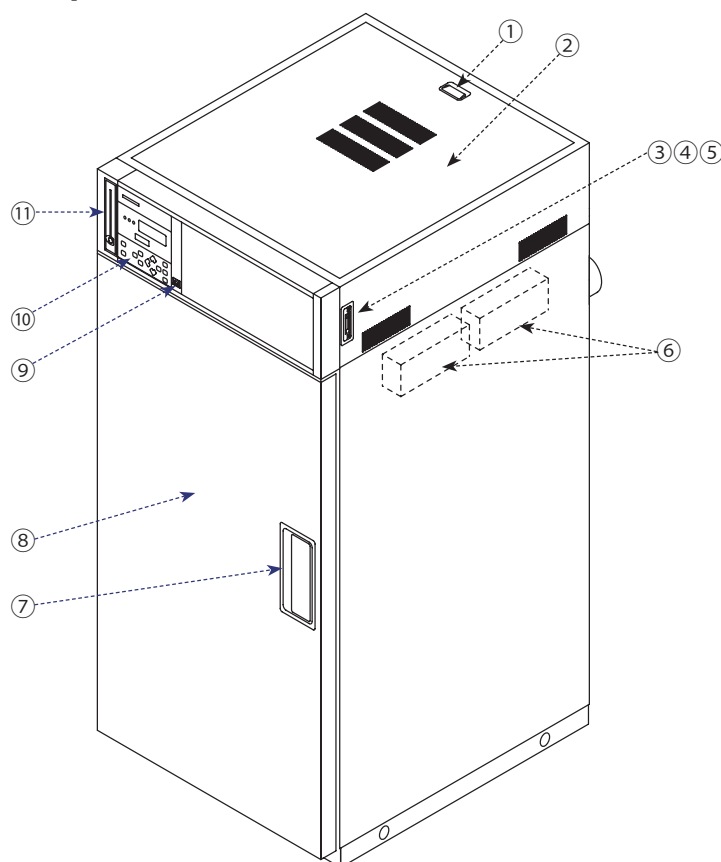
2.1 Temperature chamber models

Temperature chamber series come in different models according to control temperature range, capacity, instrumentation. This manual is applicable with all models, so explanations given in this manual may not applicable to your chamber model. Before using this manual confirm your chamber's model as the below.



2.2 Names and Functions of Parts

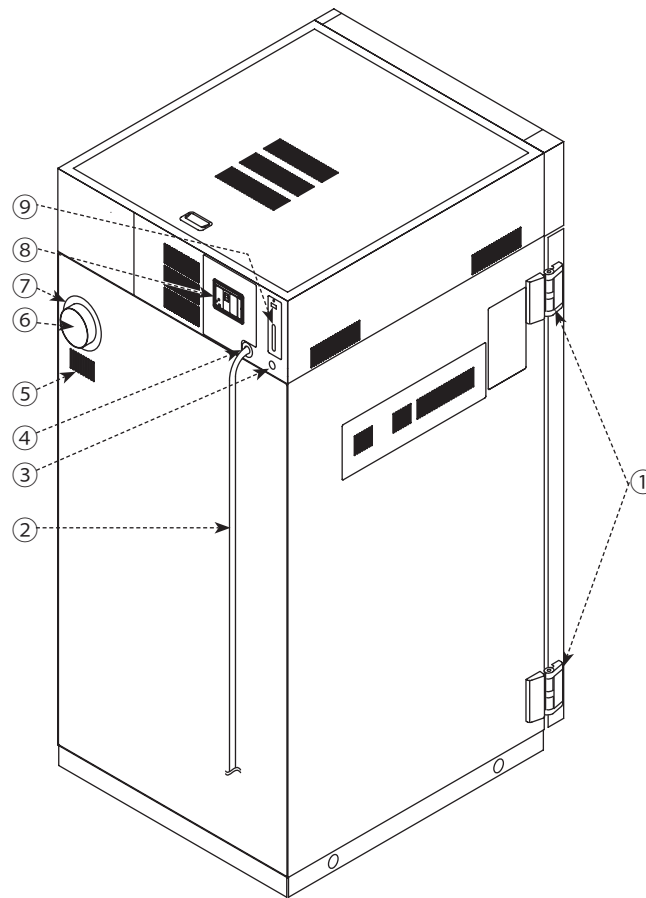
Front, Right and Top



	Name	Function/Use
①	Electric parts compartment cover handle	Use to open and close the electric parts compartment cover.
②	Electric parts compartment cover	Detach to access the electric parts compartment.
③	Specimen power supply control terminals	Used for charge specimen. If trouble occurs and when the chamber operation stops, it stops charging specimen.
④	External alarm terminal (option)	Used to notify an external point when the chamber has been stopped by a safety device tripping.
⑤	Time-up output terminal (option)	Outputs a signal via a contact when the timer of the temperature controller elapses.
⑥	Heater	Heats inside the chamber.
⑦	Door handle	Use to open/close the chamber door.
⑧	Door	Open to access the test area.
⑨	Overheat protector	Stops chamber operation to protect specimens against high temperature damage.
⑩	Instrumentation panel	Panel for operating the chamber and viewing status, etc. It is also used to operate options.
⑪	Manual open/close damper	Opens/Closes the damper. Open the damper to ventilate the chamber during operation or to quickly bring down temperature in the test area. (Not provided when the chamber is equipped with an optional automatic damper.)

Fig. 2.1 Front, Right and Top

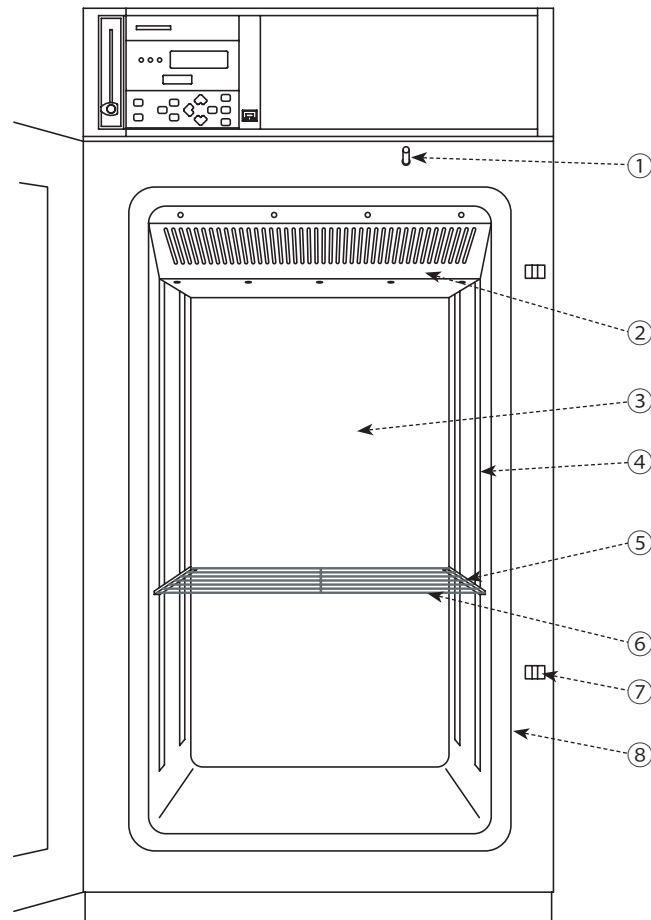
Rear, Left and Top



	Name	Function/Use
①	Hinge	When door opens/closes, it keeps the door from lowering.
②	Power cable	Connects to primary power supply.
③	N ₂ gas injection port (option)	Port to inject N ₂ gas to inside the chamber.
④	Power cable port	Feeds power cable through here to inside the chamber.
⑤	Air supply port	Introduces outside air into the test area.
⑥	Exhaust port	Exhausts hot air.
⑦	Exhaust port flange (option)	Use to connect an exhaust duct for channeling exhausted hot air away from the chamber.
⑧	Main power switch (leakage breaker)	Turns primary power supply to the chamber ON/OFF. Also, prevents leakage current, overloads and short circuit.
⑨	Communication port, temperature recorder terminal	Use to connect communication connector, temperature recorder.

Fig. 2.2 Rear, Left and Top

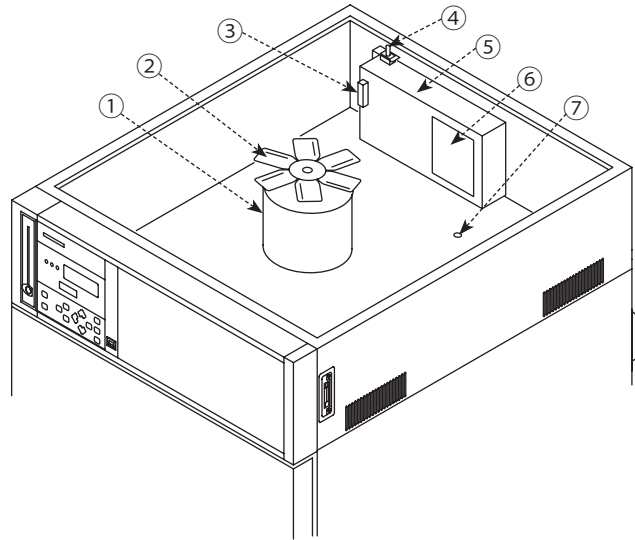
Test Area



	Name	Function/Use
①	Door switch	Detects when the door is open.
②	Exhaust damper maintenance port cover	Detach to clean the exhaust damper.
③	Test area	Area where specimens are located for temperature tests.
④	Shelf brackets support	Install shelf brackets here.
⑤	Shelf bracket	Holds the specimen shelf. To change the specimen shelf height, reposition the brackets on the support.
⑥	Shelf	Holds specimens during tests.
⑦	Lock catch	Holds the door closed.
⑧	Chamber packing	Keeps outside air from penetrating the chamber.

Fig. 2.3 Test Area

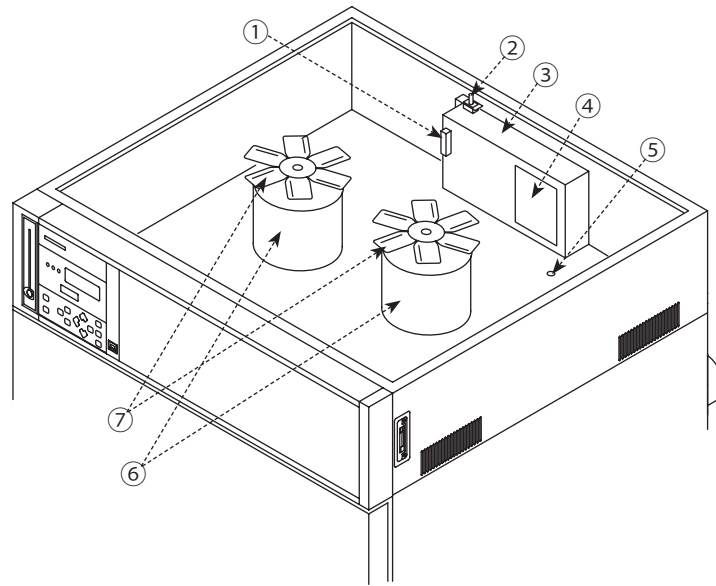
Electric Parts Compartment (PV(H)-212, 222, 232)



	Name	Function/Use
①	Air circulator	Circulates air inside the chamber.
②	Electric parts compartment cooling fan	Cools inside the electric parts compartment.
③	Cartridge fuse	Protect the electrical circuits from short circuiting and overcurrent.
④	Electric parts compartment cover switch	Detects the electric parts compartment cover in the open position.
⑤	Electric parts chassis	Distributes power to heaters, the air circulator and other components.
⑥	Temperature controller	Controls temperature and equipment operation.
⑦	Temperature sensor	Detects temperature inside the chamber.

Fig. 2.4 Electric Parts Compartment (PV(H)-212, 222, 232)

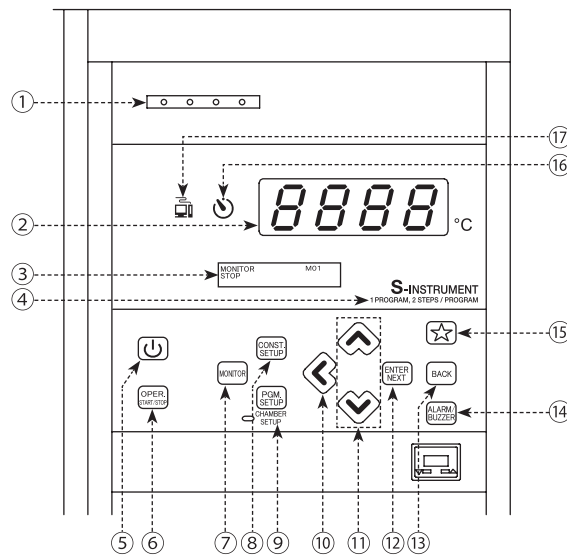
Electric Parts Compartment (PV(H)-332)



	Name	Function/Use
①	Cartridge fuse	Protect the electrical circuits from short circuiting and overcurrent.
②	Electric parts compartment cover switch	Detects the electric parts compartment cover in the open position.
③	Electric parts chassis	Distributes power to heaters, the air circulator and other components.
④	Temperature controller	Controls temperature and equipment operation.
⑤	Temperature sensor	Detects temperature inside the chamber.
⑥	Air circulator	Circulates air inside the chamber.
⑦	Electric parts compartment cooling fan	Cools inside the electric parts compartment.

Fig. 2.5 Electric Parts Compartment (PV(H)-332)

Instrumentation Panel



	Name	Function/Use
①	Status LEDs	Indicate the operating status of the chamber. : Control power OFF (Orange lamp lit) : Control power ON with chamber stopped (Green lamp lit) : Running (Green lamps lit) : Chamber shuts down temporarily (Green lamps flashing) : Active warning (Red lamps lit) : Active error (Red lamps flashing)
②	Temperature display	Constantly indicates the temperature measured inside the test area.
③	LCD	Displays operating status, setting information, etc.
④	Instrumentation type	Indicates instrumentation type; Standard-instrumentation: S-INSTRUMENT 1 PROGRAM, 2 STEPS / PROGRAM M-instrumentation: M-INSTRUMENT 10 PROGRAM, 20 STEPS / PROGRAM
⑤	key	Turns power to the instrumentation ON/OFF.
⑥	key	Press to start/stop chamber operation.
⑦	key	Press to view detailed settings of the chamber. For instructions on how to make settings, see "Monitoring during Operation" in the Reference manual.
⑧	key	Press to set up operation for the constant mode. For details on constant mode settings, see "Constant Mode Settings" in the Reference manual.
⑨	key	Press to set up operation for the program mode. For details on program mode settings, see "Program Mode Settings" in the Reference manual. Press and hold for over 1 sec to configure the chamber. For details on configuration mode settings, see "Control Settings" in the Reference manual.
⑩	key	Moves the active digit (position) when changing settings. Press and hold for 1 sec and more, active digit moves to right.
⑪	key	Changes the displayed setting value.

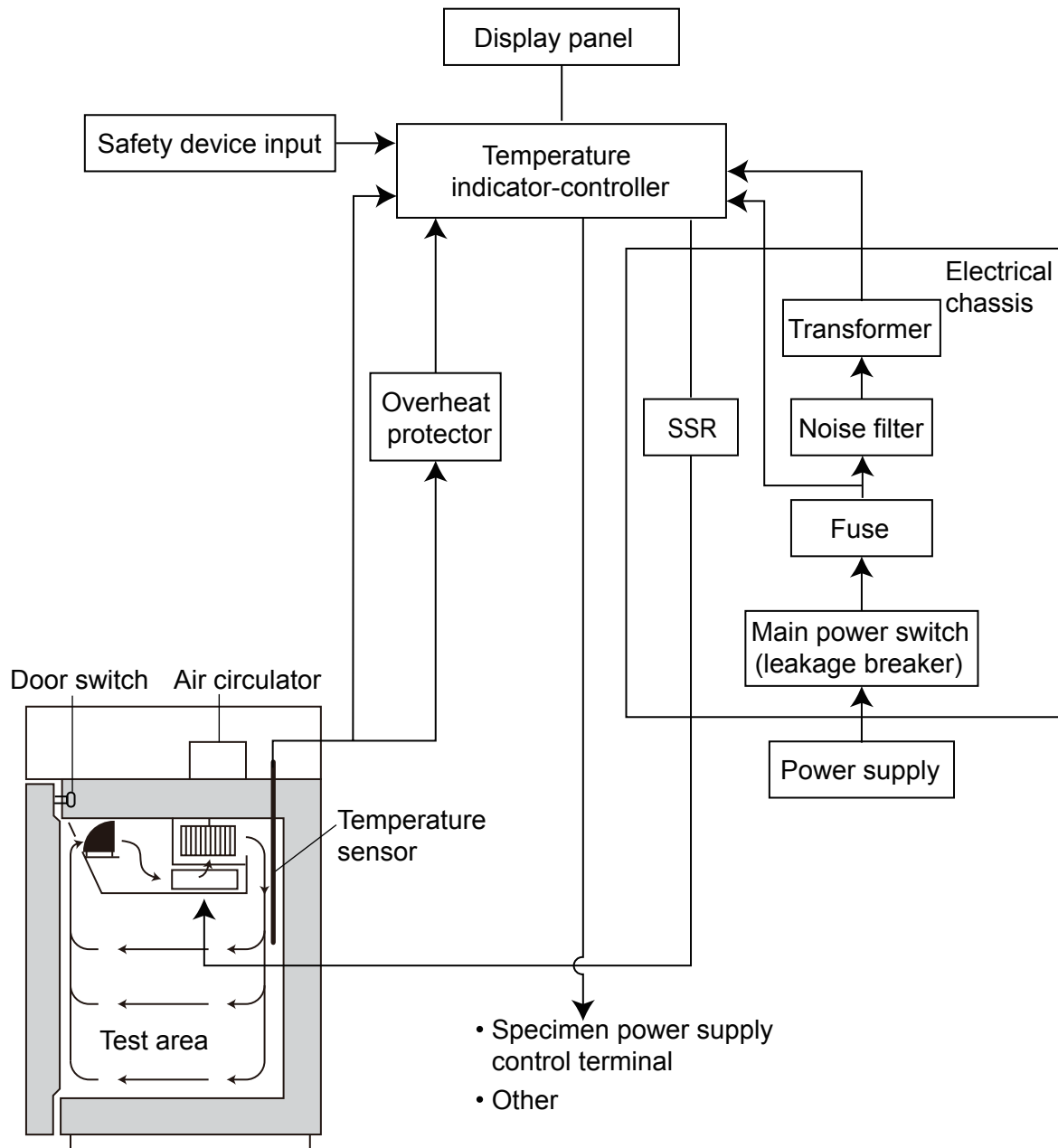
	Name	Function/Use
⑫	 key	Enters the displayed setting and displays the next setting item.
⑬	 key	Returns to the previous setting item to enable setting changes.
⑭	 key	Press to silence the buzzer and view alarm information, if an alarm occurs. Pressing it a second time returns the previously displayed information. For instruction to remedy when alarm occurs, see "Alarm and Action", details on alarms see "Alarm Table".
⑮	 key (Quick operation key)	Displays a user-setting item. Press and hold for 1 sec and more, Quick Operation setting window appears. For instructions on how to set the quick operation feature, see "Setting Up the Quick Operation" in the Reference manual.
⑯	Timer icon	Indicates the status of the timer. Lit while the auto start timer is counting down.
⑰	Remote mode icon	Indicates the status of remote communications. Flashes during remote operation and during signal transmission and reception.

Fig. 2.6 Instrumentation Panel

2.3 Control system

Basic configuration of the chamber

The basic control system of the chamber is as below figure.



2.4 Safety Features (Standards)

Temperature chambers are designed and built in compliance with IEC/EN and JIS as indicated below.

JIS B 9960-1 (EN60204-1)

Safety of machinery - Electrical equipment of machines -

JIS B 9960-1 stipulates safety standards for moving electrical equipment of machines.

Wiring Colors

- AC and DC power circuits ... Black
- AC control circuits ... Red
- DC control circuits ... Blue
- Interlock control circuits from external power supplies ... Orange

Chapter 3

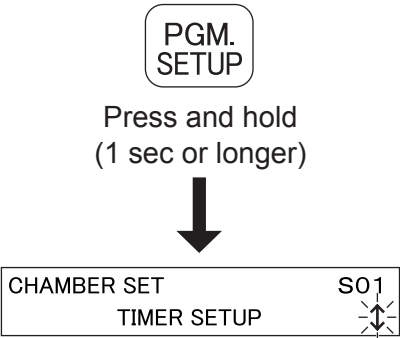
Precautions in Operation

This chapter discusses common problems that occur in chamber use and how to remedy them.

3.1 How to Unlock Keys (Protection)

If you cannot make settings or operate the chamber because protection is ON, turn the protection OFF as follows.

- Procedure**
1. Get the chamber configuration mode.
Press and hold the  button on the main menu for 1 sec or longer.



2. Press the  key several times to get the protection Setting screen.



3. Select the desired operation using the  button, and unlock keys (OFF).

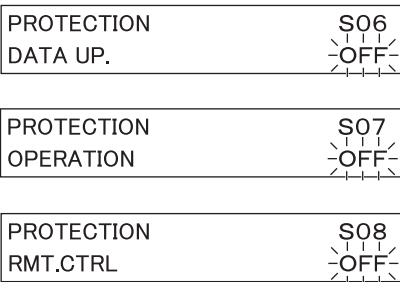


Table 3.1 Prevent changes to settings.

Prevent data update.	Makes data editing keys irresponsive to touch.
Prevent operation control changes.	Makes buttons on the Operation Mode Selection screen and the POWER key on the operating panel irresponsive to touch.
Prevent remote control.	Date changes and operation mode requests sent via RS-485, RS-232C and GPIB communications* are ignored.

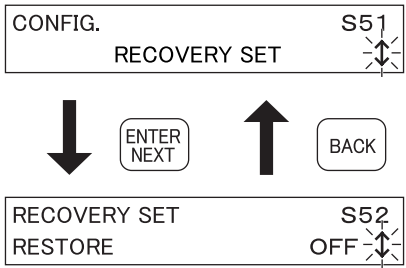
* RS-485, RS-232C and GPIB communications are options.

3.2 Test Resume Status If Power Is Lost While Running a Program

Test resume status after a power failure depends on whether the user selects [Power OFF] or [Continue] for the power recovery mode on the Recovery Setup screen of the Chamber Configuration.

- When [Power OFF] is selected:
Testing does not resume
Control power remains OFF after power is restored from a failure.
- When [Continue] is selected:
Testing resumes.
Operation resumes from the point it was interrupted by the power failure once the power is restored. The timer resumes counting from the point the power failure occurred.

<Reference>: Recovery Setup screen



<Example>: When [Continue] is selected

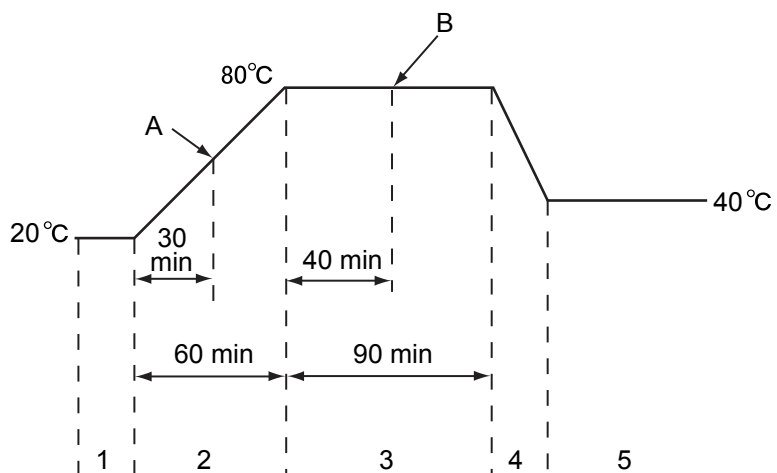


Fig. 3.1 Program pattern

If power is lost at points A and B during the above program, the program resumes running from point A and subsequently from point B once power is restored in those separate instances. However, because of the effects of the power failure, test area temperature does not follow the program pattern, as shown in Fig. 3.2.

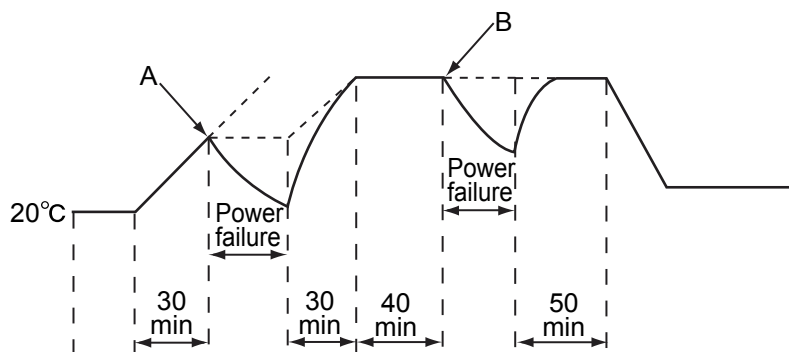


Fig. 3.2 Test area temperature after power failure

Chapter 4

Troubleshooting

This chapter explains what to check and how when trouble occurs during chamber use, as well as what remedial action should be taken to correct the trouble. Explanations are presented as check lists.

4.1 Troubles Not Displayed as Alarms



DANGER

- **ELECTRIC SHOCK! Before working on the power circuit on the primary side of the main power switch (leakage breaker), shut OFF primary power supply and check the line is dead. Also, take measures to prevent accidental charging.**

Working with primary power supply ON runs the risk of electric shock.

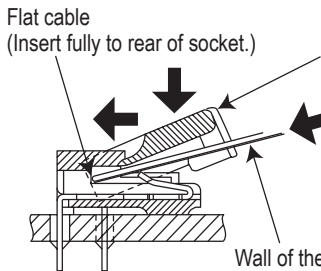
- **Shut OFF power from the main power switch (leakage breaker) BEFORE detaching the electric parts compartment cover.**

This section explains troubles undetected in chamber self-checks and cases of misoperation which are easily mistaken as trouble. If the trouble cannot be remedied after taking the prescribed action, contact the place of purchase or ESPEC CORP.

The display does not light up when the **POWER** key is pressed.

NO.	Check item	Check method	What to do
1	Power check	Check primary power source and that rated primary power is supplied to main power switch (LB1). • Rated power supply voltage $\pm 10\%$	Supply rated voltage.
2	Main power switch trip	Check main power switch (LB1) can be set in ON position. • If switch's leakage indicator button (yellow) has popped out, circuit insulation may have broken down (current leak). • If switch's leakage indicator button (yellow) has not popped out, an overload or overcurrent (short-circuit) in the circuit may have occurred. • If main power switch trips even when secondary wires are disconnected, trouble is in switch itself.	Locate insulation breakdown. Locate overcurrent. Replace switch (LB1). See "5.1 Electric Parts Compartment".
3	Electric parts compartment panel switch operation check	Check continuity across C-NC electric parts compartment panel switch (DS1). • When panel is open: Continuous (Closed) • When panel is closed: Not continuous (Open)	Replace electric parts compartment panel switch as necessary.
4	Fuse check	Check if fuse (F1) in electric parts compartment has blown or not. • If fuse blows in short amount of time (instantly), trouble may be overcurrent caused by short-circuiting in either load or load circuit wiring. • If not blown to the eye, check with tester. If not continuous, more often than not fuse is at end of service-life. • If fuse blows soon after replacing, trouble is in fuse holder or caused by faulty contact such as a loose cap.	Replace fuse (F1) as necessary. See "5.1 Electric Parts Compartment".
5	Program setter/Temperature controller wiring check	Check for faulty contact in connectors, etc.	Reconnect connector.
6	Emergency stop switch (option) operation	Check continuity across C-NC terminals of emergency stop push-button switch (ES1). • If depressed: Continuous (Closed) • If out: Not continuous (Open)	Replace push-button switch.

The display goes out suddenly or the displayed message is strange.

NO.	Check item	Check method	What to do
1	Display unit – Temperature controller connection check	• Check flat cable is properly connected. • Check flat cable for disconnection and open circuit.  Flat cable (Insert fully to rear of socket.) Retainer cover (Slide to lock.) How to insert flat cable [1] With pins facing downward, insert flat cable until contacting the wall of the insulator. [2] While pressing retainer cover downward, slide in direction of arrow to lock. Wall of the insulator	• Reconnect or replace flat cable as necessary.
2	Input voltage of temperature controller	• Check input and output voltage of transformer (TF1). • Check continuity of wiring from transformer to temperature controller.	Repair power supply line.
3	Poor connector connection of temperature controller	Check connection of CN1 connector of temperature controller. • Check for disconnected pins, disconnected wires and inadequate crimping.	Repair connector.
4	Defective parts in temperature controller and display unit	Service call check	Replace temperature controller and display unit as necessary. (Service call)

Strange noises are heard.

NO.	Check item	Check method	What to do
1	Rotating status of air circulator motor	Turn motor shaft by hand from inside the test area and check rotation. If turns smoothly without catching, motor is OK.	Detach air circulator fan motor and check for looseness in screws and eccentricity in motor, shaft and fan. See "5.3 Test Area".

Strange odors and smoke are detected.

NO.	Check item	Check method	What to do
1	Foreign matter inside of chamber	• Overhaul test area and heater, and check for foreign matter and dust.	Remove foreign matter.

Temperature does not rise or rises slowly.

NO.	Check item	Check method	What to do
1	Target temperature	Check if target temperature is wrongly set.	Change setting.
2	Heater output status check	Check heater output from temperature controller. • Check heater output on heater output (OUT) screen in service mode. To get setting screen, see “7.1 Window Tree, Monitoring window, Operating setup”.	Replace temperature controller. (Service call)
		Check SSR operation (arc). • Check for voltage on input side of SSR. If there is no voltage and voltage is output from temperature controller, SSR is defective. • Check for SSR output.	Replace SSR.
3	Heater check	• Check voltage is applied to heater. If not, check SSR. • Check heater continuity. If not continuous, heater needs replacing.	Replace heater.
4	Damper opening-closing/aperture check	Check if damper is closed. Also, check for foreign matter, etc.	Close damper. Remove foreign matter.
5	Door hot air leaks	Check for hot air leaks caused by deteriorated door packing, etc.	Adjust lock catch and hinges. Replace door packing.
6	Air circulator	Check air circulator is functioning properly.	Replace air circulator.
7	Test area check	Check airflow in test area is not obstructed.	Improve airflow.
8	Specimen heat load	Check specimen behavior.	Reduce specimen quantity.

Temperature uniformity is bad or temperature control is destabilized.

NO.	Check item	Check method	What to do
1	Specimen heat generation	Check specimen behavior.	Reduce heat generated from specimens.
2	Temperature sensor	• Check insertion depth. • Check connection.	Correct insertion depth. Peel off sheathing and reconnect sensor.
3	Damper opening-closing/aperture check	Check if damper is closed. Also, check for foreign matter, etc.	Close damper. Remove foreign matter.
4	Door hot air leaks	Check for hot air leaks caused by deteriorated door packing, etc.	Adjust lock catch and hinges. Replace door packing.
5	Air circulator	Check air circulator is functioning properly.	Replace air circulator.
6	Test area check	Check airflow in test area is not obstructed.	Improve airflow.
7	Specimen heat load	Check specimen behavior.	Reduce specimen quantity.

4.2 Displayed as Alarms

DANGER

- **ELECTRIC SHOCK!** Before working on the power circuit on the primary side of the main power switch (leakage breaker), shut OFF primary power supply and check the line is dead. Also, take measures to prevent accidental charging.

Working with primary power supply ON runs the risk of electric shock.

- **Shut OFF power from the main power switch (leakage breaker) BEFORE detaching the electric parts compartment cover.**

This section explains troubles undetected in chamber self-checks and cases of misoperation which are easily mistaken as trouble. If the trouble cannot be remedied after taking the prescribed action, contact the place of purchase or ESPEC CORP.

WAR: W02 DEV. TEMP.

Upper deviation temperature alarm

- **Alarm trip condition:** Measured temperature $\geq$ (Target temperature + Deviation temperature)
Initial setting of deviation temperature: 10°C
- **Input:** TEC1
- **Part symbol:** TC1 (Instrumentation), Controller judgment
- **Equipment reaction to warning:** SSR output/OFF, Air circulator output/Continues in current state, Specimen power supply control output/Continues in current state (If equipped with optional automatic damper/Damper fully opens.)
- **How to restore operation:** Restores automatically when alarm trip condition is eliminated.

NO.	Check item	Check method	What to do
1	Upper deviation temperature alarm setting check	Check upper deviation temperature setting on upper deviation limit setting screen. (Initial setting: 10°C) To get setting screen, see "7.1 Window Tree, Monitoring window, Operating setup".	Correct setting as necessary.
2	Specimen quantity	Check if airflow is blocked by excessive specimens.	Reduce specimen quantity.
3	Specimen heat generation (When charged)	Check if alarm tripped by specimen generated heat.	Reduce heat load. Adjust damper.
4	Solid-state relay (SSR)	Check SSR operation. Disconnect input terminal 1D of SSR. • SSR is defective if current still flows to heater circuit.	Replace SSR. See "5.1 Electric Parts Compartment".
5	Temperature controller (TC1)	Temperature controller (TC1) is defective if 24V DC are applied to input terminal of SSR when target temperature is lower than test area temperature.	Replace temperature controller. (Service call)

**CAUTION**

- **Immediately after operation ends, the chamber is hot on the inside (specimens, shelf, and test area walls). Therefore, allow it to cool sufficiently before opening the chamber door.**

WAR: W60 DOOR OPEN**The door is open**

- **Alarm trip condition:** If door is detected in the open position while the chamber is running. (Door open detection alarm can be set from 0 to 180 min. Initial setting: 3 min)
- **Input:** Di 0
- **Part symbol:** DS2
- **Equipment reaction to warning:** SSR output/OFF, Air circulator output/OFF, Specimen power supply control output/OFF
- **How to restore operation:** Restores automatically when alarm trip condition is eliminated.

NO.	Check item	Check method	What to do
1	Door	Check whether door is open/closed.	Close door.
2	Limit switch	Check limit switch (DS2) is functioning properly.	Replace limit switch (DS2).
3	Faulty connector contact of temperature controller (TC1)	Check connection of connector CN5 on temperature controller (TC1). (Wire Nos. 11D, 12D) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity between limit switch and TC1 board.	Repair connector.
4	Temperature controller (TC1)	Temperature controller (TC1) is defective if connector CN5 on temperature controller (TC1) is properly connected and wire Nos. 11D and 12D are continuous.	Replace temperature controller. (Service call)



CAUTION

- **Always set the absolute upper and lower limit temperature alarms BEFORE beginning tests. Set alarms according to the type of specimens and test conditions.**

Unless properly set, the absolute high/low limit temperature alarms will not be triggered in the event of chamber trouble, which could lead to specimen damage.

ERR: E00 UPPER TEMP.

Absolute high temperature limit

- **Alarm trip condition:** If overheating is detected.
- **Input:** TEC1
- **Part symbol:** TC1 (Instrumentation), Controller judgment
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/Continues in current state, Specimen power supply control output/OFF (If equipped with optional automatic damper/Damper fully opens.)
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Absolute high temperature alarm setting check	Check absolute high temperature limit setting on absolute high temperature limit setting screen. (Normally, set to target temperature +10°C.) To get setting screen, see "7.1 Window Tree, Monitoring window, Operating setup". * The setting location is different between the constant mode and the program mode.	Correct setting as necessary.
2	Specimen quantity	Check if airflow is blocked by excessive specimens.	Reduce specimen quantity.
3	Specimen heat generation (When charged)	Check if alarm tripped by specimen generated heat.	Reduce heat load. Adjust damper.
4	Solid-state relay (SSR)	Check SSR operation. Disconnect input terminal 1D of SSR. • SSR is defective if current still flows to heater circuit.	Replace SSR. See "5.1 Electric Parts Compartment".
5	Faulty connector contact of temperature controller	Check connection of connector CN5 on temperature controller (TC1). (Wire Nos. 16D, 19D) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity between TC1 board and each OHP board and thermal fuse.	Repair connector.
6	Temperature controller (TC1)	Temperature controller (TC1) is defective if 24V DC are applied to input terminal of SSR when target temperature is lower than test area temperature.	Replace temperature controller. (Service call)

**CAUTION**

- **Always set the absolute upper and lower limit temperature alarms BEFORE beginning tests. Set alarms according to the type of specimens and test conditions.**

Unless properly set, the absolute high/low limit temperature alarms will not be triggered in the event of chamber trouble, which could lead to specimen damage.

ERR: E01 LOWER TEMP.**Absolute low temperature limit**

- **Alarm trip condition:** If overcooling is detected.
- **Input:** TEC1
- **Part symbol:** TC1 (Instrumentation), Controller judgment
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/OFF, Specimen power supply control output/OFF (If equipped with optional automatic damper/Damper fully closes.)
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Absolute low temperature alarm setting check	Check absolute low temperature limit setting on absolute low temperature limit setting screen. (Normally, set to target temperature -5°C or more.) To get setting screen, see "7.1 Window Tree, Monitoring window, Operating setup". * The setting location is different between the constant mode and the program mode.	Correct setting as necessary.
2	Damper aperture check	Check if damper is opened more than needed.	Reduce damper aperture.
3	Temperature control status check	Run chamber at target temperature of 60°C and check control. • Check SSR if heater stays OFF (temperature control OFF). • Disconnect wire from SSR LOAD terminal and measure resistance of LOAD terminal once each at opposite polarities using tester. SSR is OK if approx. $10\ \Omega$ or less.	Replace SSR. See "5.1 Electric Parts Compartment".
4	Heater check	• Check voltage is applied to heater. If not, check SSR. • Check heater continuity. If not continuous, heater needs replacing.	Replace SSR and/or heater as necessary.
5	Temperature controller (TC1)	Temperature controller (TC1) is defective if 24V DC are applied to input terminal of solid-state contactor when target temperature is higher than test area temperature.	Replace temperature controller. (Service call)

ERR: E04 HEATER ERR

Heater failure

- **Alarm trip condition:** If the circuit protector (CP) trips.
- **Input:** Di 3
- **Part symbol:** CP
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/OFF, Specimen power supply control output/OFF
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Circuit protector	Check circuit protector (CP) is functioning properly. Check current during chamber operation. If over the allowed level, short-circuit or overcurrent in the heater circuit is thinkable.	Identify cause and repair as necessary. (Wiring, heater grounding, etc.)
2	Faulty connector contact of temperature controller	Check connection of connector CN5 on temperature controller. (Wire Nos. 80D, 17D) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity between circuit protector and temperature controller.	Repair connector.
3	Temperature controller (TC1)	Temperature controller (TC1) is defective if connector CN5 on temperature controller (TC1) is properly connected and wire Nos. 80D and 17D are continuous.	Replace temperature controller. (Service call)

ERR: E06 OVERHEAT Overheating

- **Alarm trip condition:** If the external overheat protector trips or thermal fuse blows.
- **Input:** Di 2
- **Part symbol:** OHP1 and MF1
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/Continues in current state, Specimen power supply control output/OFF (If equipped with optional automatic damper/Damper fully opens.)
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Specimen quantity	Check if airflow is blocked by excessive specimens.	Reduce specimen quantity.
2	Specimen heat generation (When charged)	Check if alarm tripped by specimen generated heat.	Reduce heat load. Adjust damper.
3	Solid-state relay (SSR)	Check SSR operation. Disconnect input terminal 1D of SSR. • SSR is defective if current still flows to heater circuit.	Replace SSR. See "5.1 Electric Parts Compartment".
4	Faulty connector contact of temperature controller	Check connection of connector CN5 on temperature controller (TC1). (Wire Nos. 16D, 19D) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity between TC1 board and each OHP board and thermal fuse.	Repair connector.
5	Temperature controller (TC1)	Temperature controller (TC1) is defective if 24V DC are applied to input terminal of SSR when target temperature is lower than test area temperature, or if connector CN5 on temperature controller (TC1) is properly connected and wire Nos. 16D and 19D are continuous.	Replace temperature controller. (Service call)

ERR: E60 FAN ERROR**Air circulator failure**

- **Alarm trip condition:** If the air circulator built-in temperature switch trips (Trip temperature: $135\pm5^{\circ}\text{C}$)
- **Input:** Di 1
- **Part symbol:** Temperature switch/MTS1, Thermal relay/Th1, Th2, (Wind velocity controller board/SPC1-ALM)
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/OFF, Specimen power supply control output/OFF
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Foreign matter on air circulator blade	Visually check blades for foreign matter.	Remove foreign matter.
2	Rotating status of air circulator motor	Turn motor shaft by hand from inside the test area and check rotation. If turns smoothly without catching, motor is OK.	Detach air circulator fan motor and check for and remove any foreign matter. See "5.3 Test Area".
3	Self-cooling fan	Check if the self-cooling fan has detached from the electric parts compartment.	Reinstall self-cooling fan. See "5.3 Test Area".
4	Faulty contact check board components, relay connectors	Check contact of connector CN5 of temperature controller and relay connector near to motor. (Wire Nos. 13D, 15D) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity of wiring between motor and temperature controller.	Repair connector.
5	Temperature controller (TC1)	Temperature controller (TC1) is defective if connector CN5 on temperature controller (TC1) is properly connected and wire Nos. 13D and 15D are continuous.	Replace temperature controller. (Service call)
6	Wind velocity controller unit (option) check	Check alarm output contact (SPC1-ALM) on wind velocity controller unit board. (Wire Nos. 21D, 15D) If contact is not continuous, alarm was output by self-check feature of board, therefore check following. If trouble cannot be identified, board itself may be defective. In such case, replace board. Speed input signal trouble: Check for disconnected, open or shorted wire. Power supply trouble: Check power supply and voltage are normal. Motor trouble: Check if difference between set speed and actual speed is out of range for 2 min or more.	Identify cause and replace defective parts as necessary.

ERR: E63 DAMPER ERR

Damper failure

(When equipped with optional automatic damper only)

- **Alarm trip condition:** Disconnected, open or shorted damper open-close signal cable inside of drive unit
Conflict between damper open-close information of drive unit and position information
If the damper overrun limit switch inside the drive unit trips.
Trouble in the drive unit control board
Trouble in the drive unit power supply
- **Input:** Di 4
- **Part symbol:** DC1 (Automatic damper board)
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/Continues in current state, Specimen power supply control output/OFF (Drive unit motor/Stops and is held in stopped state.)
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Limit switch (L1) operation	Turn the cam and check continuity of limit switch. Turn cam clockwise by hand and check if limit switch (hinge lever) turns ON-OFF. (Do not apply excessive force to cam when turning.)	Replace limit switch.
2	Automatic damper drive motor (DM1) operation	Check operation of motor (DM1). 100V AC is applied to drive motor (Wire Nos. 107, 108, or 107, 109) when damper is opened/closed from instrumentation. If cam turns smoothly without catching when voltage is applied, motor is OK.	Detach air circulator fan motor and check for and remove any foreign matter. See "5.3 Test Area".
3	Damper vane, packing damage	Check if foreign matter is caught in damper vane or rotating parts of packing.	Remove foreign matter.
4	Faulty contact check Board components	Check contact of connector CN5 of temperature controller. (Wire Nos. 121, 122) • Check for disconnected pins, disconnected wires and inadequate crimping. • Check continuity of wiring between door switch and temperature controller.	Repair connector.
5	Temperature controller (TC1)	Temperature controller (TC1) is defective if connector CN5 on temperature controller (TC1) is properly connected and wire Nos. 121 and 122 are continuous.	Replace temperature controller. (Service call)

ERR: E70 BURN-OUT**Sensor disconnection (Ch-1)**

- **Alarm trip condition:** If a disconnection is detected in the temperature sensor input to the temperature controller.
- **Input:** TEC1
- **Part symbol:** TC1 (Instrumentation), Controller judgment
- **Equipment reaction to alarm:** SSR output/OFF, Air circulator output/OFF, Specimen power supply control output/OFF
- **How to restore operation:** Does not restore automatically. Clear alarm trip condition, then reactivate control power.

NO.	Check item	Check method	What to do
1	Looseness or faulty contact in analog board terminals of temperature controller	Check temperature controller terminals for looseness and faulty contact.	Tighten terminals.
2	Sensor disconnection/open circuit check	Disconnect concerned sensor from temperature controller and measure resistance at both ends of lead. If between 10 and several 10 Ω , sensor is OK. If high, the sensor is defective.	Replace sensor. See below sensor list.
3	Temperature controller (TC1)	Short-circuit input terminals of concerned sensor and check whether alarm clears or not. If it clears, temperature controller is defective.	Replace temperature controller. (Service call)

Chapter 5

Parts Replacement

This chapter explains how to replace parts.



DANGER

- **ELECTRIC SHOCK!** Shut OFF power from the main power switch before replacing parts.
- **SHARP EDGES!** Wear gloves when handling metal panels to prevent cutting hands on corners and edges.

5.1 Electric Parts Compartment (Chamber and Operating Panel)

(1) Main Power Switch (Leakage Breaker)

■ Replacement

- Procedure
1. Set the main power switch in the OFF position.

2. Stop power feeding in the primary power supply.

3. Remove the decorative cover of main power switch unit located on chamber rear side..... Philips screwdriver

4. Disconnect the wires from the main power switch (leakage breaker).
(Main circuit, door switch, emergency stop switch)
Philips screwdriver

5. Detach the main power switch (leakage breaker)... Philips screwdriver

6. Install a new main power switch in the opposite order in which the old one was detached.
Terminal screws should be tightened with the normal torque.

Table 5.1 Normal torque

Model	Normal torque
PV(H)-212, PV-222	2N•m
All other models	3N•m

 **DANGER**

- **Securely tighten screws that anchor primary and secondary wires to prevent burning caused by loose connections.**
 - Do not forget to use spring washers.
 - Coat with locking agent to prevent loosening.
(ThreeBond 1401B [part code: 20308010007XX] or similar product)

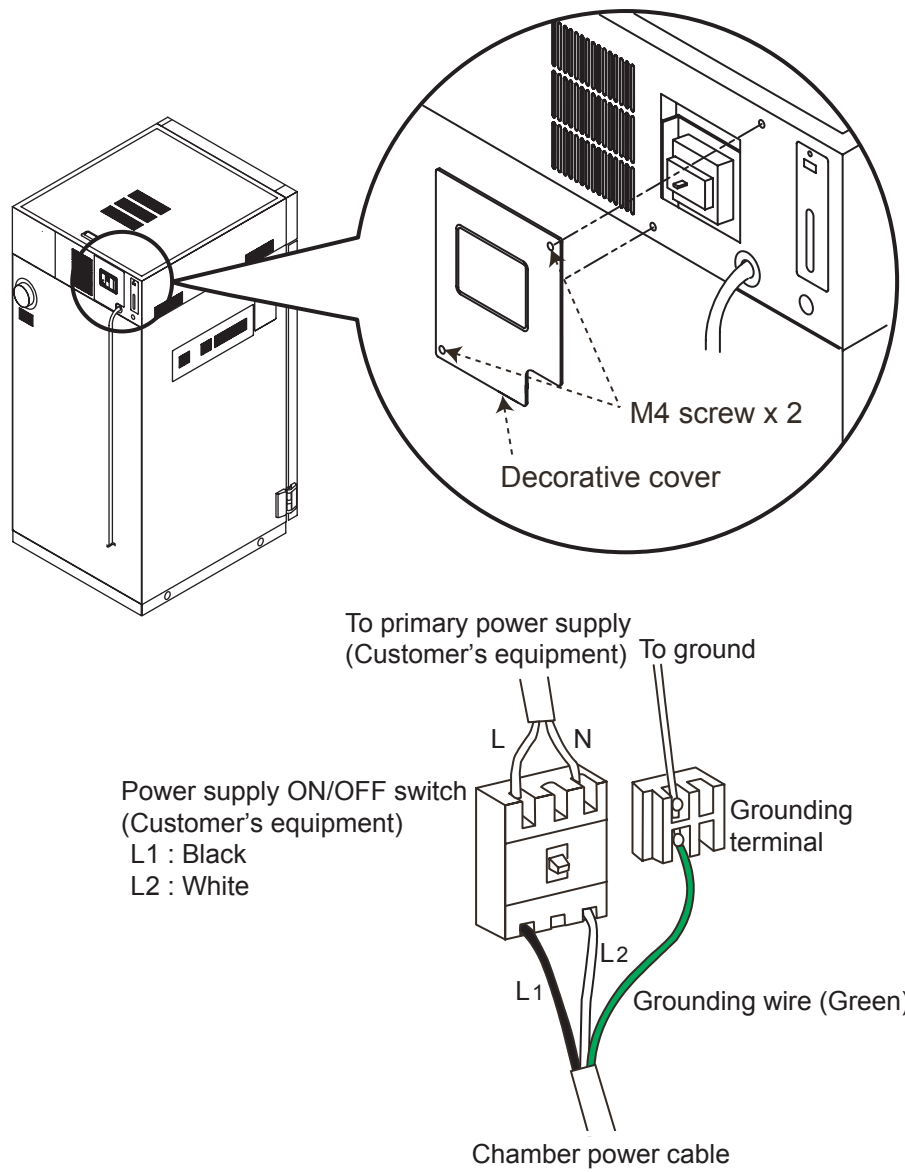


Fig. 5.1 Main Power Switch (Leakage Breaker)

(2) Overheat protector

■ Replacement

- Procedure**
1. Set the main power switch in the OFF position.
 2. Detach the electric parts compartment right cover.
..... Philips screwdriver
 3. To replace the setter (instrumentation panel), disconnect wires from the overheat protector board, and install and rewire a new setter.
 4. To replace the overheat protector board, disconnect connectors and wires from the setter. Philips screwdriver, pincers
 5. Install a new overheat protector board and a new setter in the opposite order in that old ones were detached.
 6. Set "alarm temperature range", "alarm mode" and "alarm setting temperature" as the below.

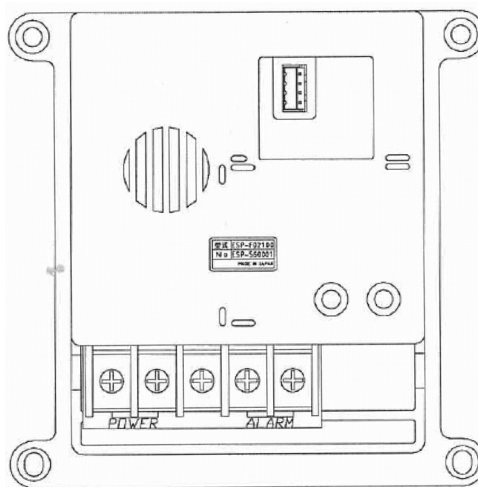


Fig. 5.2 Overheat Protector (board) ESP-F02

■ Overheat (overcool) protector setter

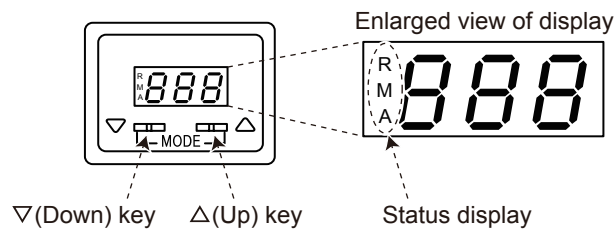


Fig. 5.3 Overheat (overcool) protector setter ESP-C01

Procedure 1. Set the alarm temperature thermocouple range and alarm mode

- (1) While in the set value indication mode, press $\triangle$ and ∇ keys at the same time for 5 sec or more.
- (2) The current alarm setting appears on the display and "R" appears on the status display.
- (3) Set the alarm temperature range according to the chamber models, using $\triangle$ and ∇ keys, select one from six types for thermocouple-T, seven types for thermocouple-K and two types for thermocouple-N.

Table 5.2 Alarm temperature range and indication

Thermocouple-T		Thermocouple-K		Thermocouple-N	
Temp. range	Indication	Temp. range	Indication	Temp. range	Indication
-99 to 199	^R t20	0 to 199	^R 220	0 to 499	^R n50
-60 to 120	^R t12	0 to 220	^R 222	0 to 599	^R n60
-60 to 170	^R t17	0 to 299	^R 230		
-99 to 0	^R t0	0 to 320	^R 232		
0 to 99	^R t10	0 to 399	^R 240		
0 to 299	^R t30	0 to 599	^R 260		
		0 to 799	^R 280		

Table 5.3 Chamber model and indication

Model	Range indication
PV	^R 222
PVH	^R 232

- (4) When 5 sec or more elapse without key input, the setting is entered and the display changes to next step. (*Also, if press $\triangle$ and ∇ keys at the same time for 0.5 sec or more, the setting is entered and the display changes to next step.)
- (5) The current alarm mode appears on the display and "M" appears on the status display.

- (6) Set the alarm mode using $\triangle$ and ∇ keys, select upper limit alarm or lower limit alarm.

Table 5.4 Alarm mode and indication

Alarm mode	Indication
Upper limit alarm	M 
Lower limit alarm	M 

- (7) 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. (*Also, if press $\triangle$ and ∇ keys at the same time for 0.5 sec or more, the setting is entered and the display returns to the set value indication mode.)

2. Set alarm temperature

Set the temperature in the below 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.

- (1) The current alarm setting and "A" appear on the setting device display.
Set the desired temperature using the $\triangle$ key and ∇ key.
- (2) 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.

(3) Electric parts (electromagnetic switch, SSR, cartridge fuses, etc.)

■ Replacement

- Procedure**
1. Set the main power switch in the OFF position.
 2. Detach the electric part compartment ceiling cover. . Philips screwdriver
 3. Refer the installation location of the electric parts as Fig. 5.4 and replace them as needed. Philips screwdriver

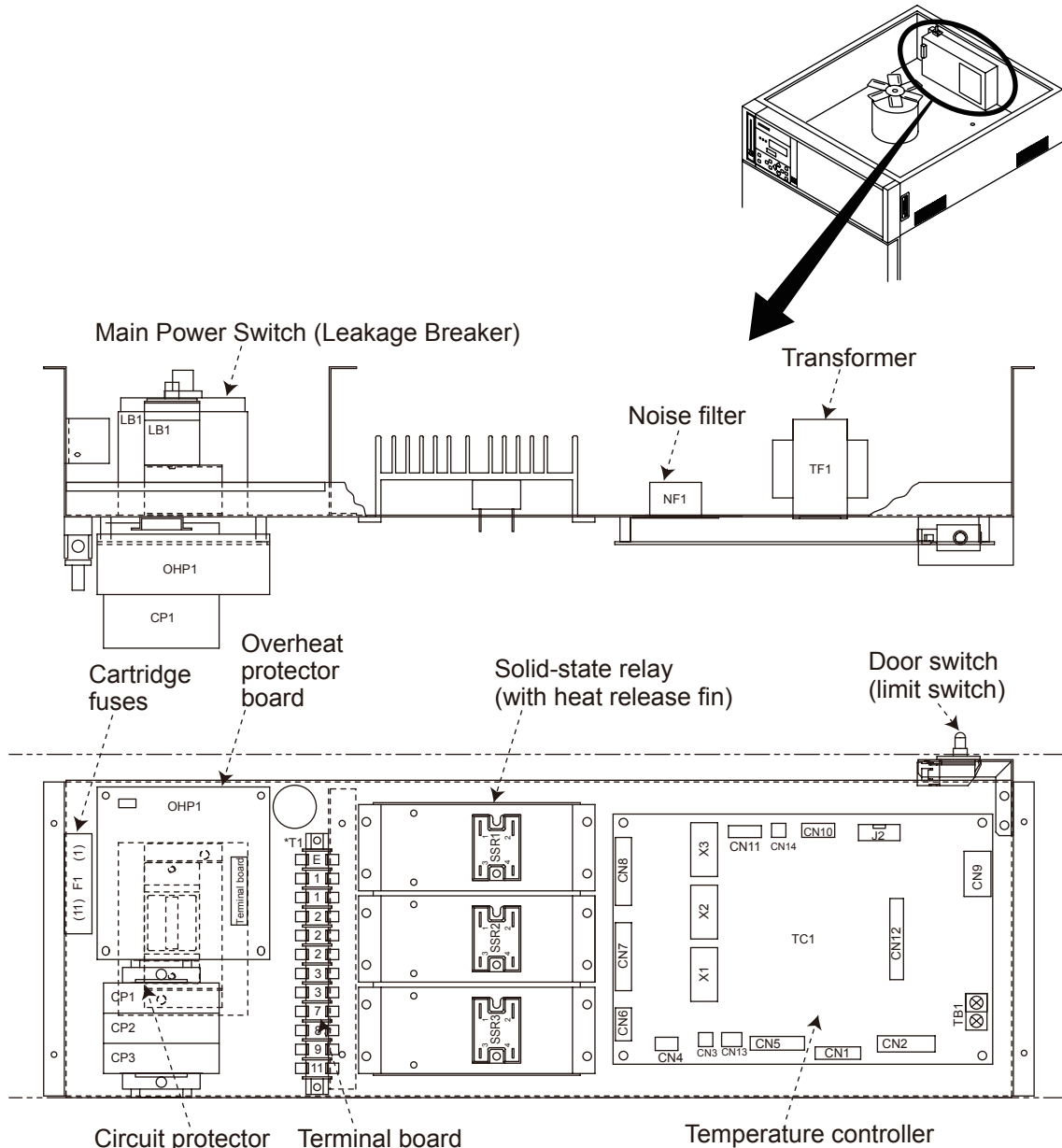


Fig. 5.4 Electric parts chassis layout for all models of PV(H)-212, 222, 232, 332 200V AC

(4) Fan motor

■ Replacement

Reference It requires to detach the sirocco fan before replacement of the motor fan. See "5.3 Test area".

- Procedure**
1. Set the main power switch in the OFF position.
 2. Detach the electric part compartment ceiling cover. . Philips screwdriver
 3. Detach the sirocco fans.
See “5.3 Test area (2) Fan” for procedures.
 4. Detach the self-cooling fan. M5 hexagon socket screw key
 5. Detach the motor. Boxhead driver (10mm)
 6. Prepare and install new parts in the opposite order in which the old ones were detached.

 CAUTION
• Two sirocco fans are installed for PV(H)-332. Each fan has different rotation direction.

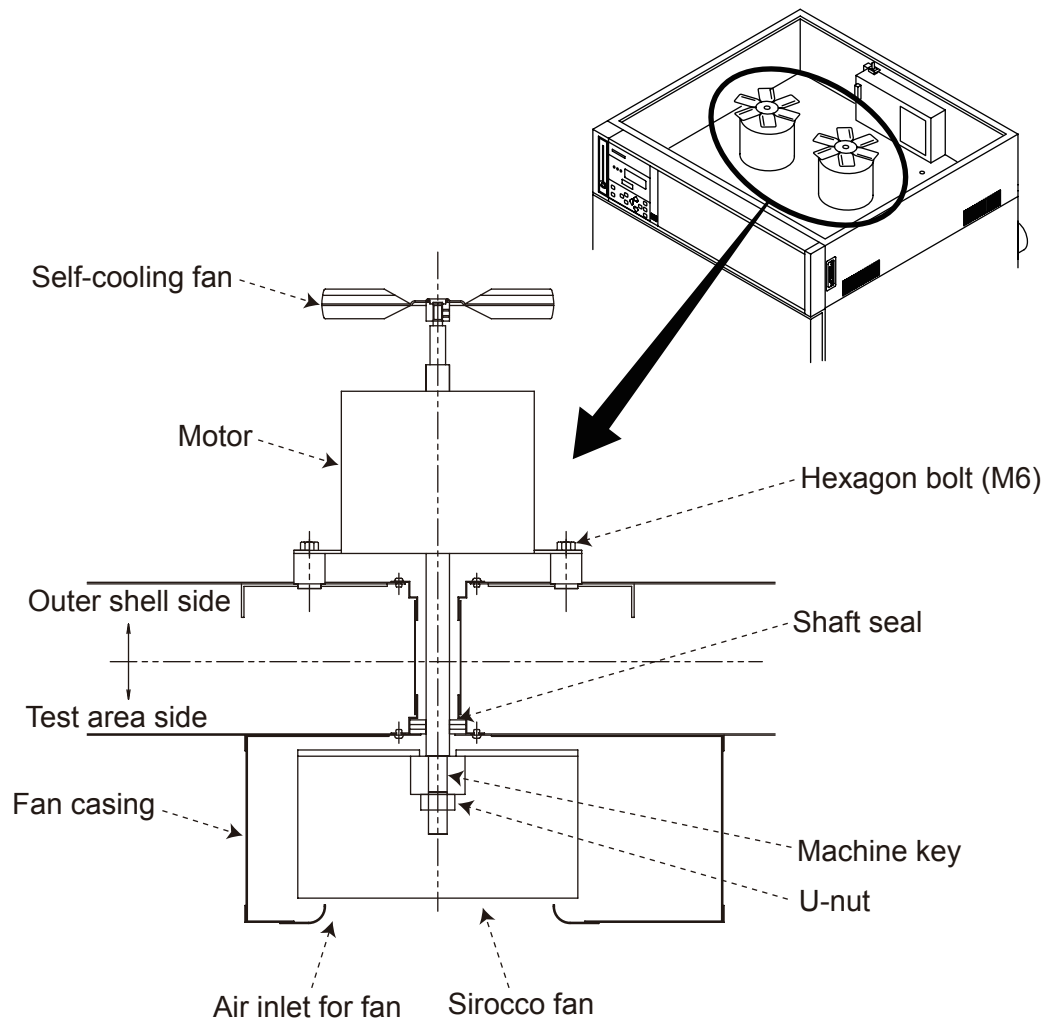


Fig. 5.5 Air circulator assembly diagram

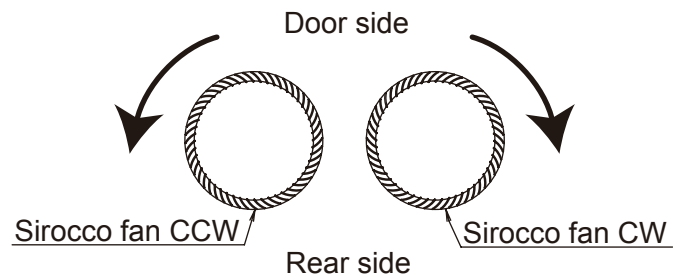


Fig. 5.6 Rotation direction of sirocco fan (seen from the test area)

(5) Manual damper knob

■Preparation

- Special tool is required to dismount the manual damper knob.
- To purchase the special tool, contact the place of purchase or ESPEC CORP.

 CAUTION
• Do not use any tools other than the special tool. Other tools can damage the equipment.

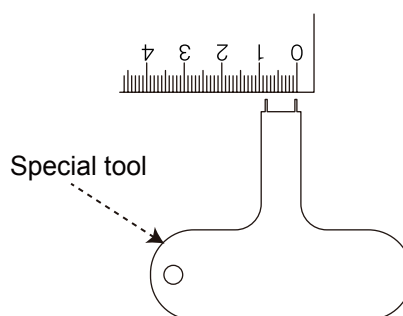


Fig. 5.7 Special tool for damper knob dismounting

■Replacement

- Procedure**
1. Detach the cap. Flat head screwdriver
 2. Insert the special tool onto the two holes ($\phi 2$) on the stopper, loosen and detach the stopper.

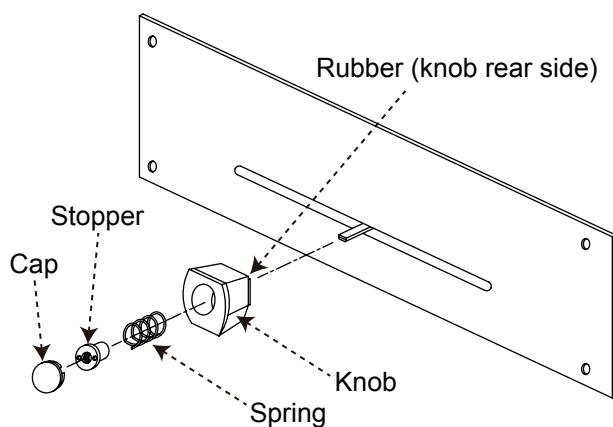
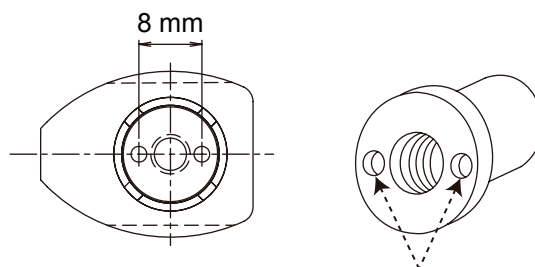


Fig. 5.8 Damper knob assembly



Insert and rotate the special tools onto these holes to loosen the stopper.

Fig. 5.9 Damper knob stopper

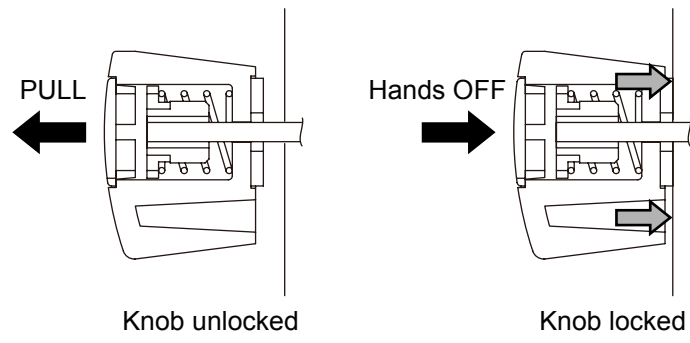


Fig. 5.10 Lock mechanism

5.2 Door

(1) Door lock mechanism (lock mechanism unit, lock catch)



CAUTION

- **The test area may be hot after operations start.**
Cool test area parts before attempting to replace them.

■ Replacement

<Door lock mechanism>

Procedure

1. Detach the door inner panel (lock mechanism side).
See Fig. 5.11. Philips screwdriver
2. Dismount door handle from test area side. Do not lose door handle assembly spacer after dismounting the door handle.
See Fig. 5.12. Philips screwdriver
3. Detach the lock mechanism unit which was fixed with nuts on stud bolt of the door outside panel.
See Fig. 5.13. Spanner (8mm)
4. If the door base was damaged, replace it.
See Fig. 5.15. Flat head screwdriver
5. Install new lock mechanism unit in the opposite order in which the old one was detached.
At the installation, check fixing position of the lock mechanism unit.
See Fig. 5.14.

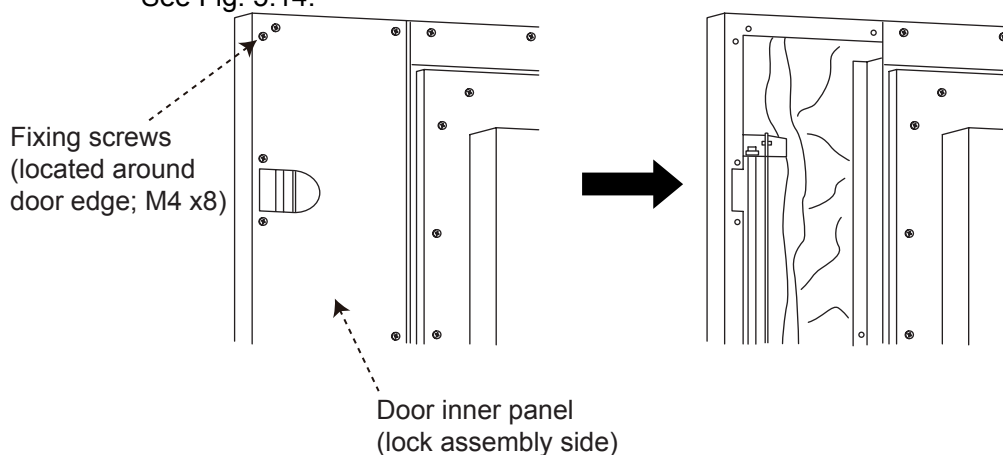


Fig. 5.11 Door inner panel (lock mechanism side) and related parts

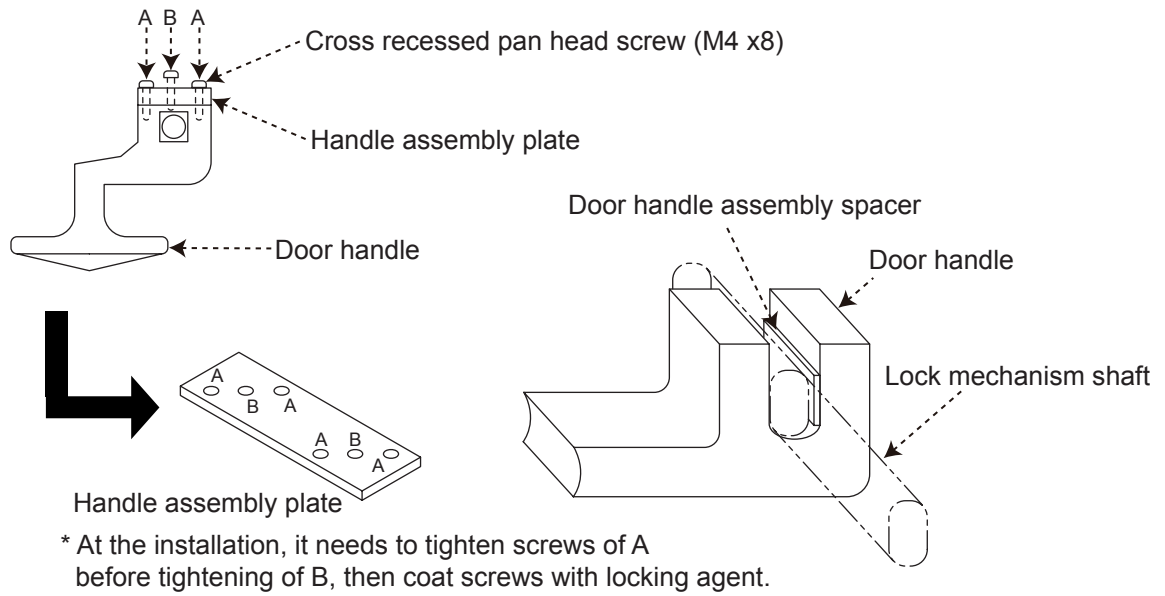


Fig. 5.12 Disassembly of door handle

 DANGER
• Coat nuts with locking agent when installing the door lock.

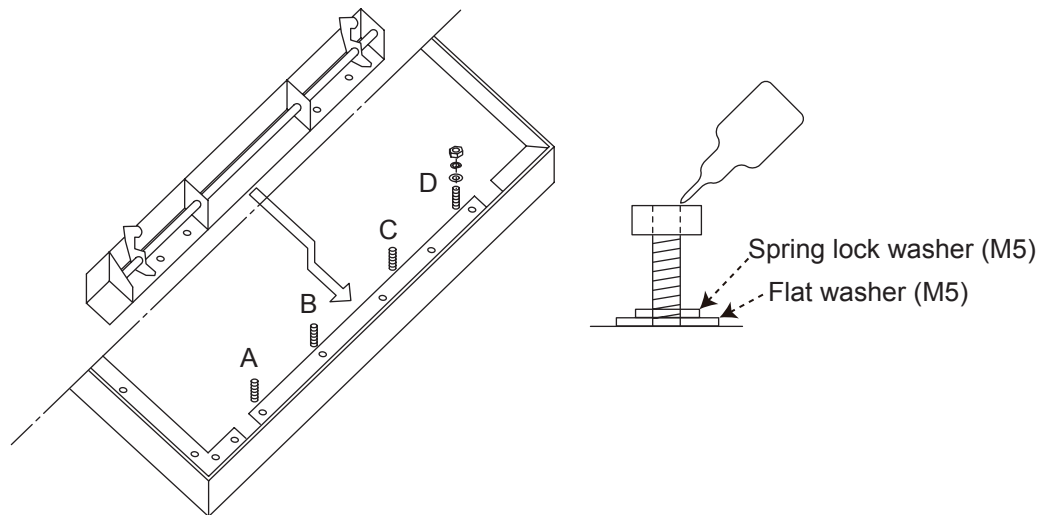


Fig. 5.13 Door lock mechanism unit (assembly)

Check the fixing position of the door lock mechanism unit before tightening nuts to fix.

*At the installation check also the dimension as below figure.

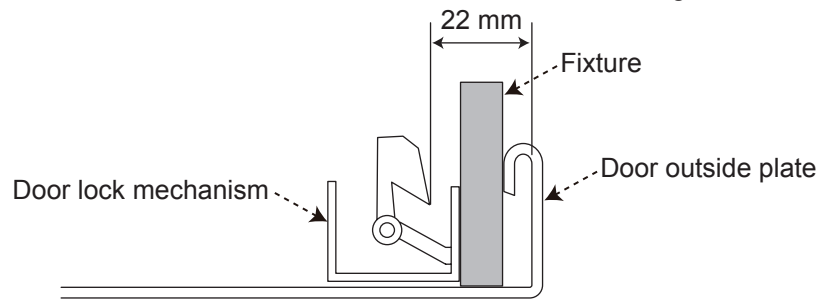


Fig. 5.14 Installation of door lock mechanism unit (assembly)

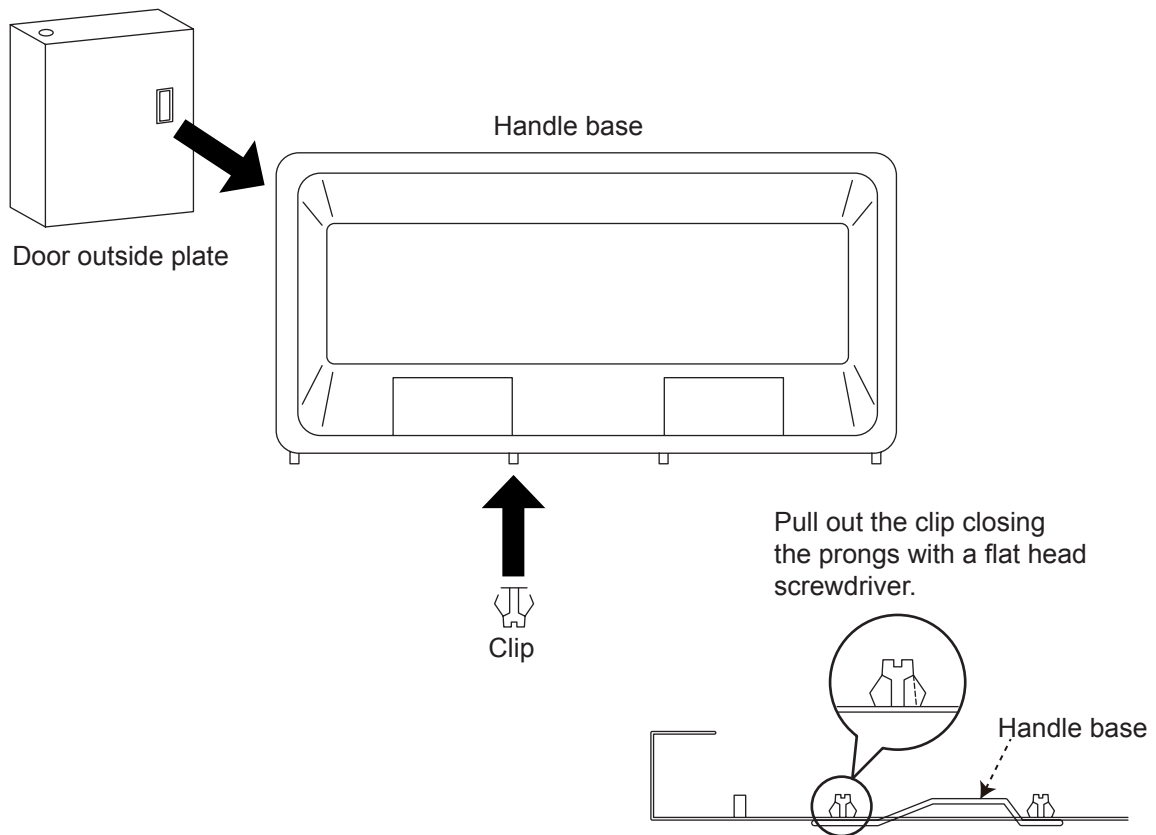


Fig. 5.15 Fixing door handle base

<Door lock catch>

- Procedure**
1. Remove the small screws that attach the door lock catch to the holder.
..... Philips screwdriver
 2. Loosen the small screws fixing the door catch holder to adjust the clearance between the chamber and the door, which is so as to be 10 to 12mm. Philips screwdriver

Mechanical lock catch unit (catch, pin, collar, holder) x1 set

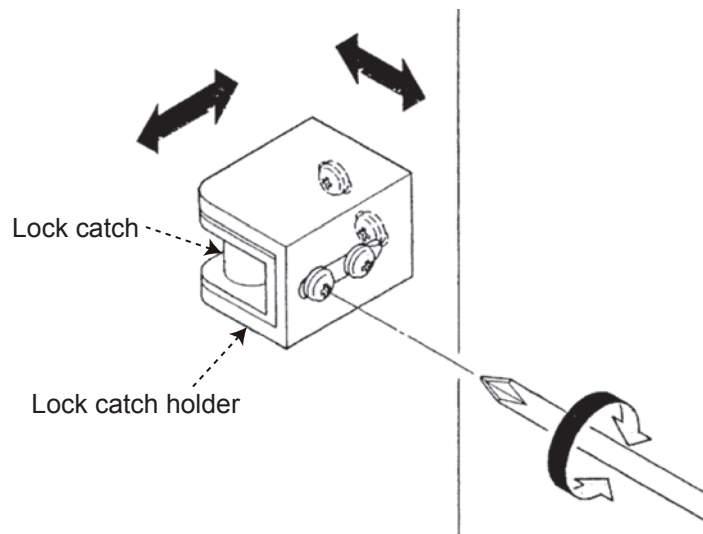


Fig. 5.16 Adjustment of door lock catch

(2) Door hinge

■ Replacement

Procedure

1. Pry off the door hinge cover.
See Fig. 5.17. Flat head screwdriver
2. Detach the hinge installation bolts and replace the hinge.
See Fig. 5.18. Boxhead driver (8mm)
3. Tighten the hinge installation bolts, once positioned properly.
..... Boxhead driver (8mm)
4. Reattach the hinge cover.
The clearance between the chamber and door should be 10 to 12 mm.

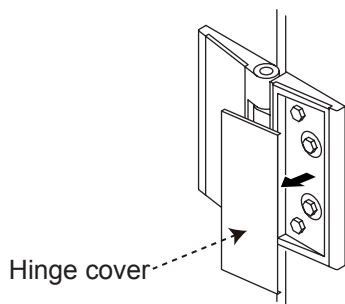


Fig. 5.17 Detaching hinge cover

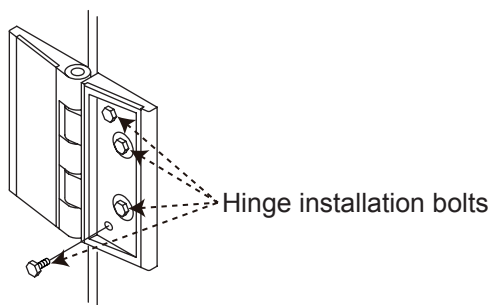


Fig. 5.18 Detaching hinge installation bolts

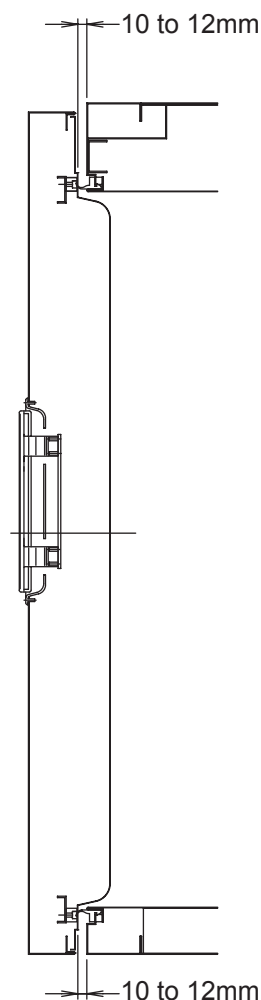


Fig. 5.19 Clearance between the chamber and door

For door lowering protection, it requires also hinge spacer (20406010183XX).

(3) Packing (gasket)

■ Replacement

- Procedure**
1. Pull the cut end of the door gasket at the bottom center of the chamber with force.
See Fig. 5.20.
 2. Pull the door gasket gradually from the chamber until removed.
Be careful because some of the gasket may stick to the chamber.
 3. Install a new door gasket. Press inward with force to install.
The clearance between the chamber and door should be 10 to 12 mm.

Reference

- PV door gasket (Bengala red)
- PVH door gasket (Black, double packing)

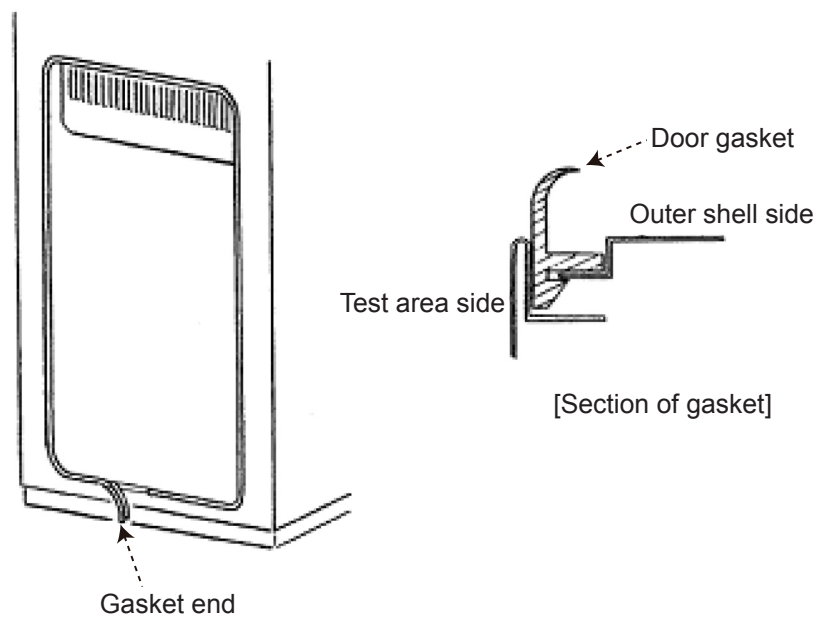


Fig. 5.20 Door gasket

5.3 Test Area

(1) Heater, thermal fuses

 CAUTION
• The test area may be hot after operations start. Cool test area parts before attempting to replace them.

■Replacement

- | | |
|------------------|---|
| Procedure | <ol style="list-style-type: none">1. Set the main power switch in the OFF position.2. Remove the small installation screws of the heater access port cover.
..... Philips screwdriver3. Remove glass caps from the heater terminals.4. Loosen the hexagon nuts from the heater terminals and disconnect the heater leads (front end round terminals) and thermal fuse leads.
..... Boxhead driver (8mm)5. Remove the small installation screws of the heater unit and pull out the unit. Philips screwdriver6. Remove the thermal fuses including the glass that lock down fuses.
..... Philips screwdriver7. Install a new heater unit. Philips screwdriver8. Install thermal fuses on the new heater unit. Philips screwdriver9. Reconnect the wiring as before.
The nuts that lock down the leads should be tightened with the normal torque (normal torque: 3.5N•m). |
|------------------|---|

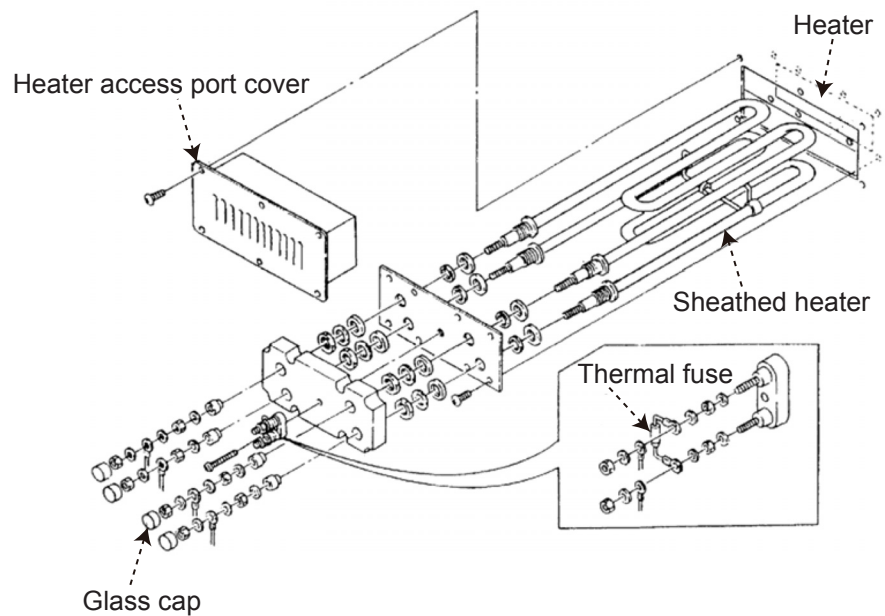


Fig. 5.21 Heater unit

■ Thermal fuse preparation

Clip round solderless terminals for high temperature to the thermal fuse leads. Bend the lead wires like as ones of old thermal fuses. Do not apply excessive force on the thermal fuse body and especially to the glass part.



CAUTION

- Hold the terminals of the heater leads to keep the terminal screws from turning.
- Do the same with the thermal fuse.
- Securely tighten heater nuts because looseness can lead to fire.
- Prepare new nuts, washers, solderless terminals at heater replacement. If reuse the old ones, make sure to eliminate the locking agent which coated these parts.
If remained locking agent is lugged, contact resistance may increase and can lead fire.
- After connecting heater leads, coat about 1/4 of the nut and the threads on both sides with locking agent.

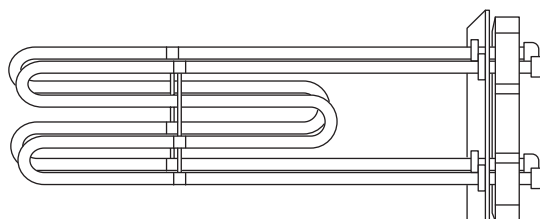


Fig. 5.22 Heater unit on delivery

(2) Air circulator

■ Preparation

Tool required: Specialized tool for dismounting the sirocco fan
See Fig.5.23.

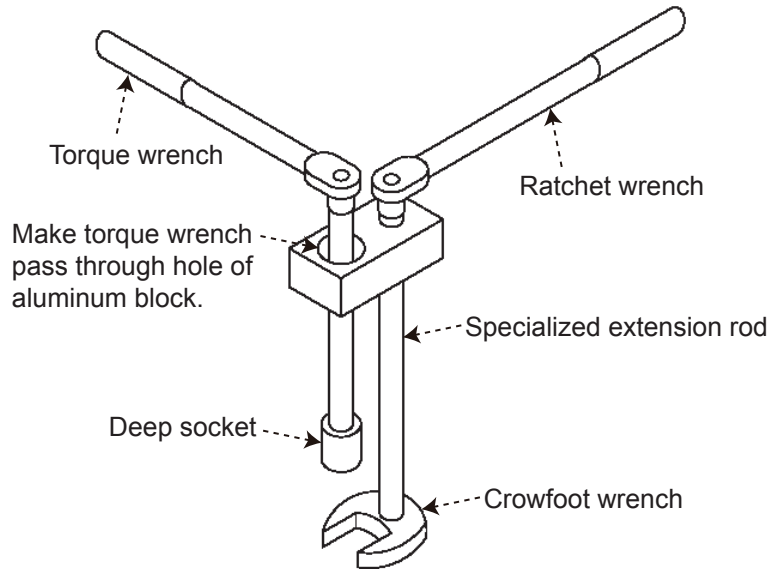


Fig. 5.23 Specialized tool for dismounting the sirocco fan

* To purchase the specialized tool for dismounting the sirocco fan, contact the place of purchase or ESPEC CORP.

■ Replacement

- Procedure**
1. Set the main power switch in the OFF position.
 2. Remove the heater unit.
See "5.3 Test Area, (1) Heater, thermal fuses".
 3. Remove the small installation screws of the test area ceiling panel.
..... Philips screwdriver
 4. Remove the small installation screws of the air inlet port for fan.
..... Philips screwdriver
 5. Loosen locking nuts of the sirocco fan and the motor, remove down the sirocco fan. Specialized tool for dismounting the sirocco fan
* If installation screws are sintered, use a screw loosening agent rather than trying to force them free.
 6. Dismount the sirocco fan.
 7. Prepare and install new sirocco fan in the opposite order in which the old one was dismounted.

**CAUTION**

- **Do not use any tools other than the special tool.**
Other tools can damage the equipment.
- **Be careful not to apply excessive force to blades as this may deform them.**
- **Use a screw loosening agent for sintered setscrews rather than trying to force them free.**

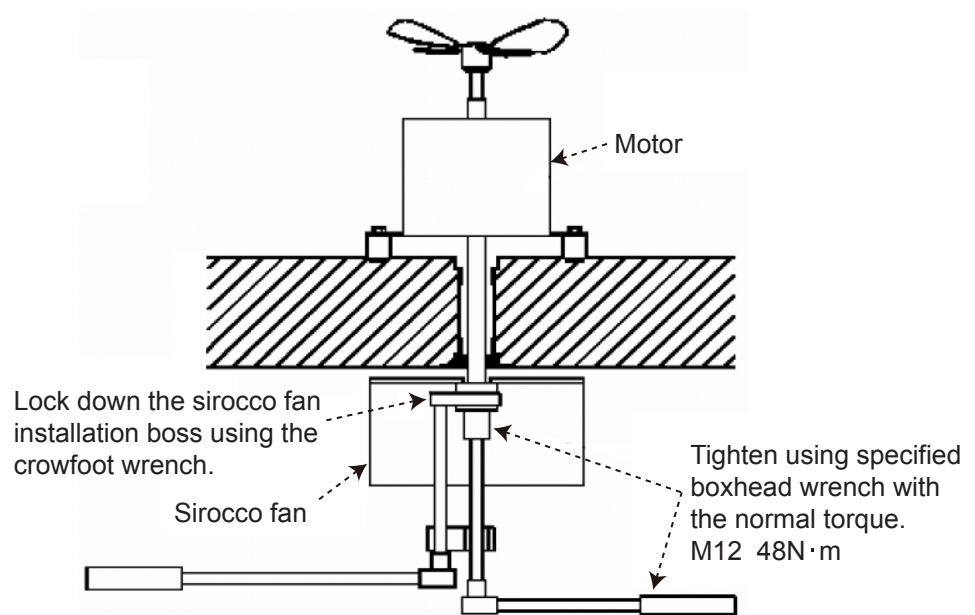
■ Use of the specialized tool

Fig. 5.24 Use of the specialized tool for dismantling the sirocco fan

(3) Temperature sensors

■ Replacement

- Procedure**
1. Set the main power switch in the OFF position.
 2. Open door of the electric parts compartment. Philips screwdriver
 3. Disconnect leads from input terminals of the temperature controller and overheat protector setter.
..... Philips screwdriver, Flat head screwdriver
 4. Pull the temperature sensor terminal out to the electric parts compartment. Cutter knife
It also needs to remove silicone sealant which was coated on rubber bushing outside chamber.
 5. Install new temperature sensor terminal according to the adjusting criteria. After inserting the sensor terminal, check rubber bushings for the sensor terminal on test area and outside are securely installed. Coat the rubber bushings again with silicone sealant.



DANGER

- **Do not get sensor polarity backwards. (Red +, White -) Also, check that the screw is not tightened on the sensor sheath and that the sensor is securely installed.**

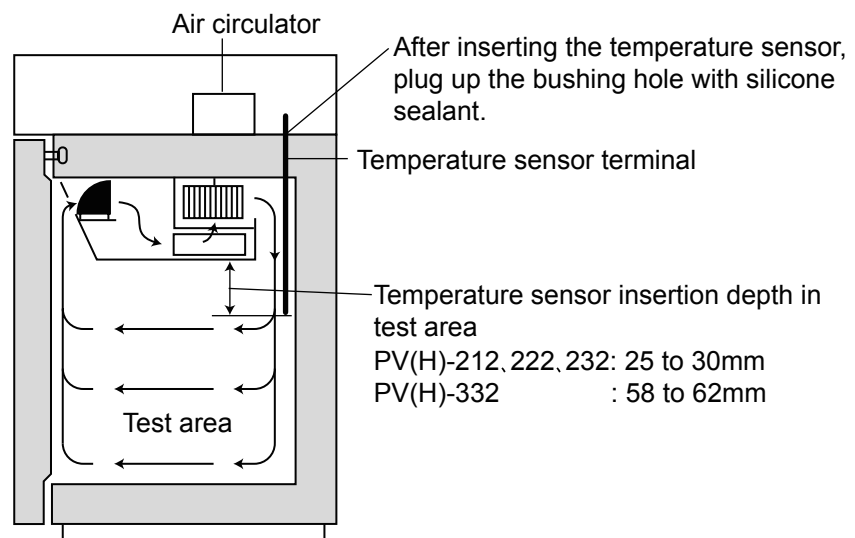


Fig. 5.25 Temperature sensor insertion depth

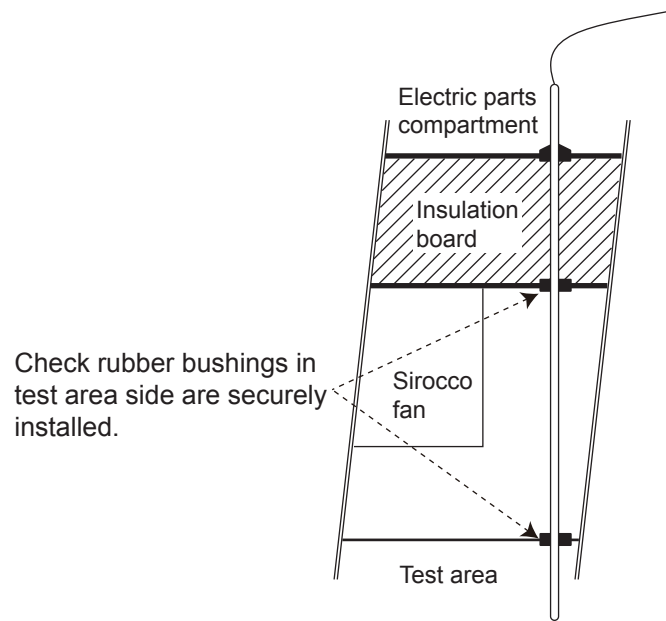


Fig. 5.26 Check rubber bushings installation in test area

Chapter 6

Sensor Offset

This chapter explains how to offset sensors.



DANGER

- **ELECTRIC SHOCK!** Shut OFF power from the main power switch before replacing parts.
- **SHARP EDGES!** Wear gloves when handling metal panels to prevent cutting hands on corners and edges.

6.1 Sensor Offset

 CAUTION

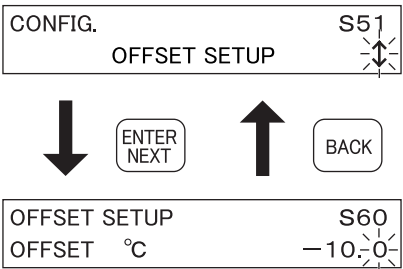
- The sensor offset applies to all measured values on monitor displays and trend graphs.
- All measured values are offset, therefore individual adjustments cannot be made.
- Use a calibrated reference device for offsetting.
- Activate and warm up the temperature controller and reference device for at least 30 minutes.

■ Offsetting

- Procedure**
1. Connect a calibrated equipment (voltage generator + cold contact) to the temperature sensor input terminal of the temperature controller. You must disconnect the chamber sensor first.

	Temperature sensor signal	Terminal No.	Thermocouple
PV, PVH	TEC1	TB1	Type K

2. Output the reference voltage from the reference device.
3. Get the offset setup screen from the program setter as follows.
Get the Control setting mode ⇒ CONFIG. ⇒ OFFSET SETUP ⇒ OFFSET °C
(For details, see “7.1 Window Tree”.)



4. Compare the measured value against the reference temperature, input the offset in [OFFSET °C], and press  button. Once entered, the offset will be added to the measured temperature and the process value will read the corrected temperature

5. Press  button to end.

 DANGER

- **After calibrating the sensor, disconnect it from the reference device and check that the sensor reading after being returned to the temperature controller is accurately indicated on the monitor display.**

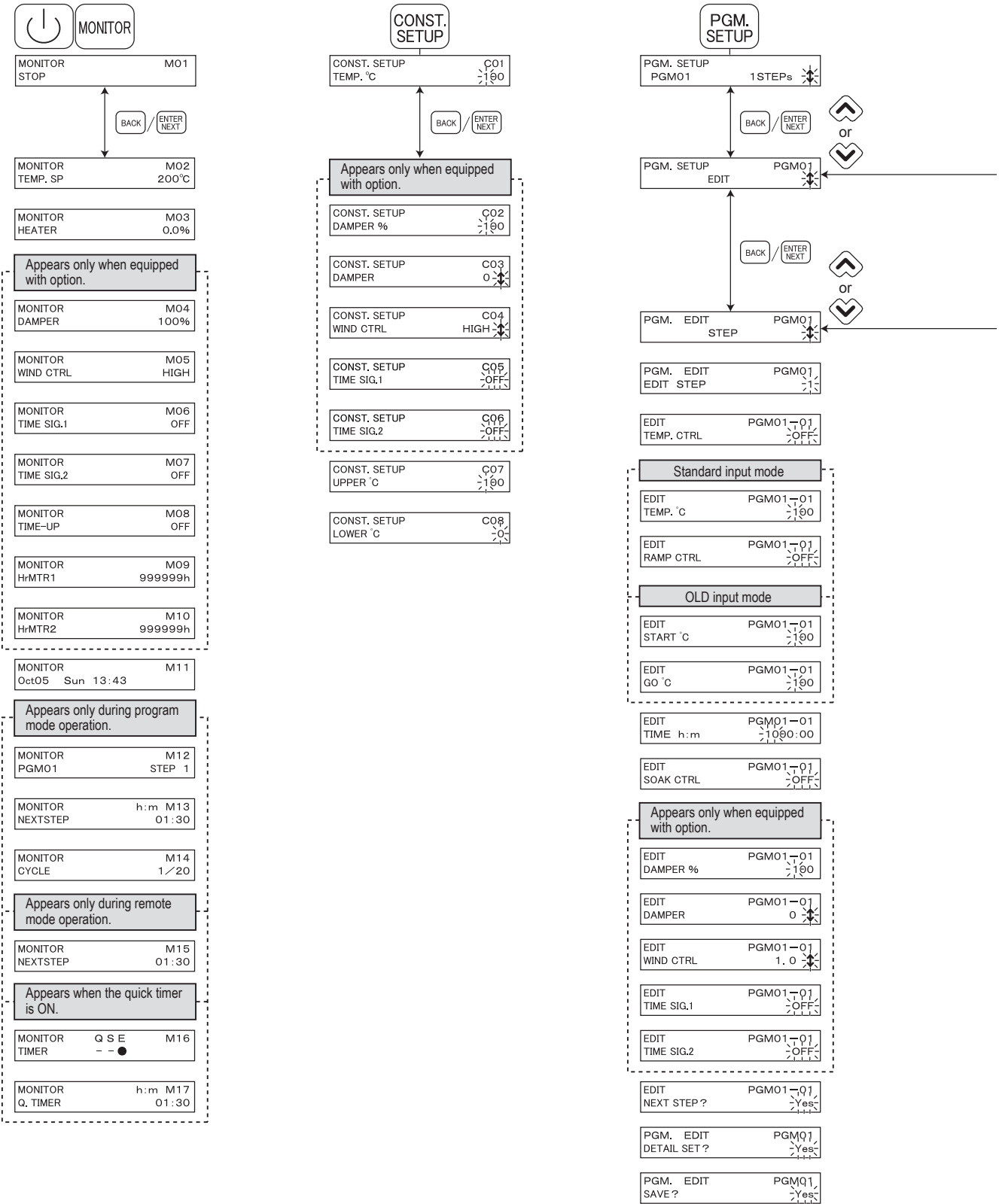
Chapter 7

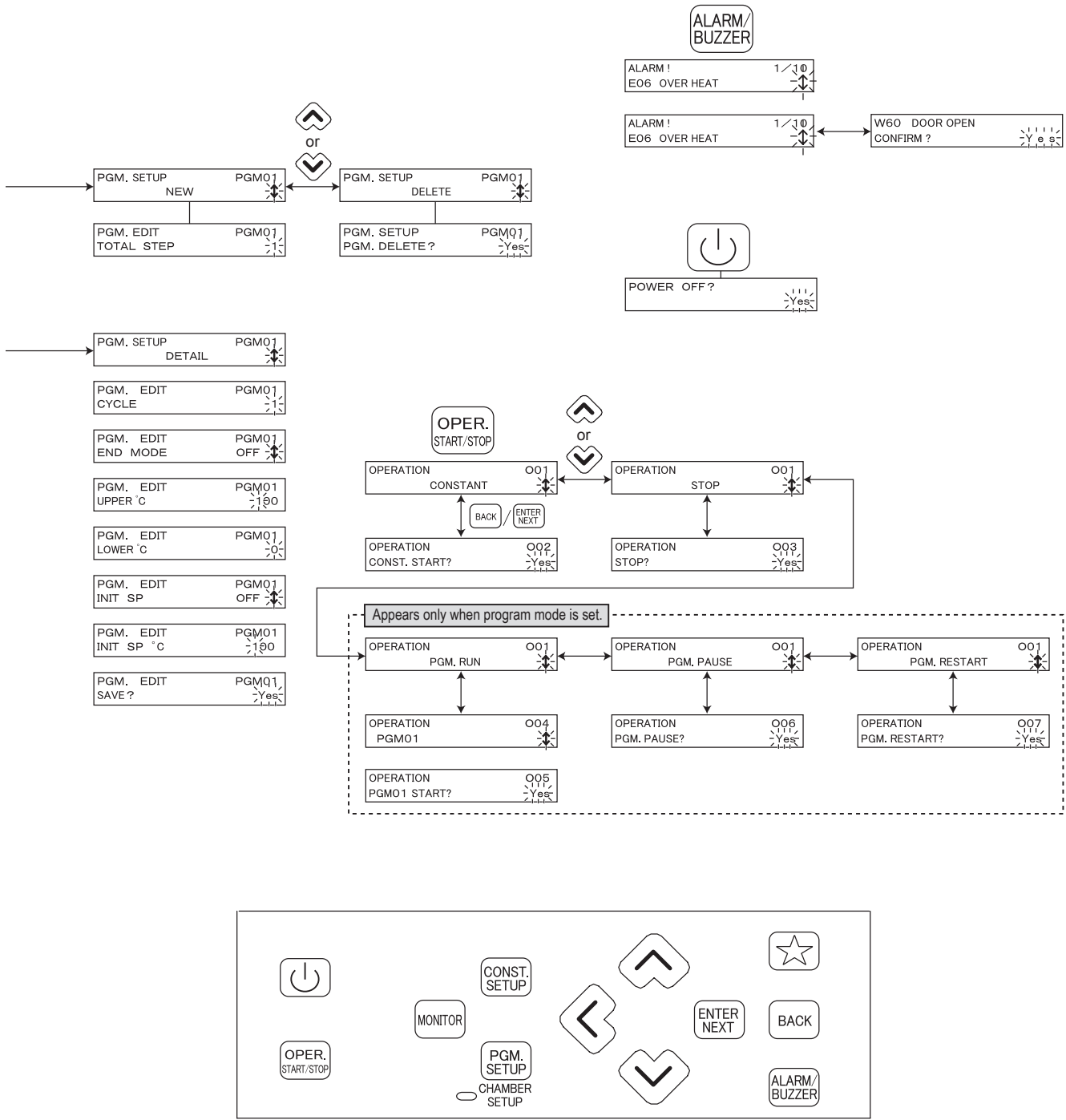
Appendix

7.1 Window Tree

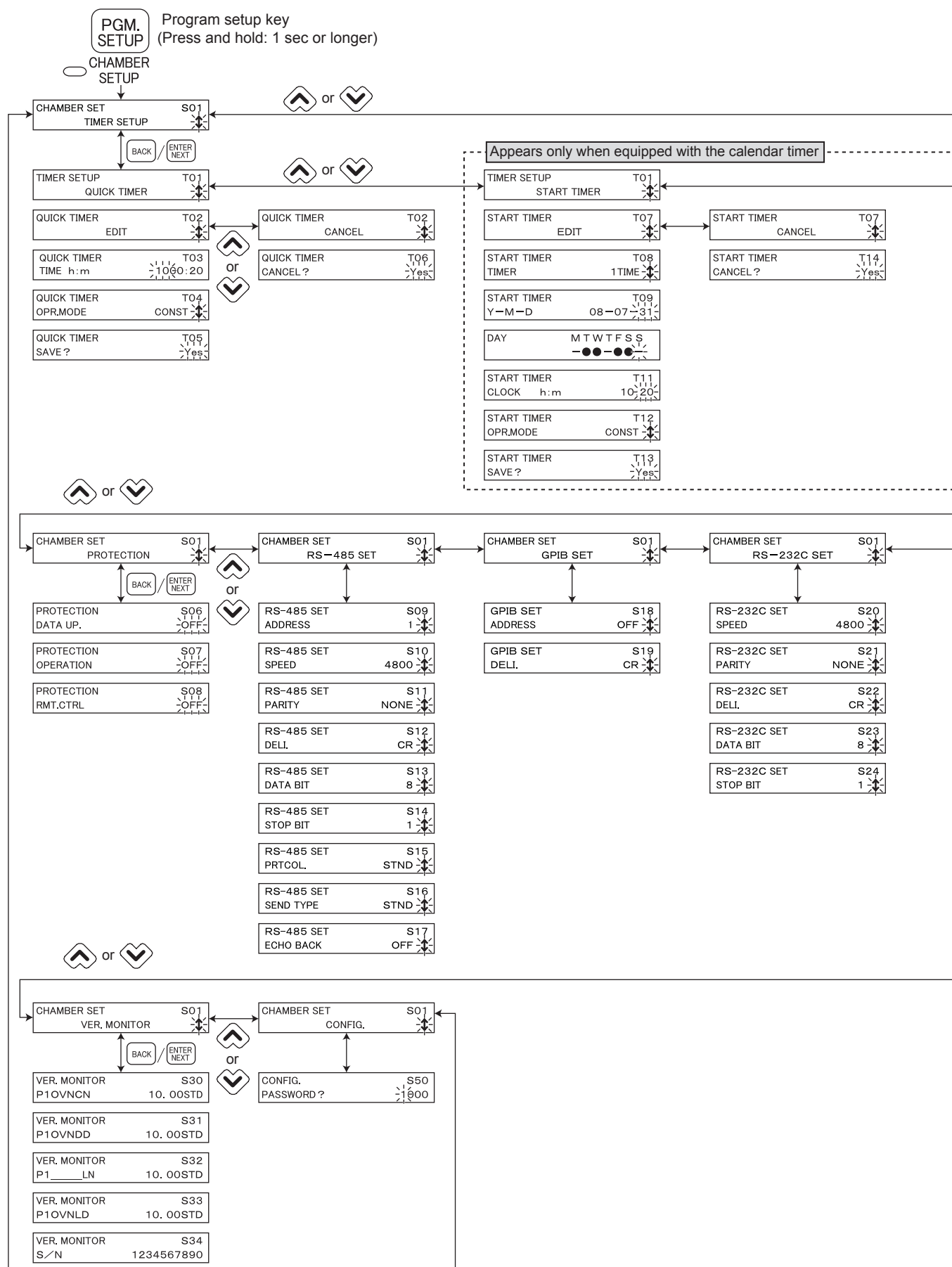
Monitoring window, Operating setup

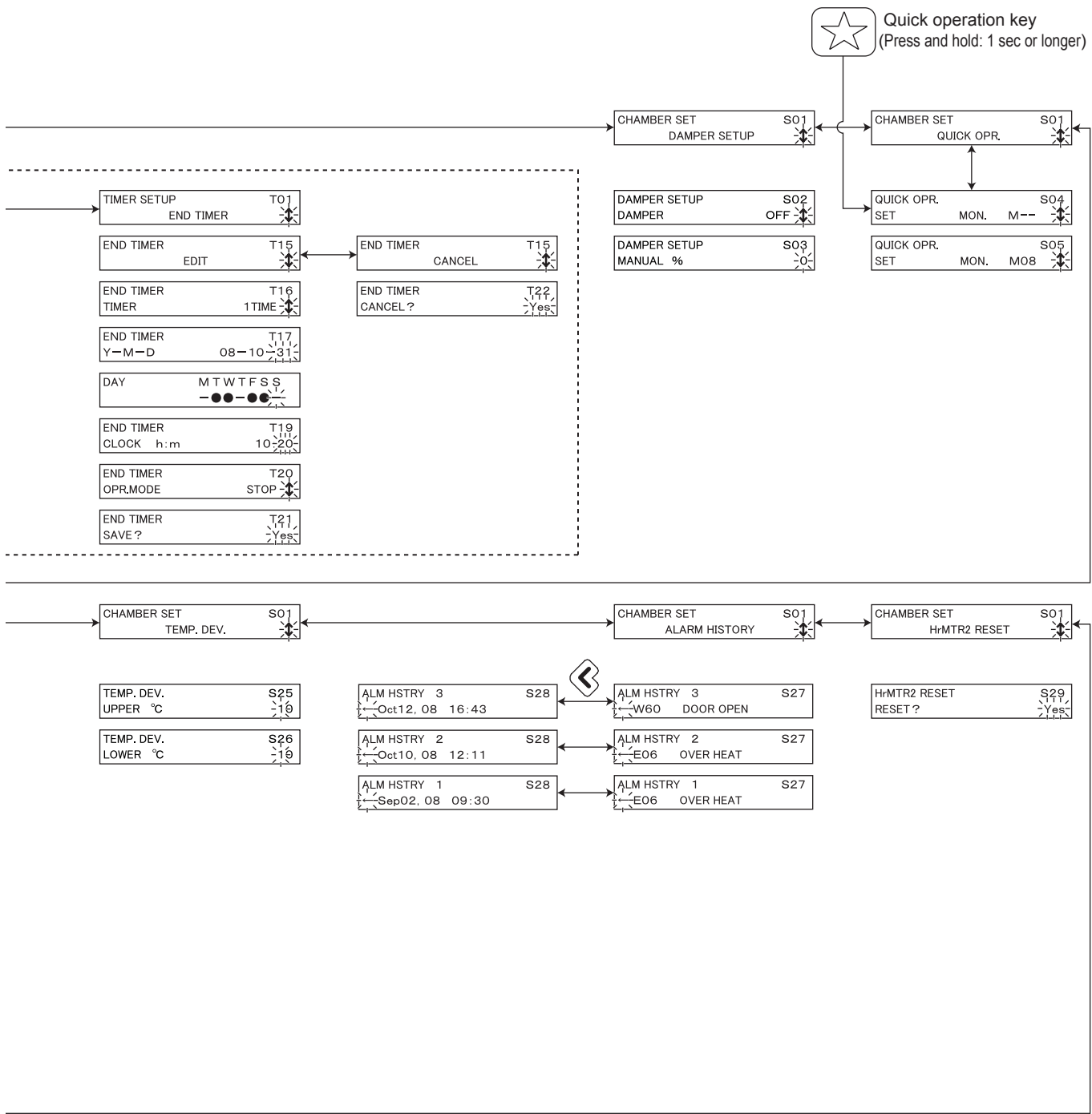
* Window display will vary according to conditions (with or without options, settings, operation type (constant or program mode), etc.).



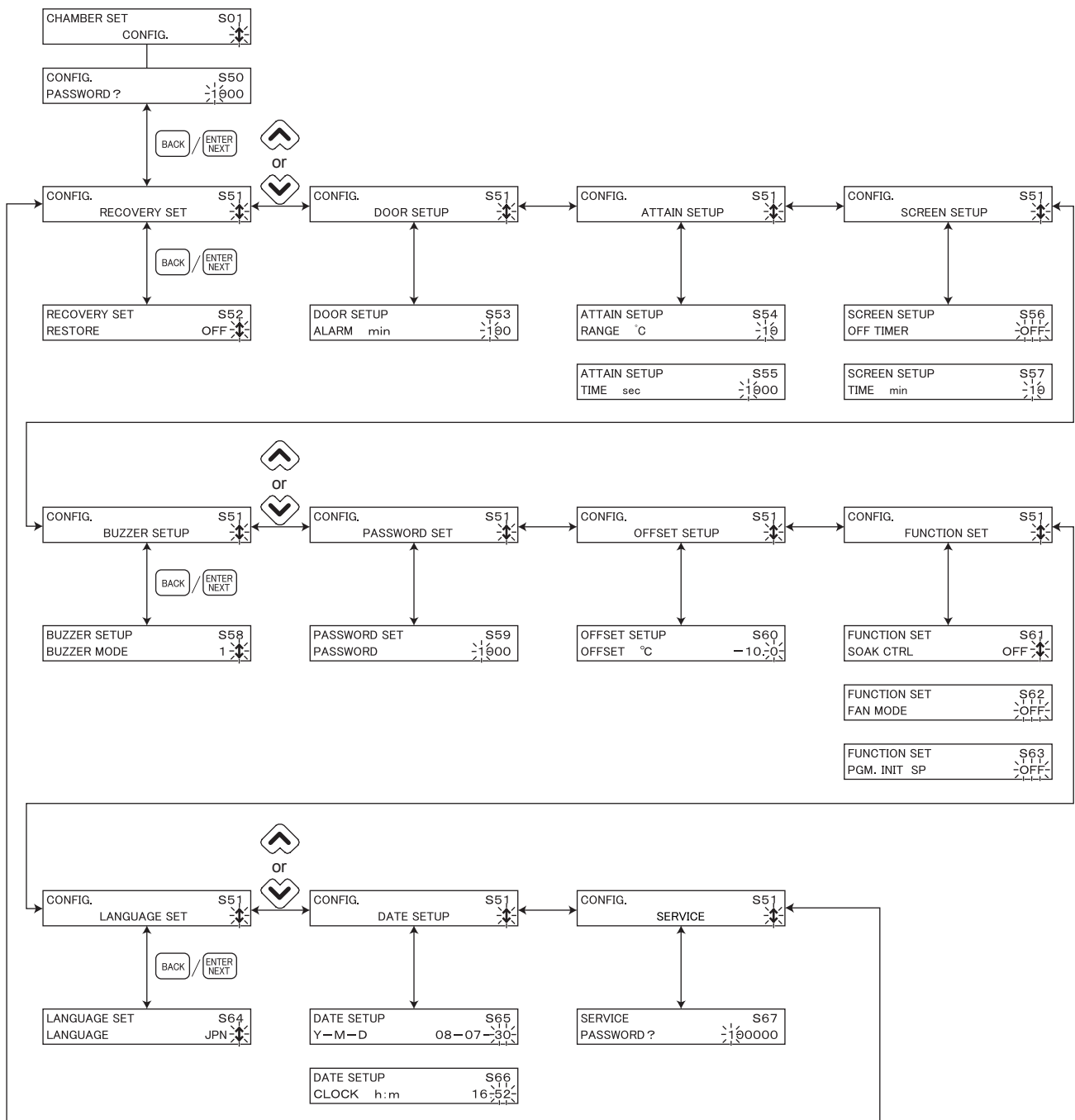


Control settings





Configuration mode selection



7.2 Electric Circuit Diagram

200V AC Spec.

- PV(H)-212, PV-22278
- PVH-222, PV(H)-23280
- PV(H)-33282

220V AC Spec.

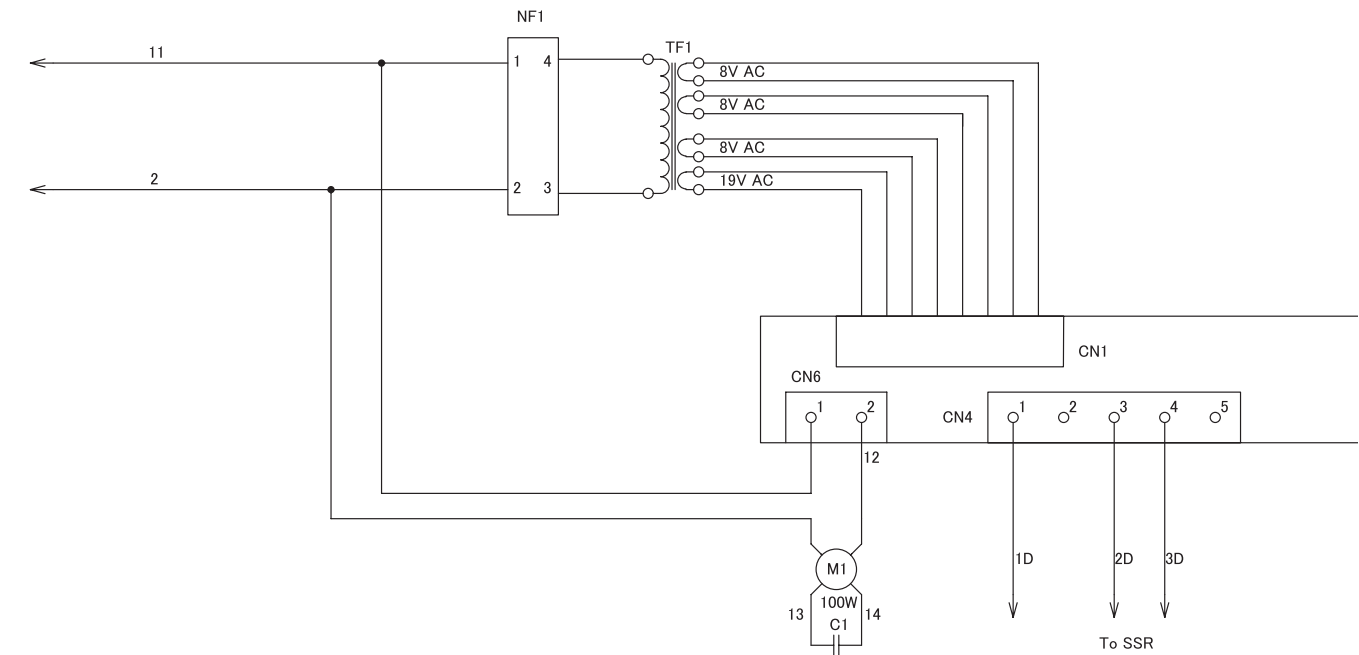
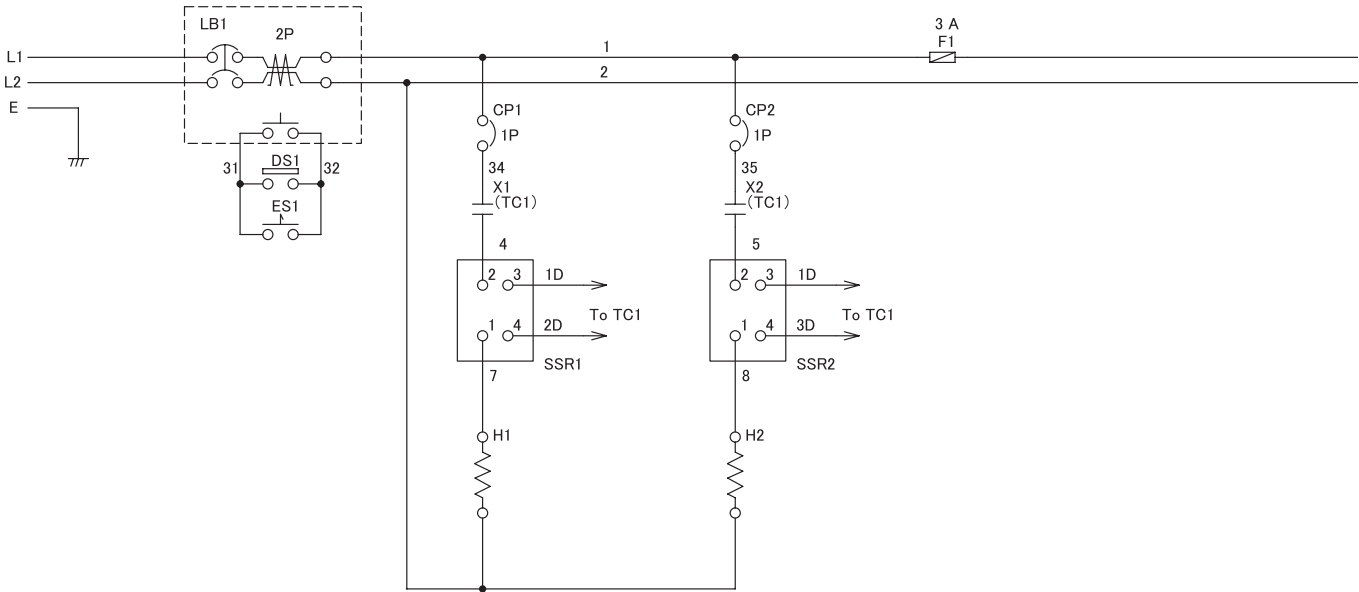
- PV(H)-212, PV-22284
- PVH-222, PV(H)-23286
- PV(H)-33288

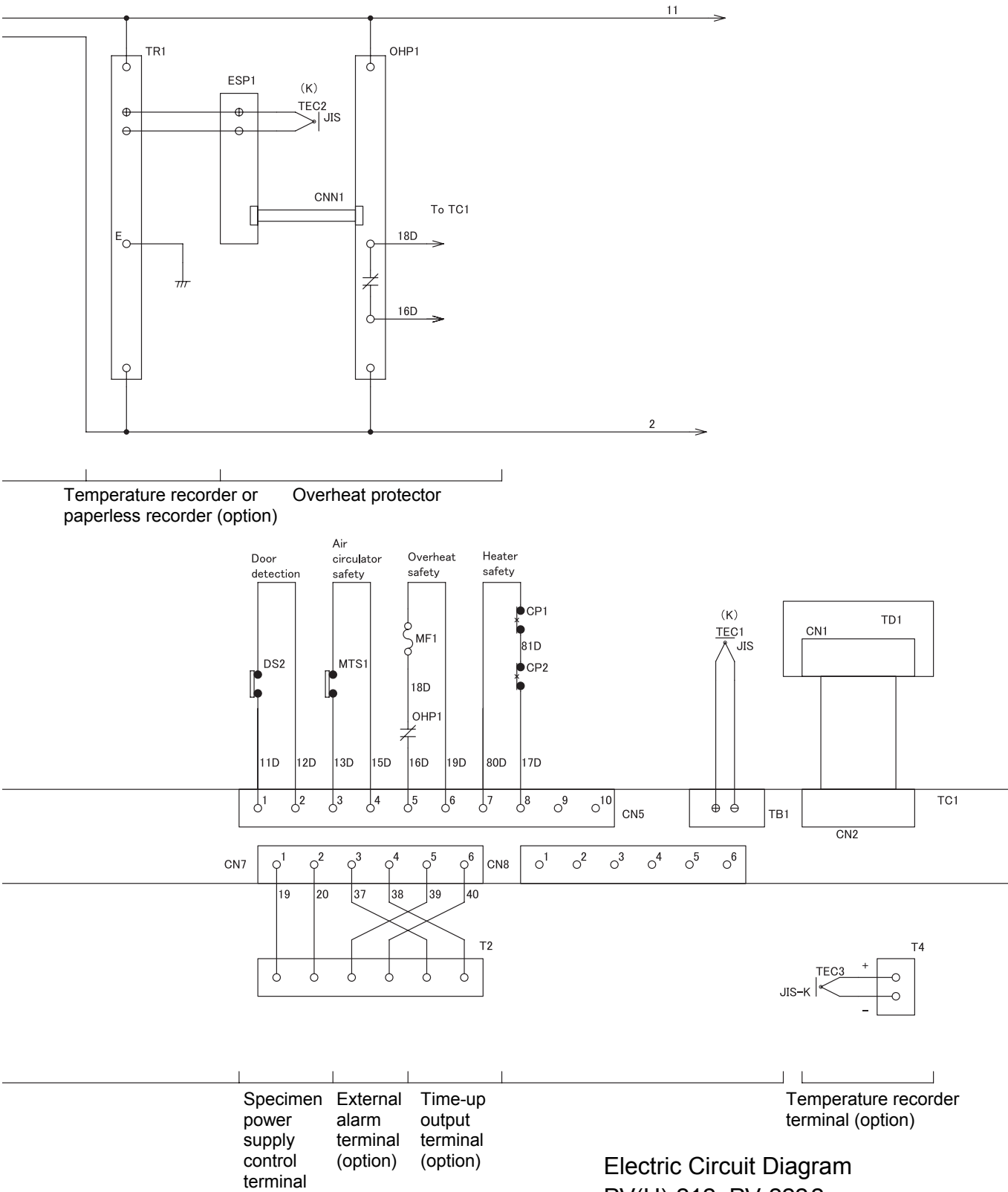
230V AC and 240V AC Spec.

- PV(H)-212, PV-22290

200V AC Spec.

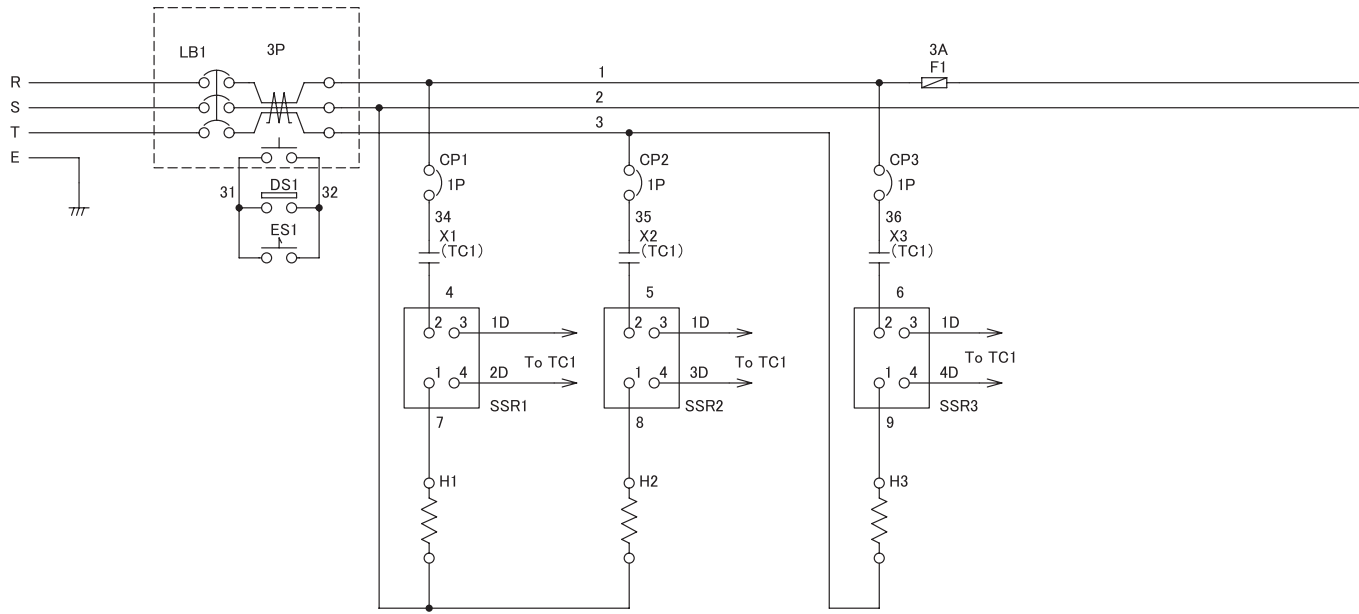
200V AC 1 ϕ





Electric Circuit Diagram
PV(H)-212, PV-2222
402223001000

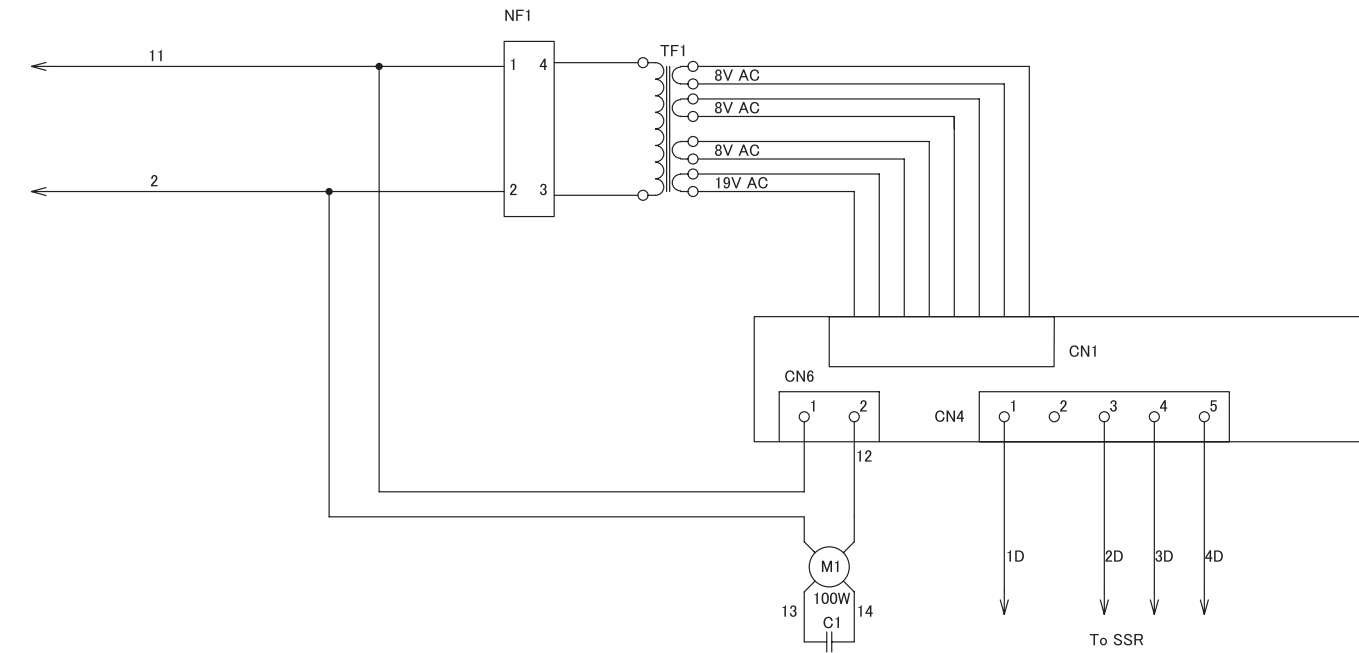
200V AC 3 ϕ



Leakage
breaker

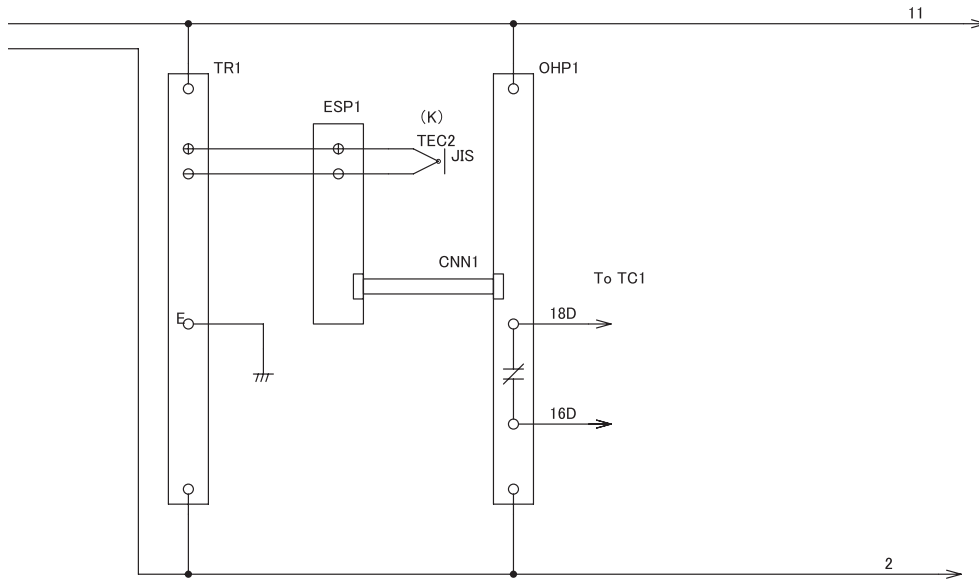
Emergency stop
switch (option)

Heater circuit



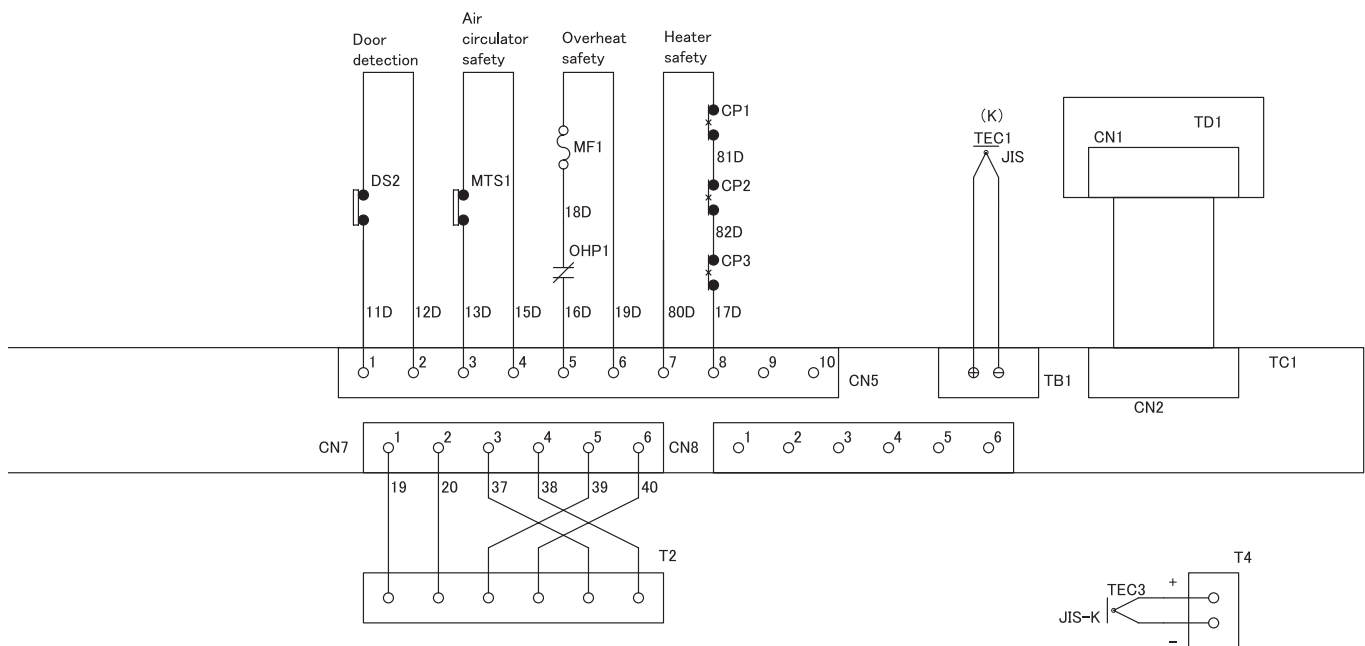
Air circulator

Heater control output



Temperature recorder or
paperless recorder (option)

Overheat protector



Specimen
power
supply
control
terminal

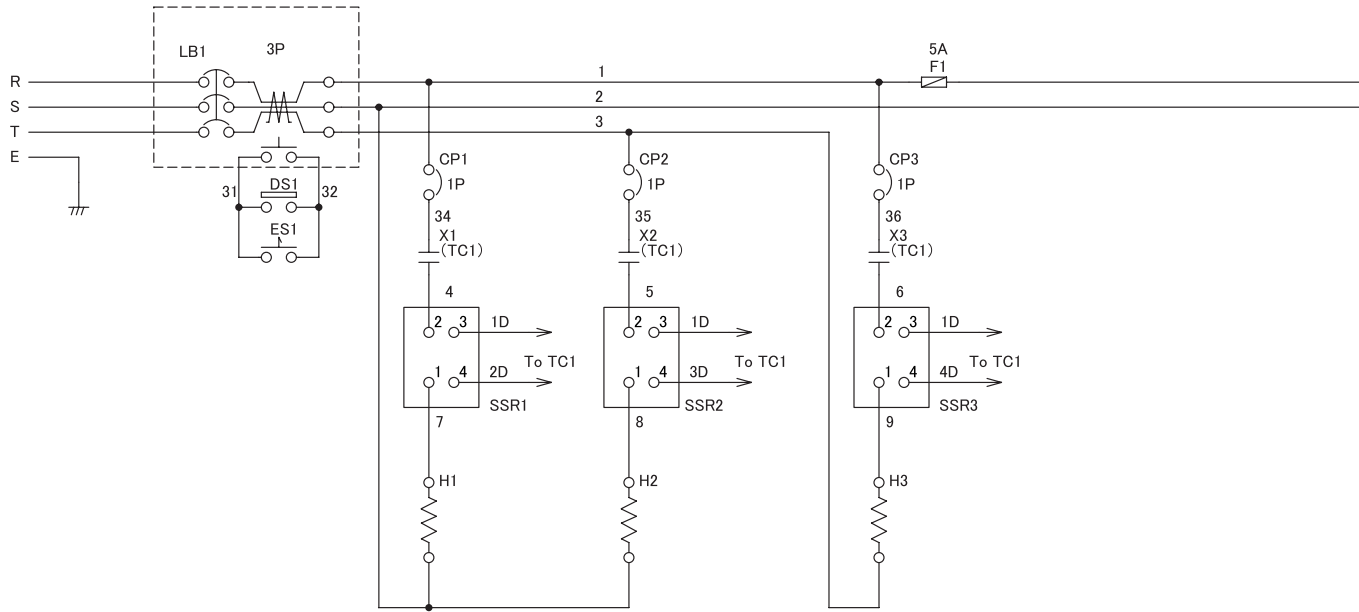
External
alarm
terminal
(option)

Time-up
output
terminal
(option)

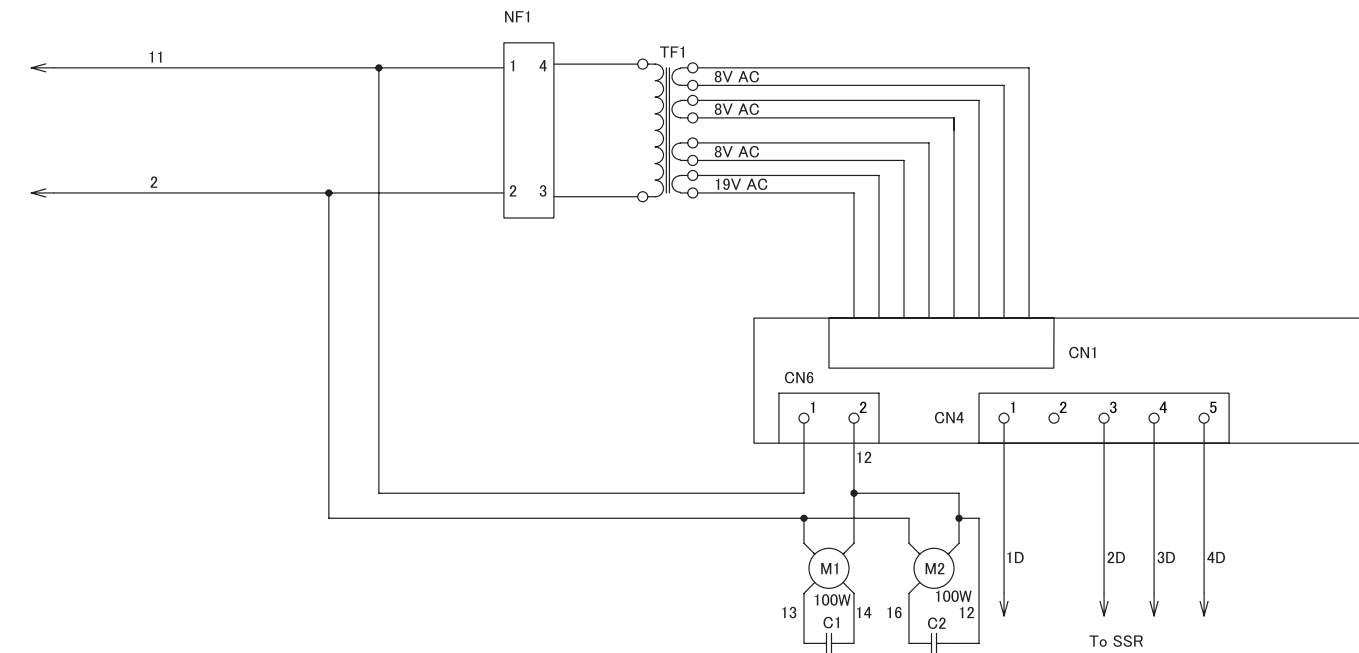
Temperature recorder
terminal (option)

Electric Circuit Diagram
PVH-222, PV(H)-232
402223001100

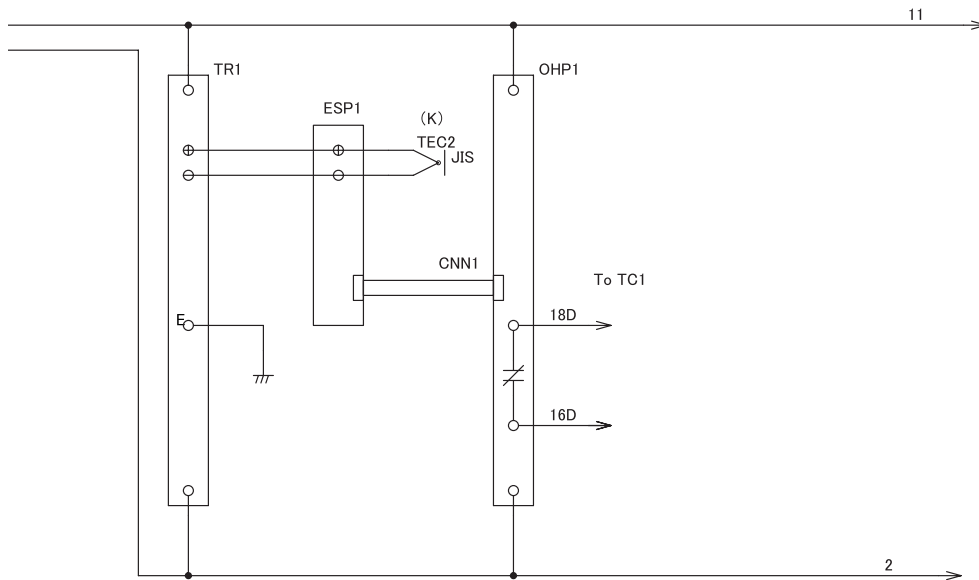
200V AC 3 ϕ



Leakage breaker Emergency stop switch (option) Heater circuit

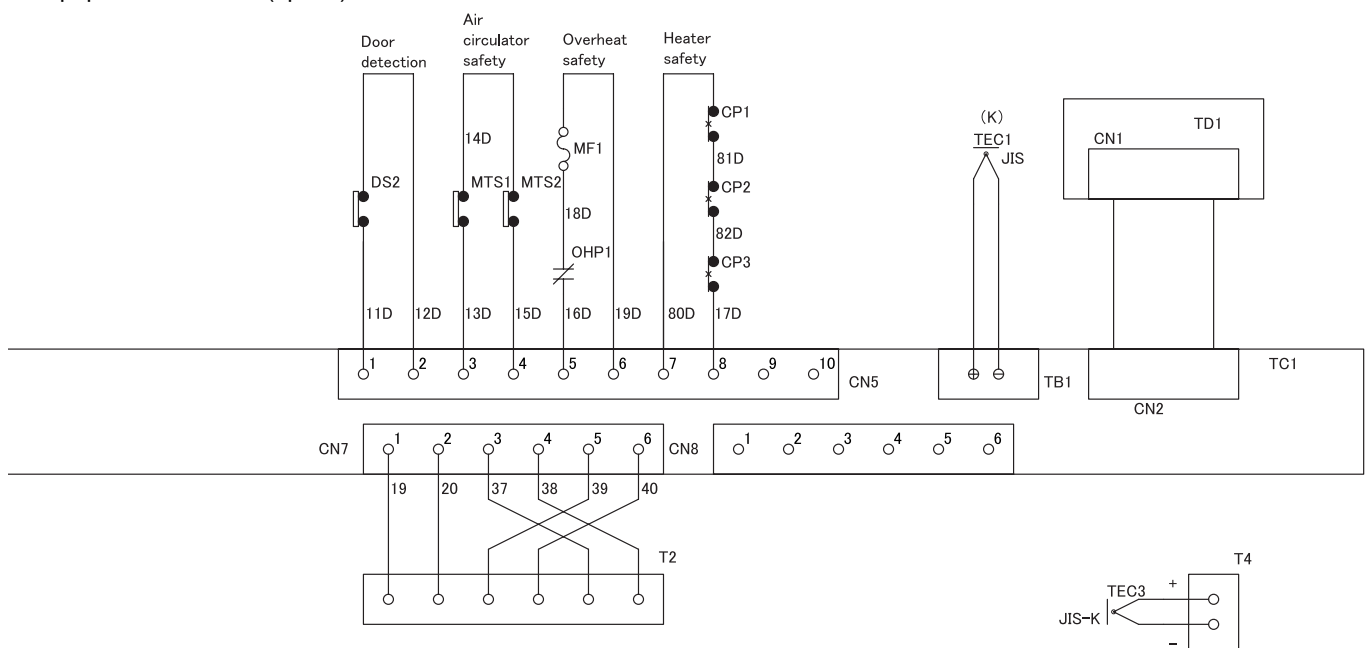


Air circulator Heater control output



Temperature recorder or
paperless recorder (option)

Overheat protector



Specimen
power
supply
control
terminal

External
alarm
terminal
(option)

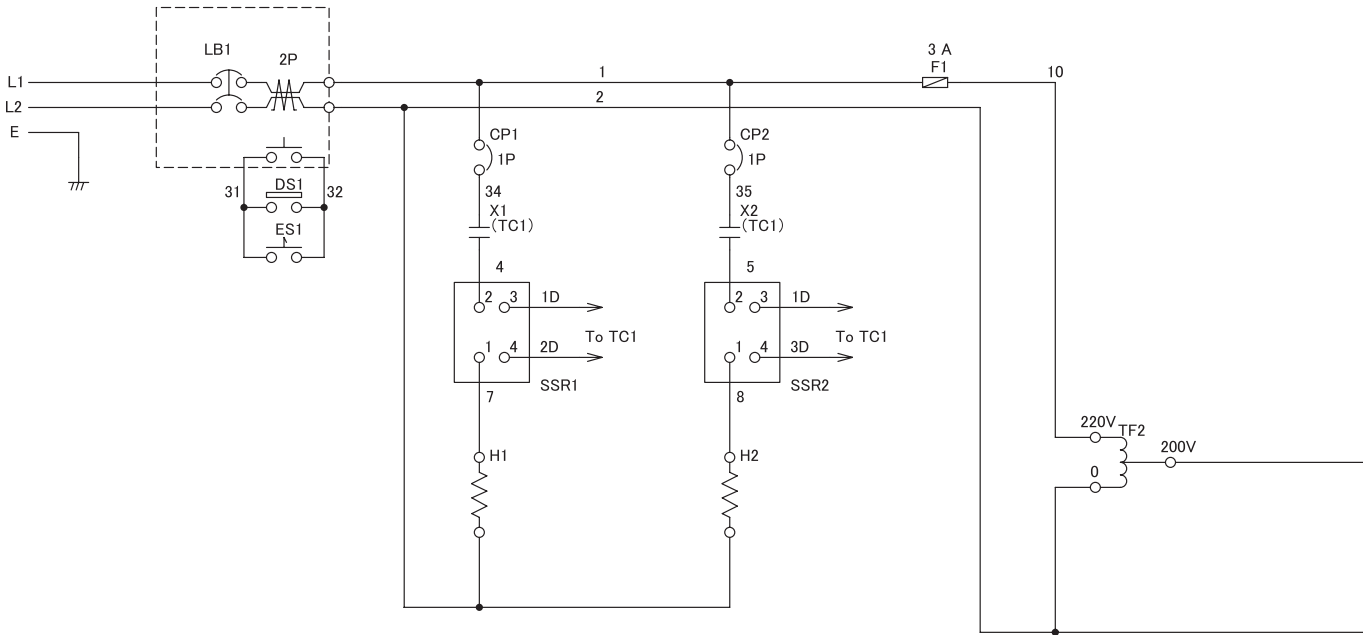
Time-up
output
terminal
(option)

Temperature recorder
terminal (option)

Electric Circuit Diagram
PV(H)-332
402223001100

220V AC Spec.

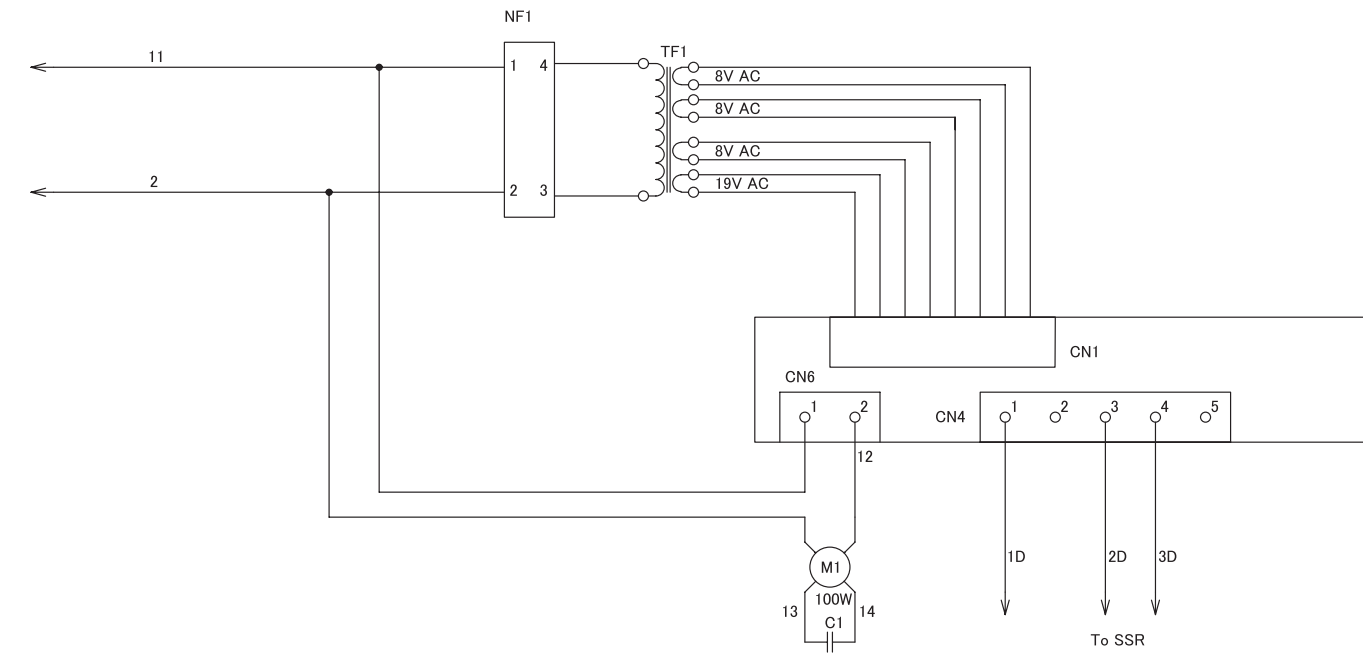
220V AC 1 ϕ



Leakage
breaker

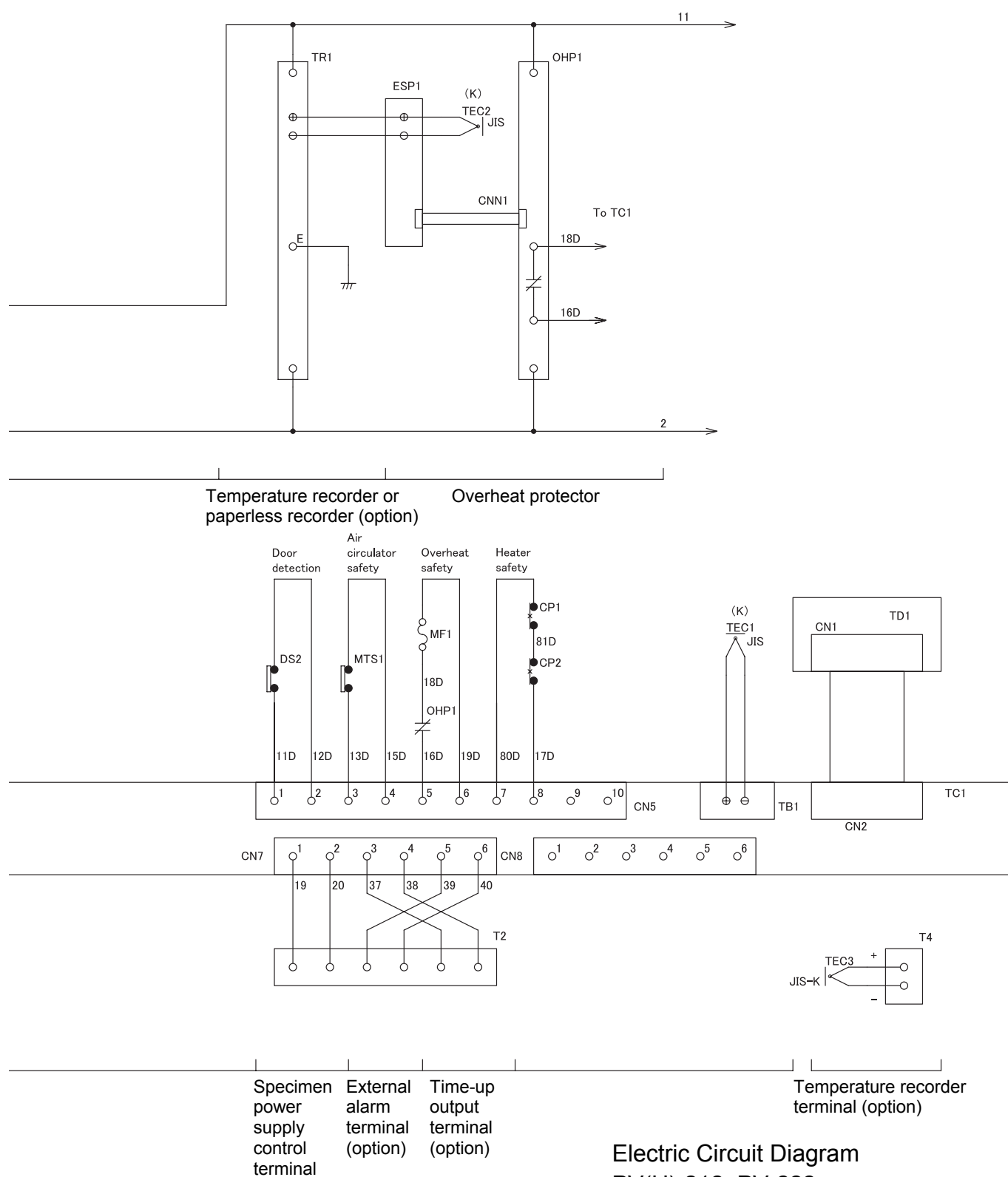
Emergency stop
switch (option)

Heater circuit



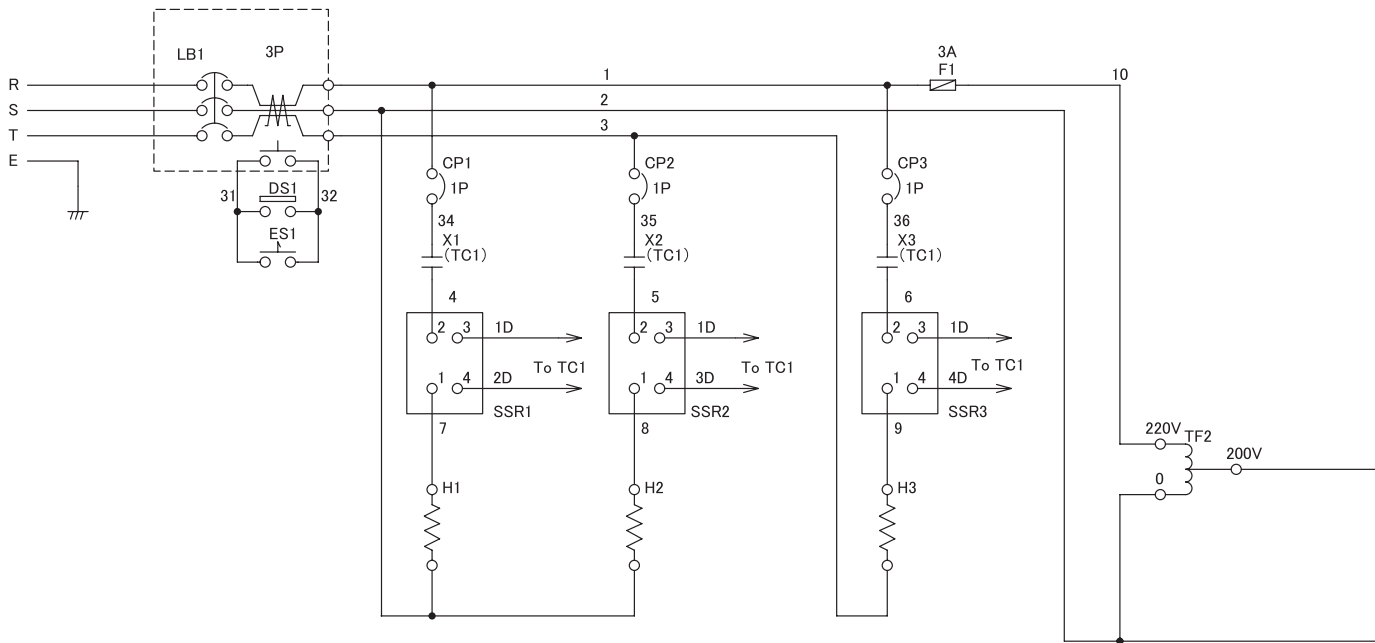
Air circulator

Heater control output



Electric Circuit Diagram
PV(H)-212, PV-222
4022223001400

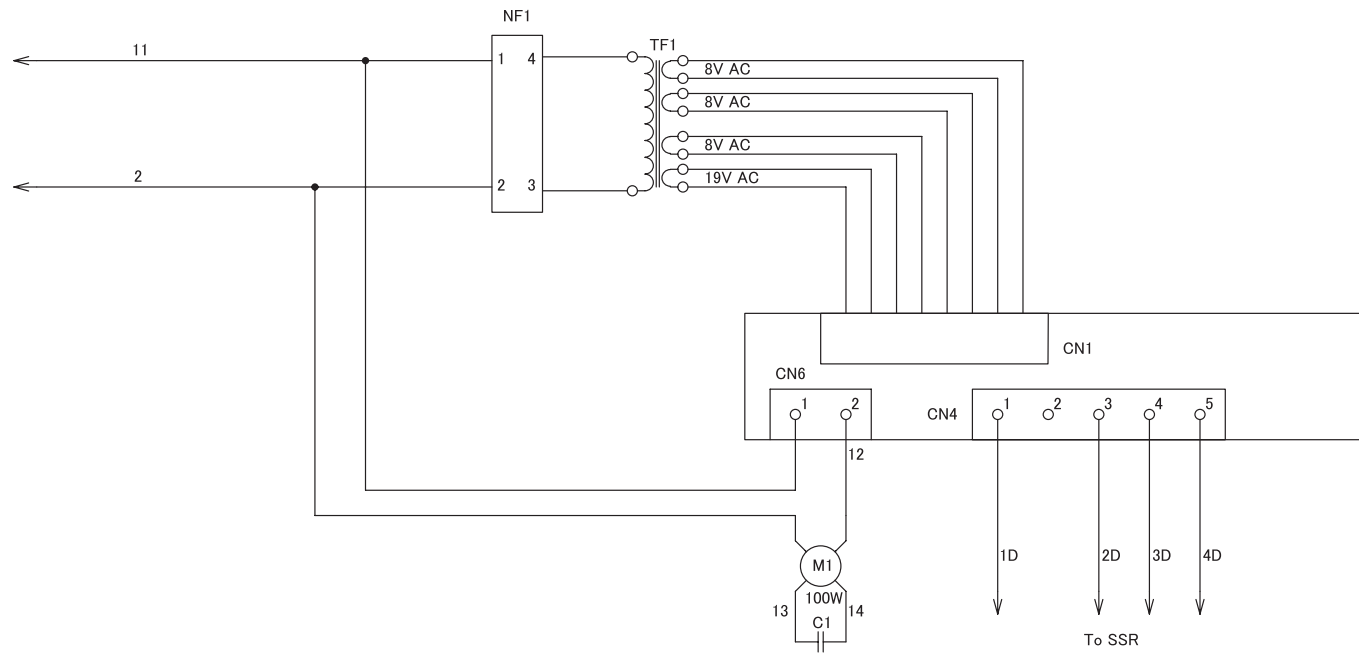
220V AC 3 ϕ



Leakage
breaker

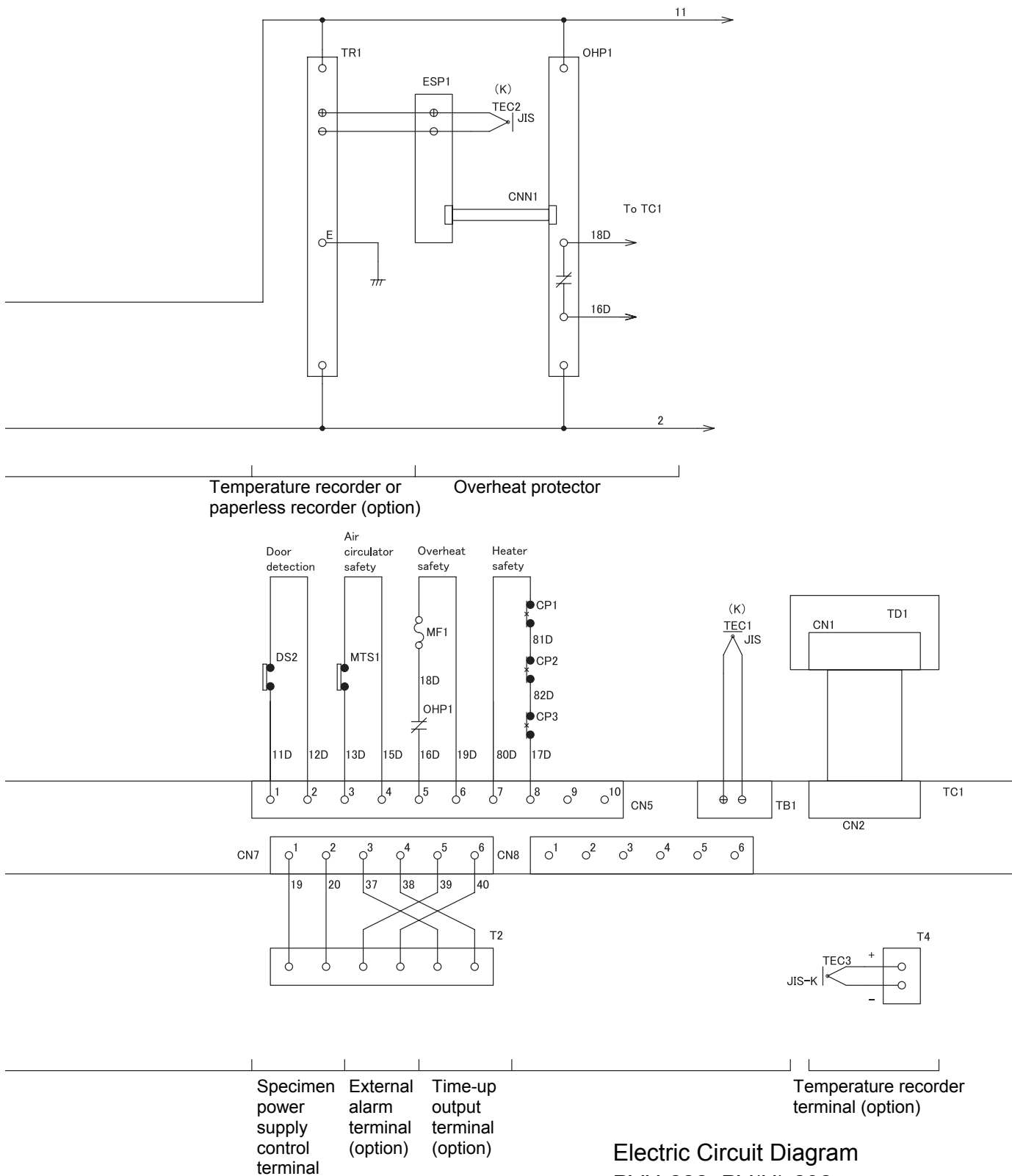
Emergency stop
switch (option)

Heater circuit



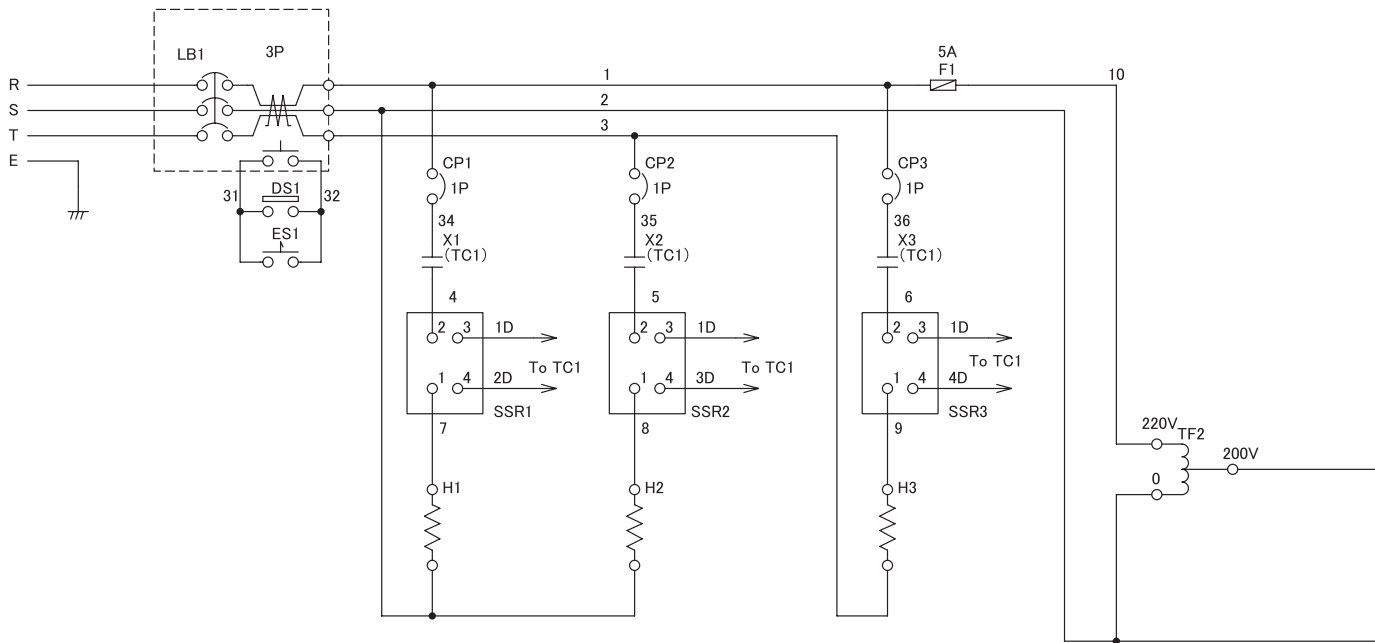
Air circulator

Heater control output



Electric Circuit Diagram
PVH-222, PV(H)-232
4022223001600

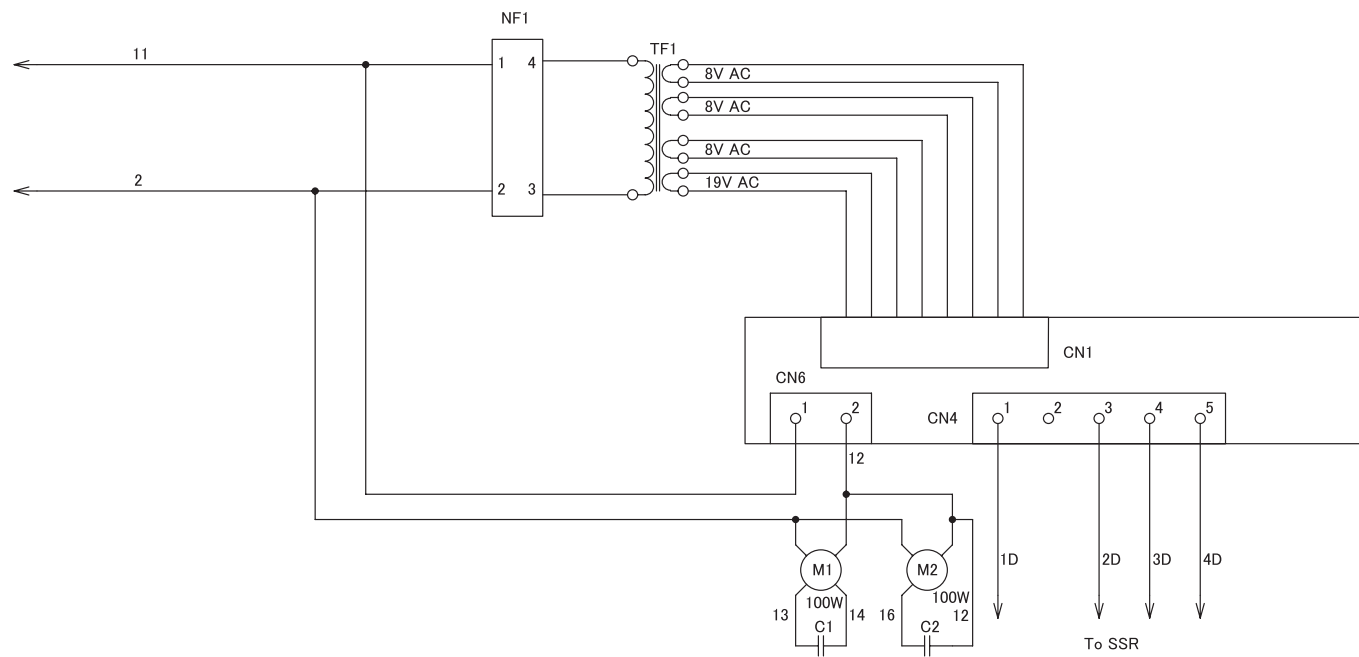
220V AC 3 ϕ



Leakage
breaker

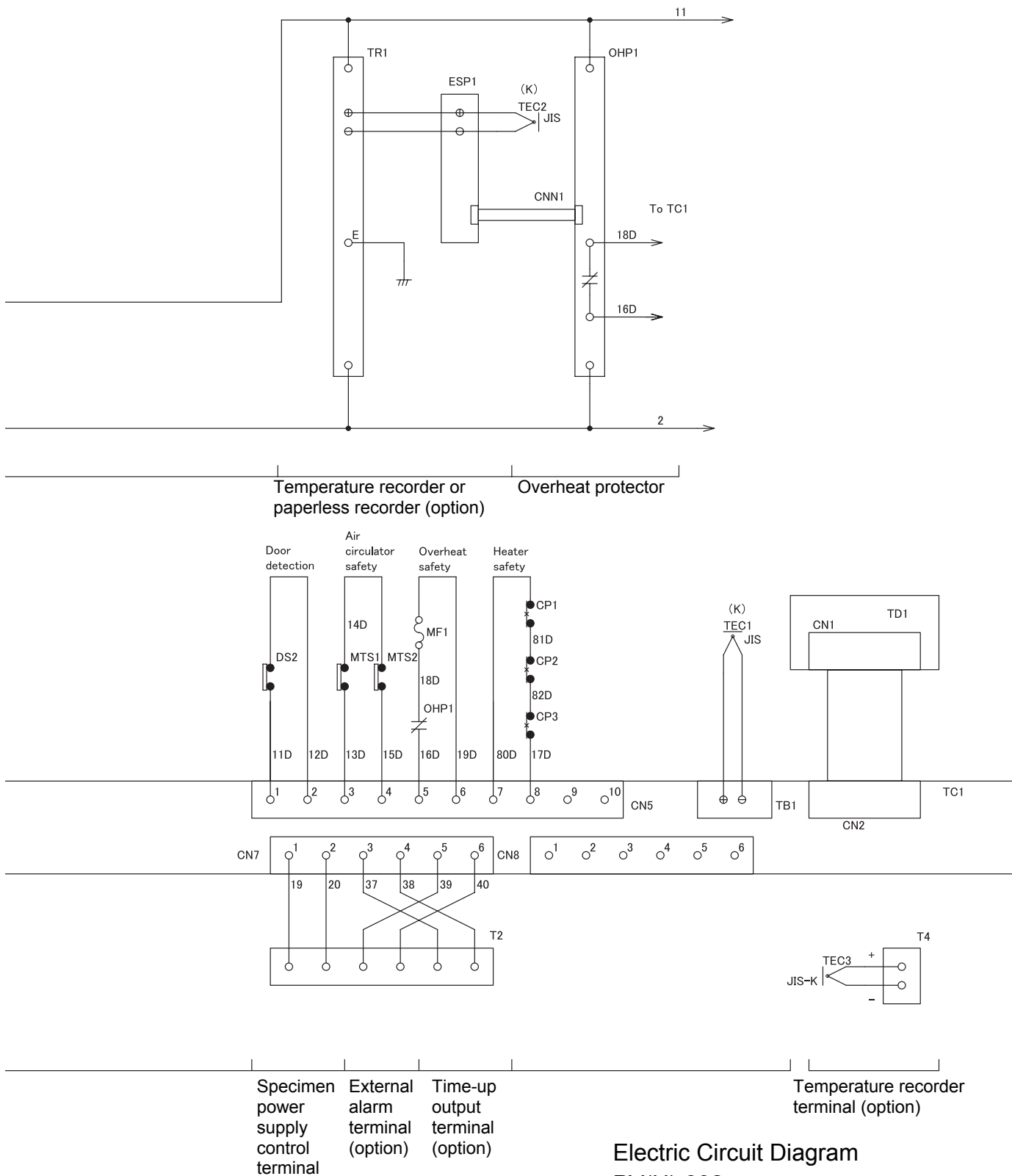
Emergency stop
switch (option)

Heater circuit



Air circulator

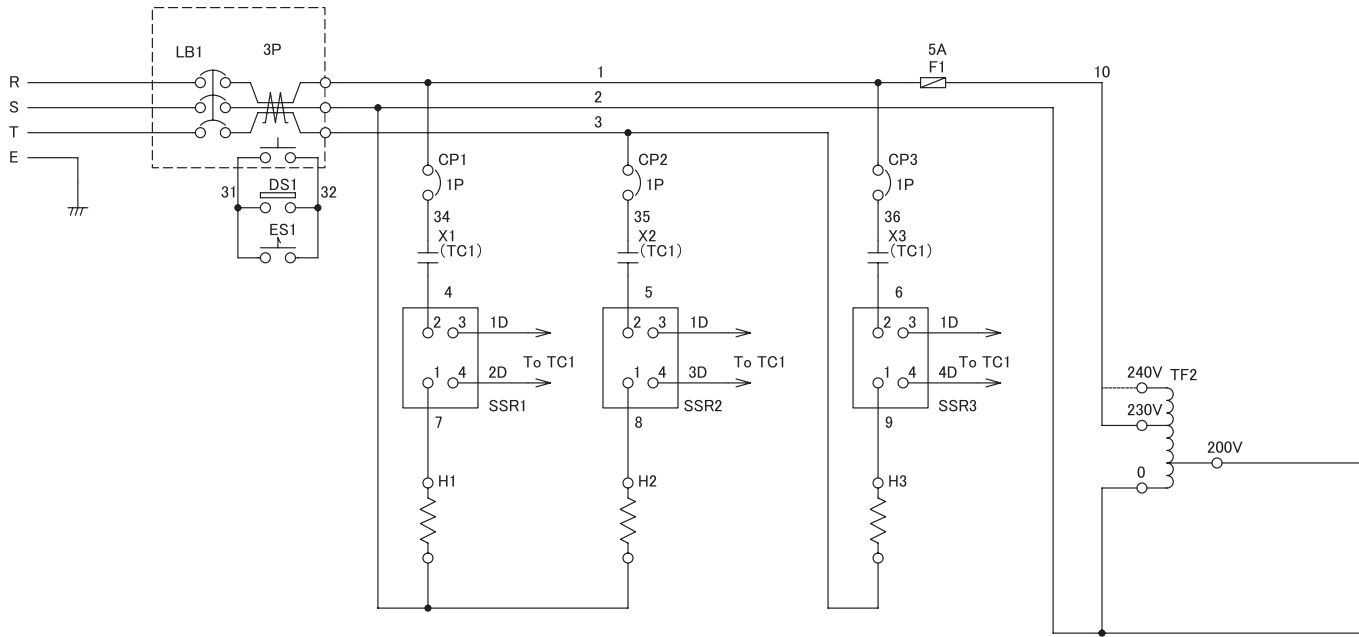
Heater control output



Electric Circuit Diagram
PV(H)-332
4022223001800

230V AC and 240V AC Spec.

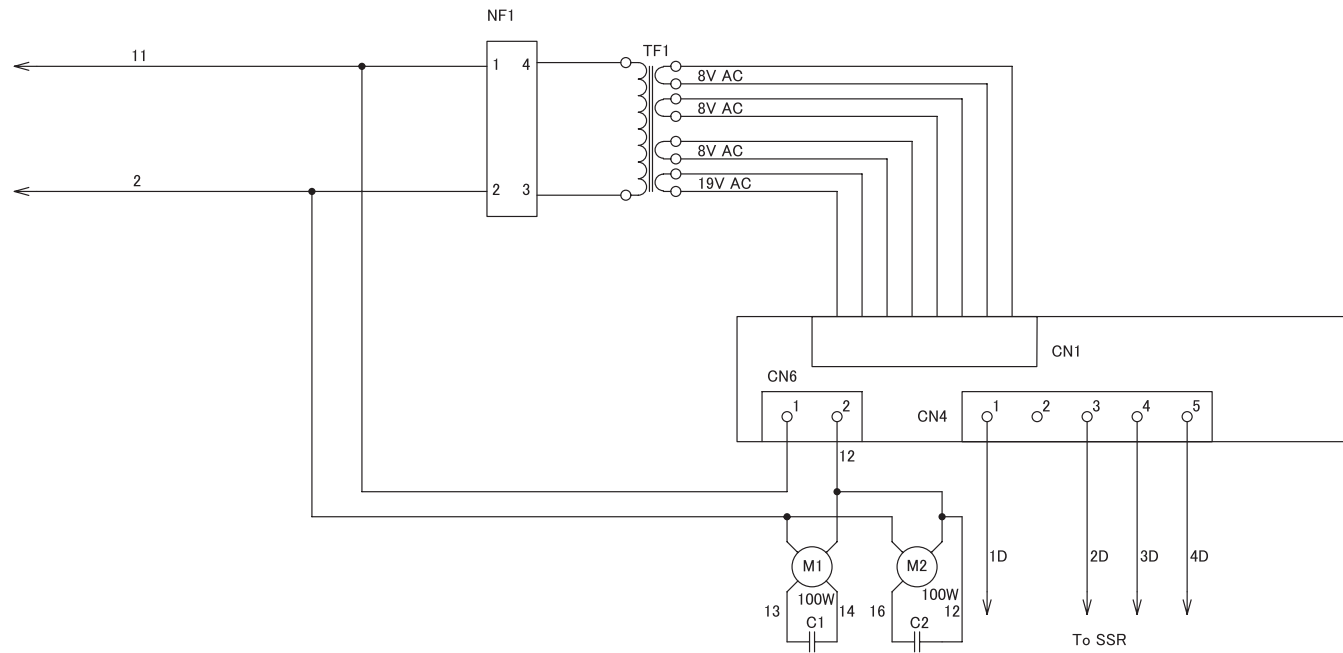
230V AC, 240V AC 1 ϕ



Leakage
breaker

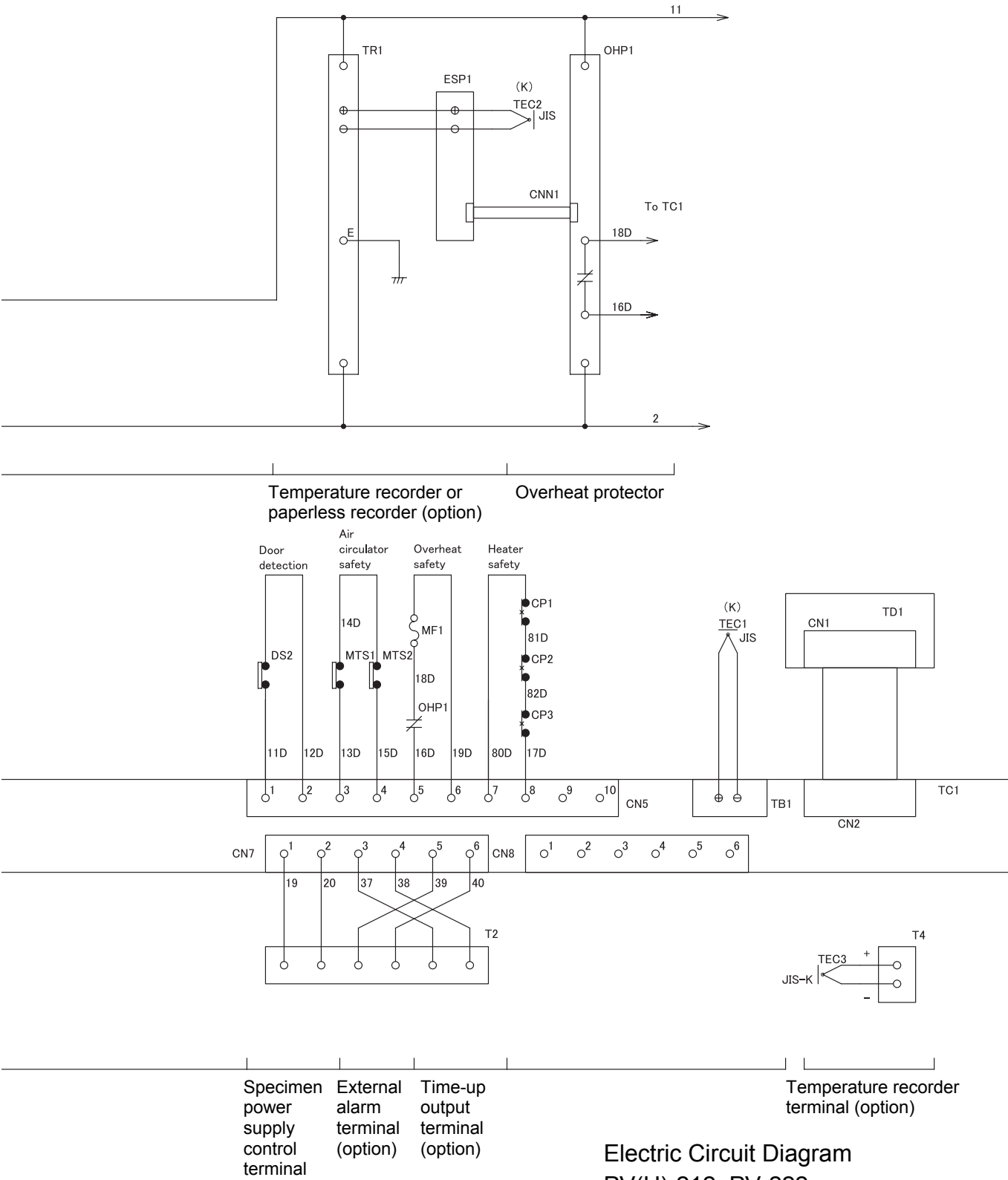
Emergency stop
switch (option)

Heater circuit



Air circulator

Heater control output



Electric Circuit Diagram
PV(H)-212, PV-222
4022223002000

7.3 Parts List

Note

- Using the circuit mark on the remarks, it allows verify electrical symbols on the electric circuit diagrams to check if the voltage of parts meets to your chamber.
- At part replacement, it may be required to replace other parts simultaneously. Contact the place of purchase or ESPEC CORP to verify it before purchase new parts.
- When replace heater and heater control parts, verify the power supply voltage.

No.	Parts	Specifications	Remarks/Circuit mark *0:For 200V only *2:For 220V only *3:For 230V only *4:For 240V only	PV-212	PV-222	PV-232	PV-332	PVH-212	PVH-222	PVH-232	PVH-332
	Electric parts compartment										
21402010065XX	Temperature sensor	KK-3-M-4-400-1X2	TEC1,2	1	1	1	-	1	1	1	-
21402010066XX	Temperature sensor	KK-3-M-4-400-3X2	TEC1,2	-	-	-	1	-	-	-	1
21701010009XX	Main power switch (Leakage breaker)	BJS_3032N91, 2P, 30A, 240V AC	LB1	1	1	-	-	1	-	-	-
21701010228XX	Main power switch (Leakage breaker)	EG33AC/20-30mA-TL	LB1	-	-	1	-	-	1	-	-
21701010229XX	Main power switch (Leakage breaker)	EG33AC/30-30mA-TL	LB1	-	-	-	1	-	-	1	1
22106010254XX	Terminal cover (Short)	BZ6TS10C3	For LB1	-	-	1	1	-	1	1	1
21405010107XX	Door switch (limit switch)	D3D-111_1c	DS1	1	1	1	1	1	1	1	1
22001010793XX	Transformer (for P-100)	EI-08-2-1	TF1	1	1	1	1	1	1	1	1
21702010273XX	Circuit protector	BACS112151_15A	CP1,2,3	2	2	3	3	2	3	3	1
21702010274XX	Circuit protector	BACS112201_20A	CP3	-	-	-	-	-	-	-	2
21702010291XX	Circuit protector	BACS112101_10A	CP1,2 *3 *4	2	-	-	-	2	-	-	-
21707010002XX	Cartridge fuse	3A, Class A, 250V	F1	1	1	1	-	1	1	1	-
21707010021XX	Cartridge fuse	5A, Class A, 250V	F1	-	-	-	1	-	-	-	1
21707010164XX	Fuse holder	FHC-15	For F1	1	1	1	1	1	1	1	1
22005010126XX	Noise filter	ZMB2203-13	NF1	1	1	1	1	1	1	1	1
21706010203XX	Solid-state relay	AQJ416V	SSR1,2,3	2	2	3	3	2	3	3	3
22199010333XX	Heat release fin	NO.9889A1007P3D	For cooling SSR	2	2	3	3	2	3	3	3
21801010634XX	Overheat protector (board)	ESP-F02	OHP1	1	1	1	1	1	1	1	1

No.	Parts	Specifications	Remarks/Circuit mark *0:For 200V only *2:For 220V only *3:For 230V only *4:For 240V only	PV-212	PV-222	PV-232	PV-332	PVH-212	PVH-222	PVH-232	PVH-332
21910010001XX	Locking card spacer	KGLS- 6S	For fixing OHP1, TC1	8	8	8	8	8	8	8	8
21801010556XX	Overheat /overcooling protector setter	ESP-C01	ESP1	1	1	1	1	1	1	1	1
21801010558XX	Overheat /overcooling protector setter extension Cable	ESP-K02		-	-	-	1	-	-	-	1
22001010119XX	Transformer	220V/220V AC, 2A	TF *2	1	1	1	-	1	1	1	1
22001010120XX	Transformer	220V AC/200V AC, 3A	TF *2	-	-	-	1	-	-	-	1
22001010121XX	Transformer	240-230V /200V AC, 2A	TF *3	1	1	-	-	1	-	-	-
22001010121XX	Transformer	240-230V /200V AC, 2A	TF *3	1	1	-	-	1	-	-	-
	Air circulator										
21601010230XX	Fan motor (motor)	ESM-100W with condenser	M1,2(C1,2)	1	1	1	2	1	1	1	2
20601010694XX	Sirocco fan (CW)	S2-178095R-12U	Simultaneously replaced with fan	1	1	1	1	1	1	1	1
20601010695XX	Sirocco fan (CCW)	S2-178095L-12U	Simultaneously replaced with fan	-	-	-	1	-	-	-	1
20504011958XX	U-nut	SUS_M12_P1.75 for fixing fan	Simultaneously replaced with fan	1	1	1	2	1	1	1	2
20502010003XX	Parallel key	4×4×16(SUS) for fixing fan	Simultaneously replaced with fan	1	1	1	2	1	1	1	2
20601010067XX	Fan	CCW yellow	Self-cooling fan for M1	1	1	1	1	1	1	1	1
20601010066XX	Fan	CW yellow	Self-cooling fan for M2	-	-	-	1	-	-	-	1
20199017525XX	Bolt (hexagon)	M6×16	For motor installation	4	4	4	8	4	4	4	8
20504010073XX	Spring washer	SUS304	For condenser installation	1	1	1	2	1	1	1	2
20504010074XX	Flat washer	4×10×0.8_SUS304	For condenser installation	1	1	1	2	1	1	1	2
20504010674XX	Hexagon nut	M4_SUS304	For condenser installation	1	1	1	2	1	1	1	2
20415010119XX	Shaft seal (Fine flex)	20415010119XX	Shaft seal	3	3	3	6	3	3	3	6
	Heater										
20608010218XX	Heater (sheathed heater)	200V AC, 1.8kW×2	H1,2 *0	1	-	-	-	-	-	-	-
20608010222XX	Heater (sheathed heater)	200V AC, 2.2kW×2	H1,2 *0	-	1	-	-	-	-	-	-
20608010227XX	Heater (sheathed heater)	200V AC, 1.8kW×2+1.8kW×1	H1,2,3 *0	-	-	1	-	-	-	-	-
20608010230XX	Heater (sheathed heater)	200V AC, 2.0kW×2+2.0kW×1	H1,2,3 *0	-	-	-	1	-	-	-	-
20608010239XX	Heater (sheathed heater)	200V AC, 1.8kW×2	H1,2 *0	-	-	-	-	1	-	-	-
20608010240XX	Heater (sheathed heater)	200V AC, 1.8kW×2+1.8kW×1	H1,2,3 *0	-	-	-	-	-	1	-	-
20608010241XX	Heater (sheathed heater)	200V AC, 1.8kW×2+2.2kW×1	H1,2,3 *0	-	-	-	-	-	-	1	-
20608010244XX	Heater (sheathed heater)	200V AC, 3.0kW×2+2.0kW×1	H1,2,3 *0	-	-	-	-	-	-	-	1
20608010221XX	Heater (sheathed heater)	220V AC, 1.8kW×2	H1,2 *2	1	-	-	-	1	-	-	-
20608010223XX	Heater (sheathed heater)	220V AC, 2.2kW×2	H1,2 *2	-	1	-	-	-	-	-	-

No.	Parts	Specifications	Remarks/Circuit mark *0:For 200V only *2:For 220V only *3:For 230V only *4:For 240V only	PV-212	PV-222	PV-232	PV-332	PVH-212	PVH-222	PVH-232	PVH-332
20608010226XX	Heater (sheathed heater)	220V AC, 1.8kWX2+1.8kWX1	H1,2,3 *2	-	-	1	-	-	1	-	-
20608010231XX	Heater (sheathed heater)	220V AC, 2.0kWX2+2.0kWX1	H1,2,3 *2	-	-	-	1	-	-	-	-
20608010247XX	Heater (sheathed heater)	220V AC, 1.8kWX2+2.2kWX1	H1,2,3 *2	-	-	-	-	-	-	1	-
20608010248XX	Heater (sheathed heater)	220V AC, 3.0kWX2+2.0kWX1	H1,2,3 *2	-	-	-	-	-	-	-	1
20608010220XX	Heater (sheathed heater)	240V AC, 1.8kWX2	H1,2 *3	1	-	-	-	1	-	-	-
20608010225XX	Heater (sheathed heater)	240V AC, 2.2kWX2	H1,2 *3	-	1	-	-	-	-	-	-
20608010220XX	Heater (sheathed heater)	240V AC, 1.8kWX2	H1,2 *4	1	-	-	-	1	-	-	-
20608010225XX	Heater (sheathed heater)	240V AC, 2.2kWX2	H1,2 *4	-	1	-	-	-	-	-	-
21402010079XX	Thermal fuse (work item) for crimp-style terminal	E4A50167C (167°C) OFF+ NHR1.25-4	MF1	1	1	1	1	-	-	-	-
21402010081XX	Thermal fuse (work item) for crimp-style terminal	E4A50184C (184°C) OFF+ NHR1.25-4	MF1	-	-	-	-	1	1	1	1
20504013093XX	Cross recessed truss head screw (thermal protected)	M4×8_SUS304	Heater unit installation plate	8	16	16	16	8	16	16	16
	Chamber door										
40222220008XX	Door lock mechanism assembly	For PV(H)-1,2		1	1	1	-	1	1	1	-
40222220008XX	Door lock mechanism assembly	For PV(H)-3		-	-	-	1	-	-	-	1
20506010029XX	Door handle	20506010029XX		1	1	1	1	1	1	1	1
20506010028XX	Door handle base	20506010028XX		1	1	1	1	1	1	1	1
22109010030XX	Clip (stud)	75391-30020		10	10	10	10	10	10	10	10
20408010050XX	Hinge (assembly)	NO.13178H459P3 (NO.M-91150)		2	2	3	3	2	2	3	3
20405012158XX	Hinge decorative cover	20405012158XX		4	4	6	6	4	4	6	6
20504014461XX	Bolt (hexagon)	M5×25 SUS	For fixing hinge	8	8	12	12	8	8	12	12
20413011198XX	Lock lever gasket	20413011198XX		-	-	-	1	-	-	-	1
20406010914XX	Handle installation plate	20406010914XX		1	1	1	1	1	1	1	1
20505010711XX	Boss (unlock unit parts)	20505010711XX		-	-	-	1	-	-	-	1
20505010712XX	Bush (unlock unit parts)	20505010712XX		-	-	-	1	-	-	-	1
20505010713XX	Link (unlock unit parts)	20505010713XX		-	-	-	1	-	-	-	1
20505010715XX	Bush (unlock unit parts)	20505010715XX		-	-	-	1	-	-	-	1
20499011040XX	Door handle installation spacer	20499011040XX		2	2	2	2	2	2	2	2
20401015020XX	Gasket retainer	20401015020XX		-	-	-	2	-	-	-	2
22204010155XX	Cross recessed truss head screw	M4×30_SUSXM7	For door inner panel (right) fixing	-	-	-	2	-	-	-	2
	Test area										
20499016579XX	Air circulator insertion port flange	20499016579XX		1	1	1	2	1	1	1	2
20410010093XX	Rubber bushing	20410010093XX	For temperature sensor	2	2	2	2	2	2	2	2

No.	Parts	Specifications	Remarks/Circuit mark *0:For 200V only *2:For 220V only *3:For 230V only *4:For 240V only	PV-212	PV-222	PV-232	PV-332	PVH-212	PVH-222	PVH-232	PVH-332
20504013093XX	Cross recessed truss head screw (thermal protected)	M4×8_SUS304	For fixing parts	20	20	20	20	20	20	20	20
	Damper										
20506010489XX	Manual damper knob	20506010489XX		1	1	1	1	1	1	1	1
	Manual damper assembly	Damper unit assembly		1	1	1	1	1	1	1	1
	Chamber										
21708010039XX	Door switch (limit switch)	1VAP2-26 (with V-5-1A3)	For detecting door in open/closed position	1	1	1	1	1	1	1	1
20413010117XX	Gasket (door)	3200mm PV-211		1	-	-	-	-	-	-	-
20413010119XX	Gasket (door)	3700mm PV-221		-	1	-	-	-	-	-	-
20413010121XX	Gasket (door)	4300mm PV-231		-	-	1	-	-	-	-	-
20413010122XX	Gasket (door)	4700mm PV-331		-	-	-	1	-	-	-	-
20413010128XX	Gasket (door)	3200mm+3300mm		-	-	-	-	1	-	-	-
20413010129XX	Gasket (door)	3700mm+3800mm		-	-	-	-	-	1	-	-
20413010130XX	Gasket (door)	4300mm+4400mm		-	-	-	-	-	-	1	-
20413010131XX	Gasket (door)	4700mm+4800mm		-	-	-	-	-	-	-	1
20505010266XX	Lock mechanism parts, catch	20505010266XX		2	2	2	2	2	2	2	2
20505010267XX	Lock mechanism parts, pin	20505010267XX		2	2	2	2	2	2	2	2
20505010696XX	Roller lock unit parts	20505010696XX		2	2	2	2	2	2	2	2
20406010920XX	Lock mechanism parts, catch support	20406010920XX		2	2	2	2	2	2	2	2
	Accessory										
21707010002XX	Cartridge fuse	3A, Class A, 250V		2	2	2	-	2	2	2	-
21707010021XX	Cartridge fuse	5A, Class A, 250V		-	-	-	2	-	-	-	2
20417010264XX	Shelf (PV-2)	20417010264XX		2	2	2	-	2	2	2	-
20417010167XX	Shelf (PV-3)	20417010167XX		-	-	-	2	-	-	-	2
20417012988XX	Shelf bracket (Type 2)	20417012988XX		4	4	4	-	4	4	4	-
20417010170XX	Shelf bracket (Type 3)	20417010170XX		-	-	-	4	-	-	-	4

Service Manual

**Temperature Chamber
(Vertical type)**

PV(H)-212, 222, 232, 332

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