

Service Manual

Highly Accelerated Stress Test System (HAST Chamber)

EHS-211(M), 221(M), 411(M)
EHS-211MD, 221MD, 411MD

4013305000320



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

ESPEC CORP.

Introduction

This Service Manual explains troubles that occur with chambers of the HAST Series and trouble-specific remedial procedures, in an easy way to understand.

To help you accurately identify the cause, procedures are given in flowchart form with criterion for making judgments provided for each step. It will sometimes be necessary to use instruments like testers or tools in diagnosing trouble.

In addition, the manual contains parts replacement procedures to help you remedy trouble surely and effectively.

If trouble persists despite your taking the remedial action described in this manual, contact your dealer from which you purchased the chamber or the headquarter of ESPEC ENGINEERING CORP.

■ The following safety symbols are used throughout this manual.

•Degree of DANGER

 VERY DANGER	This mark means extremely dangerous consequences may arise, with the possibility of death or serious injury to the serviceman, if the equipment is handled incorrectly.
 DANGER	This mark means dangerous consequences may arise, with the possibility of death or serious injury to the serviceman, if the equipment is handled incorrectly.
 CAUTION	This mark means dangerous consequences may arise, with the possibility of somewhat serious injury to the serviceman and/or damage to equipment and facilities, if the equipment is handled incorrectly.

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- This chapter contains precautions to observe when troubleshooting with chambers of the HAST Series.

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Chapter 1 Precautions in Service

Safety Precautions

This chapter explains safety precautions that should be observed when servicing the equipment.

WITHOUT FAIL, read this chapter carefully to prevent accidents to you, equipment, specimens or the user's facilities. These precautions apply to all environmental test chambers although some elements may be irrelevant depending on the specific model.

1 – 1 Who may Service the Equipment



DANGER

- This Service Manual was written for persons trained and certified by ESPEC ENGINEERING CORP. or servicepeople with the same knowledge and skill. Because of the dangers involved, persons untrained in service procedures should never perform servicing described herein.

1 – 2 Being Prepared



DANGER

- 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 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.

Always obtain the customer's permission BEFORE using open flames, and obey all safety requirements enforced by the customer.

1 – 3 Clothing and Safety Gear for Servicepeople

Always be appropriately dressed when servicing the equipment.

With the exception of clean room work, regular work clothes should be worn for all types of work.

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 (Check with customer in advance.)

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;

- Servicepeople from ESPEC ENGINEERING CORP. should report the situation as explained in the "PL Complaint Report Manual".
- Servicepeople from authorized dealers should report the situation to the headquarter of ESPEC ENGINEERING CORP. or International Business Headquarters of ESPEC CORP.

1 – 5 Precautions in Service

1 – 5 – 1 Before starting

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

1 - 5 - 2 Troubleshooting, checks and adjustments

Because power is ON (live parts) 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 the equipment.

(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 circuit when running the chamber. If however unavoidable, restore the safety circuit and check tripping after servicing the equipment.
- ④ Door opening-closing during high temperature, high humidity operations
 - Do not suddenly open the door.
 - Use extreme caution when opening the door if fire alarm is located directly above the chamber.
- ⑤ Door opening-closing during high temperature, high pressure operations
 - Do not open the door when the chamber is pressurized on the inside.

1 - 5 - 3 Repair work

- Turn power to the equipment 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 circuits and coat with locking paint to prevent loosening.

(2) Precautions in refrigeration circuit work

- ① Keep combustible refrigerant and additives away from potential sources of fire.
- ② Perform welding and work in which required to handle refrigerant and solvents outdoors where possible, or in a well-ventilated place.

If any of the following situations occur when handling chemicals and refrigerants, take the prescribed action immediately.

Contact with eyes: Flush with clean water for at least 15 minutes and consult a physician.

Contact with skin: Flush affected area abundantly with water.

Inhaled chemical vapors: Seek fresh air, and where necessary, consult a physician.

- ③ Always keep a dry chemical fire extinguisher and bucket of water nearby when welding or using open flames.
Also, do not weld or use open flames where prohibited or in the vicinity of hazardous, ignitable or flammable substances.
- ④ Observe the following points with water-cooled refrigerators.
 - Set an adequate drain pan in dew forming spots before shutting off the water circuit.
 - Use adequate couplings and sealant when connecting water circuit pipes.
 - After cleaning the water circuit, dilute drainage to the accepted level with fresh water before discharging it into the public sewer system.
- (3) Precautions in water circuit work
 - ① Set an adequate drain pan in dew forming spots before shutting off the water circuit.
 - ② Use adequate couplings and sealant when connecting water circuit pipes.
- (4) Precautions in air circuit work
 - Disconnect tubes and release air inside the circuit before removing air circuit parts.
- (5) Precautions in using solvents
 - Perform work in which required to handle refrigerant and solvents outdoors where possible, or in a well-ventilated place.
- (6) Precautions in working in high places
 - ① Take measures to prevent tools and supplies from dropping to below.
 - ② Use adequate step ladders or other means for climbing to high places.
- (7) Precautions in moving heavy objects
 - Have other persons help you as needed. Also, wear leather gloves to keep your hands from slipping.
- (8) Precautions in using quick-bonding agents
 - ① Wear a dust-proof goggles and vinyl gloves (or of similar material).
 - ② Be careful not to touch the bonding agent with hands when oozing from applied areas.
- (9) Special precautions in servicing incubators
 - Wash hands and tools with alcohol before servicing the incubator.
- (10) Other
 - ① Take measures to keep the door from accidentally closing when working inside the chamber.
 - ② Perform work in which required to use auxiliary cooling gas outdoors where possible, or in a well-ventilated place, to prevent local accumulation or asphyxiation.
 - ③ Avoid prolonged contact with cold parts. Show extreme caution when detaching the cooler and cold accumulator.
 - ④ Wear leather gloves when handling sheet metal.

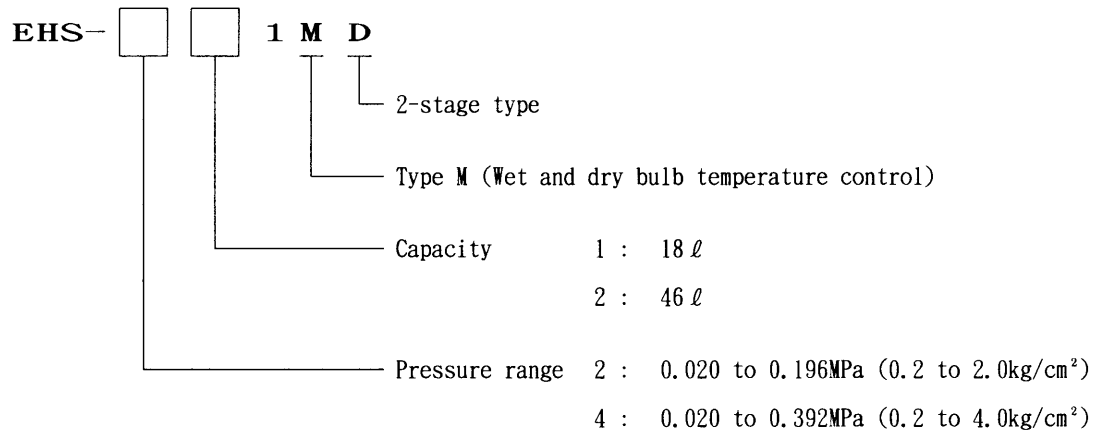
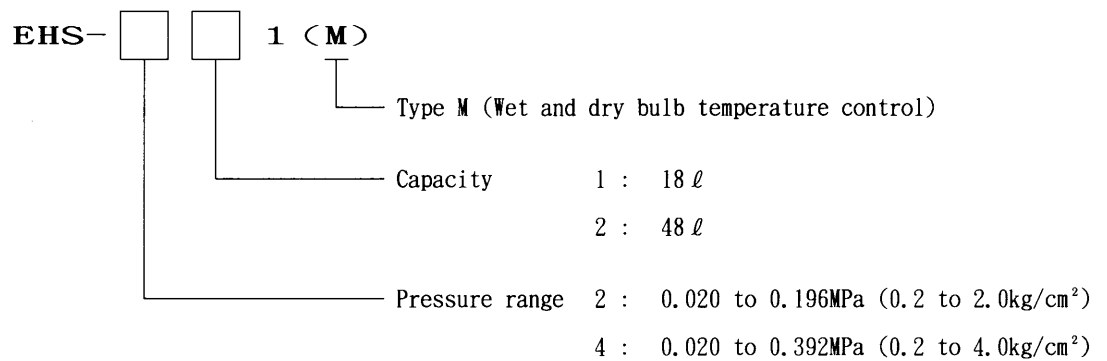
1 - 5 - 4 After servicing equipment

- (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 correctly set.
- (3) Check screw-locked terminals in load circuit are tight.
- (4) Check for leaks.
 - ① Check around the chamber for leaking water.
 - ② Check for deterioration in cooling water circuit tubes and pressure-proof hoses.
 - ③ Check the drain hose is securely connected to the building's drain convergence line.

Chapter 2 Chamber Construction

2 - 1 HAST Chamber Models

HAST chamber models differ according to temperature range (pressure range) and test area capacity. This manual applies to all of them. You may discover that some of the functions and parts mentioned in this manual are not found on your equipment. Check which model you have before reading this manual. Equipment coding is shown below.



2 - 2 Names of Parts

(1) Chamber Front

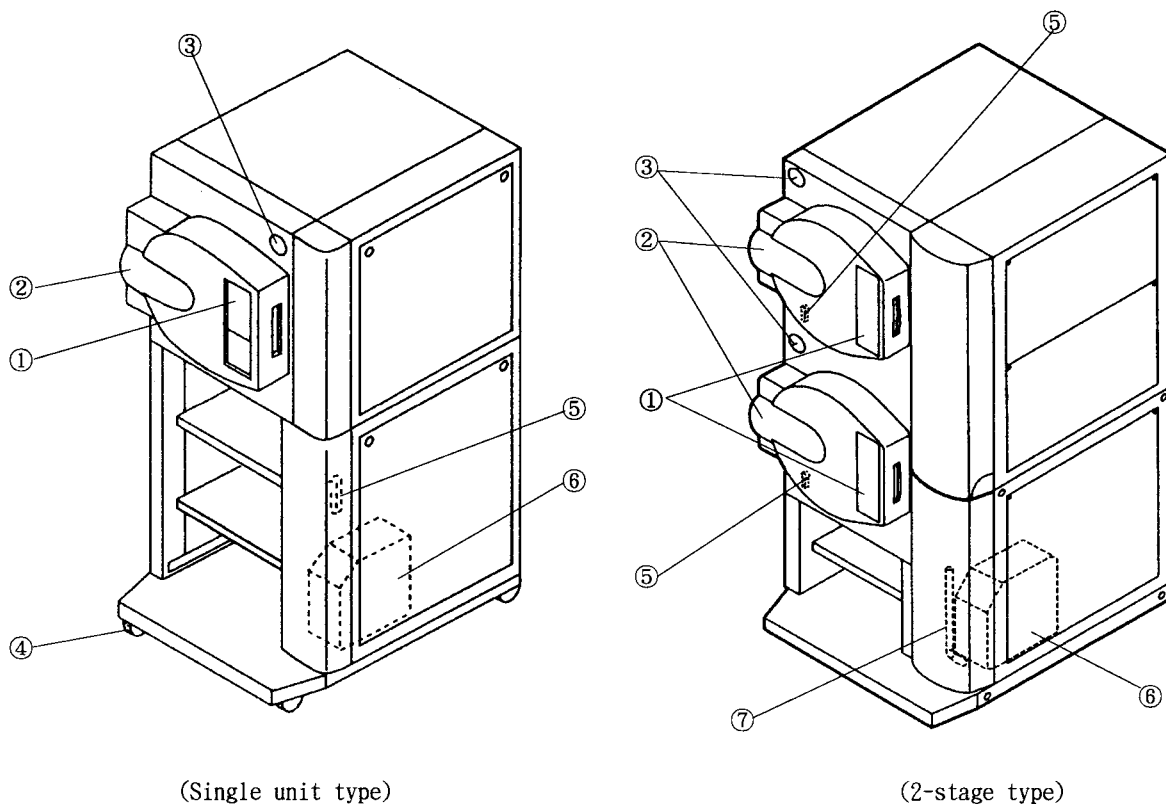


Fig. 2.1 Chamber front

- | | |
|--------------------------------|--|
| ① Operating panel | For setting and displaying test conditions (temperature, humidity and time).
Lock/Unlock the chamber door from this panel. |
| ② Door | Open to load/unload specimens. |
| ③ Pressure gauge | Indicates pressure inside the chamber. Pressure is given as gauge pressure.
The absolute pressure is needle reading plus 0.1 MPa. |
| ④ Caster with stopper | Used to move and anchor the chamber. |
| ⑤ Manual drain valve | Use to drain humidifying water (i.e.: When cleaning inside the chamber). |
| ⑥ Water tank | Holds pure water used for humidifying test area atmosphere. |
| ⑦ Drain hose
(2-stage type) | Doubles as a water level gauge and drain hose. |

(2) Chamber Rear

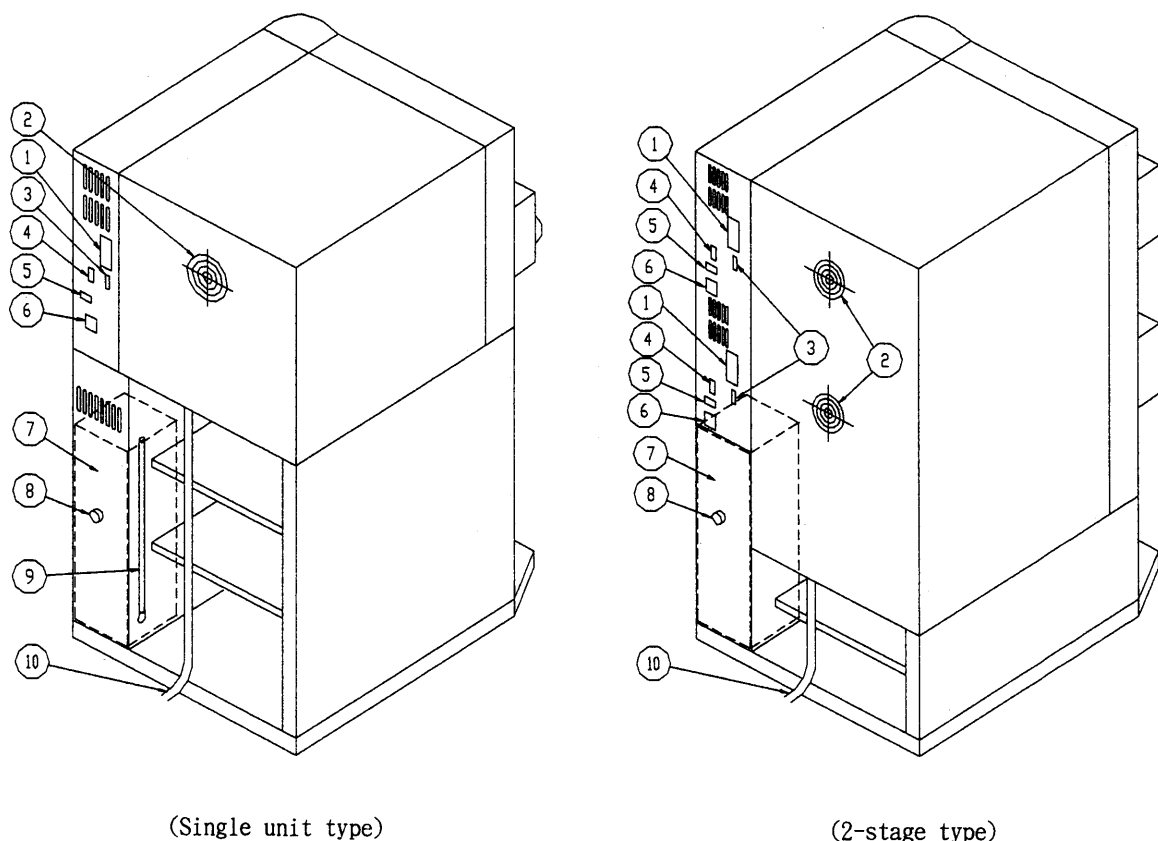


Fig. 2.2 Chamber rear

- | | |
|---------------------------------------|--|
| ① Communication port | Connect an external PC to this port for RS-485 communication (RS-232C or E-BUS (Excluding 230V AC chambers) communication is optional.). |
| ② Cooling fan | Ventilates the control console to prevent overheating. |
| ③ Recorder output terminal (Option) | Connect a recorder here to read temperature, humidity and pressure signals from the chamber. |
| ④ Recorder power supply port (Option) | Use as a power supply port for optional recorders. |
| ⑤ Integrating hour meter | Counts chamber running time. |
| ⑥ Leakage breaker | Shuts OFF power supply to the chamber when current equal to or higher than the rated current is supplied to the chamber or if current leaks. |
| ⑦ Drainage tank | This is where humidifying water and steam drained from the chamber are collected and cooled. |
| ⑧ Overflow hole | Connect a drainage system here. The connection requires the included hose nipple. |
| ⑨ Drain hose (for single unit type) | Doubles as a water level gauge and drain hose. |
| ⑩ Power cable | |

(3) Test Area

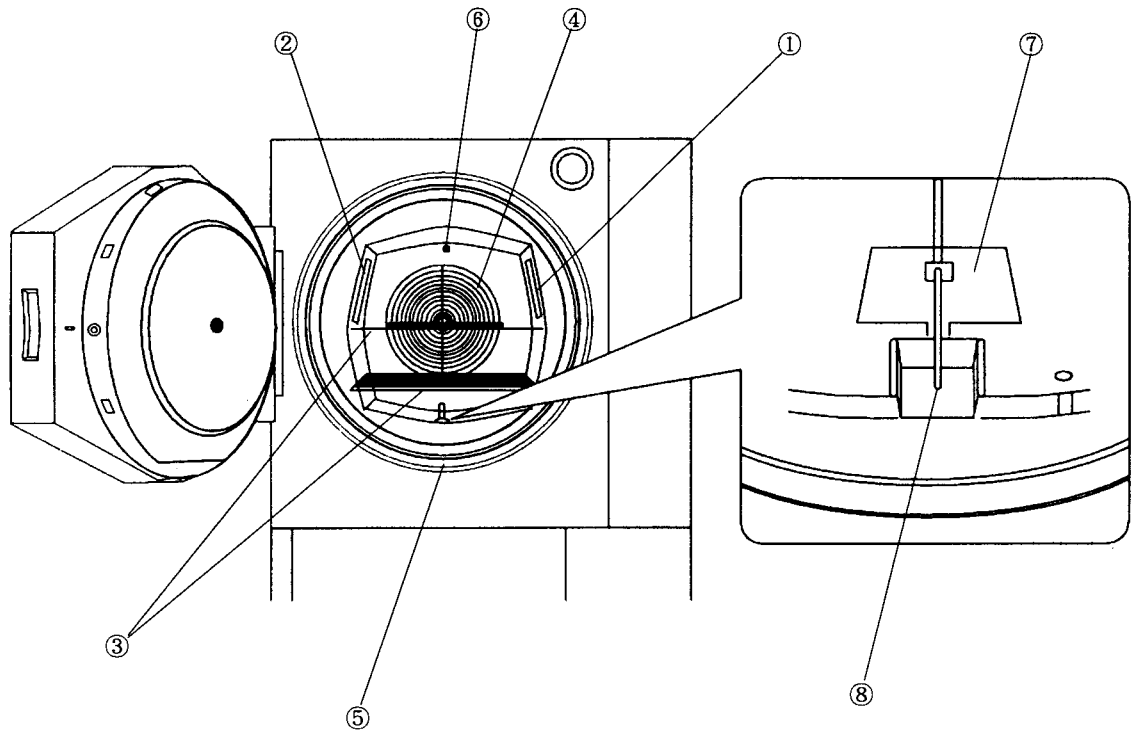


Fig. 2.3 Test area

- | | |
|--|--|
| ① Inner cylinder | This is where specimens are loaded. The ceiling is arched to prevent condensation from dripping on specimens. |
| ② Specimen signal terminals (Inside) | For charging specimens inside the chamber or sending signals. The terminals are connected to terminal outside the chamber. |
| ③ Shelf | Holds up to 3 kg of specimens. The chamber comes with two shelves. |
| ④ Air-circulating fan | Circulates air inside the chamber so as to keep temperature and humidity constant. |
| ⑤ Door packing | Ensures the chamber is airtight. |
| ⑥ Chamber temperature sensor | Detects temperature inside the chamber. |
| ⑦ Drain filter cover | Remove to clean the drain filter. |
| ⑧ Wet-bulb temperature sensor (For M-type chambers only) | Used in the DRY & WET BULB temperature control mode. Before use, always check the sensor is wrapped with a cloth wick. |

(4) Top Operating Panel (Controller)

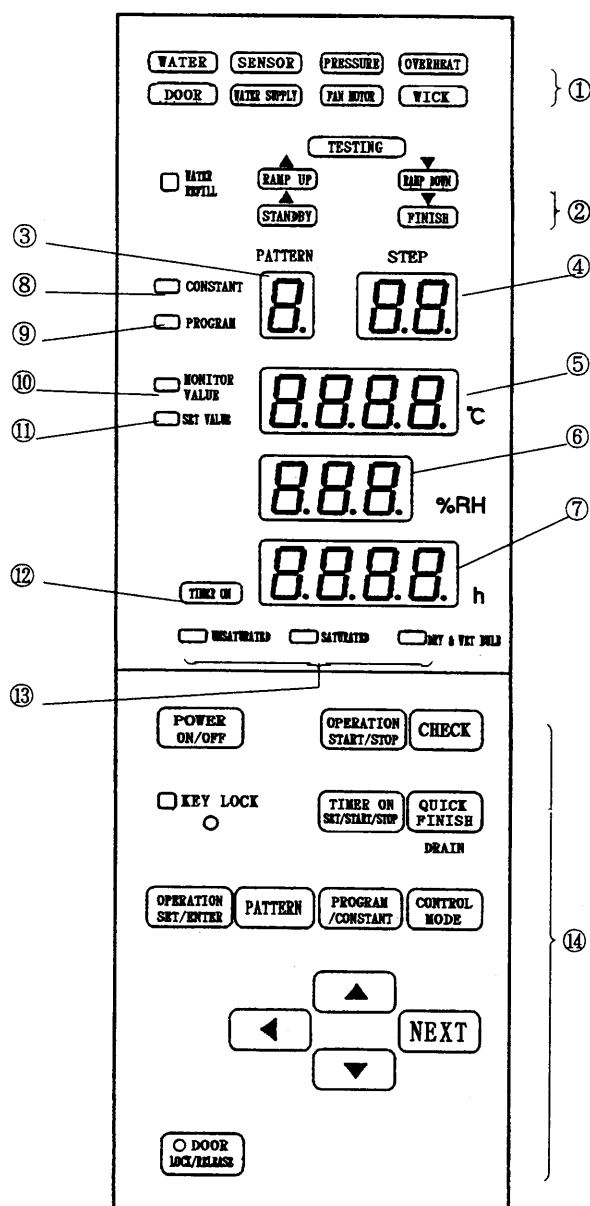


Fig. 2.4 Top operating panel

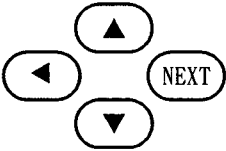
① Alarm lamps

The alarm lamps light up when trouble occurs with the chamber.

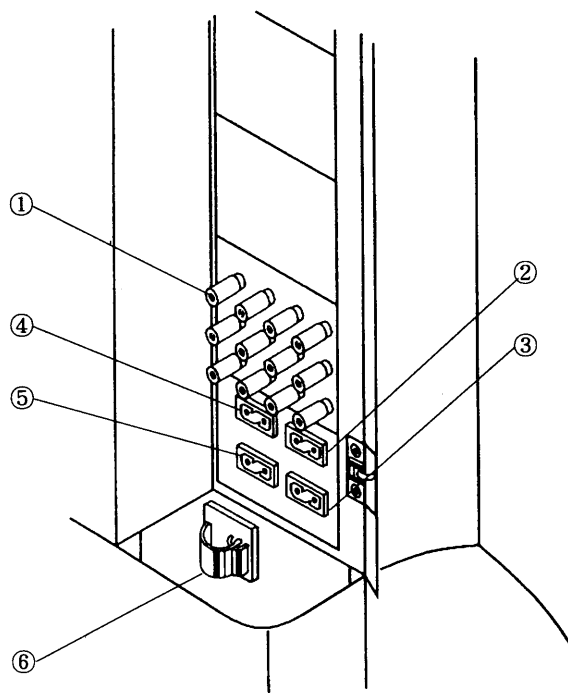
- 1) [WATER] Lights up when water level in the water tank is low.
- 2) [SENSOR] Lights up when a temperature sensor is disconnected or when there is an open circuit in sensor wiring.
- 3) [PRESSURE] Lights up when pressure inside the chamber is too high.
- 4) [OVERHEAT] Lights up when the chamber overheats on the inside or when the boil-dry alarm is triggered.
- 5) [DOOR] Lights up when trouble occurs with the door lock.
- 6) [WATER SUPPLY] Lights up when the water supply alarm is triggered.

- 7) FAN
MOTOR Lights up when the fan/motor rotation alarm is triggered.
 - 8) WICK Lights up when the wet-bulb wick is dry (For M-type chambers only).
- ② Test process lamps The process lamps light to indicate chamber status during testing.
- 1) WATER
REFILL Flashes while water is being supplied to the chamber.
Water is automatically supplied to the chamber when the OPERATION START/STOP key is pressed. The lamp goes out when the tank is full.
 - 2) STANDBY Lit while the chamber is on standby. The lamp flashes while the chamber door is unlocked but lights up when the door is locked.
 - 3) RAMP UP Lit while the conditions inside the chamber rise from the standby state to the set temperature, humidity and pressure.
 - 4) TESTING Lit while testing is in progress. The lamp initially lights up after the set temperature, humidity and pressure have all been attained and testing has started.
 - 5) RAMP DOWN Lights up after testing is complete and stays lit while temperature, humidity and pressure are being returned to safe levels. (With M-type chambers, the lamp is lit during keeping.)
 - 6) FINISH Lights up when all test cycles have ended.
- ③ PATTERN No. display Displays the pattern No. in each control mode.
- ④ STEP No. display Displays the step No. in the dry & wet-bulb temperature control mode (For M-type chambers only).
- ⑤ Temperature display Displays the temperature monitored inside the chamber or the temperature setting. Also, when trouble occurs, an error code is displayed here.
- ⑥ Humidity display Displays the humidity monitored inside the chamber or the humidity setting. Also, when trouble occurs, an error code is displayed here.
- ⑦ Time display Displays the time remaining until the current step finishes or the test time setting. Also, in the auto start timer mode, it displays the time remaining until testing starts or the auto start time setting.
- ⑧ Constant mode lamp
- ⑨ Program mode lamp
- ⑩ Monitor displayed lamp
- ⑪ Setting displayed lamp
- ⑫ Timer running lamp
- ⑬ Control mode lamps These lamps light up when the corresponding mode is selected. The DRY & WET BULB temperature control mode is for M-type chambers only.

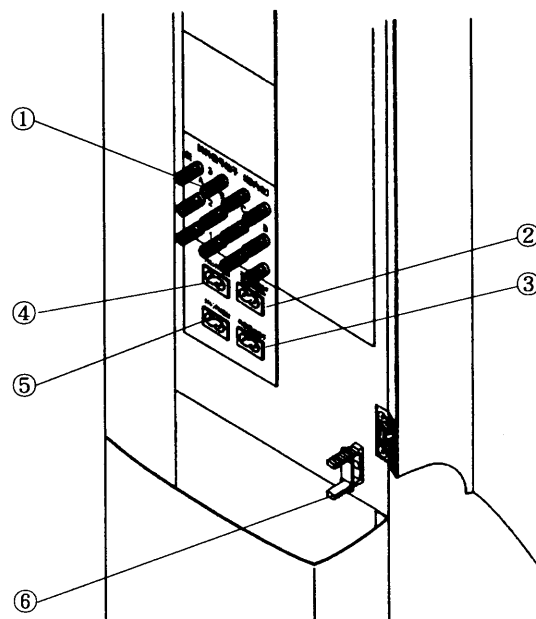
⑭ Operation keys

- (a) **POWER ON/OFF** Turns power supply to the chamber ON/OFF.
- (b) **OPERATION START/STOP** Starts/Stops testing.
- (c) **CHECK** Displays test settings while testing is in progress. Normally, monitored values are displayed. Settings are displayed for the duration this key is held down only.
- (d) **TIMER ON SET/START/STOP**
- (e) **QUICK FINISH** Use to suspend testing in progress.
- (f) **OPERATION SET/ENTER**
- (g) **PATTERN** Use to set pattern No. in each of the control modes.
- (h) **PROGRAM/CONSTANT** Switches between the program and constant mode.
- (i) **CONTROL MODE** Use to select control mode. The DRY & WET BULB temperature control mode is for M-type chambers only.
Use to set temperature, relative humidity, testing time and auto start time.
- (j) 
 - 1) The **NEXT** key switches between the temperature, humidity and time settings in the given order. The display flashes when active. The setting can be changed only while the display is flashing.
 - 2) The **▲** key increases the setting.
 - 3) The **▼** key decreases the setting.
 - 4) The **◀** key shifts to the next highest digit in the currently active display.
- (k) **DOOR LOCK/RELEASE**
- (1) **KEY LOCK key and lamp** Locks/Unlocks keys. Locking keys protects test conditions against accidental changes. The lamp is lit while keys are locked.

(5) Bottom Operating Panel (Terminals)



(Single unit type)



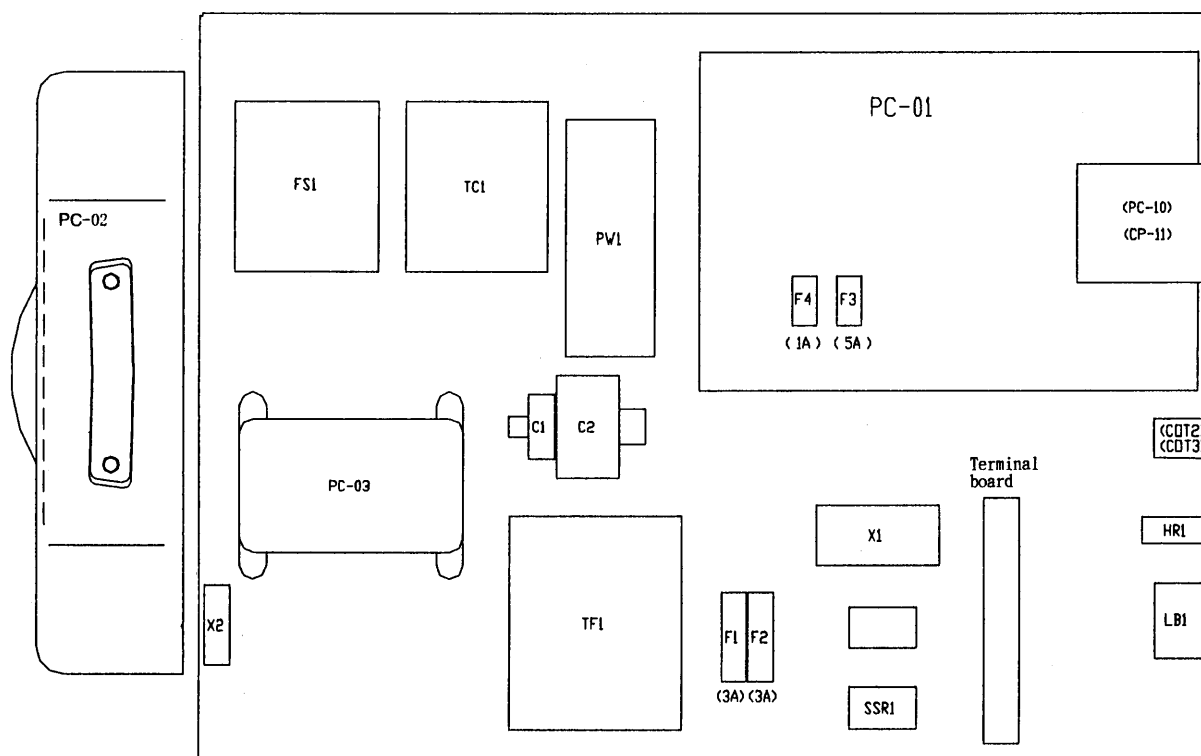
(2-stage type)

Fig. 2.5 Bottom operating panel

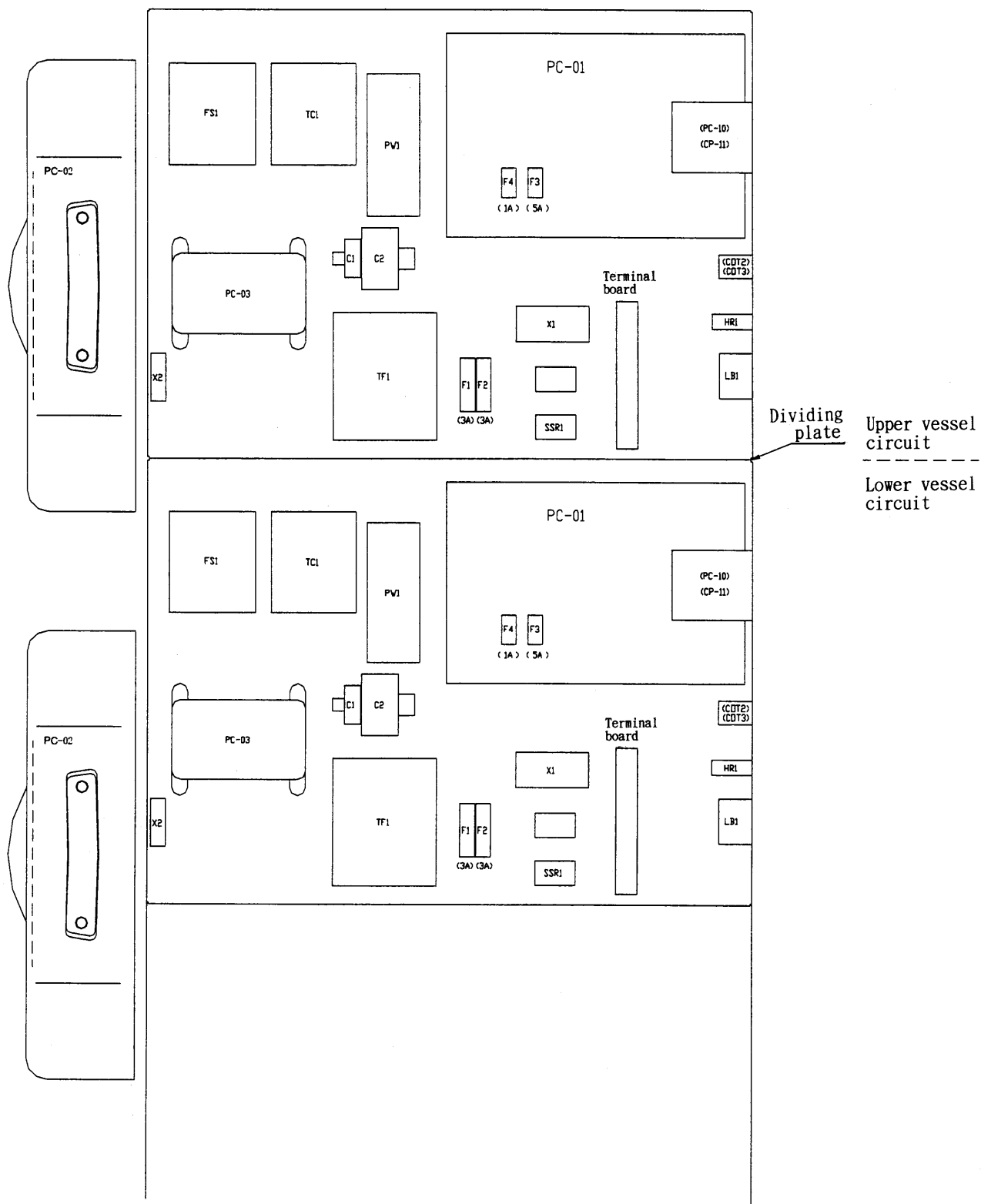
- | | |
|--|---|
| ① Specimen signal terminals (Outside)
(Max. 125V AC, 1A) | For charging specimens inside the chamber or sending signals.
The terminals are connected to terminal points inside the chamber. |
| ② Specimen power supply control terminal
(Max. 125V AC, 1A) | Always use this terminal to charge specimens. |
| ③ External alarm terminal
(Max. 125V AC, 1A) | Use as a contact for sending alarm signals to an external point. |
| ④ Time signal contact No. 1 (Option) | } For turning signals ON/OFF on a step-by-step basis. |
| ⑤ Time signal contact No. 2 (Option) | |
| ⑥ Cable clamp (Included) | Use to bundle signal wires connected to the outside specimen signal terminals. |

(6) Electric Parts Chassis

* See the parts list in the electric circuit diagram.



(Single unit type)



(2-stage type)

(7) I/O Board (PC-01) Terminal Board Signals

Terminal Borad (TB3, Input)

Upper	Lower	Upper	Lower
50	51	GND2	Overheat
50	52	GND2	Boil-dry
50	53	GND2	Overpressure
50	54	GND2	Door open limit position
50	55	GND2	Door closed
50	56	GND2	Door open
50	57	GND2	Door unlocked
50	58	GND2	Door locked
50	59	GND2	Humidifying water level

Terminal Borad (TB4, Input)

50	60	GND2	Water tank level
50	61	GND2	(Not in use)
50	62	GND2	(Not in use)
50	63	GND2	(Not in use)
50	64	GND2	(Not in use)
50	65	GND2	(Not in use)
50	66	GND2	(Not in use)
50	49	GND2	+12V
50	49	GND2	+12V

Terminal Borad (TB1, Output)

Upper	Lower	Upper	Lower
23	23	Exhaust valve open	
24	20	Exhaust valve closed	0V AC
91	20	Drain valve	0V AC
92	20	Drain valve	0V AC
93	94	Water/Air supply valve	Water/Air supply valve
95	96	Overflow valve	Overflow valve
22	20	Cooling fan	0V AC
30	20	Heater shut-off relay	0V AC
31	20	Water pump	0V AC
32	20	Air pump	0V AC
33	33	Door unlocked	Condenser (C2)
34	34	Door locked	Condenser (C2)

Terminal Borad (TB2, Input)

35	20	PS2	0V AC
35	20	PS2	0V AC
36	20	Not in use	0V AC
22	20	100V AC	0V AC
22	20	100V AC	0V AC
22	22	100V AC	100V AC
38	20	Chamber heater (H3)	0V AC
38	20	Chamber heater (H4)	0V AC
19	20	100V AC	0V AC
41	42	Specimen power supply control terminal	Specimen power supply control terminal
43	44	Contact output 1 (OP)	Contact output 1 (OP)
81	82	Contact output 2 (OP)	Contact output 2 (OP)

2 – 3 Operation Tables

(1) Normal Operation

EHS-XX1 (M) operation matrix (Normal operation)

ON: Normally ON, OFF: Normally OFF, -: Continued operation, C: Control depends on operating state.

	Heater shut-off relay	Chamber heater	Humidifying heater	Chamber heater	Exhaust motor valve	Drain motor valve	Air/Water supply valve	Overflow valve	Water pump	Air pump	Door motor	Power supply control terminal	External alarm terminal	Remarks
Breaker in ON position Breaker in OFF position	X1	H1	H2	H3	MV1	MV2	MV3	MV5	WP1	AP1	M1			
	OFF	OFF	OFF	OFF	OFF	OFF	CLOSE	CLOSE	OFF	OFF	OFF	OFF	OFF	
	OFF	OFF	OFF	OFF	OFF	OFF	CLOSE	CLOSE	OFF	OFF	OFF	OFF	OFF	
	ON	OFF	OFF	ON	OPEN	CLOSE	CLOSE	OPEN	OFF	OFF	-	OFF	-	
	ON	OFF	OFF	ON	OPEN	CLOSE	OPEN	OPEN	ON	OFF	-	OFF	-	
	ON	OFF	OFF	OFF	OPEN	CLOSE	CLOSE	OPEN	OFF	OFF	OFF	OFF	-	
	ON	OFF	OFF	ON	OPEN	CLOSE	CLOSE	OPEN	OFF	OFF	OFF	OFF	-	
	ON	C	C	C	OPEN→CLOSE	CLOSE	CLOSE	CLOSE	OFF	OFF	OFF	OFF	-	
	ON	C	C	C	CLOSE	CLOSE	CLOSE	CLOSE	OFF	OFF	OFF	ON	-	
	ON	OFF	OFF	OFF	CLOSE	CLOSE→OPEN	CLOSE	CLOSE	OFF	OFF	OFF	OFF	-	
	ON	OFF	OFF	OFF	OPEN	CLOSE	OPEN	OPEN	OFF	ON	-	OFF	-	
	ON	OFF	OFF	OFF	OPEN	CLOSE	CLOSE	OPEN	OFF	OFF	-	OFF	-	
	-	-	-	OFF	-	-	-	-	-	-	C	OFF	-	Locking/Unlocking enabled only when in STANDBY or FINISH processes
	-	-	-	OFF	-	-	-	-	-	-	C	OFF	-	
Remarks	OFF when alarm generated	Always OFF in saturated control mode		Always OFF in saturated control mode	CLOSED during ramp up or after bleeding air from the chamber	OPEN immediately after FINISH process	CLOSED during FINISH in saturated and dry & wet bulb temperature control modes			Always OFF in saturated and dry & wet bulb temperature control modes				

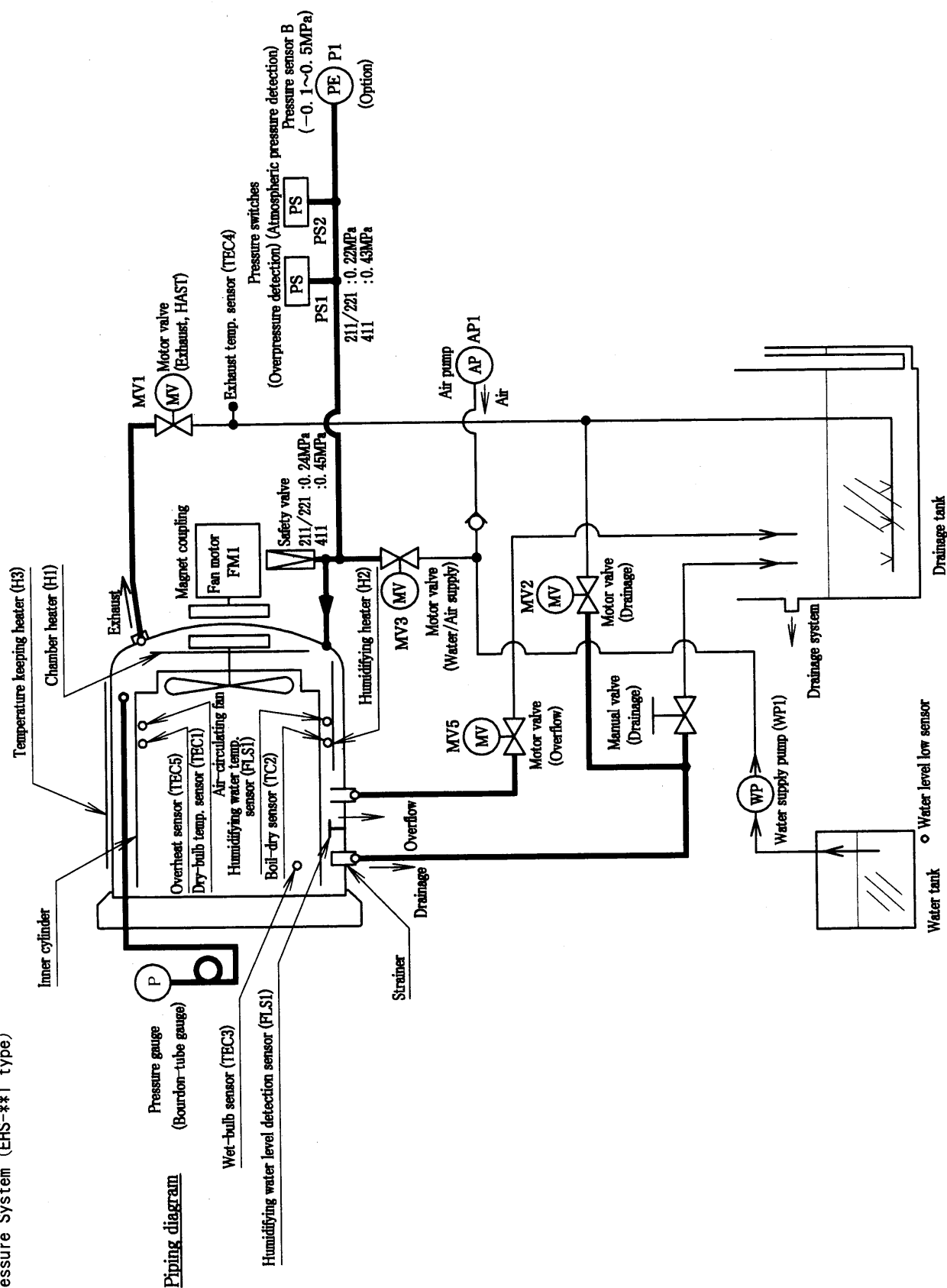
(2) Safety Device Operation

EHS-XX1 (M) (D) operation matrix (Safety device operation)

Trouble		Safety device operation (∴ Device held after trip.)								Reset condition	Indication
		All heaters	Exhaust valve	Drain valve	Air circulating fan	Water pump	Door motor	Specimen power supply control terminal	External alarm terminal		
1	Overheating ・Overheat protector (TC1) tripped.	OFF	・	・	・	・	・	OFF	ON	Latch-controlled	OVERHEAT lamp and temperature display flash. Alarm sounds.
	・Detected temperature is +10℃ or more higher than max. allowed temperature setting.	EHS-411 EHS-211, 221	172.2℃ 152.9℃								
2	Boil-dry ・Boil-dry protector (TC2) tripped.	OFF	・	・	・	・	・	OFF	ON	Latch-controlled	OVERHEAT lamp and humidity display flash. Alarm sounds.
	・Detected water temperature is +10℃ or more higher than max. allowed temperature setting.	EHS-411 EHS-211, 221	161.1℃ 142.9℃								
3	Power lost for 3 minutes or more	OFF	・	・	STOPPED	・	・	OFF	ON	Latch-controlled	Time display flashes. Alarm sounds.
4	Temperature sensor disconnected or open circuit	OFF	・	・	STOPPED	・	・	OFF	ON	Latch-controlled	"999" flashes on temperature display: Chamber temperature sensor is disconnected or circuit is open. "999" flashes on humidity display: Humidifying water temperature sensor is disconnected or circuit is open. "888" flashes on humidity display: Exhaust temperature sensor is disconnected or circuit is open. "777" flashes on humidity display: Wet-bulb temperature sensor is disconnected or circuit is open. (For M-type chambers only)
5	Abnormal pressure	OFF	OPEN	・	・	・	・	OFF	ON	Latch-controlled	PRESSURE lamp flashes. Alarm sounds.
6	Door opened during operation	OFF	OPEN	OPEN	・	・	・	OFF	ON	Latch-controlled	Process lamps flash. Alarm sounds.
7	Fan rotation trouble	・	・	・	・	・	・	・	・	Auto reset	FAN MOTOR lamp flashes. Alarm sounds.
8	Dry wet-bulb wick	・	・	・	・	・	・	OFF	ON	Latch-controlled	WICK lamp flashes. Testing continues.
9	Water supply trouble	・	・	・	・	STOPPED	・	OFF	ON	Latch-controlled	WATER SUPPLY lamp flashes. Alarm sounds. Time to cutoff point: EHS-211, 411(3 min. 30 sec.) EHS-221 (4 min. 30 sec.)
10	Door trouble	・	・	・	・	・	・	OFF	ON	Latch-controlled	DOOR lamp flashes. Alarm sounds. Error codes displayed on temperature display. "Err10": Cannot unlock door. "Err11": Cannot lock door. "Err12": Door limit switch trouble "Err13": Door was opened while locked.

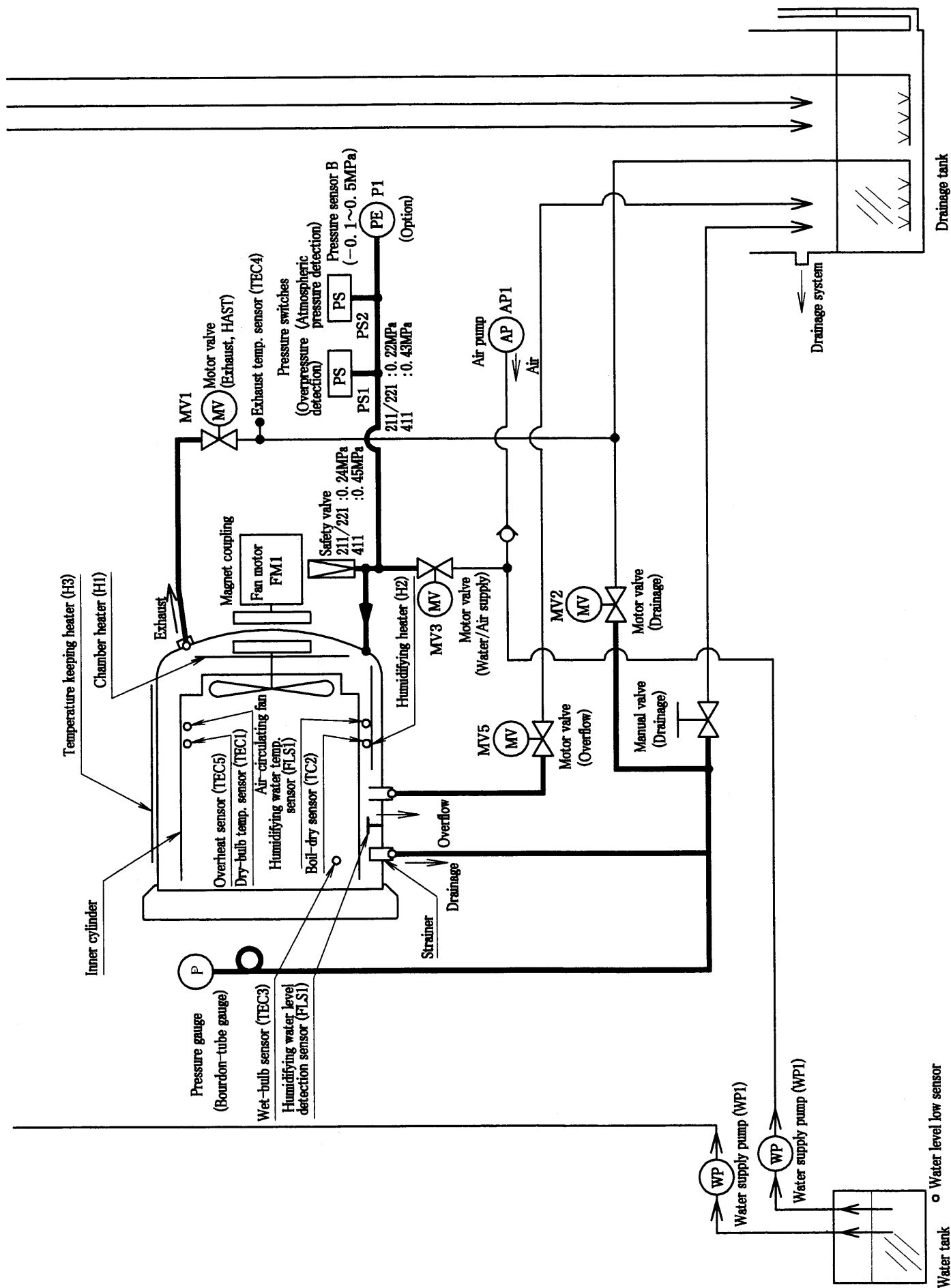
2 - 4 System Diagrams

(1)-1 Pressure System (EHS-#1 type)

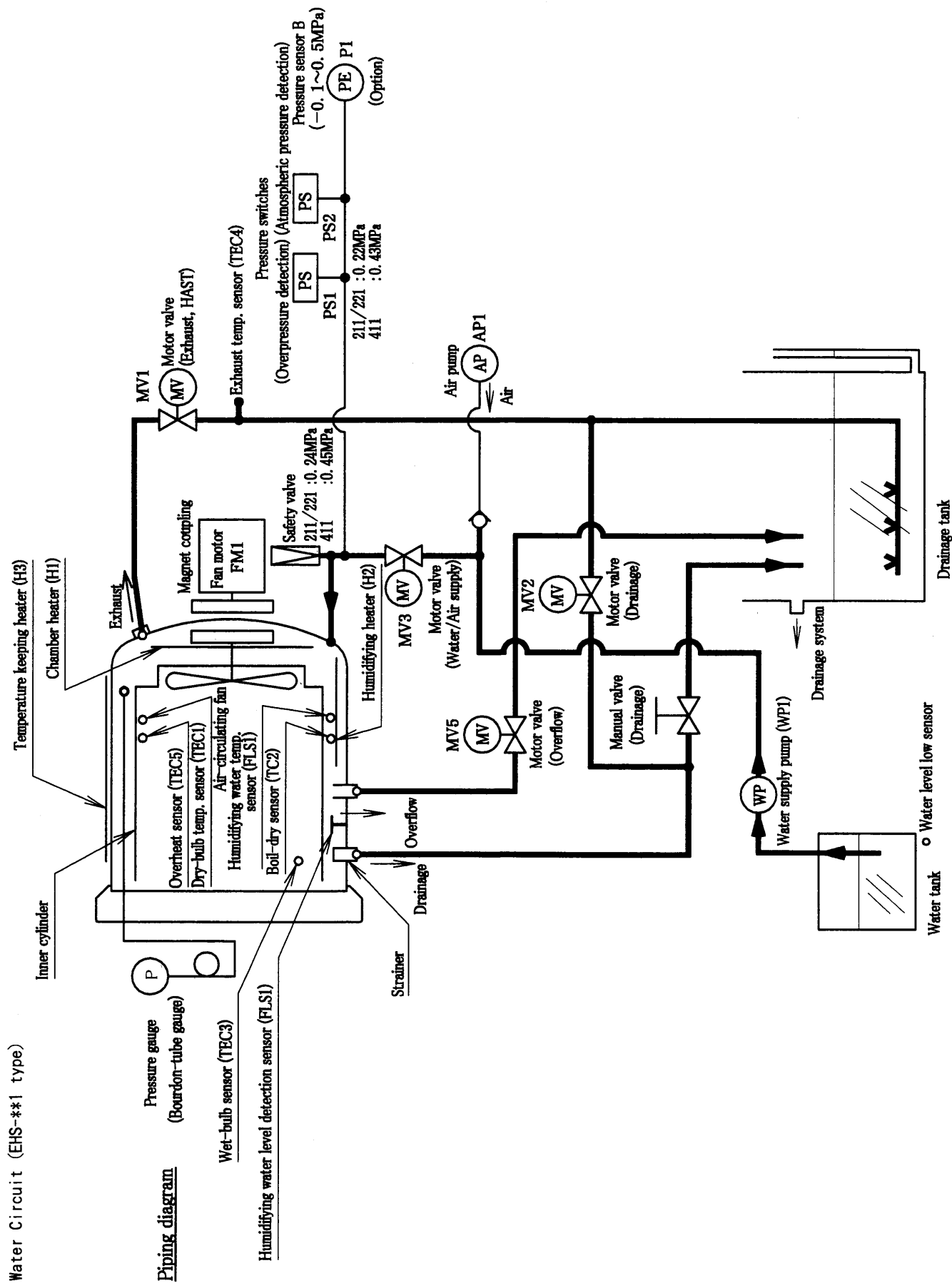


The diagram illustrates the piping system for the environmental test chamber. Key components and connections include:

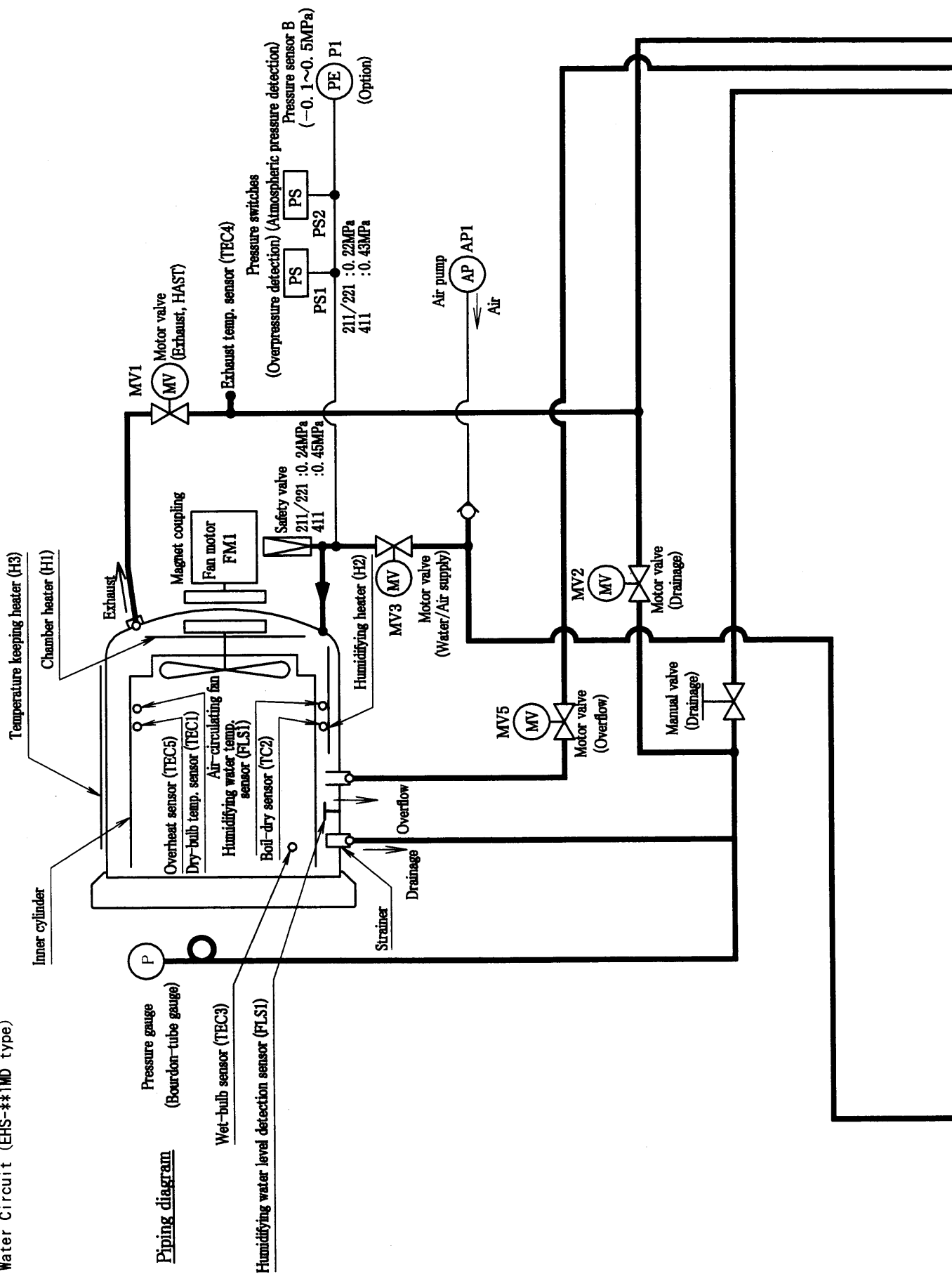
- Chamber Components:** Inner cylinder, Temperature keeping heater (H3), Chamber heater (H1), Exhaust, Overheat sensor (TEC5), Dry-bulb temp. sensor (TEC1), Air-circulating fan, Humidifying water temp. sensor (FLS1), Boil-dry sensor (TC2), Humidifying heater (H2), Strainer, Drainage, and Overflow.
- Pressure and Temperature Sensors:**
 - Pressure gauge (Bourdon-tube gauge) (P)
 - Wet-bulb sensor (TEC3)
 - Humidifying water level detection sensor (FLS1)
 - Exhaust temp. sensor (TEC4)
 - Pressure sensor B (-0.1 ~ -0.5 MPa) (PS)
 - Pressure sensor A (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor C (211/221 : 0.24 MPa / 411 : 0.45 MPa) (PS)
 - Pressure sensor D (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor E (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor F (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor G (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor H (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor I (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor J (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor K (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor L (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor M (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor N (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor O (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor P (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor Q (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor R (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor S (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor T (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor U (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor V (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor W (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor X (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor Y (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
 - Pressure sensor Z (211/221 : 0.22 MPa / 411 : 0.43 MPa) (PS)
- Valves and Actuators:**
 - Motor valve (Exhaust, HAST) (MV1)
 - Motor valve (Water/Air supply) (MV3)
 - Motor valve (Drainage) (MV2)
 - Motor valve (Overflow) (MV5)
 - Manual valve (Drainage)
- Other Components:**
 - Magnet coupling
 - Fan motor (FM1)
 - Safety valve (211/221 : 0.24 MPa / 411 : 0.45 MPa)
 - Air pump (AP1)



(2)-1 Water Circuit (EHS-**1 type)



(2)-2 Water Circuit (EHS-**1MD type)



2 - 5 Chamber Components

The test area is a hermetically-sealed pressure vessel. Pressure inside is maintained with steam. The steam is produced by the humidifying heater and is reheated inside the test area. A fan circulates the steam through and around the inner cylinder.

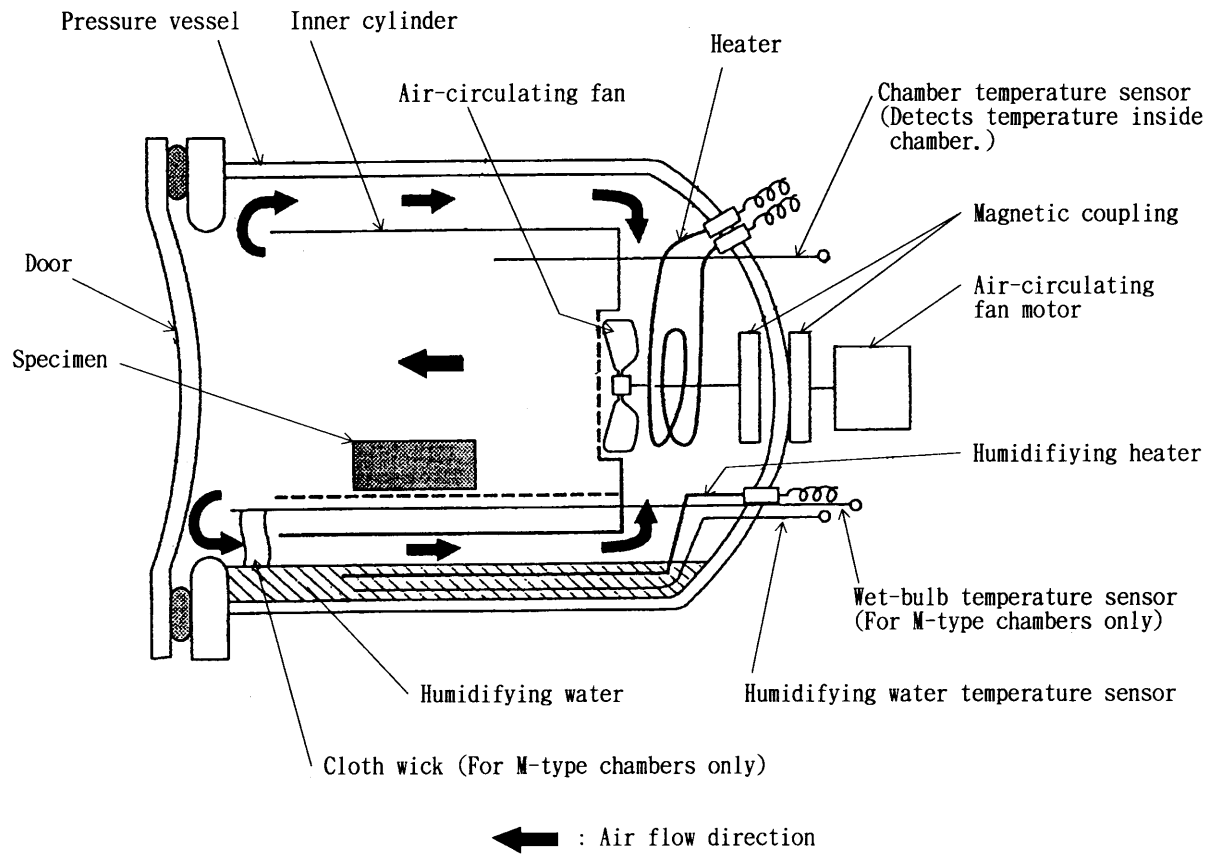


Fig. 2.6 Pressure vessel construction

Chapter 3 Troubleshooting

This chapter explains how to deal with troubles which occur during chamber operation.

Troubleshooting procedures are presented in flowchart form. Reference is made to specific parts, some of which may be of no importance to you depending on the model of chamber you are servicing and the options there included. To identify chamber model, see "Chapter 2 Chamber Construction".

To locate parts mentioned in this chapter, see "2-2 Names of Parts". Parts are located in slightly different positions depending on chamber model.



DANGER

- **BEFORE** unlocking the door, check pressure inside the chamber is 0 MPa.

If, for some reason, the chamber's safety devices are not working, the door might blow open, whereby releasing pressurized hot steam from the inside.



CAUTION

- Be careful of electric shock while troubleshooting.
- **HOT ON THE INSIDE!** Immediately after testing, the chamber is **HOT** on the inside (door gasket, test area walls and specimens).
Direct contact may result in burns.
Be careful when troubleshooting inside the chamber.

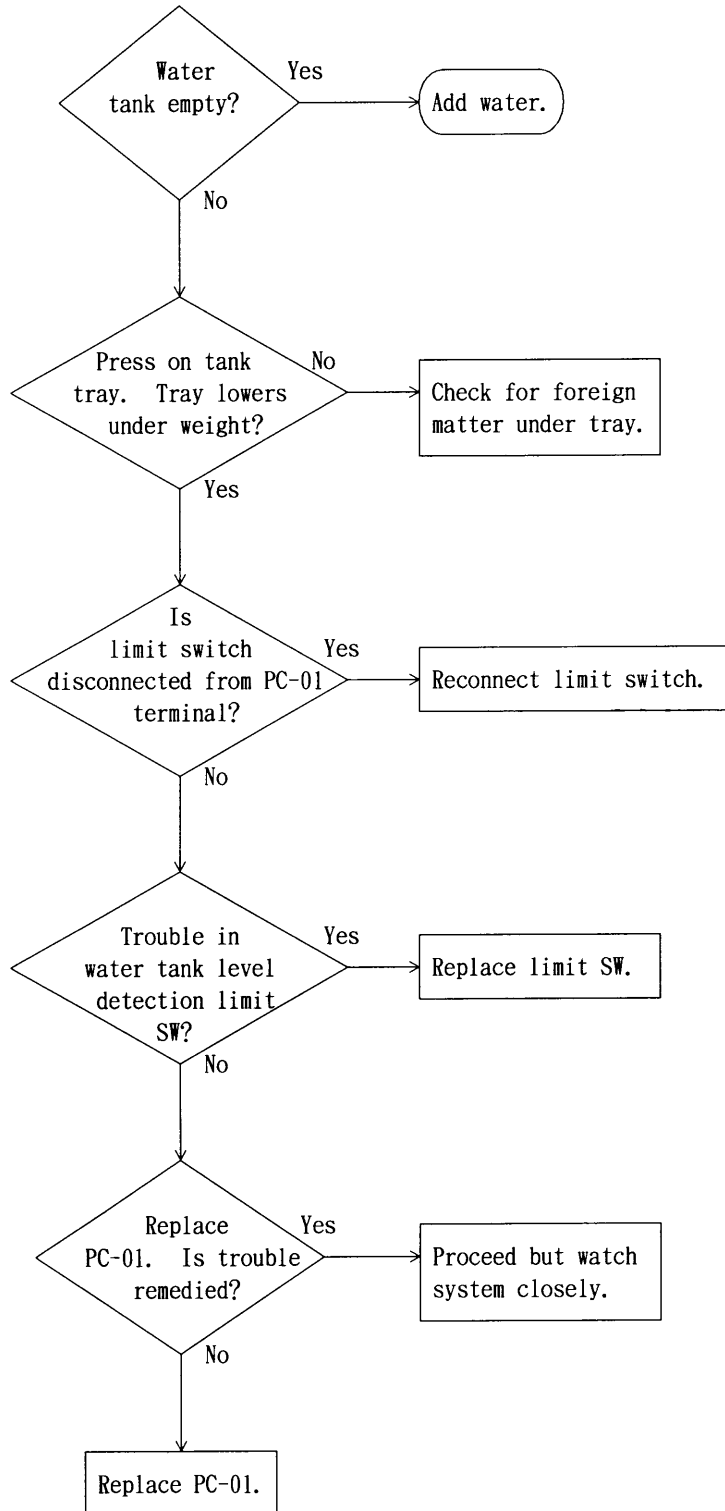
3 - 1 Troubles with Displayed Indications

Display lamp

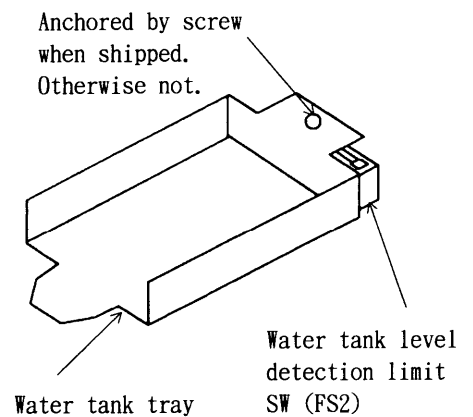
WATER

Water tank level is low.

【Notes】

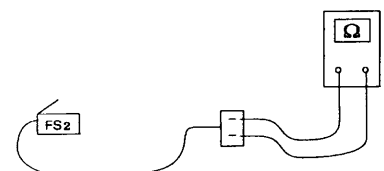


- The limit switch is on the rear of the tank tray. Water level is detected from the weight of the water in the tank.

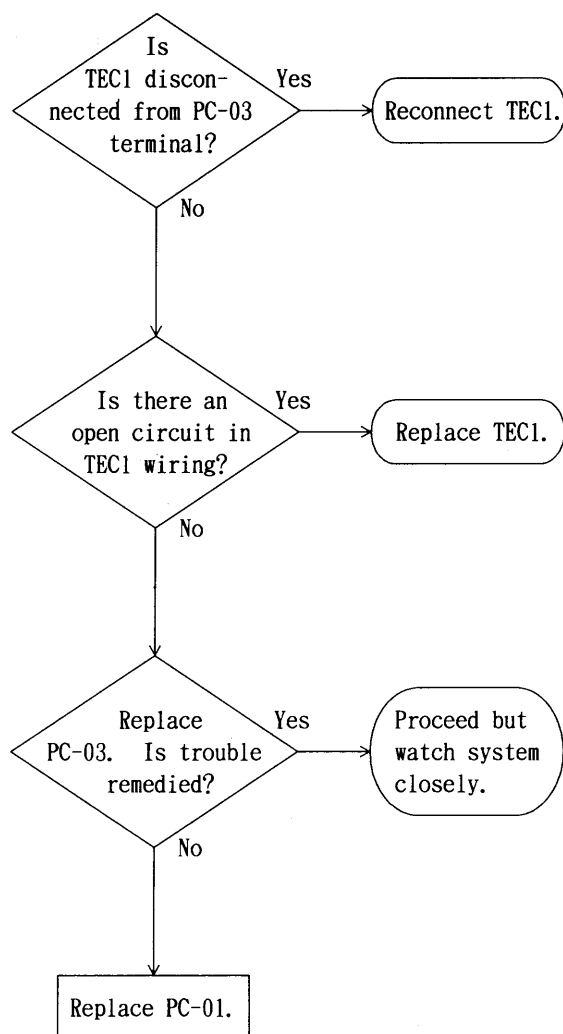


- If the water tank contains sufficient water, disconnect the limit SW relay terminal and check switch resistance.

Normal	Required resistance
	0 Ω



1. When "999.9" is flashing on the temperature display

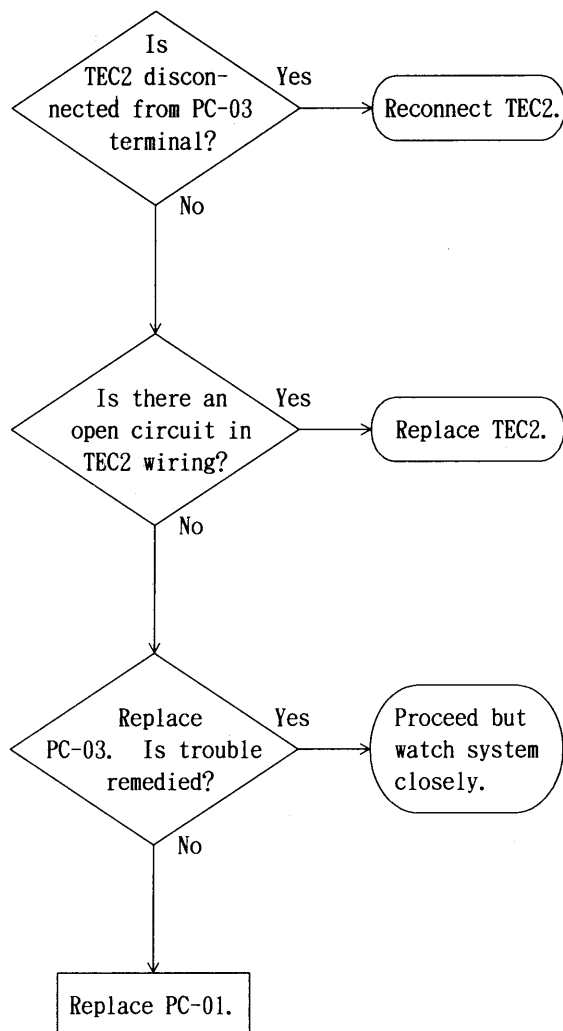


• The chamber temperature sensor (TEC1) is connected to the temperature-pressure detection unit (PC-03).

• Disconnect the TEC1 from PC-03 and measure resistance across $\oplus - \ominus$ of the sensor.

Terminal measured	Required resistance
TEC1 $\oplus - \ominus$	Approx. 10Ω

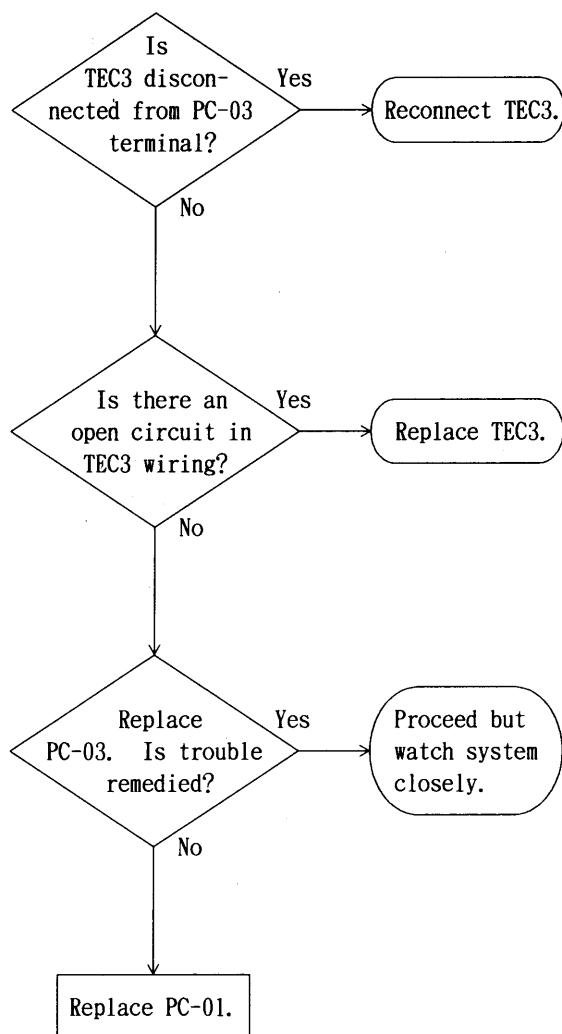
2. When "999" is flashing on the humidity display



• Disconnect the TEC2 from PC-03 and measure resistance across $\oplus - \ominus$ of the sensor.

Terminal measured	Required resistance
TEC2 $\oplus - \ominus$	Approx. 10Ω

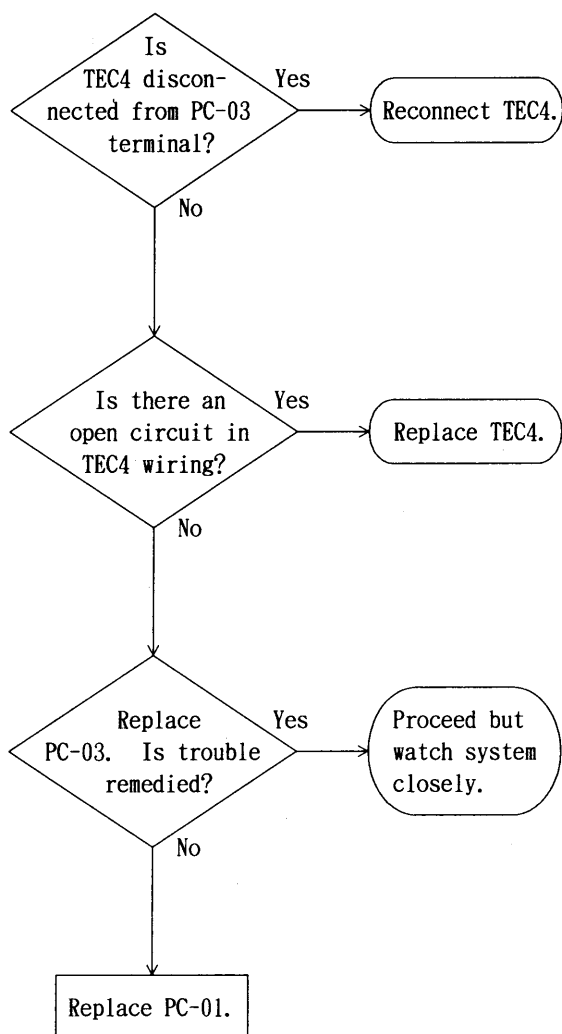
3. When "888" is flashing on the humidity display



- Disconnect the TEC3 from PC-03 and measure resistance across $\oplus - \ominus$ of the sensor.

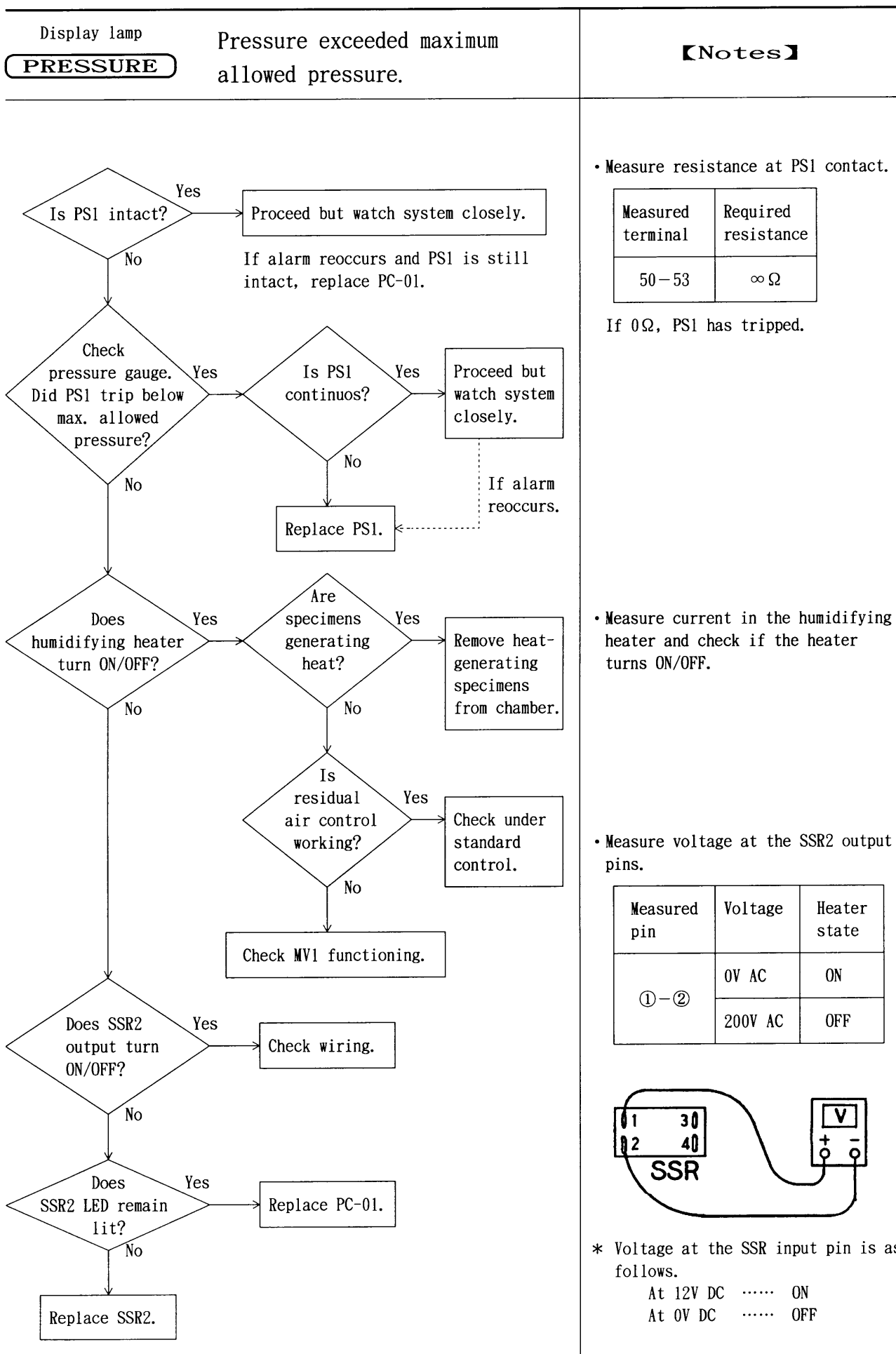
Terminal measured	Required resistance
TEC3 $\oplus - \ominus$	Approx. 10Ω

4. When "777" is flashing on the humidity display



- Disconnect the TEC4 from PC-03 and measure resistance across $\oplus - \ominus$ of the sensor.

Terminal measured	Required resistance
TEC4 $\oplus - \ominus$	Approx. 10Ω



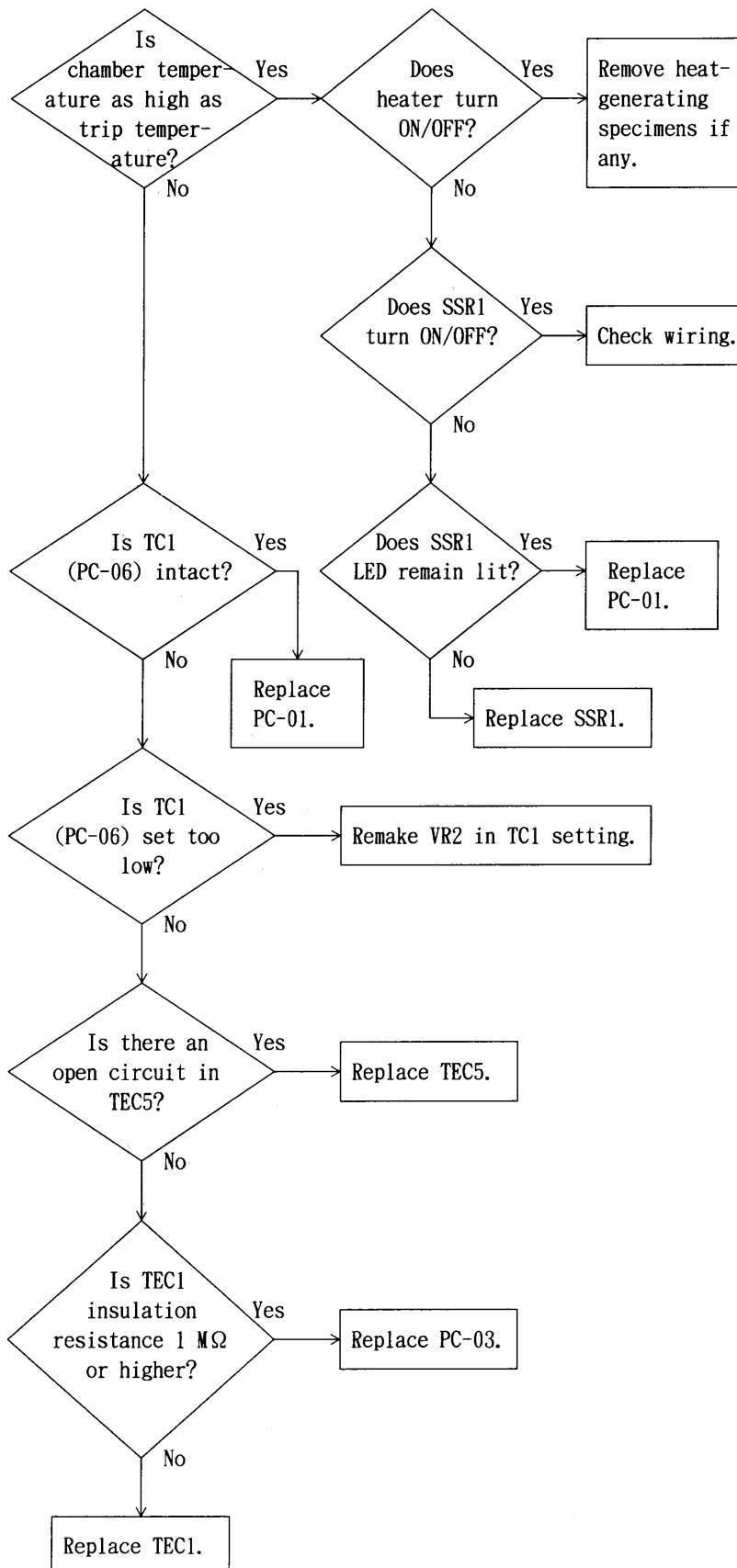
Display lamp

OVERHEAT

Overheat (Overwet) protector
has tripped. (1/2)

【Notes】

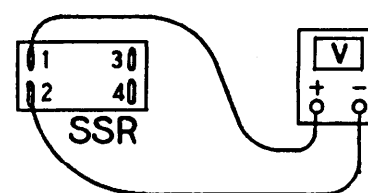
1. When the temperature display is flashing



- Overheat protector trip temperature
For EHS-211, 221 type: 160°C
For EHS-411 type: 180°C

- Measure voltage at the SSR1 output pins.

Measured pin	Voltage	Heater state
①-②	0V AC	ON
	200V AC	OFF



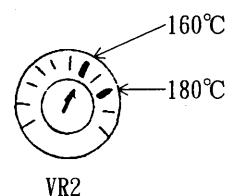
- *Voltage at the SSR input pin is as follows.

At 12V DC ON
At 0V DC OFF

- Measure resistance at the TC1 contact.

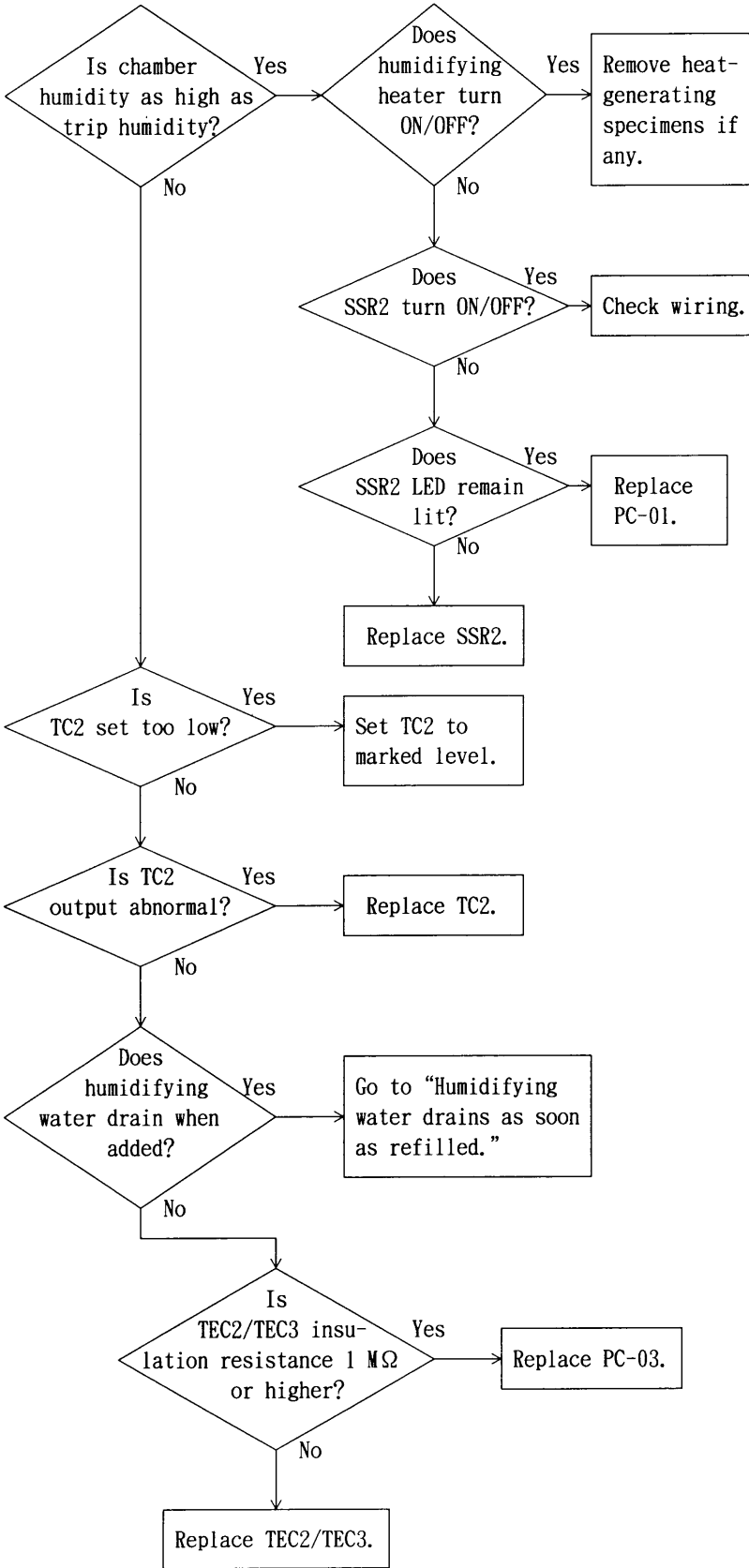
Measured pin	Required resistance
50-51	$\infty \Omega$

- VR2 setting for TC1



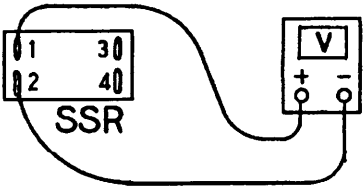
- Disconnect TEC1 from PC-03, and measure resistance in the sensor lead and protective tube.

2. When the humidity display is flashing



• Measure voltage at the SSR2 output pins.

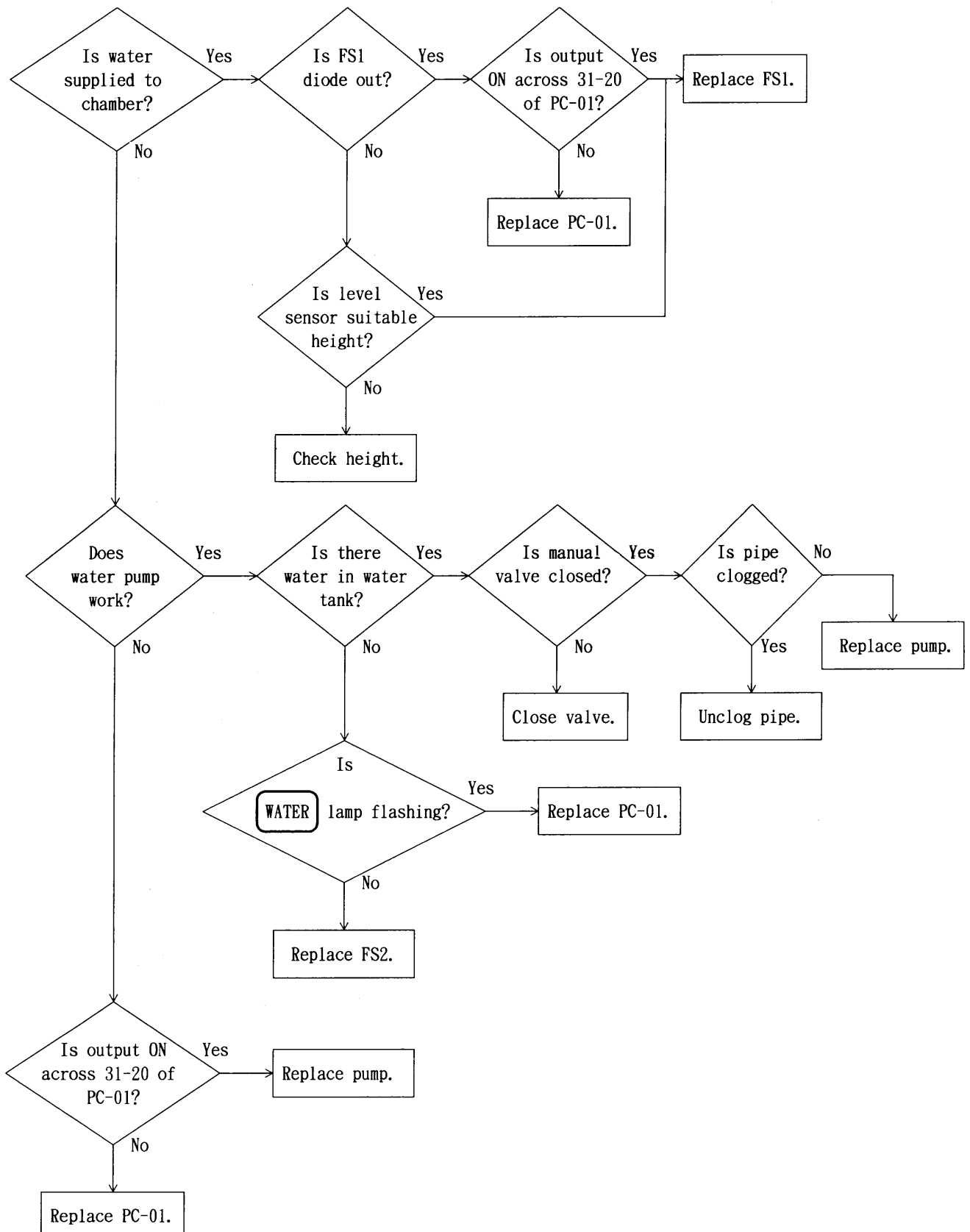
Measured pin	Voltage	Heater state
①-②	0V AC	ON
	200V AC	OFF



* Voltage at the SSR input pin is as follows.

At 12V DC ON
At 0V DC OFF

• Disconnect TEC2/TEC3 from PC-03, and measure resistance in the sensor lead and protective tube.

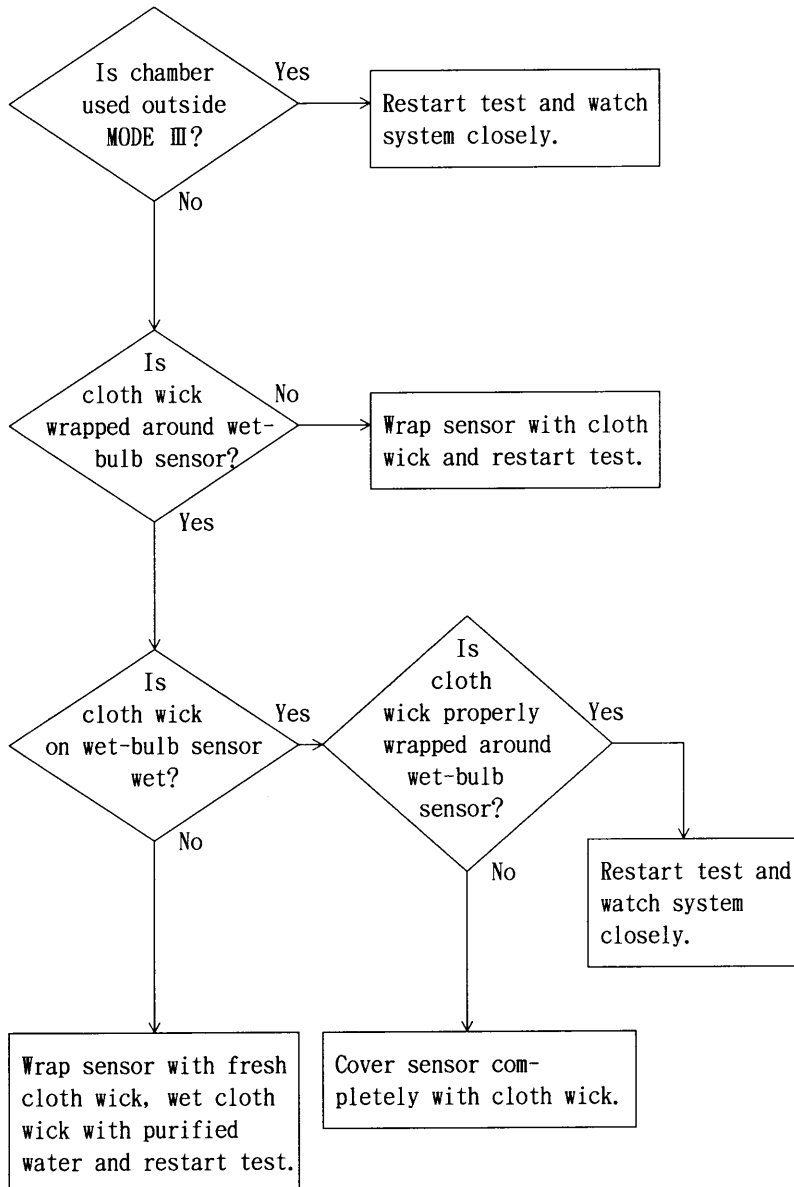


Display lamp

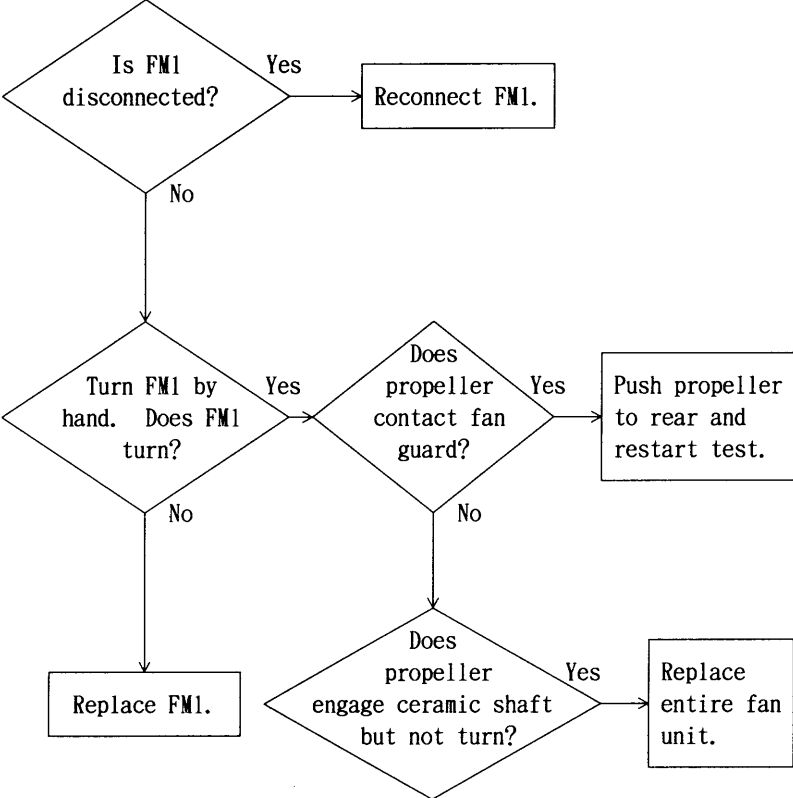
WICK

Wick is dry.

【Notes】



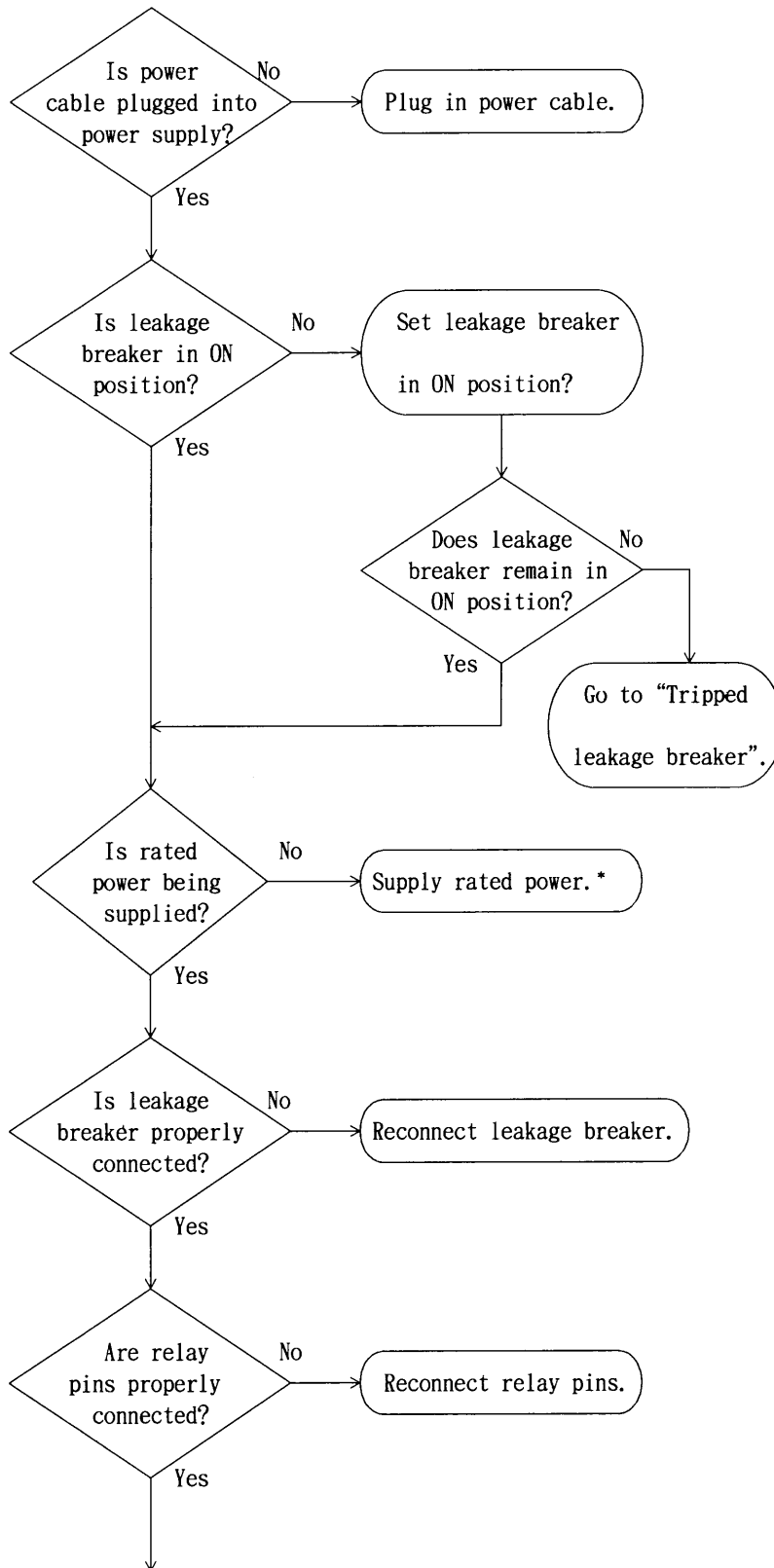
* The wet-bulb sensor should not be seen through gaps in the cloth wick. The cloth wick should also cover the sensor all the way to the rear.

Display lamp FAN MOTOR	Air-circulating fan rotation trouble	【Notes】
 <pre> graph TD Q1{Is FM1 disconnected?} -- Yes --> A1[Reconnect FM1.] Q1 -- No --> Q2{Turn FM1 by hand. Does FM1 turn?} Q2 -- Yes --> Q3{Does propeller contact fan guard?} Q2 -- No --> A2[Replace FM1.] Q3 -- Yes --> A3[Push propeller to rear and restart test.] Q3 -- No --> Q4{Does propeller engage ceramic shaft but not turn?} Q4 -- Yes --> A4[Replace entire fan unit.] </pre>		

3 - 2 Troubles without Displayed Indications

Chamber does not work when POWER ON/OFF key
is pressed. (1/2)

【Notes】



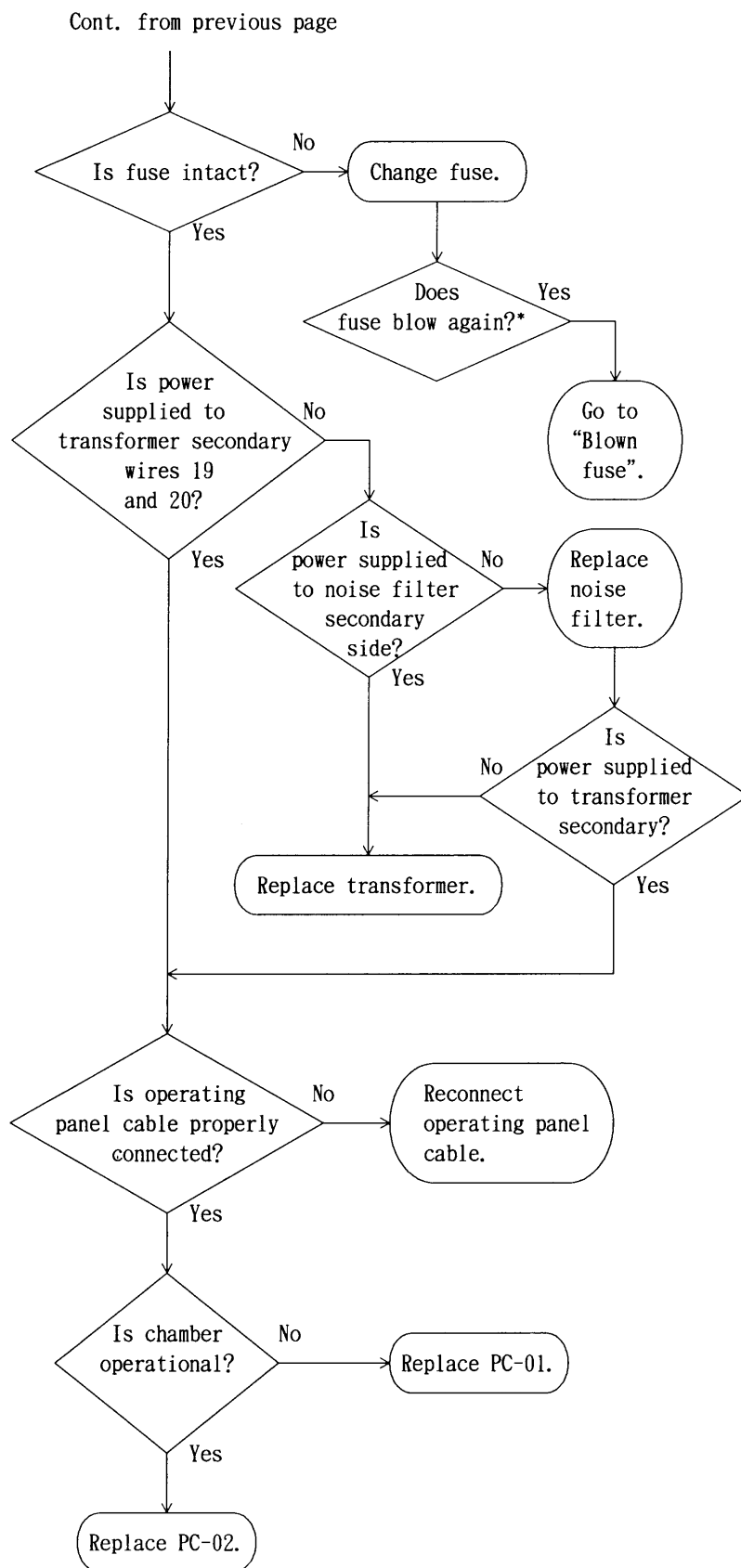
* Rated voltage $\pm 10\%$

Cont. on next page

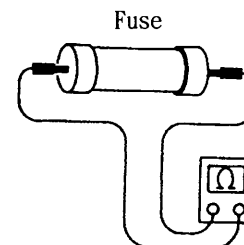
Chamber does not work when POWER ON/OFF key
is pressed.

(2/2)

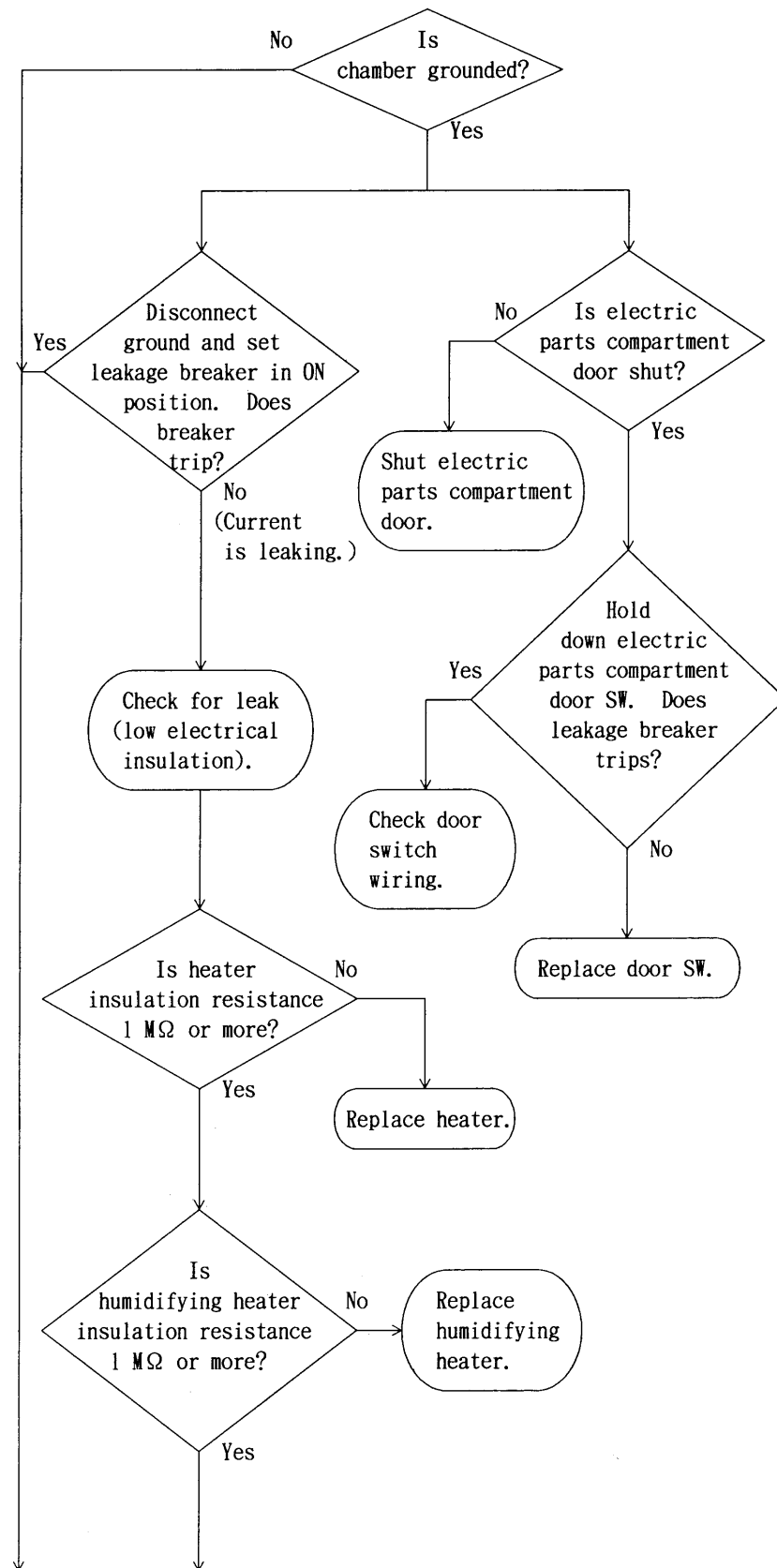
【Notes】



* 3A glass tube fuse



• The transformer secondary is 100V AC.

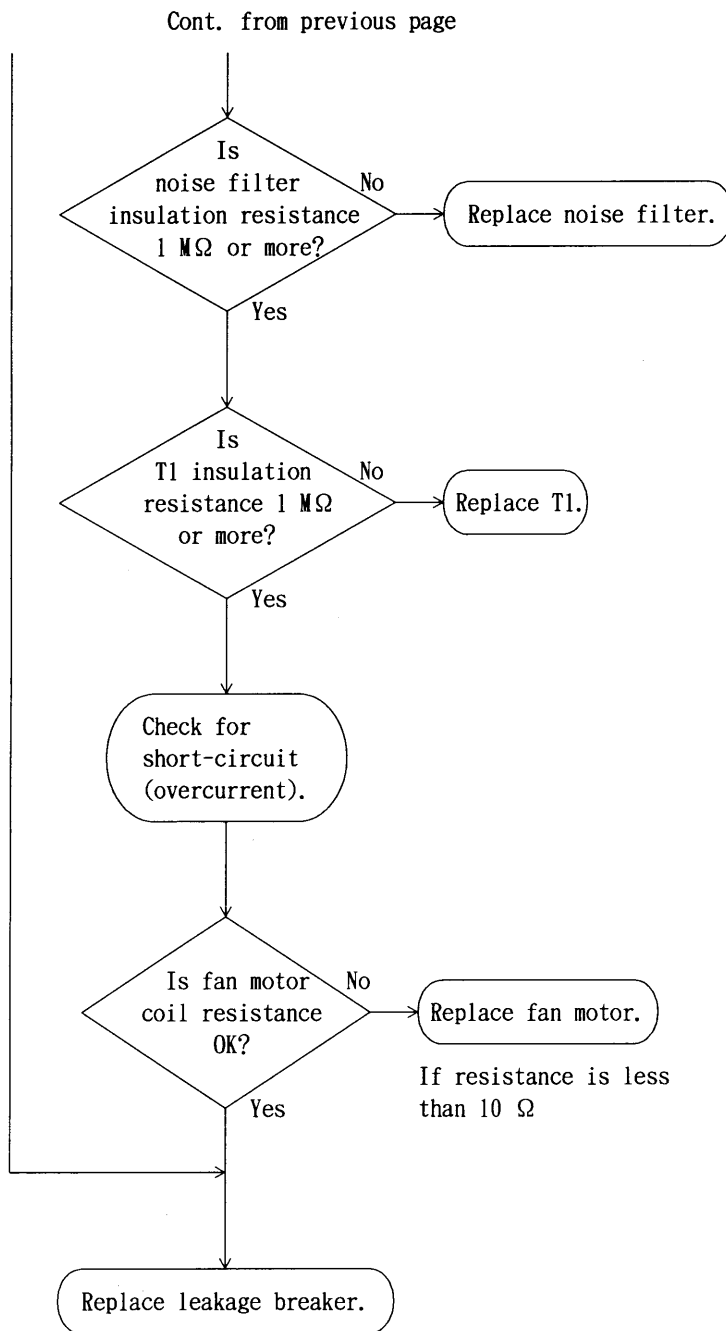


• Do not measure insulation resistance on circuit boards.

• Measure insulation resistance across wires Nos. 3, 4 and ground.

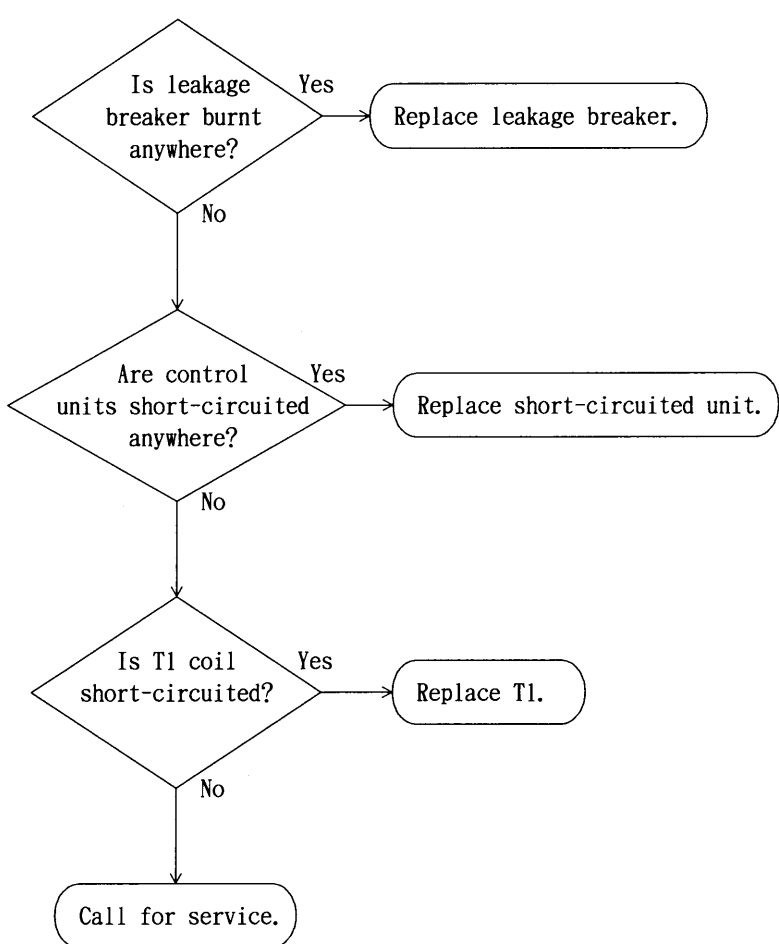
• Measure insulation resistance across wires Nos. 3, 5 and ground.

Cont. on next page



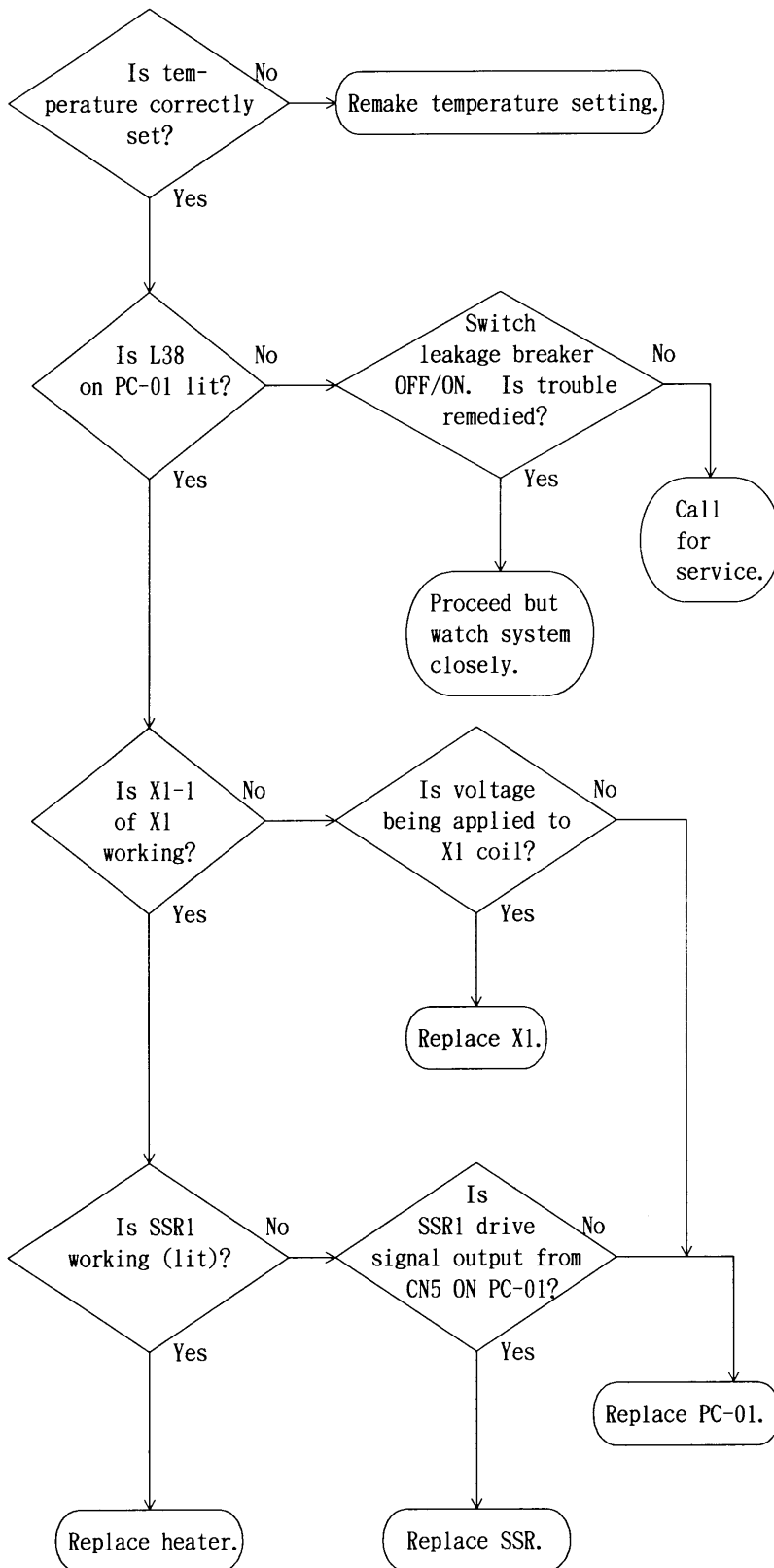
After replacing the leakage breaker, always perform a trip test. (Press the red button and check power supply is shut OFF.)

The above described trouble can lead to electric shock and/or equipment damage. If the trouble is not remedied by the above procedure, promptly call for service.

Tripped leakage breaker (2)	【Notes】										
 <pre> graph TD A{Is leakage breaker burnt anywhere?} -- Yes --> B(Replace leakage breaker.) A -- No --> C{Are control units short-circuited anywhere?} C -- Yes --> D(Replace short-circuited unit.) C -- No --> E{Is T1 coil short-circuited?} E -- Yes --> F(Replace T1.) E -- No --> G(Call for service.) </pre>	• Check pins are not loose or damaged. Check especially the following parts. <table border="0"> <tr> <td>I/O unit:</td><td>PC-01</td></tr> <tr> <td>Power unit:</td><td>PC-05</td></tr> <tr> <td>Overheat protector:</td><td>TC1</td></tr> <tr> <td>Noise filter:</td><td>LF1</td></tr> <tr> <td>Varistor:</td><td>V1</td></tr> </table>	I/O unit:	PC-01	Power unit:	PC-05	Overheat protector:	TC1	Noise filter:	LF1	Varistor:	V1
I/O unit:	PC-01										
Power unit:	PC-05										
Overheat protector:	TC1										
Noise filter:	LF1										
Varistor:	V1										

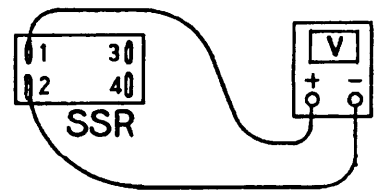
Temperature does not rise.

【Notes】



- Measure voltage at the SSR1 output pins.

Measured pin	Voltage	Heater state
①-②	0V AC	ON
	200V AC	OFF

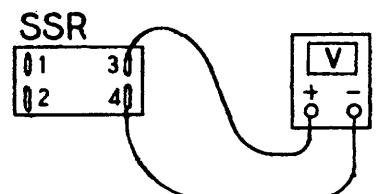


- Check the SSR1 drive signal is being output from the temperature-humidity controller.

Measure voltage at output pins 3 and 4 of SSR1.

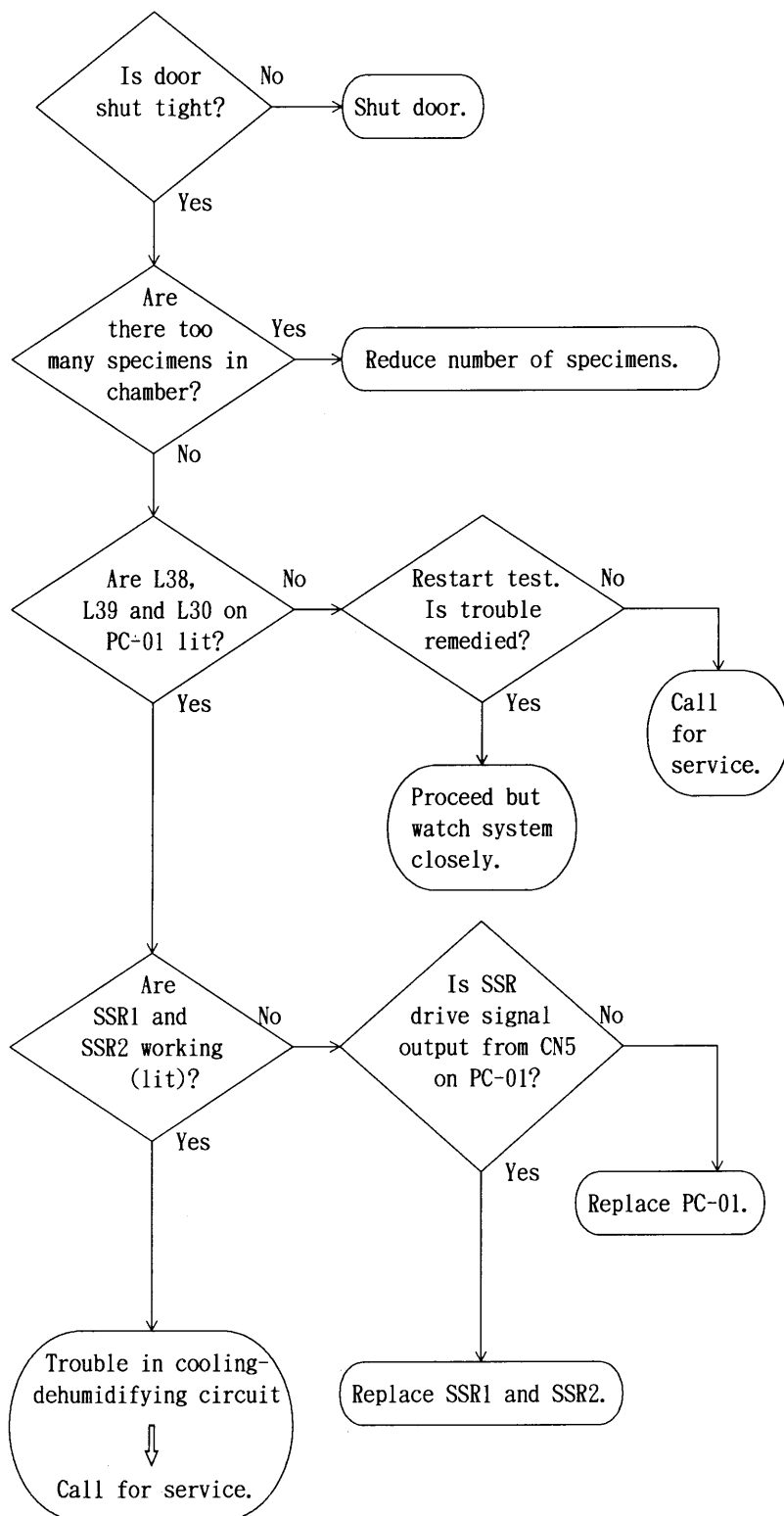
Set voltage measurement to the DC range.

Measured pin	Voltage	Heater state
③, ④ Polarity: +, -	Approx. 6 ~ 24V DC	ON
	Almost 0V	OFF



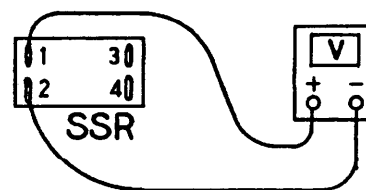
Temperature rises slowly or does not attain set temperature.

【Notes】



- Measure voltage at the SSR2 output pins.

Measured pin	Voltage	Heater state
①-②	0V AC	ON
	200V AC	OFF

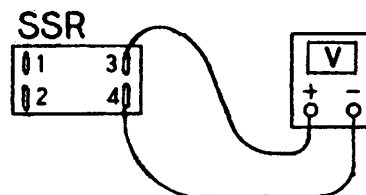


- Check the SSR1 drive signal is being output from the temperature-humidity controller.

Measure voltage at output pins 3 and 4 of SSR1.

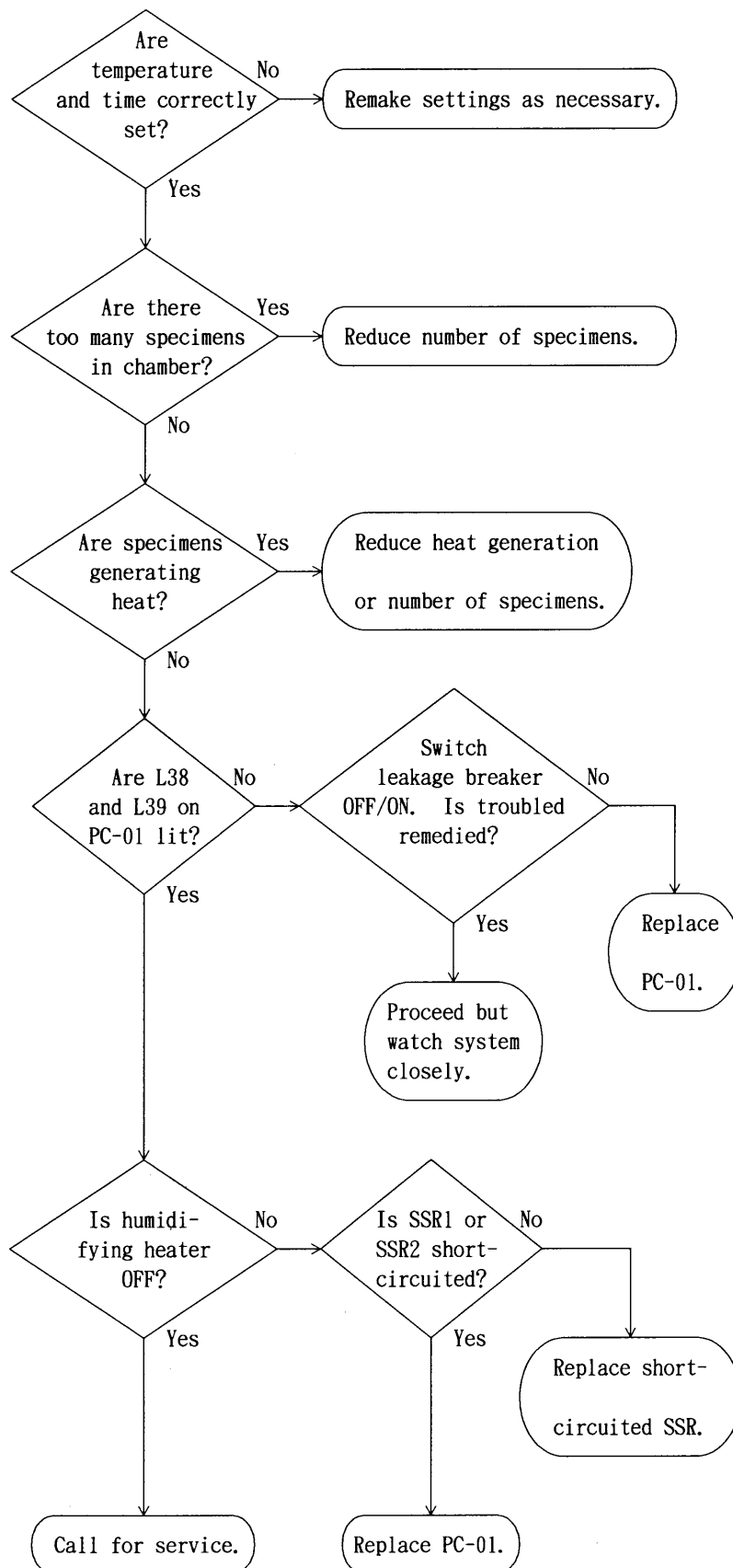
Set voltage measurement to the DC range.

Measured pin	Voltage	Heater state
③, ④ Polarity: +, -	Approx. 6 ~ 24V DC	ON
	Almost 0V	OFF



Temperature does not lower.

【Notes】

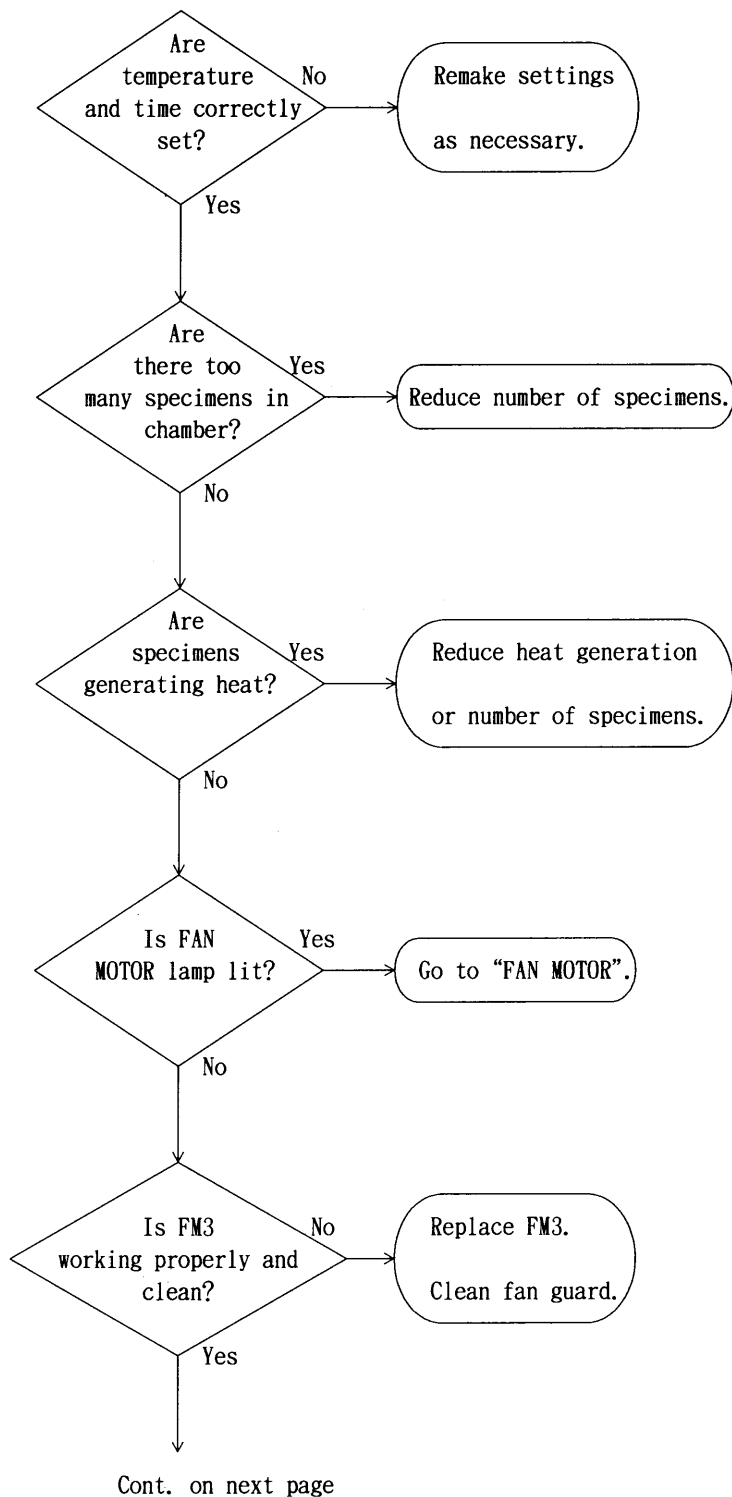


• See "2-2(7) I/O board (PC-01) terminal board signals".

Temperature lowers slowly or does not
attain set temperature.

(1/2)

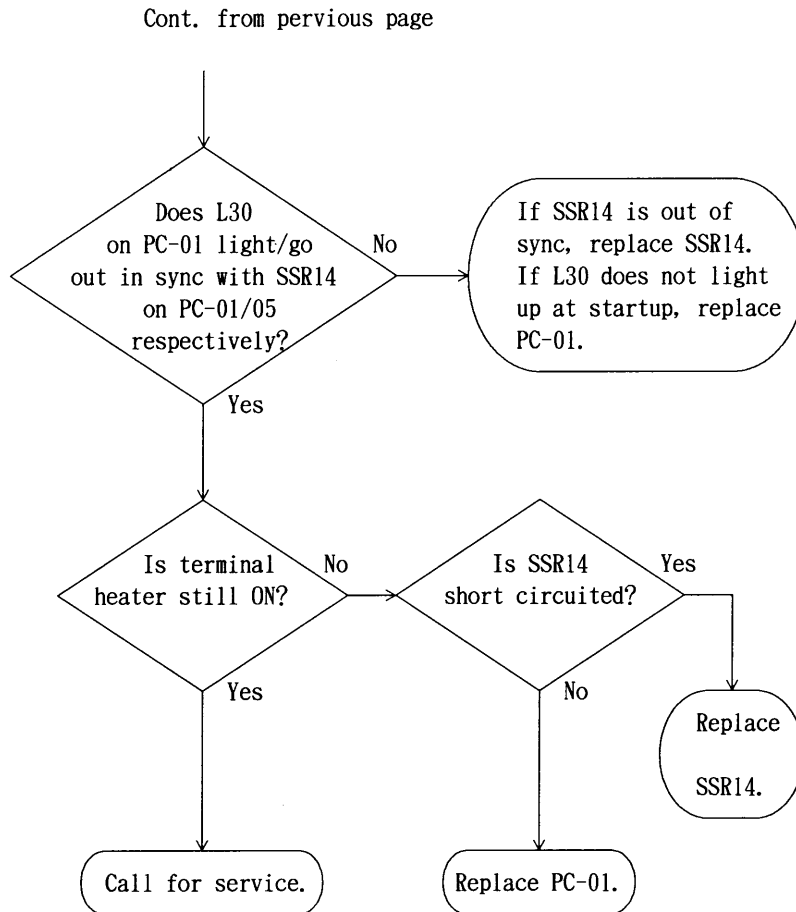
【Notes】



Temperature lowers slowly or does not attain set temperature.

(2/2)

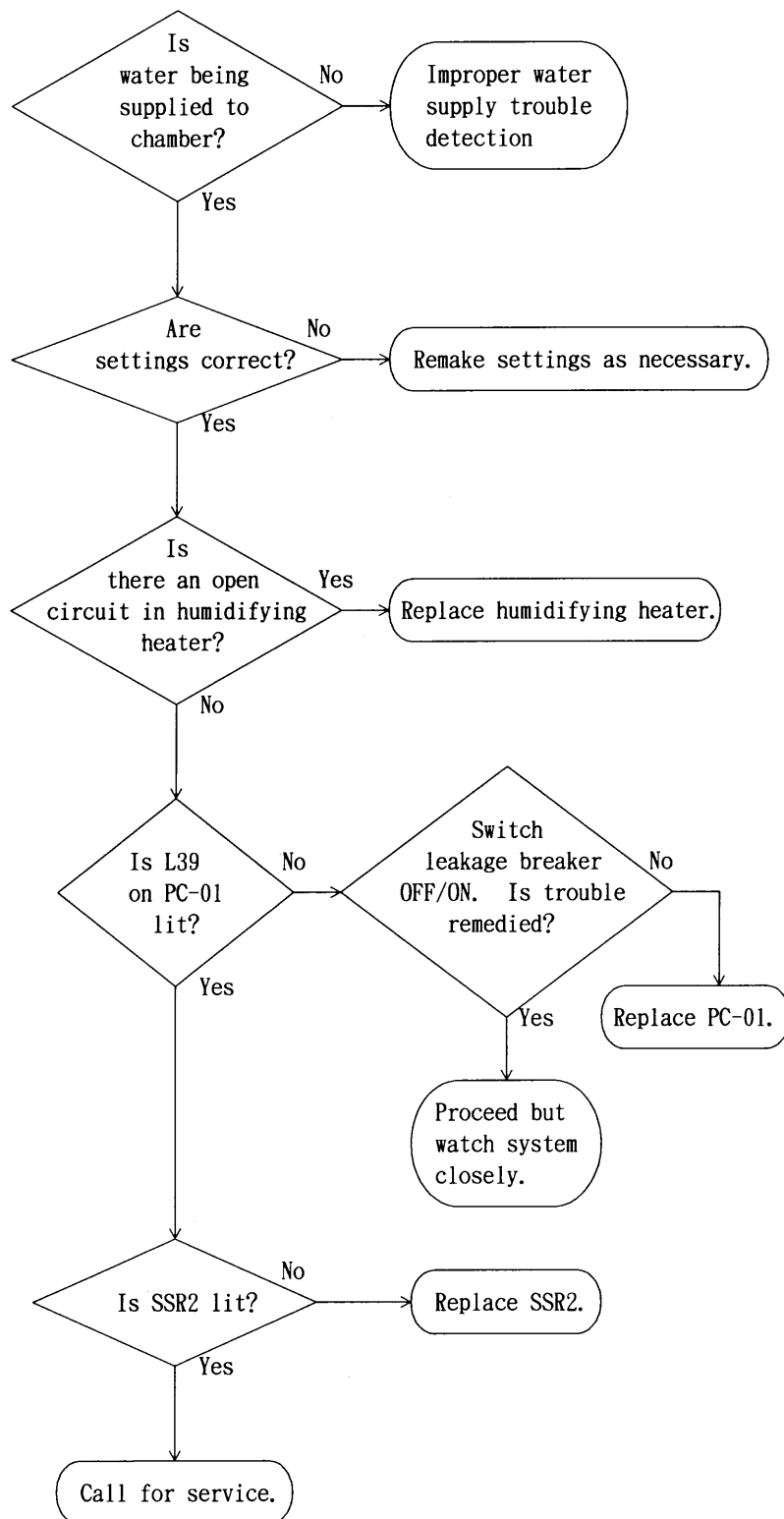
【Notes】



• See “2-2(7) I/O board (PC-01) terminal board signals”.

Humidity does not rise.

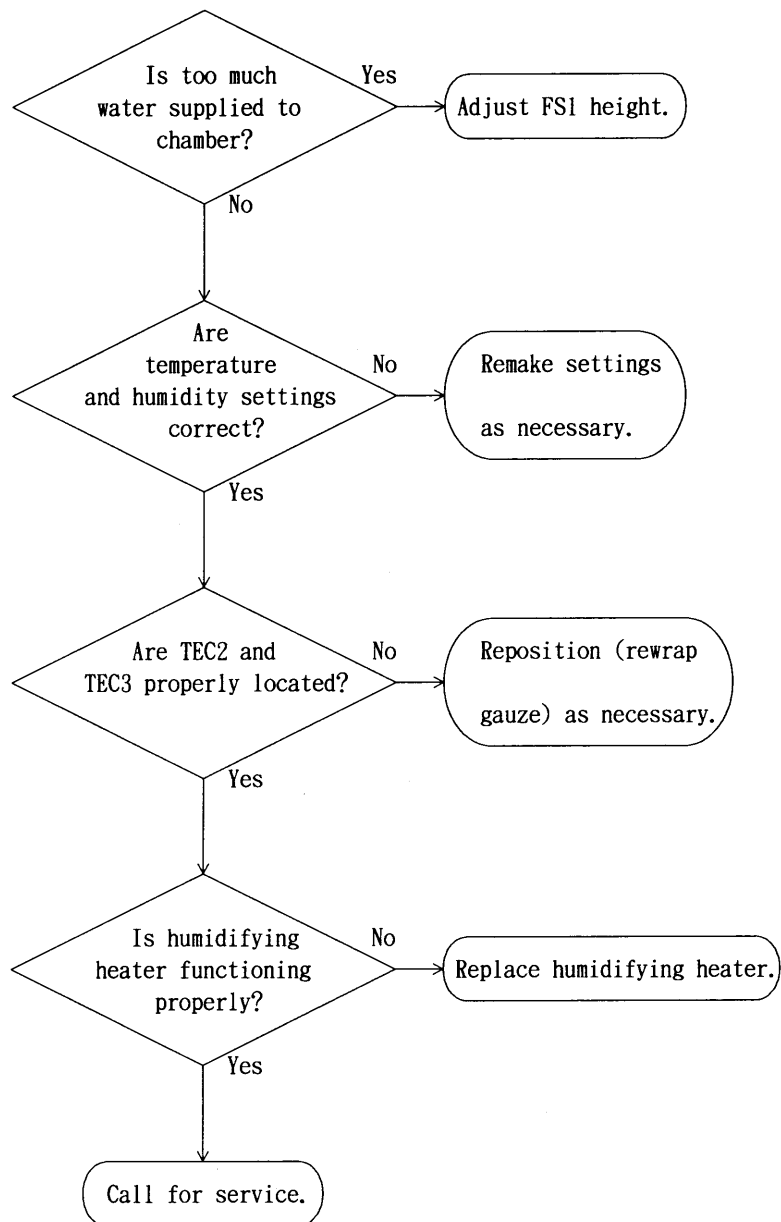
【Notes】



• See "2-2(7) I/O board (PC-01) terminal board signals".

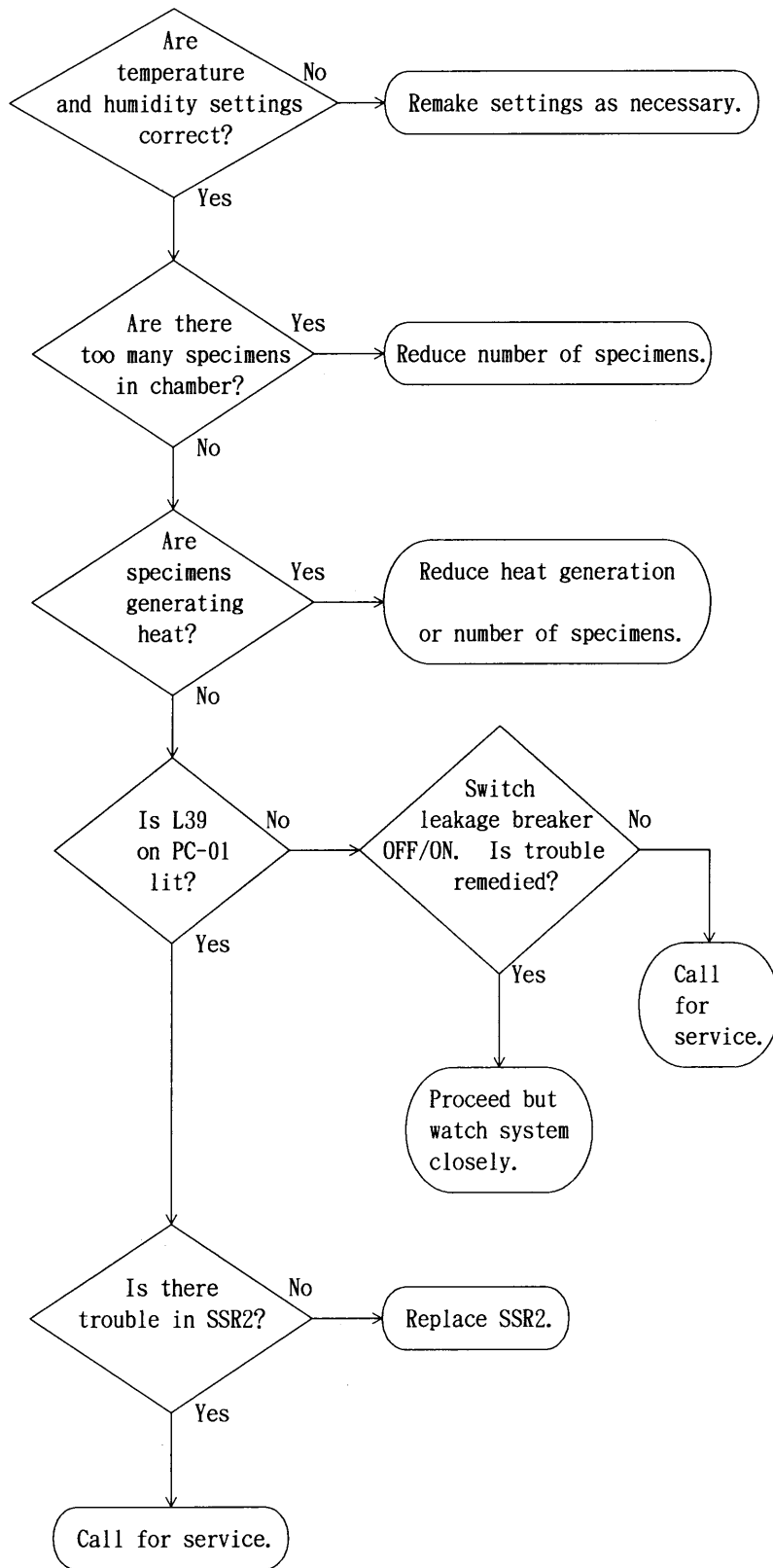
Humidity rises slowly or does not attain set humidity.

【Notes】



Humidity does not lower.

【Notes】

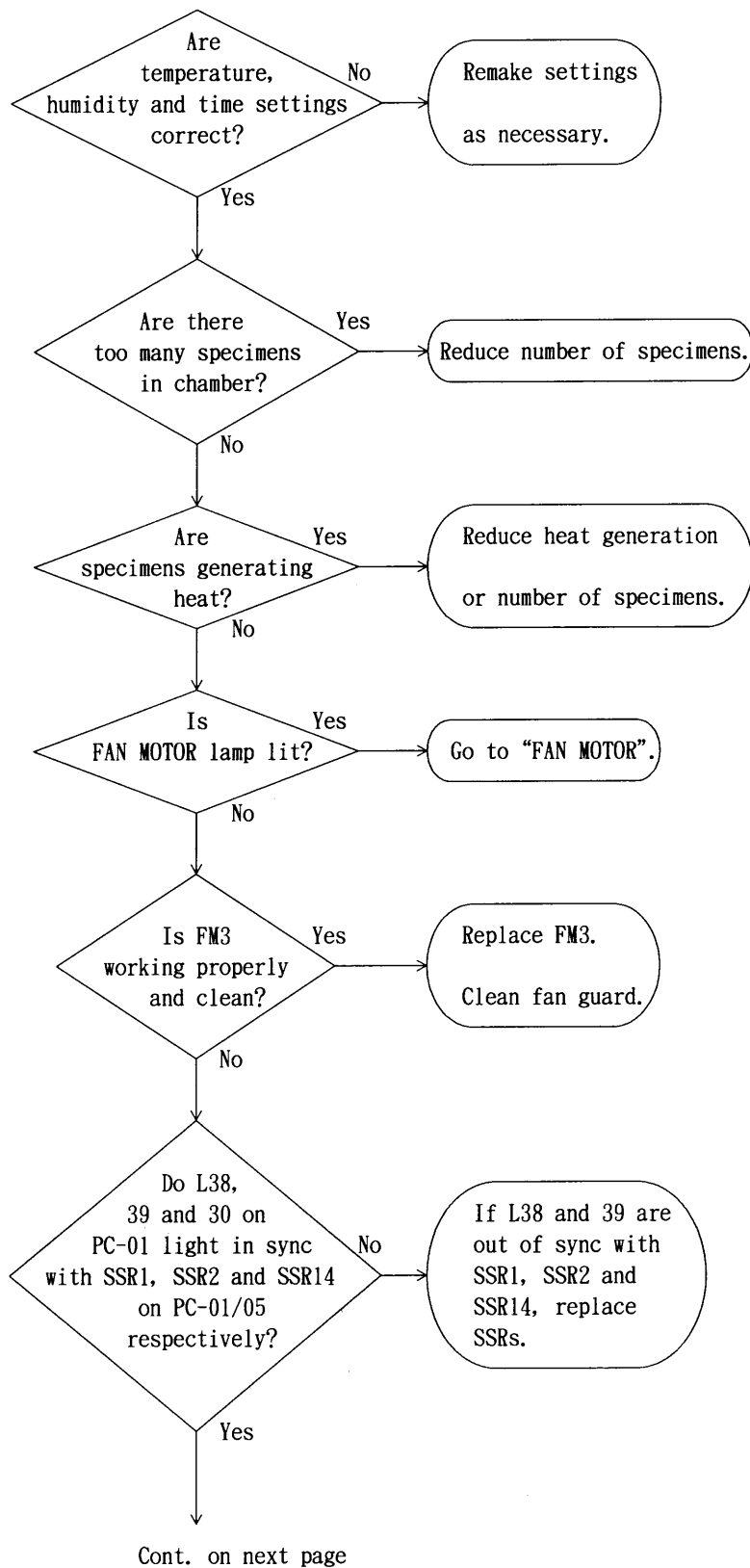


• See "2-2(7) I/O board (PC-01) terminal board signals".

Humidity lowers slowly or does not
attain set humidity.

(1/2)

【Notes】

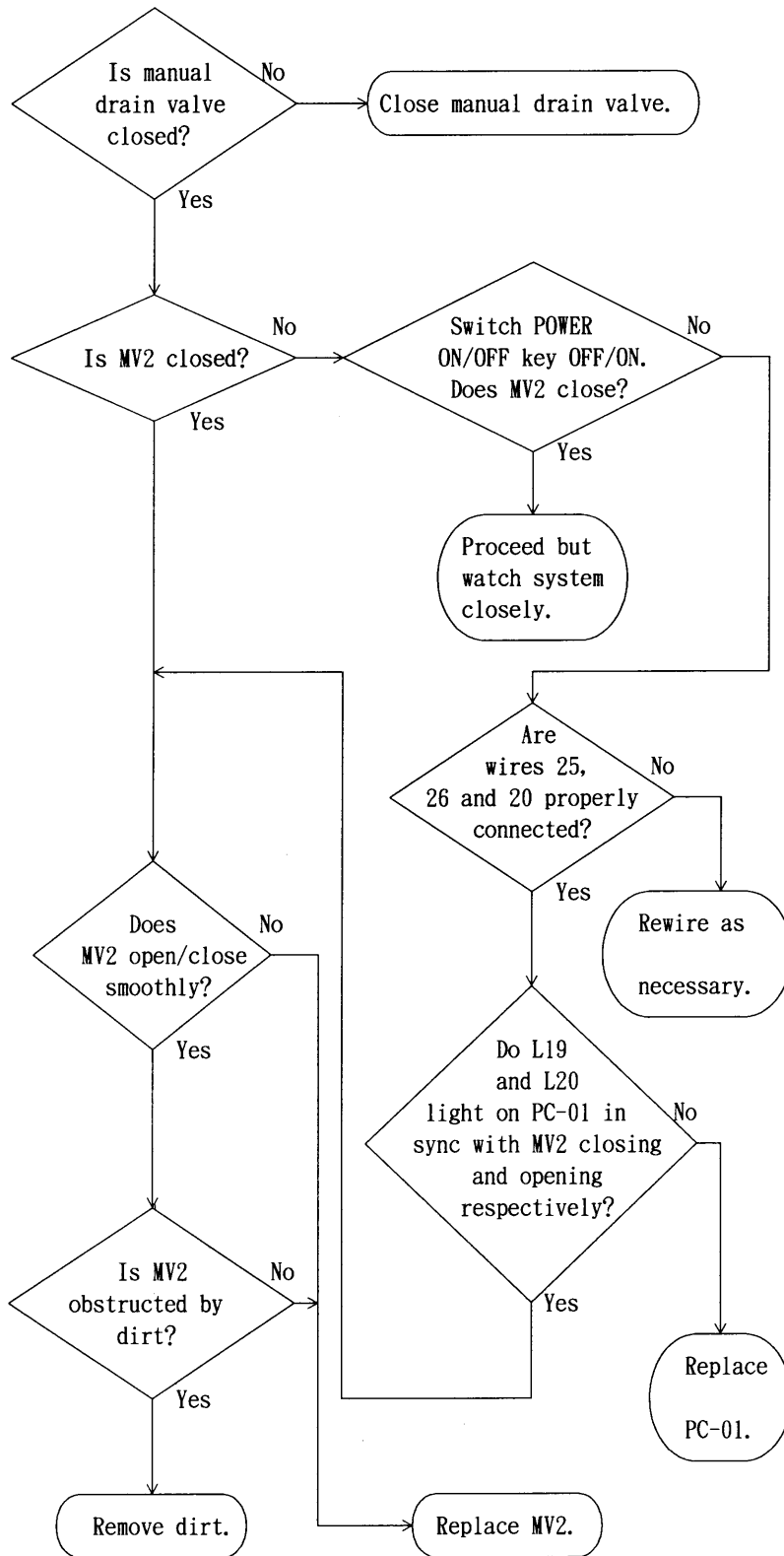


• See "2-2(7) I/O board (PC-01) terminal board signals".

Humidity lowers slowly or does not attain set humidity. (2/2)	【Notes】
Cont. from previous page <pre> graph TD Start([Cont. from previous page]) --> D1{Are L38, 39 and 30 working properly?} D1 -- No --> R1([Replace PC-01.]) D1 -- Yes --> P1([Proceed to FINISH process.]) P1 --> D2{Are TEC1, TEC2, TEC3 and gauze properly installed?} D2 -- No --> R2([Reinstall, restart test and watch system closely.]) D2 -- Yes --> P2([Restart test. If humidity lowers slowly or not at all, call for service.]) </pre>	• See “2-2(7) I/O board (PC-01) terminal board signals”.

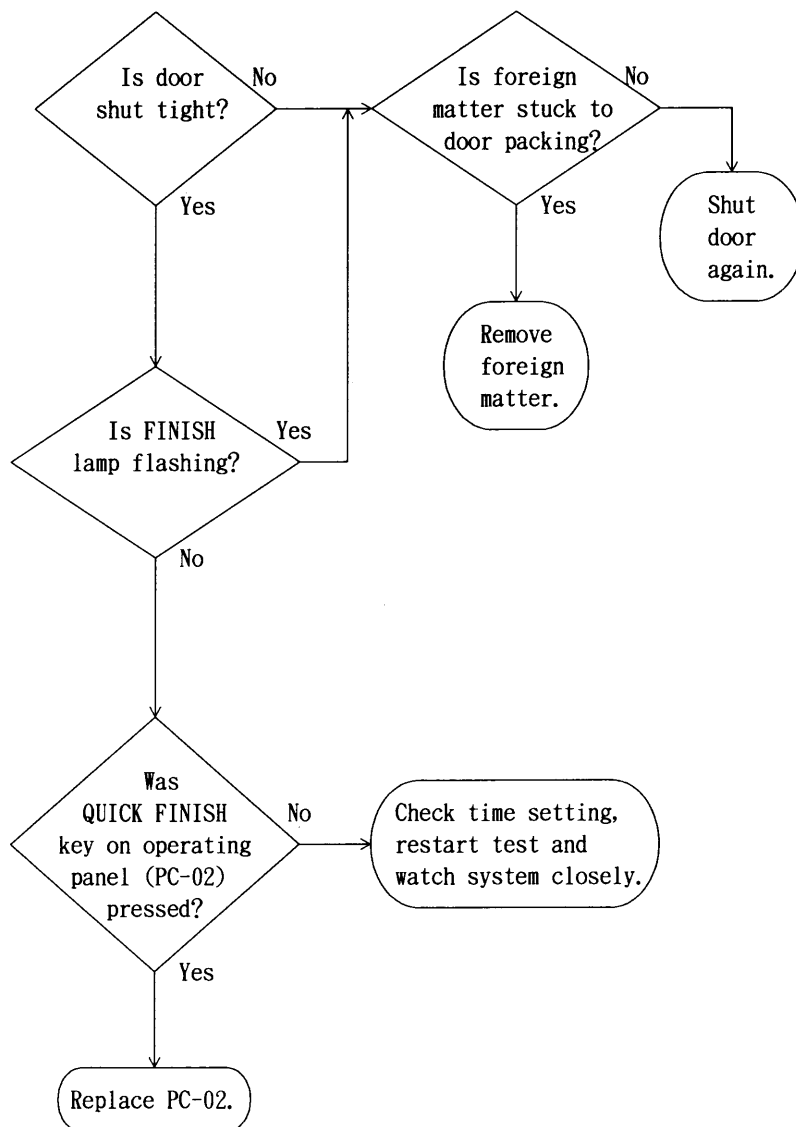
Humidifying water drains as soon as refilled.

【Notes】



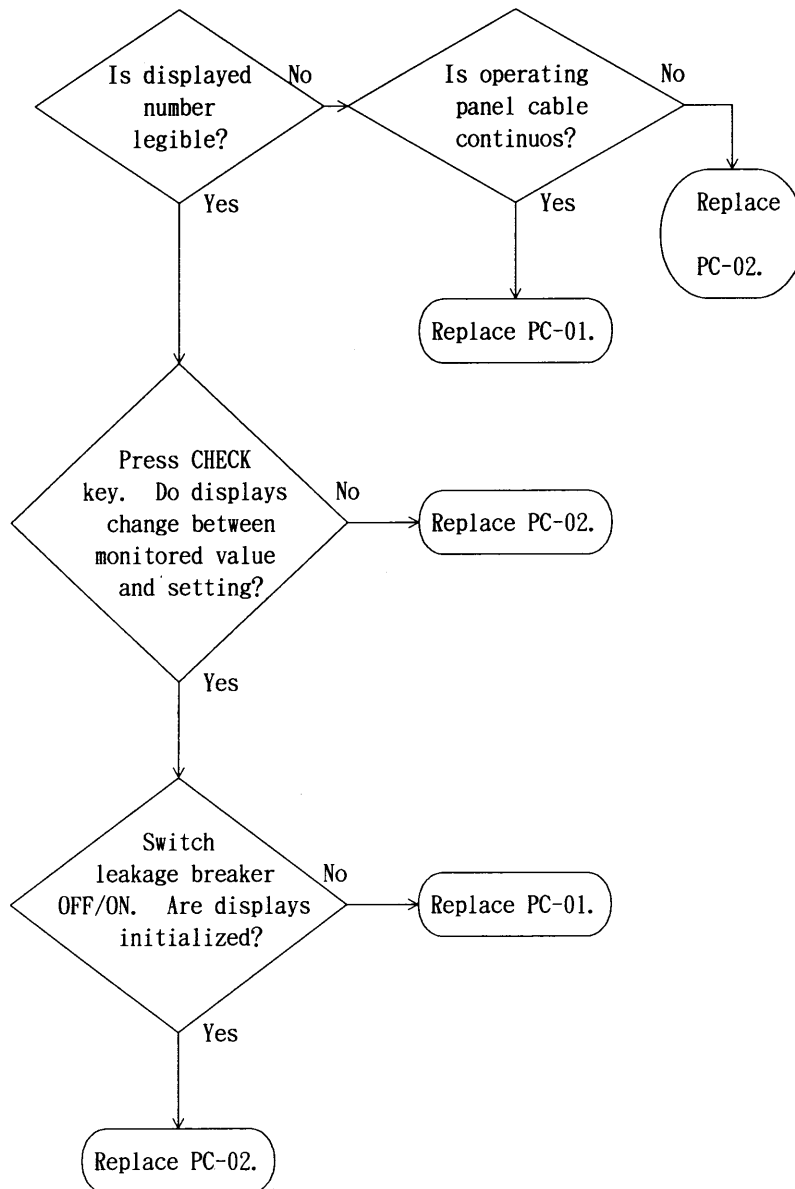
Test jumps to FINISH process unexpectedly.

【Notes】



Display does not change in response to
arrow keys.

【Notes】



Chapter 4 Parts Adjustment and Replacement

This chapter explains how to position, adjust and replace parts.

Some of the information herein may not apply to your chamber. See "Chapter 2 Chamber Construction" and "4-2 Parts Location".



CAUTION

- Always shut OFF power from the leakage breaker before replacing parts.
- Detach plates with care. Wear work gloves to prevent cuts from corners and edges.
- Because of their importance to safety, do not make adjustments to the following parts.
 - Door lock system
 - Safety valve
- BEFORE unlocking the door, check pressure inside the chamber is 0 MPa.
- After detaching/reattaching or replacing chamber parts or piping parts, run the chamber at the maximum allowed pressure and check for steam leaks.
- After changing the door packing, check the door close detection limit switch functions properly.

4 - 1 Preparatory/Incidental Work

(1) Detaching the rear panel (Fig. 4.1)

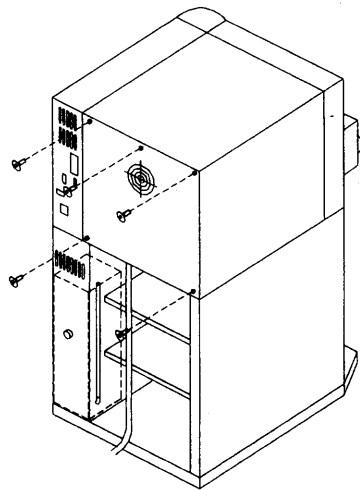
[How to detach]

1. Remove the M4 screws (Single unit type $\times 5$, 2-stage type $\times 14$)

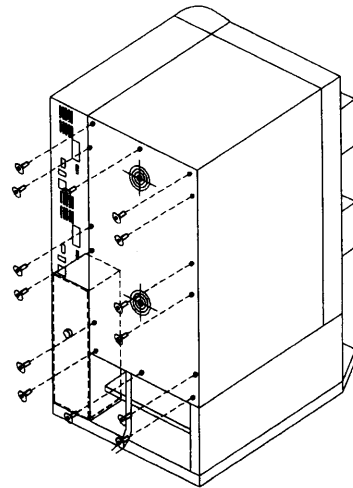
locking down the rear panel. Phillips screwdriver

[How to attach]

1. Screw the panel back onto the chamber rear.



(Single unit type)



(2-stage type)

Fig. 4.1

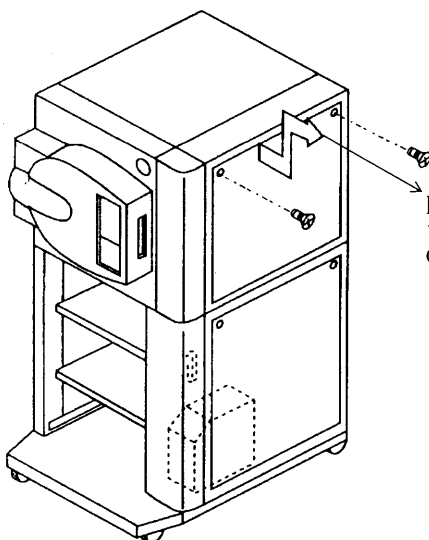
(2) Detaching the electric parts compartment panel (Fig. 4.2)

[How to detach]

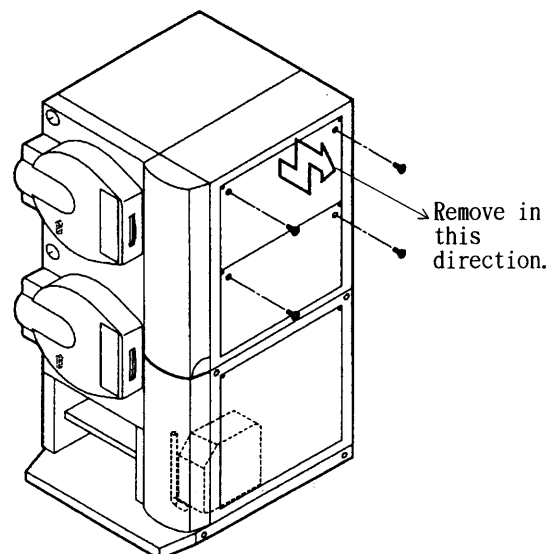
1. Remove the M4 screws ($\times 2$) locking the right side panel to the chamber. Phillips screwdriver
2. Let the top of the panel fall outward slightly, then lift upwards to remove.

[How to attach]

1. Attach the panel in the reverse order in which it was detached.



(Single unit type)



(2-stage type)

Fig. 4.2

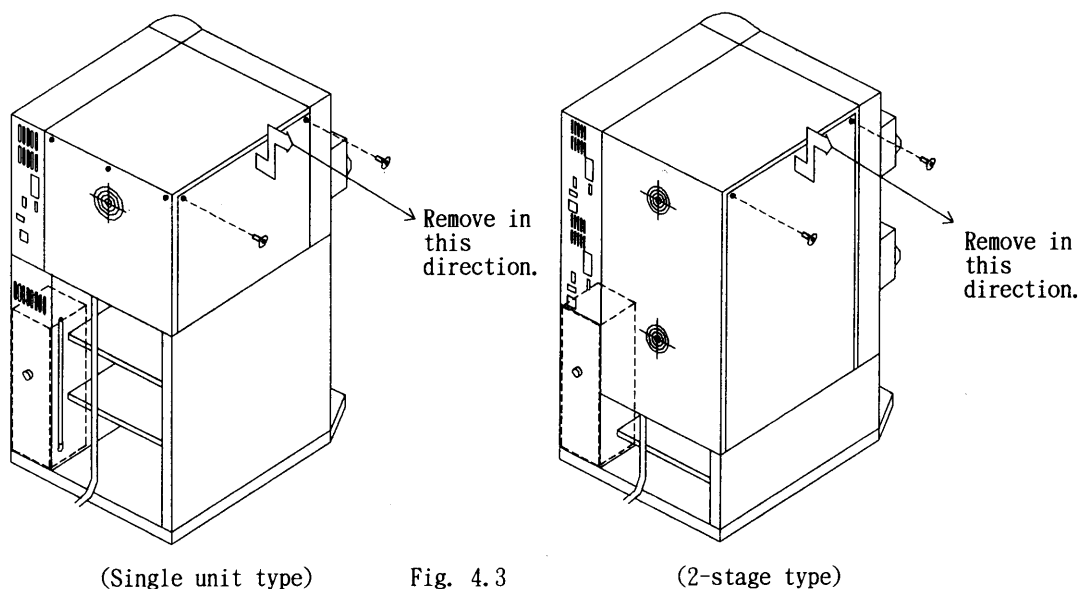
(3) Detaching the left side panel (Fig. 4.3)

[How to detach]

1. Remove the M4 screws ($\times 2$) locking the left side panel to the chamber. Phillips screwdriver
2. Let the top of the panel fall outward slightly, then lift upwards to remove.

[How to attach]

1. Attach the panel in the reverse order in which it was detached.



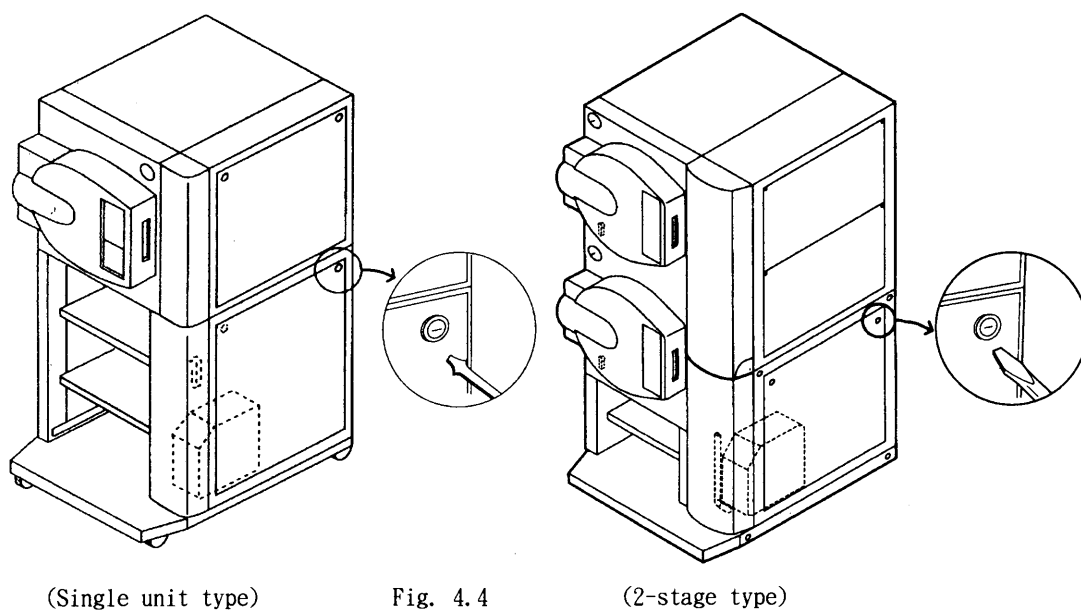
(4) Detaching the stand right side panel (Fig. 4.4)

[How to detach]

1. Turn the lock on the stand right side panel Slotted head screwdriver
2. Let the top of the panel fall outward slightly, then lift upwards to remove.

[How to attach]

1. Attach the panel in the reverse order in which it was detached.



4 - 2 Parts Location

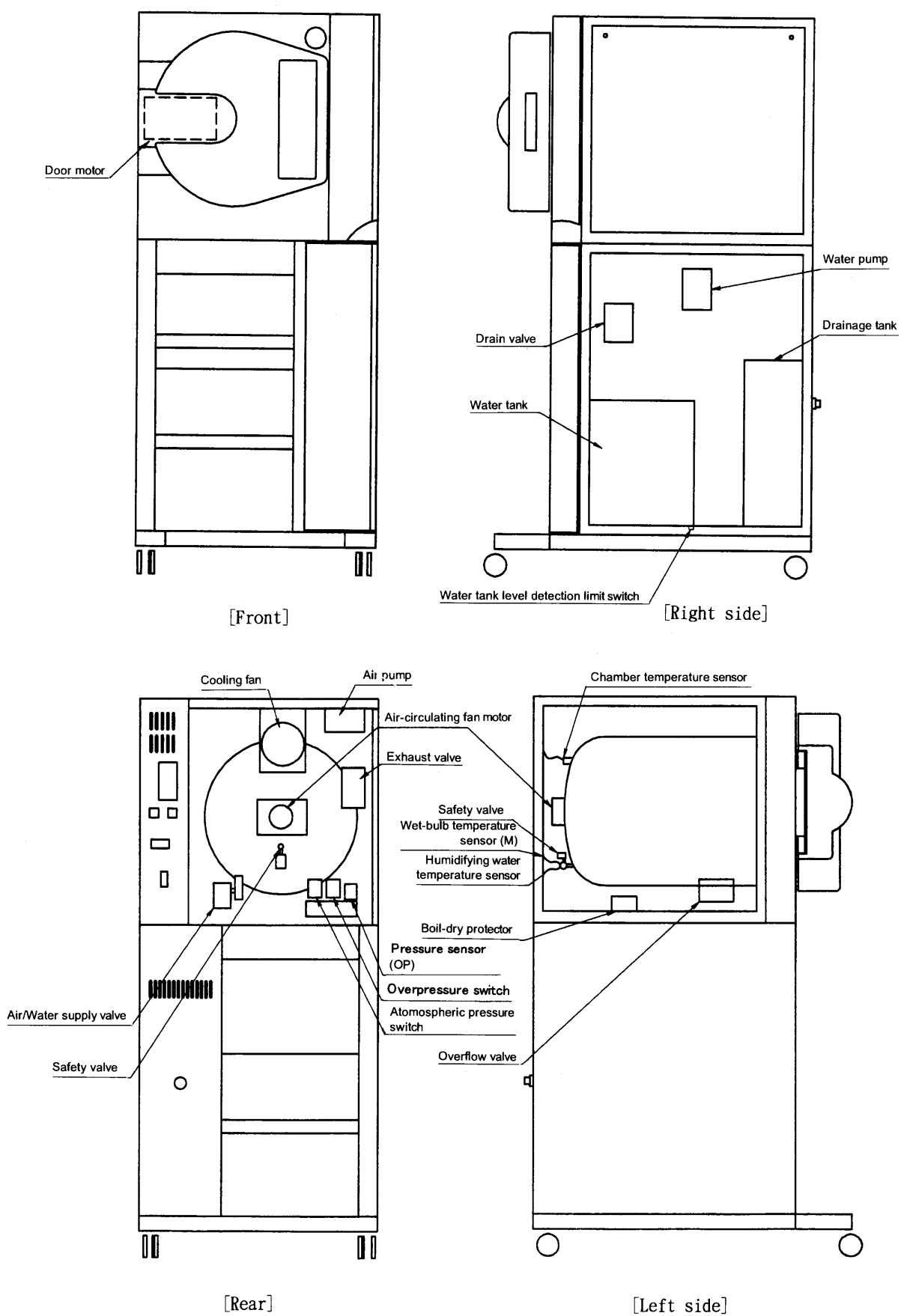


Fig. 4.5

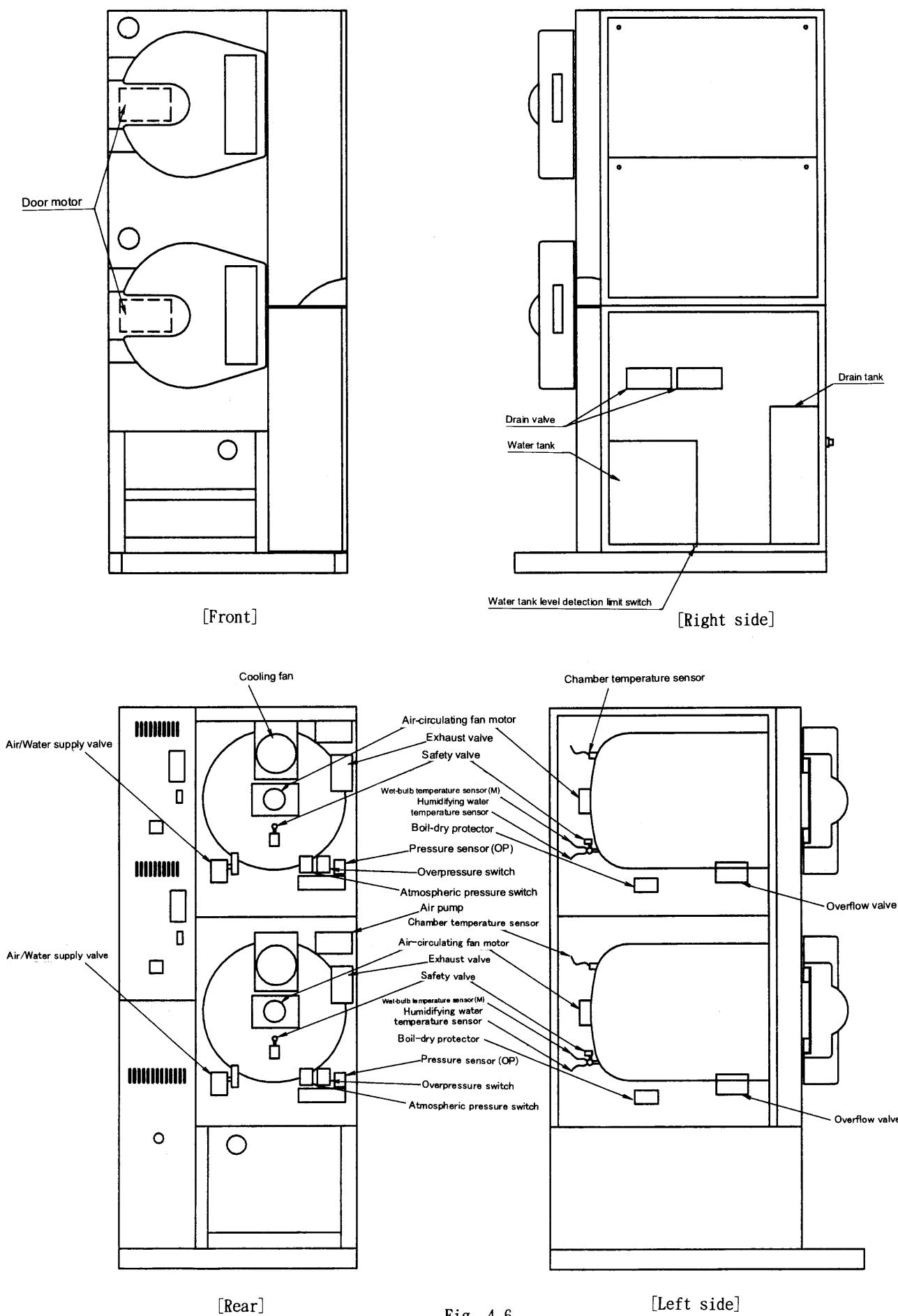


Fig. 4.6

4 – 3 Parts Adjustment and Replacement

This section explains about parts which require periodic checks and replacement.

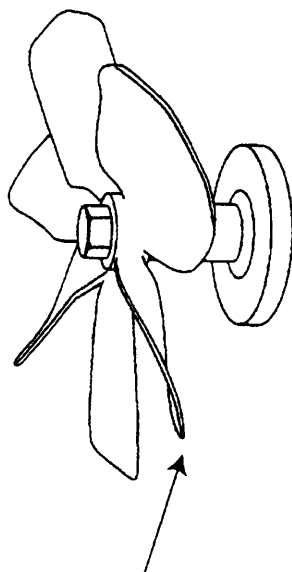
Maintenance item	Replacement/Check interval
Air-circulating fan replacement	Every 5,000 to 7,000 running hours
Door greasing	Once every year
Water tank cleaning	Once every year
Parts tightening	Once every year
Safety valve bleed check	Once every year

4 – 3 – 1 Air-circulating fan replacement

1. Remove the screws ($\times 3$) locking the fan guard to the inner cylinder.
2. Pull the fan unit outward and off the shaft. Be sure to pull the fan straight without tilting it in any direction.
3. Insert a new fan unit over the shaft and slide straight to the rear of the shaft.
4. Reattach the fan guard to the inner cylinder.

Note

Do not disassemble the air-circulating fan. Replace the entire fan unit (with bushing).



Fan unit with bushing

Fig. 4.7

⚠ CAUTION

- When locking and unlocking the door, be careful not to get caught in the mechanism.

1. Lock the door and shut OFF power from the POWER ON/OFF key on the operating panel.
2. Set the leakage breaker in the OFF position and check power is not supplied to the chamber.
3. Remove the screws from the door handle and swing the door cover open.
4. Brush away dirt from the exposed shaft threads and coat with a thin film of grease.
5. Set the leakage breaker in the ON position followed by POWER ON/OFF key.
6. Press the DOOR LOCK/RELEASE key to unlock the door. Be careful not to pinch fingers in drive parts.
7. When the door is unlocked, again shut OFF power from the POWER ON/OFF key and set the leakage breaker in the OFF position.
8. Brush away dirt from the exposed shaft threads and coat with a thin film of grease.
9. Brush away dirt from the motor bevel gears and coat with a thin film of grease.
10. Set the leakage breaker in the ON position followed by POWER ON/OFF key.
11. Lock/Unlock the door several times from the DOOR LOCK/RELEASE key. Check the door locks/unlocks smoothly.
12. Set the POWER ON/OFF key in the OFF position followed by the leakage breaker.
13. Reattach the door cover, and again set the leakage breaker in the ON position followed by POWER ON/OFF key.
14. Lock/Unlock the door several times from the DOOR LOCK/RELEASE key. Check the door locks automatically.

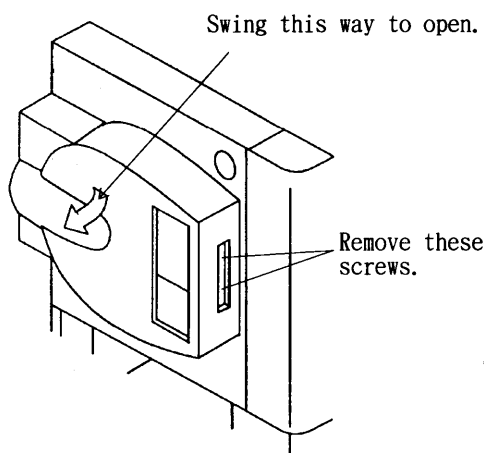


Fig. 4.8

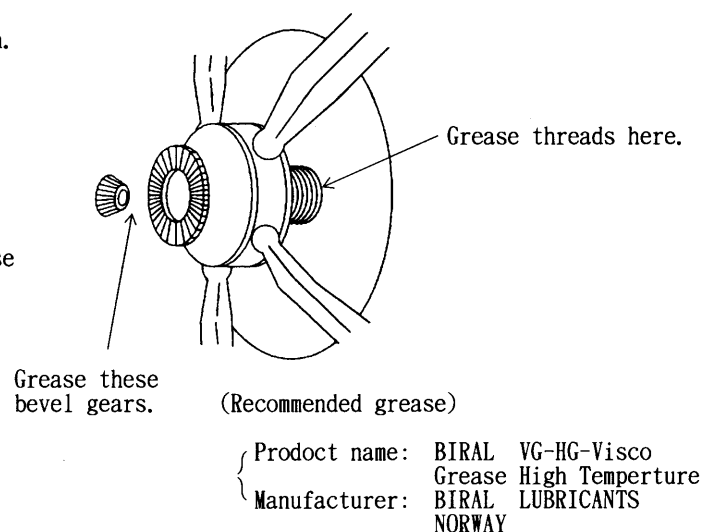


Fig. 4.9 Detail of door lock mechanism

4 - 3 - 3 Water tank detaching and cleaning

1. Detach the stand right side panel.
2. Unscrew the cap on the rear of the water tank and pull the tube out.
3. Pull the tank out of the chamber.
4. Clean inside the tank. Use only purified water and not detergent or chemicals.
Wipe with a soft clean rag.
5. Once clean, reinstall the tank inside the chamber with the tube and cap as before.
Make sure the end of the tube reaches almost to the bottom of the tank.
6. When installed, add water to the tank and check water is automatically supplied to the chamber as explained in the User's Manual.

4 - 3 - 4 Parts tightening

[Parts to tighten]

- Compression fitting used to install specimen power supply control terminal
- Boil-dry protector installation parts
- Installation parts for test area heater and humidifying heater
- Fan shaft installation parts
- Installation parts for all temperature sensors.
- Dehumidifying water level sensor installation parts
- Piping fittings and couplings



CAUTION

• This check raises pressure inside the chamber to the safety valve's bleed level, therefore observe the following without fail.

- ① Allow only personnel familiar with chamber construction and operation to perform checks.
- ② Never abandon the chamber during the check.
- ③ After finishing the check, return the chamber to normal working state.

[Objectives]

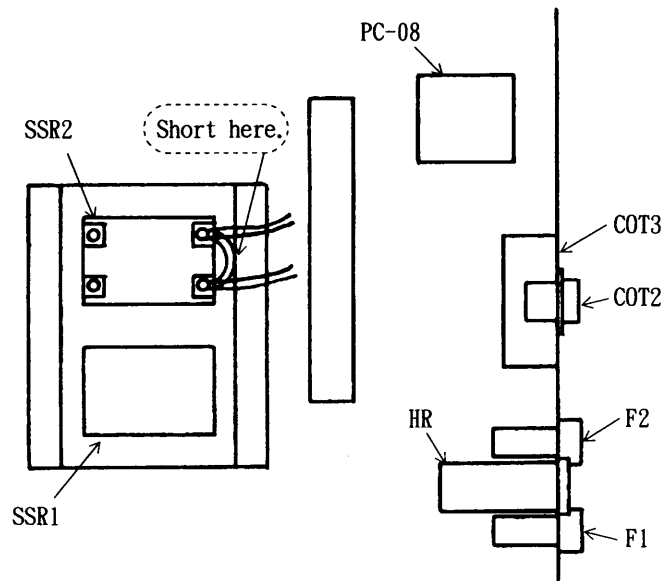
- To trigger the pressure alarm by disconnecting the pressure switch.
- To raise pressure inside the chamber by continuously force-charging the dehumidifying heater.

[Procedure]

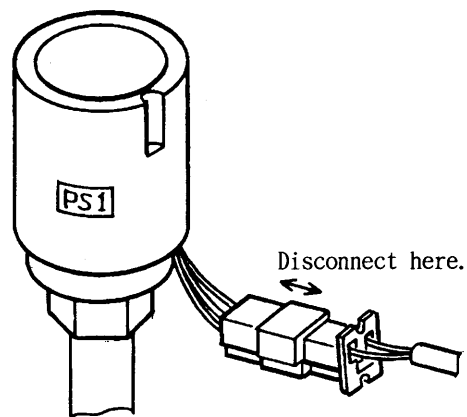
1. Detach the rear panel (See 4-1 (1)).
2. Detach the electric parts compartment panel (4-1 (2)).
3. Start the chamber in the constant mode at maximum settings.
Wait until temperature stabilizes.
4. Disconnect the overpressure switch (PS1) on the chamber rear.
2 K and 4 K switches differ in construction.
With the 4 K type, disconnect the relay connectors.
With the 2 K type, disconnect the crimp-style terminal from the pressure switch housing.
5. Set the leakage breaker in the OFF position.
Short-circuit the LOAD side of the SSR2 (electric parts compartment) using a jumper with worm clip. Then, set the leakage breaker in the ON position.
6. When the safety valve pops, check the reading on the pressure gauge.
7. Set the leakage breaker in the OFF position.
Disconnect the short-circuiting jumper. Then, set the leakage breaker in the ON position.
8. Press the QUICK FINISH key on the operating panel to bring down pressure.
9. Once pressure has dropped, set the leakage breaker in the OFF position and return the chamber to normal working state.

Note

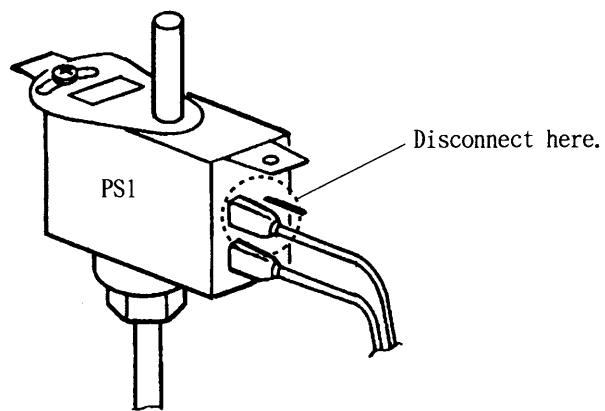
After checking the safety valve, reconnect the overpressure switch (PS1) and remove the short-circuiting jumper from SSR2.



EHS-411(M)



EHS-211(M) or EHS-221(M)



Overpressure switch

4 – 3 – 6 Temperature and pressure sensor calibration

(1) Preparations

In order to stabilize the equipment, activate the power supply to the chamber, voltmeter, and reference voltage generator (thermocouple type T [Copper/Copper-Nickel]) 30 minutes prior to calibration.

In addition, prepare a reference resistor of 100.0Ω.

< Note >

In some cases, offset values have been set in order to compensate individual differences among the thermocouples. You need to clear the offset setting before calibration. After calibration finishes, specify the offset values again.

(2) Calibration methods

(2) - 1 Clearing the offset setting

- 1) On the operating panel, press the  and  keys simultaneously. "2" appears under [PATTERN], indicating that the offset setting can be changed. ("2" refers to the humidifying water temperature sensor.)

- 2) Write down the current offset value [°C] of the humidifying water temperature sensor displayed in [%RH].

(Example: -0.3)

- 3) Every time the  key is pressed, the value under [PATTERN] changes in the order of 2 → 3 → 1 → 2 and so on.
- 4) For 1 and 3, also write down the current offset values [°C] displayed in [%RH].

"1", "2", and "3" refer to the following sensors respectively:

- 1: Chamber temperature sensor (TEC1)
- 2: Humidifying water temperature sensor (TEC2)
- 3: Wet-bulb temperature sensor (TEC3)

- 5) Press the  key.

The offset values for all sensors are cleared to 0°C.

- 6) Press the  key.

"0°C" is stored in the memory for the new offset values.

Clearing of the offset setting is complete.

(2) - 2 Calibration

- 1) On the operating panel, hold down the , , and  keys simultaneously for five seconds or more.

The chamber enters the menu selection status. The model name (Example: 411) is displayed in [°C], and "ΣEA" is displayed in [%RH].

- 2) Use the  and  keys to change the value in [h] to "6", and then press the  key.

The display changes to the calibration setting display.

- 3) Remove the cover of the PC-03 board.

Calibration precaution

To ensure stable calibration, disconnect the wiring of the sensor to be calibrated individually. Be sure that the terminals of all sensors other than the one being calibrated are not open.

Calibrating Pt 100 for zero-point compensation

- 4) Disconnect the wiring of Pt 100 for zero-point compensation from "Pt" of terminal block TB1, and connect the 100.0Ω reference resistor instead.
- 5) Hold down the  key until three long beeps and one short beep are heard.

Calibrating the thermocouple

- 6) Disconnect the wiring of chamber temperature sensor TEC1 from terminal block TB1, and connect the reference voltage generator instead. Apply 6.705mV (equivalent to 150°C).
- 7) Hold down the  key until three long beeps and one short beep are heard.

Checking the result of temperature calibration

- 8) Apply voltages from the reference voltage generator to "T1" of terminal block TB1 and check the measured values.

Pressing the  /  key decrements/increments the third digit of the value in [%RH].

Set the value to "1" to display the measured value for TEC1.

The measured value is displayed with its hundred's digit on the first digit in [%RH], and remaining digits in [h].

(Example: When "1 1" is displayed in [%RH] and "55.00" is displayed in [h] ⇒ 155.00°C)

<Voltage input by reference voltage generator>	<Temperature reading>
(160.0°C) 7.209mV	1 160.00 (±0.20)
(150.0°C) 6.704mV	1 150.00 (±0.20)
↓	↓
(100.0°C) 4.279mV	1 100.00 (±0.20)

When an error is greater than ±0.2°C, replace the PC-03 board. (The PC-03 board is faulty.)

- 9) Disconnect the reference voltage generator and reconnect the wiring of TEC1.
- 10) For TEC2 (T2 of terminal block TB1) and TEC3 (T3 of terminal block TB1), repeat the check in step 8) as for TEC1.
- 11) If there are differences greater than 0.2°C among the results of TEC1, TEC2, and TEC3, short-circuit T1 through T3 with a lead wire.

If the results do not show the same temperature (room temperature) and the differences are out of the range of ±0.2°C, replace the PC-03 board. (The PC-03 board is faulty.)
- 12) Disconnect the 100.0Ω reference resistor and reconnect the wiring.

(Calibrating the pressure gauge: The pressure gauge is optional. Perform the following as required.)

- 13) Disconnect connector CN2, connect the reference voltage generator to pins No. 2 (+) and No. 3 (-), and apply 5.000V.
- 14) Hold down the  key until three long beeps and one short beep are heard.

Checking the result of pressure calibration

- 15) Apply voltages from the reference voltage generator to CN2 (Pins No. 2 and 3), and check the measured values.

Pressing the  /  key decrements/increments the third digit of the value in [%RH].

Set the value to "δ" to display the pressure.

The measured value is displayed with its one's digit on the first digit in [%RH], and decimal digits in [h].

(Example: When "δ 0." is displayed in [%RH] and "0013" is displayed in [h] ⇒ 0.0013MPa)

<Voltage input by reference voltage generator>	<Pressure reading>
(-0.1MPa) 1.000V	δ-0.1000 (±0.0060)
(0.0MPa) 1.667V	δ 0.0000 (±0.0060)
↓	↓
(5.0MPa) 5.000V	δ 0.5000 (±0.0060)

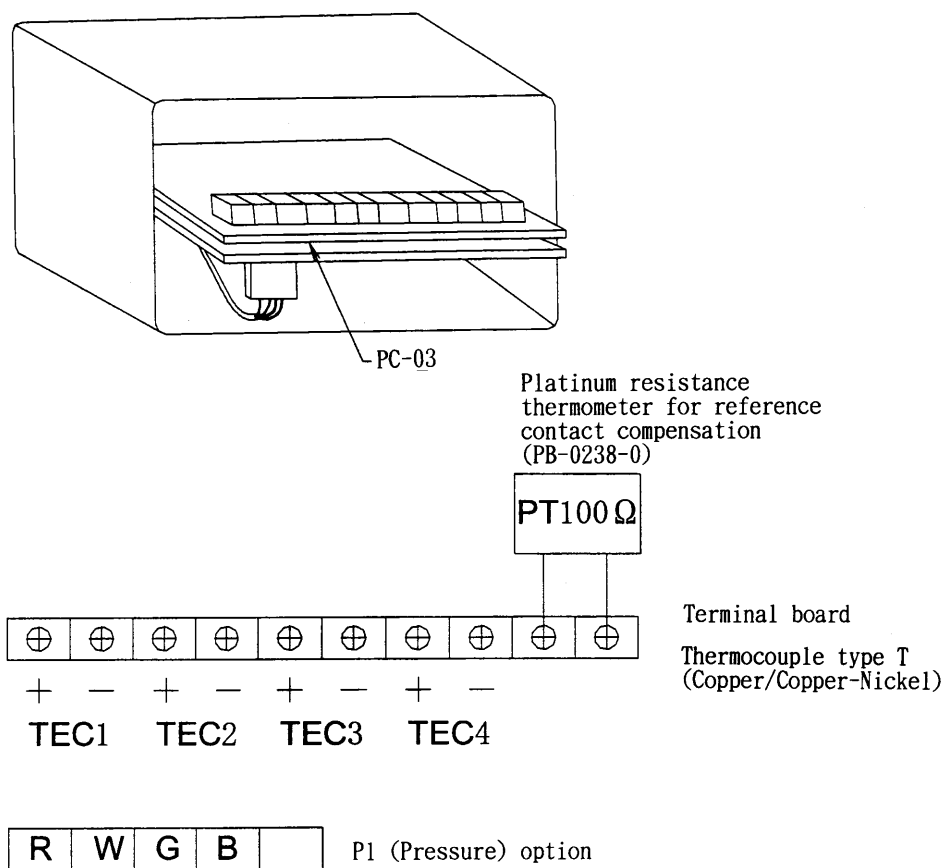
When an error is greater than 0.0060MPa, replace the PC-03 board. (The PC-03 board is faulty.)

- 16) Reconnect the wiring of CN2.
- 17) Attach the cover.
- 18) Press the  key.
The chamber returns to the menu selection status.
- 19) Pressing a key other than the , , and  keys returns the chamber to the normal display.

(2)-3 Specifying the original offset values

- 1) As in the procedure for (2)-1, press the  and  keys simultaneously on the operating panel, and set the chamber to the status where the offset setting can be changed.
- 2) Press the  key to select the sensor.
- 3) Use the  and  keys to change the value in [%RH] to the original offset value of the sensor you wrote down in (2)-1.
- 4) Press the  key to store the offset value in the memory.

Temperature detection unit



Service Manual

**Highly Accelerated Stress Test System
(HAST Chamber)**

EHS-211(M), 221(M), 411(M)
EHS-211MD, 221MD, 411MD

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