HIRAYAMA

AUTOCLAVE

HICLAVE

**HRG Series**

# SERVICE MANUAL

株式会社 平山製作所

No. P12G-001-A

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## HRG Series

# SERVICE MANUAL

**IMPORTANT**

- Read this manual carefully and follow the instructions to keep the machine in good working condition.

Issued on June 25, 2012, Revised on July 29, 2013

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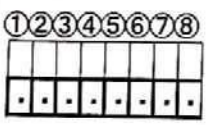
# Chapter 1. Program Specification

## 1. Specification

| Model | HRG-112 | HRG-140 | Notes |
|---|---|---|---|
| Name of a cycle | FABRIC, SOLID, LIQ(Liquid), ADD DRY | | |
| Number of programs | 3 programs for each cycle | | |
| Sterilization temperature setting range | 105~135°C | | Least input increment : 1°C |
| Sterilization time setting range | 1 min. - 60 min. | | Least input increment : 1min. |
| Dry time setting range | 1 min. - 99 min. | | Least input increment : 1min. |
| Exhaust level setting | 4 steps 0: Natural cooling<br>1:Pulse exhaust (fine exhaust)<br>2:Pulse exhaust (small amount of exhaust)<br>3:Exhaust with a valve fully open | | |
| Air removal method | •FABRIC, SOLID : Vacuum air removal which is performed twice at -0.085MPa (Vacuum suction starts from -0.075MPa for 2 min.)<br>•LIQ : Vacuum air removal and Gravity displacement air removal. Vacuum air removal is performed at -0.090MPa. (Vacuum suction starts from -0.075MPa for 2 min.), and, when temperature reaches 103°C, the gravity displacement air removal is performed until the preset time elapses. | | |
| Air removal time | 5 min. - 10 min. | | Least input increment : 1min. |
| Door lock temperature | SOLID cycle : 97°C (fixed)<br>LIQ cycle : 60.0 - 95°C<br>(Temperatures for FABRIC and ADD DRY cycles are not specified) | | Least input increment : 1°C |
| Over temperature alarm | 138°C | | |
| Programmable timer | 6 day/24 hour programmable timer | | |
| S1 dip switch setting<br>ON<br>OFF |  | | ①Model setup<br>②Model setup (spare)<br>③Floating sensor<br>④Option (spare)<br>⑤Option (spare)<br>⑥Vacuum test<br>⑦Safety valve test<br>⑧Operation check program |

## 2. Initial setting value

| Item / Cycle | Sterilization temperature | Sterilization time | Exhaust level | Drying time | Air removal time | Lid lock temperature |
|---|---|---|---|---|---|---|
| FABRIC | 121℃ | 20 min. | 3 (fixed) | 40 min. | - | - |
| SOLID | 121℃ | 20 min. | 3 (fixed) | - | - | 97℃ (fixed) |
| LIQUID | 121℃ | 20 min. | 0 | - | 5 min. | 60℃ |
| ADD DRY | - | - | - | 40 min. | - | - |

## 3. Description of error messages

| Error No. | Description of Displayed Error | Action |
|---|---|---|
| E 1 (Overheat) | •Heater surface temperature exceeds 270℃. | ①Turn off the heater circuit.<br>②Error buzzer<br>③Display of chamber temperature and chamber pressure |
| E 2 (Disconnection of control temperature sensor wire ) | •Disconnection of control temperature sensor wire is detected or temperature is below 0℃ | |
| E 3 (Over-temperature) | •The chamber temperature exceeds the upper limit + 3℃ of the settable temperature. | |
| E 3 (Over-temperature during sterilization stage) | •The chamber temperature exceeds the preset temperature + 5℃ for more than 10 seconds during sterilization stage. | |
| E 4(Over-cooling) | • The chamber temperature drops below 102℃ for more than 10 seconds during sterilization stage | |
| E 5 (Over-pressure) | •The chamber pressure exceeds the pressure that was converted from the preset temperature by more than 25kPa for more than 15 seconds. | |
| E 5 (Abnormality in the pressure sensor ) | •Pressure of more than 0.01MPa or pressure of less than -0.01MPa is indicated when the door is open | |
| E 6 (Abnormality in the door) | •The door lowers during operation. | |
| E 8 (Abnormality in the water supply and drainage) | •Water is not filled within 10 minutes after startup.<br>•Drainage is not completed within 10 minutes after start of drainage.<br>•Low water is indicated when water level is full.<br>•Full water is indicated when water level is low. | |
| E 9 (Heater abnormality ) | •The chamber temperature does not reach the preset temperature within 300minutes after startup. | |
| E P(Vacuum abnormality) | •The degree of vacuum does not reach -0.075MPa within 15 minutes when vacuum air removal is performed.<br>•Air leakage of more than 0.13kPa/min. is detected during a vacuum test. | |
| E F (Disconnection of floating sensor wire) | •Disconnection of floating sensor wire is detected or temperature is below 0℃. (when a floating sensor is installed) | |
| E L (Abnormality in the door lock) | •The door lock signal is detected when the door is open.<br>•The door release signal is detected during operation.<br>•The door lock signal is not detected during operation. | |

# 4. Error monitoring chart

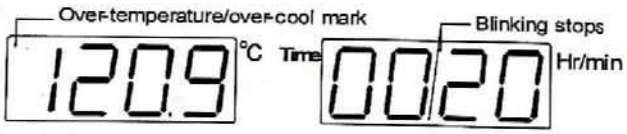
## 4.1 FABRIC cycle

| Display | Error Names | Detection | Standby | Auto water supply | Auto start | Vacuum air removal | Heating | Sterilization | Exhaust | Drainage | Dry | To normal pressure | Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E 1 | Overheat | CN4-10, CN6-1 | | | | | | | | | | | |
| E2 | Disconnection of control temperature sensor wire | CN9 | | | | | | | | | | | |
| E3 | Over-temperature | chamber | | | | | | | | | | | |
| | Over-temperature (Sterilization stage) | chamber | | | | | | | | | | | |
| E4 | Over-cool | chamber | | | | | | | | | | | |
| E5 | Over-pressure | chamber | | | | | | | | | | | |
| | Abnormality in the pressure sensor | chamber | | | | | | | | | | | |
| E6 | Abnormality in the door | CN6-3 | | | | | | | | | | | |
| E8 | Abnormality in water supply and drainage | CN4-12, CN7-1 | | | | | | | | | | | |
| E9 | Abnormality in the heater | chamber | | | | | | | | | | | |
| EP | Vacuum abnormality | chamber | | | | | | | | | | | |
| EL | Abnormality in the door lock | CN6-5,7 | | | | | | | | | | | |
| EF | Disconnection of floating sensor wire | CN10 | | | | | | | | | | | |
| ※ 1 | Over-temperature (Set temp. + 3.0℃) | chamber | | | | | | | | | | | |
| ※ 1 | Over-cool (Set temp. -0.1℃) | chamber | | | | | | | | | | | |

## 4.2 LIQUID cycle

| Display | Error Names | Detection | Standby | Auto water supply | Auto start | Vacuum air removal | Heating | Gravity displacement air removal | Heating | Sterilization | Exhaust | Drainage | Comp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E 1 | Overheat | CN4-10, CN6-1 | | | | | | | | | | | |
| E2 | Disconnection of control temperature sensor wire | CN9 | | | | | | | | | | | |
| E3 | Over-temperature | chamber | | | | | | | | | | | |
| | Over-temperature (Sterilization stage) | chamber | | | | | | | | | | | |
| E4 | Over-cool | chamber | | | | | | | | | | | |
| E5 | Over-pressure | chamber | | | | | | | | | | | |
| | Abnormality in pressure sensor | chamber | | | | | | | | | | | |
| E6 | Abnormality in the door | CN6-3 | | | | | | | | | | | |
| E8 | Abnormality in water supply and drainage | CN4-12, CN7-1 | | | | | | | | | | | |
| E9 | Abnormality in the heater | chamber | | | | | | | | | | | |
| EP | Vacuum abnormality | chamber | | | | | | | | | | | |
| EL | Abnormality in the door lock | CN6-5,7 | | | | | | | | | | | |
| EF | Disconnection of floating sensor wire | CN10 | | | | | | | | | | | |
| ※ 1 | Over-temperature (Set temp. + 3.0°C) | chamber | | | | | | | | | | | |
| ※ 1 | Over-cool (Set temp. -0.1°C) | chamber | | | | | | | | | | | |

※1 : Over-temperature or overcool mark lights



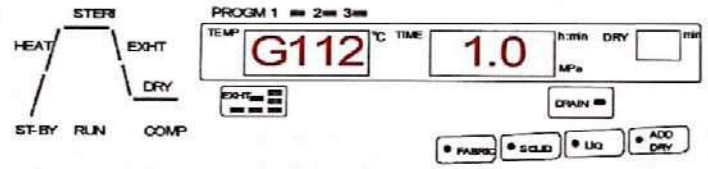
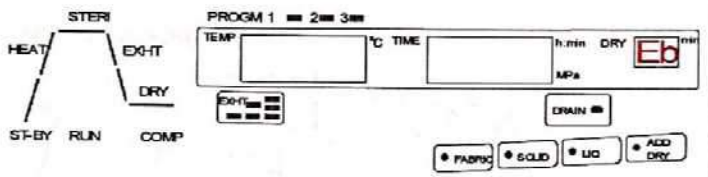
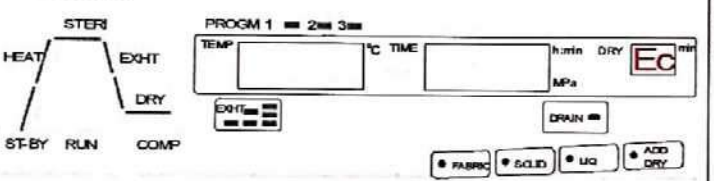
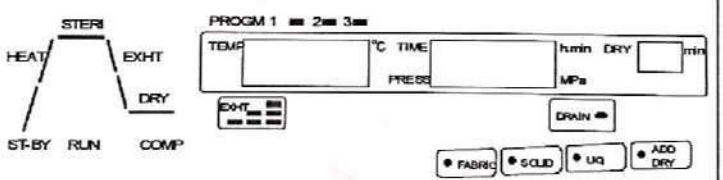

- If the chamber get overcooled, the sterilization timer stops.
- When the overcooled state is recovered, the sterilization timer resumes operation for the preset time.

※ Others

- Monitoring of "EF" works only when the floating sensor is ON.

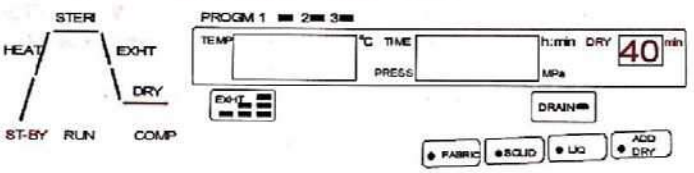
## 5. Operation

### 5.1 Turning on the power supply

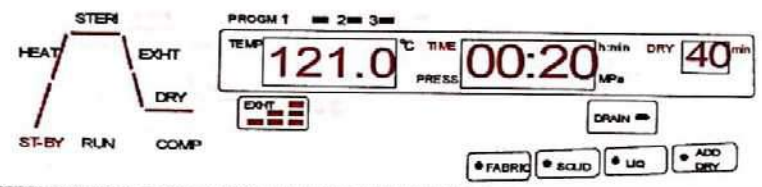
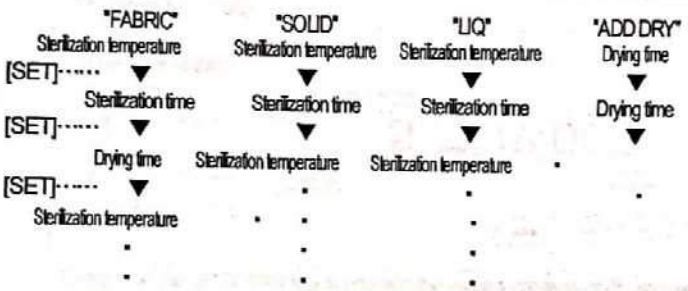
| Operation | Display | Action |
|---|---|---|
| Power key "ON" | ※A model name and program version are displayed for 2 seconds<br>Display of a model name : HRG-112=G112, HRG-140=G140<br>  | |
| | ※If voltage reduction of a backup battery occurs, the following screen is displayed for 2 seconds.<br>  | ①A buzzer sounds |
| | ※If the time-keeping of a clock IC stops, the following screen is displayed for 2 seconds.<br>  | ①A buzzer sounds<br>②Initializing the time |
| (Standby state) |  | |

※When the power supply is turned on by pressing the POWER key, the set value is initialized.
※When the power supply is turned on by pressing the POWER and FUNC keys, the set value and the cycle count (total operation number of the sterilizer) are initialized.

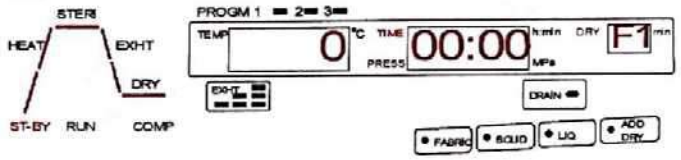
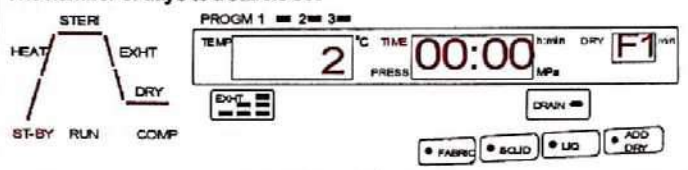
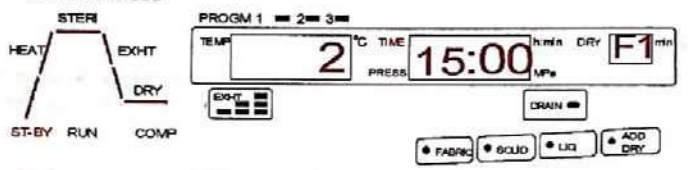
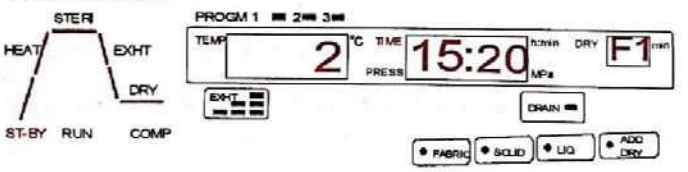
## 5.2 Changing a cycle

| Operation | Display | Action |
|---|---|---|
| OFABRIC | "ST-BY FABRIC cycle program 1"   | |
| OSOLID | "ST-BY SOLID cycle program 1"   | |
| OLIQ | "ST-BY LIQ cycle program 1"   | |
| OADD DRY | "ST-BY ADD DRY cycle program 1"   | |

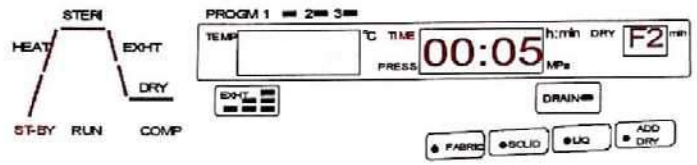
## 5.3 Changing a setting

| Operation | Display | Action |
|---|---|---|
| During standby state<br>SET<br>▲ / ▼ | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>**"Change of the sterilization temperature"**<br>  <br>Every time the UP/DOWN key is pressed, the value increases or decreases in increments of 1°C.<br>Holding down the UP/DOWN key increases or decreases the value in increments of 10°C. | |
| SET<br>. . . . . | **"Change of the sterilization time and drying time"**<br>The set value blinks as described in the change of the sterilization temperature.<br>  | ①The changed value is set. |
| A key is not operated for 5 sec. | **The display returns to the ST-BY state.** | |

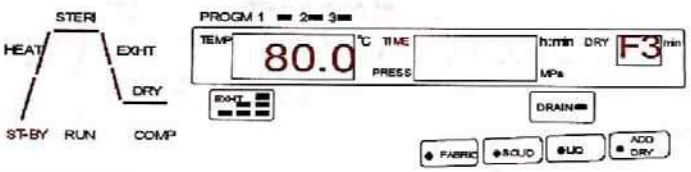
## 5.4 Confirming or setting the auto-start time

| Operation | Display | Action |
|---|---|---|
| Except ADD DRY cycle<br>FUNC. | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>**"The set auto-start time is confirmed."**<br>  | |
| SET | **"The number of days to a start is set "**<br>  <br>Every time the UP/DOWN key is pressed the value increases or decreases in increments of 1 day. | |
| SET | **"The hour is set."**<br>  <br>Every time the UP/DOWN key is pressed the value increases or decreases in increments of 1 hour.<br>Holding down the key increases or decreases the value in increments of 10 hours. | |
| SET | **"The minute is set."**<br>  | |
| SET | The display returns to the ST-BY state. | ①The auto-start time is set. |
| A key is not operated for 15 seconds when setting the day, hour and minute | The display returns to the ST-BY state. | ①The setting is cancelled. |
| A key is not operated for 5 seconds when confirming the auto-start time | The display returns to the ST-BY state. | |

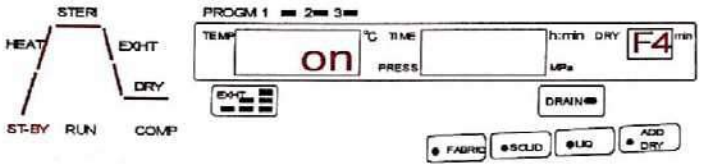
## 5.5 Setting the air removal time

| Operation | Display | Action |
|---|---|---|
| LIQ cycle only<br>FUNC.<br>×2<br>▲ / ▼ | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>  | |
| | Every time the UP/DOWN key is pressed the value increases or decreases in increments of 1 minute. | ①The changed value is set. |
| A key is not operated for 5 sec. | The display returns to the ST-BY state. | |

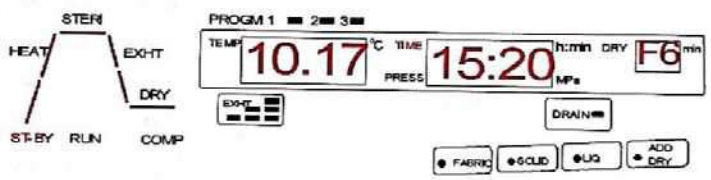
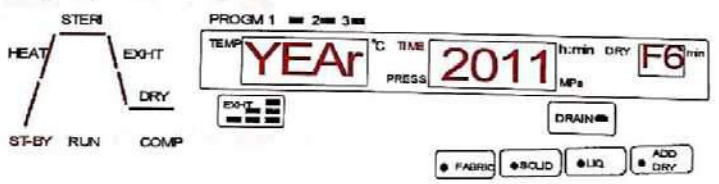
## 5.6 Setting the door lock temperature

| Operation | Display | Action |
|---|---|---|
| LIQ cycle only<br>FUNC.<br>×3<br>▲ / ▼ | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>  | |
| | Every time the UP/DOWN key is pressed the value increases or decreases in increments of 1°C.<br>Holding down the key increases or decreases the value in increments of 10°C. | ①The changed value is set. |
| A key is not operated for 5 sec. | The display returns to the ST-BY state. | |

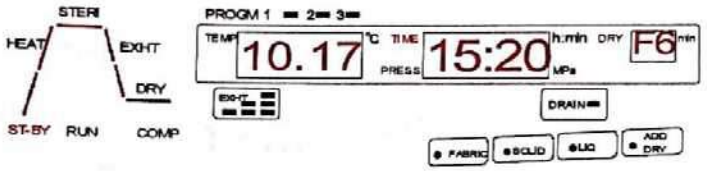
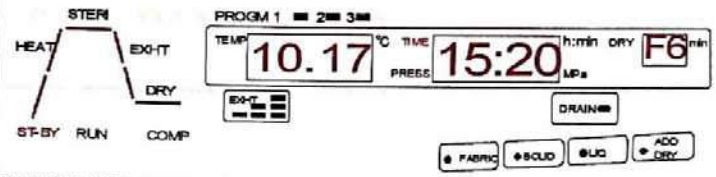
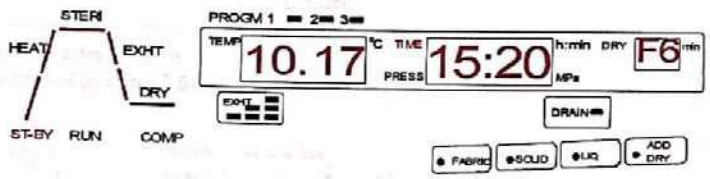
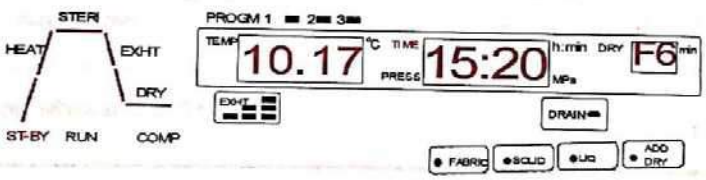
## 5.7 Setting the floating sensor

| Operation | Display | Action |
|---|---|---|
| Except ADD DRY cycle<br>FUNC.<br>×4<br>▲/▼ | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>  | ①The changed value is set. |
| | Every time the UP/DOWN key is pressed, ON and OFF are switched | |
| A key is not operated for 5 sec. | The display returns to the ST-BY state. | |

## 5.8 Confirmation and correction of the clock

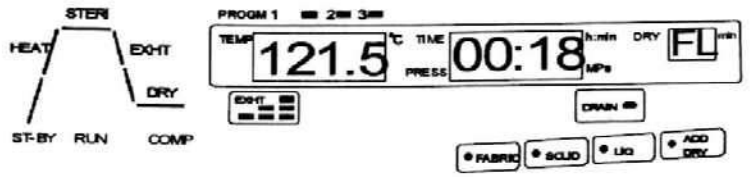
| Operation | Display | Action |
|---|---|---|
| FUNC.<br>X5 ※ | "Confirming the clock time"<br>  | |
| SET<br>▲/▼ | ※The correction value display blinks every 0.5 sec..<br>"Correcting the year"<br>  | |
| | Every time the "UP/DOWN" switch is pressed the value increases or decreases in increments of 1 year.<br>Holding down the switch increases or decreases the value in increments of 10 years. | |

- continued -

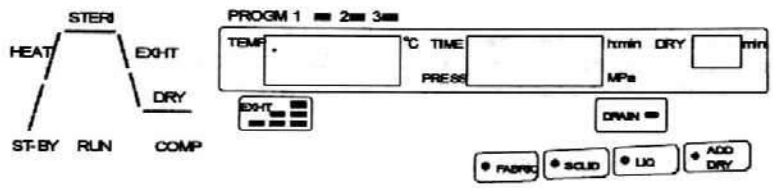
| | | |
|---|---|---|
| SET | "Correcting the month"<br>  | |
| SET | "Correcting the day"<br>  | |
| SET | "Correcting the hour"<br>  | |
| SET | "Correcting the minute"<br>  | |
| SET | Display returns to the ST-BY state. | ①The changed value is fixed. |
| Leaving it untouched for 15 seconds when correcting the time. | Display returns to the ST-BY state. | ①The set reservation time is cancelled. |
| Leaving it untouched for 5 seconds when confirming the clock time. | Display returns to the ST-BY state. | |

※ Number of time pressed the "FUNC" switch will be changed according the selected cycle or option installed.

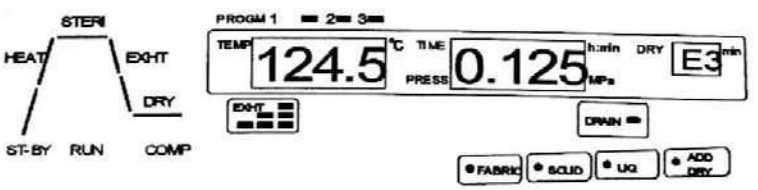
## 5.9 Confirming the floating sensor temperature

| Operation | Display | Action |
|---|---|---|
| When process is in progress<br>▼ | ※The value is displayed when ON/OFF setting of the floating sensor is ON.<br>  | |
| ▲ | Return to the display of the control sensor temperature. | |

## 5.10 Power-saving operation

| Operation | Display | Action |
|---|---|---|
| During standby state or at the end of operation<br><br>Autoclave is not operated for 10 minutes. | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>  | ①Relay output is turned OFF |
| Press any key | The display returns to the ST-BY or COMP. | ①Return to the standby or completion stage |

## 5.11 Error detection

| Operation | Display | Action |
|---|---|---|
| | ※The outline characters blink.<br>※The interval of blinking is 0.5 sec.<br>  | ①Relay output is turned OFF<br>②A buzzer sounds |

## 5.12 Printer output

| Operation | Printout |
|---|---|
| [Example]<br>AGAR cycle | ※The printer prints when the printer setting is ON.<br>※The printer does not print during 104 °C or less of sterilized setting temperature. |

**Starting the cycle**

```
HIRAYAMA  HICLAVE HRG          ←Manufacturer, Model
Version  1.0                   ←Control program version

Cycle Count  = 0001            ←Cycle count (total operating number of times)
Date         = 23 Mar 2011     ←Date of operation startup
Time         = 15:30           ←Time of operation startup

Program      = Fabric 1        ←Selected cycle and program
Steri Temp   = 121 °C          ←Set sterilization temperature
Steri Time   = 00:20           ←Set sterilization time
Dry Time     =  40 min         ←Set dry time
```

**Heating stage**

**Sterilization stage**

**Exhaust stage**

**Dry stage**

```
Tim | C.Tmp | F.Tmp | Press | S
000  24.5     24.5    0.000   H
003  22.3     24.4   -0.065   H
006  32.1     24.4   -0.060   H
  :
065 122.5    121.1    0.110   S
066 122.0    121.2    0.108   S
067 121.5    121.3    0.106   S
  :
087 100.5    100.5    0.002   E
  :
096  96.6     95.5   -0.058   D
099  93.1     95.2   -0.067   D
  :
  :
Success                        ←Completion of the cycle is printed out and printing stops.
```

←An elapsed time from a start, control sensor temperature, floating sensor temperature. ("OFF" is printed when a floating sensor is OFF), chamber pressure and the stages (H: Heating, S: Sterilization, E: Exhaust, D: Dry) are printed out every 3 minutes.

←An elapsed time from a start, control sensor temperature, floating sensor temperature, chamber pressure and the stages are printed out every 1 minute.

←An elapsed time from a start, control sensor temperature floating sensor temperature, chamber pressure and the stages are printed out every 3minutes.

**When changing to the warming stage**

```
Success                        ←Completion of the cycle is printed out and printing stops.
```

**When an operation was suspended**

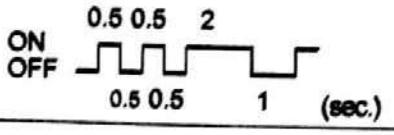
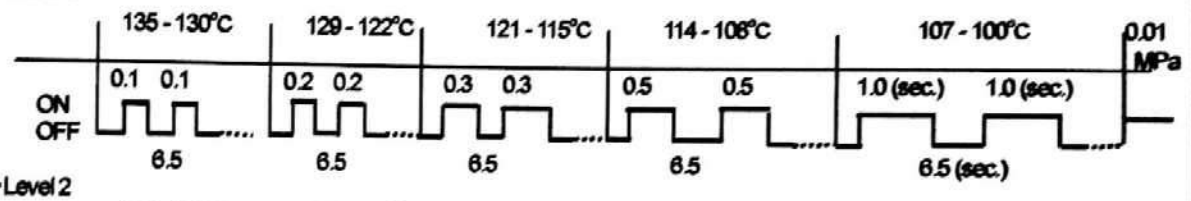
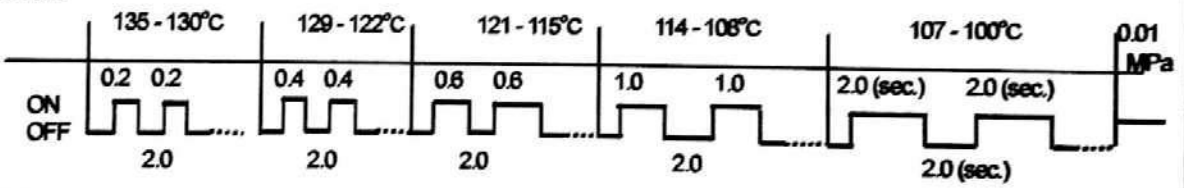
```
Canceled                       ←Printing stops.
```

**When an error is detected**

```
Error #                        ←Error number is printed and printing stops.
```

## 6. Timing chart

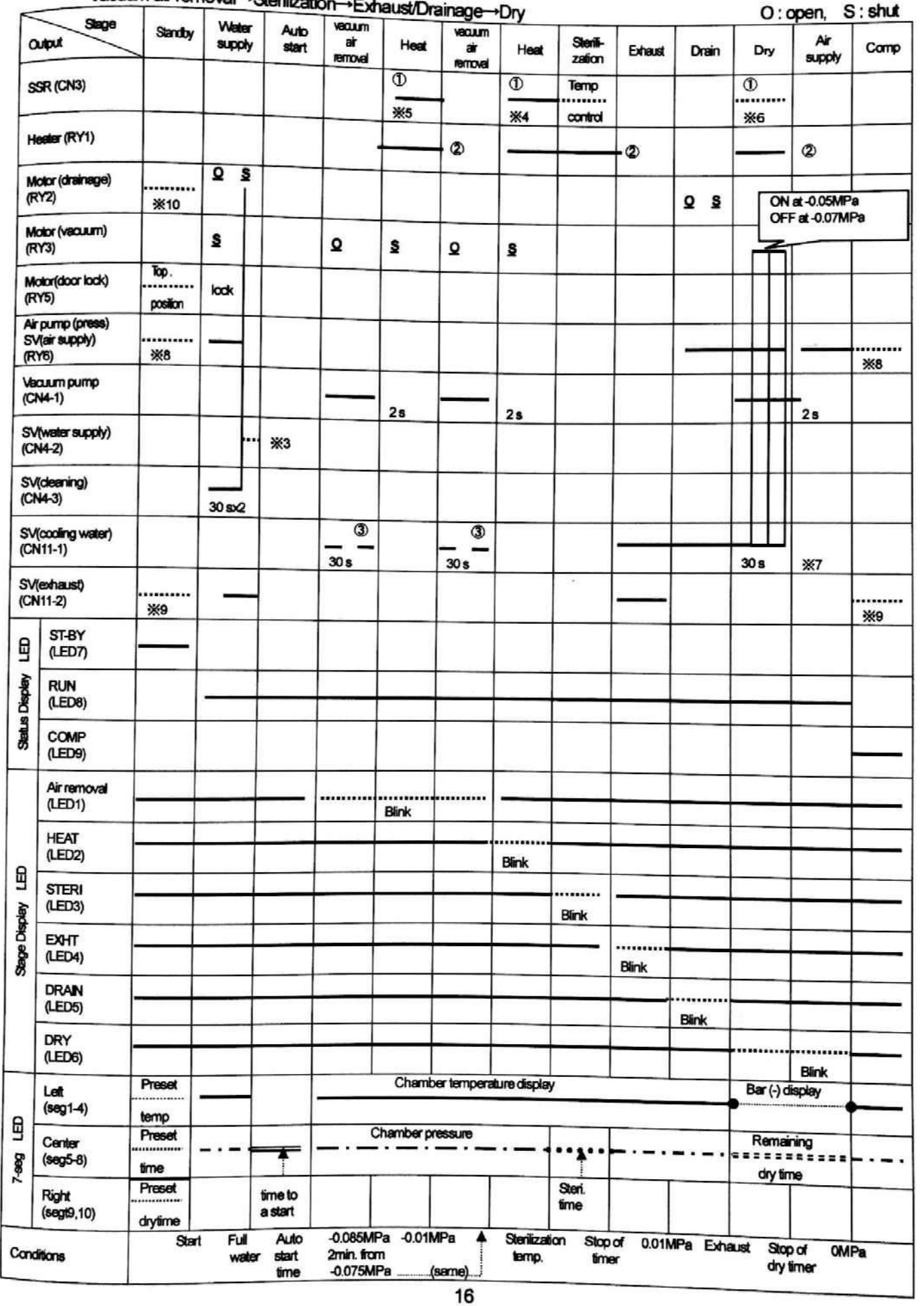
### ●Explanation of notes on the timing chart.

| Note Number | Explanation |
|---|---|
| ① | The SSR is turned ON 0.5 sec. after the RY1 heater has been turned ON. |
| ② | The heater is turned OFF 0.5 sec. after the SSR has been turned OFF. |
| ③ | The solenoid valve is turned ON when degree of vacuum reaches -0.06MPa. |
| ※1 | Completion buzzer : The buzzer rings 3 times<br>  |
| ※2 | ON/OFF time of the exhaust valve<br>The exhaust valve is turned on or off as follows according to the exhaust level setting.<br>(Exhaust level 1: the valve is always off. Exhaust level 3: the valve is always on.)<br>•Level 1<br>  <br>•Level 2<br>  |
| ※3 | When there is no water in the chamber, the solenoid valve is turned on for 20 seconds and turned off for 10 seconds. When there is water in the chamber, the solenoid valve is turned on for 5 seconds and turned off for 10 seconds. |
| ※4 | ON/OFF control of the heater is performed at 230°C that is input from the heater temperature sensor. When the floating sensor setting is on, temperature is controlled at the set temperature +1°C. |
| ※5 | The ON/OFF control of the heater is performed when temperature input from the heater temperature sensor is 230°C. |
| ※6 | The ON/OFF control of the heater is performed when temperature input from the heater temperature sensor is 160°C. |
| ※7 | When the vacuum motor valve is open and the degree of vacuum reaches -0.06MPa, the solenoid valve for cooling water supply is turned on. |
| ※8 | When pressure is 0.001MPa or more, the solenoid valve for air supply is turned off.<br>When pressure is -0.001MPa or less, the solenoid valve for air supply is turned on. |
| ※9 | When pressure is 0.005MPa or more, the solenoid valve for exhaust is turned on.<br>When pressure is 0.002MPa or less, the solenoid valve for exhaust is turned off. |
| ※10 | When the door is not locked, or, when water in the chamber is not discharged, the drain motor is turned on. |

## 6.1 FABRIC Cycle

Vacuum air removal→Sterilization→Exhaust/Drainage→Dry

O : open, S : shut



## 6.2 SOLID Cycle

Vacuum air removal→Sterilization→Exhaust/Drainage

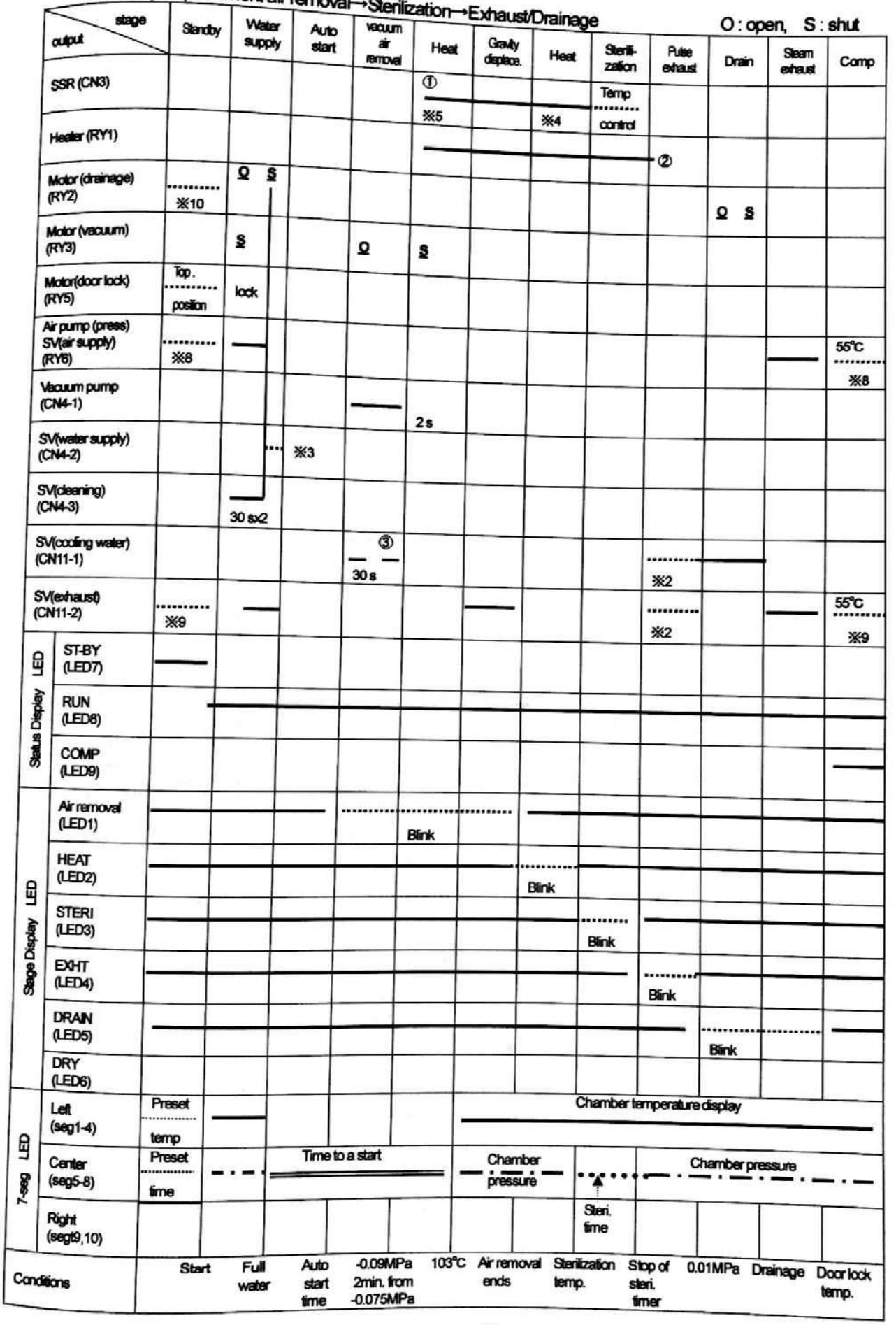
O : open, S : shut

| output \ stage | Standby | Water supply | Auto start | vacuum air removal | Heat | vacuum air removal | Heat | Sterili-zation | Exhaust | Drain | Steam exhaust | Air supply | Comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SSR (CN3) | | | | | ① ※5 | | ① ※4 | Temp control | | | | | |
| Heater (RY1) | | | | | | ② | | | ② | | | | |
| Motor (drainage) (RY2) | ※10 | O S | | | | | | | | O S | O S | | |
| Motor (vacuum) (RY3) | | S | | O | S | O | S | | | | | | |
| Motor(door lock) (RY5) | Top. position | lock | | | | | | | | | | | |
| Air pump (press) SV(air supply) (RY6) | ※8 | | | | | | | | | | | | ※8 |
| Vacuum pump (CN4-1) | | | | | 2 s | | 2 s | | | | | 2 s | |
| SV(water supply) (CN4-2) | | | ※3 | | | | | | | | | | |
| SV(cleaning) (CN4-3) | | 30 sx2 | | | | | | | | | | | |
| SV(cooling water) (CN11-1) | | | | ③ 30 s | | ③ 30 s | | | | | 30 s | | |
| SV(exhaust) (CN11-2) | ※9 | | | | | | | | | | | | ※9 |
| Status Display LED: ST-BY (LED7) | | | | | | | | | | | | | |
| Status Display LED: RUN (LED8) | | | | | | | | | | | | | |
| Status Display LED: COMP (LED9) | | | | | | | | | | | | | |
| Stage Display LED: Air removal (LED1) | | | | | Blink | | | | | | | | |
| Stage Display LED: HEAT (LED2) | | | | | | | Blink | | | | | | |
| Stage Display LED: STERI (LED3) | | | | | | | | Blink | | | | | |
| Stage Display LED: EXHT (LED4) | | | | | | | | | Blink | | | | |
| Stage Display LED: DRAIN (LED5) | | | | | | | | | | | Blink | | |
| Stage Display LED: DRY (LED6) | | | | | | | | | | | | | |
| 7-seg LED: Left (seg1-4) | Preset temp | | | Chamber temperature | | | | | | | | | |
| 7-seg LED: Center (seg5-8) | Preset time | | | Chamber pressure | | | | | Chamber pressure | | | | |
| 7-seg LED: Right (segt9,10) | | | time to a start | | | | | Steri. time | | | | | |
| Conditions | Start | Full water | Auto start time | -0.085MPa 2min. from -0.075MPa | -0.01MPa | (same) | Sterilization temp. | Stop of timer | 0.01MPa | Drainage | 5min. door lock temp. | 0MPa | |

## 6.3 LIQ Cycle

Gravity displacement air removal→Sterilization→Exhaust/Drainage

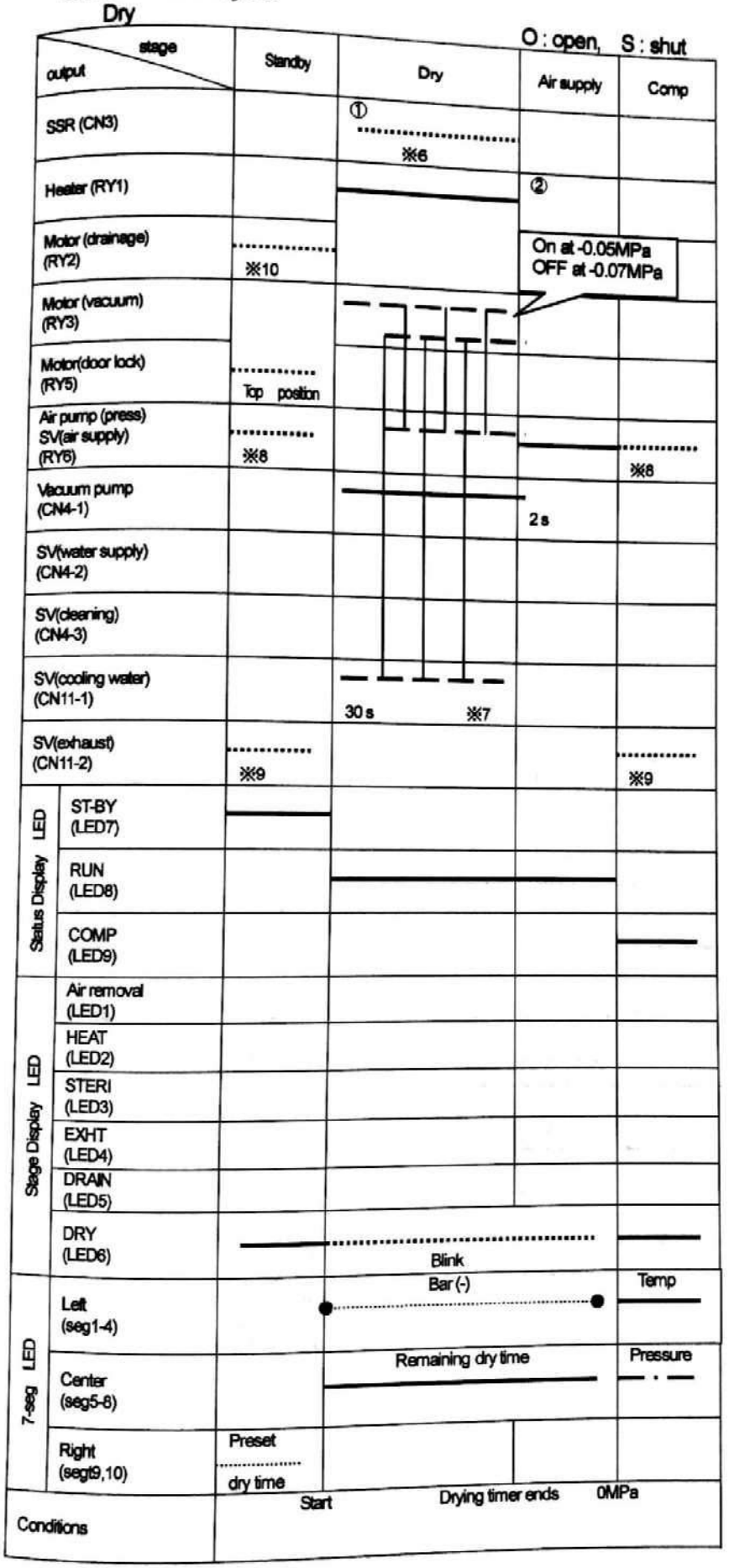
O : open, S : shut



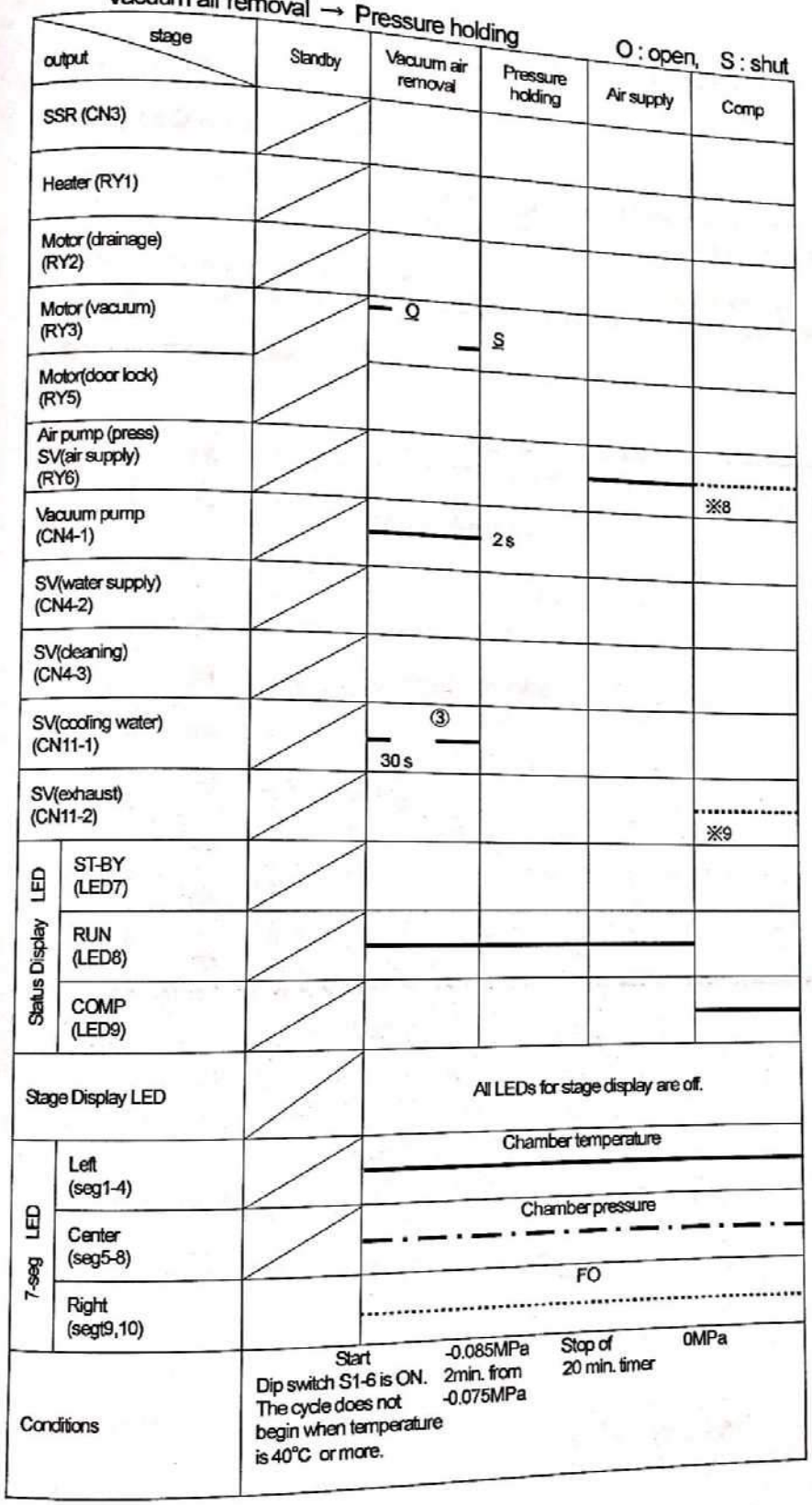
## 6.4 ADD DRY Cycle

Dry

O : open, S : shut



## 6.5 Vacuum Test Cycle



## ●Pouring water into the tank

Pressing the UP/DOWN (▲ , ▼) keys simultaneously during standby state pours water into the tank for 3 minutes.

## ●Inspecting a safety valve

Set the S1-7 of the dip switch to ON position and turn the power supply switch on.
Start the LIQ cycle and close the exhaust valve without performing air removal.

The safety valve does not operate. When the chamber pressure reaches 0.294MPa or more, an over-pressure exhaust is performed and an over-pressure alarm is activated.

## ●Function number

| | |
|---|---|
| F0 | Vacuum test (Set the S1-6 of the dip switch to ON) |
| F1 | Programmable auto-start |
| F2 | Air removal time |
| F3 | Door lock temperature |
| F4 | Setting of a floating sensor |
| F5 | |
| F6 | Time setting |
| F7 | |
| F8 | |
| F9 | |

# Chapter 2. Maintenance and Service

## 1. Replacing the door gasket

①Open the door.

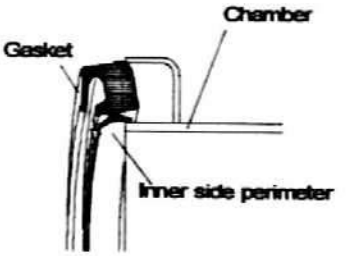
②Pull out the old gasket.

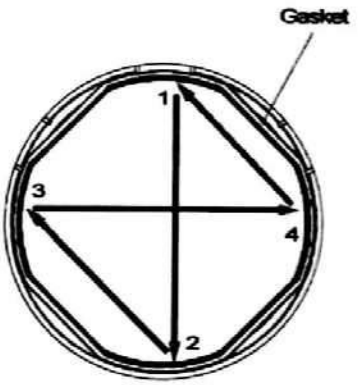
③Using a cloth, wipe off the part where the old gasket was installed.

④Install the new gasket in the chamber

- Insert a little the inner side perimeter of the new gasket into the outer side perimeter of the chamber in the order shown in the figure so that each length becomes almost same.
- Then, gradually and evenly insert the entire gasket while taking care so as not to damage the inner side perimeter of the new gasket.

  In addition, touch the gasket with your finger along the inner side perimeter and the outer side perimeter and push it in to eliminate unevenness of the gasket surface.
- If there is unevenness on the gasket surface, it causes air leakage or makes noise when operating the door.





⑤Set the sterilization temperature to the upper limit.
Start an operation and check the gasket for steam leak.

## 2. Replacing the Solid State Relay (SSR)

①Pull out the Faston terminals connected to the solid state relay (SSR).

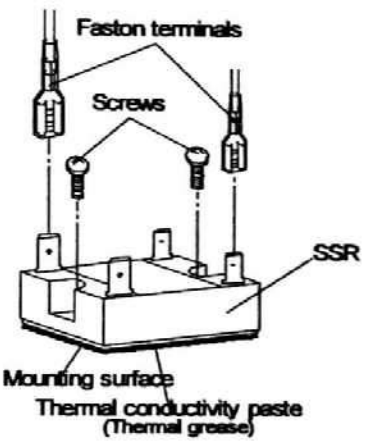
②Take out the screws and remove the SSR from the switchboard.

③Wipe off the thermal grease and dust which adhere around the screw holes of the switchboard.

④Clean the mounting surface of the new SSR, then apply thermal grease evenly on it.

⑤Install the SSR on the switchboard and connect the Faston terminals.

- As the IN side of the SSR has polar direction, be sure to connect it as before.



## 3. Replacing the Backup Battery

●If Eb or Ec is displayed when turning on the main power supply, replace the backup battery as described below.

**⚠ CAUTION**

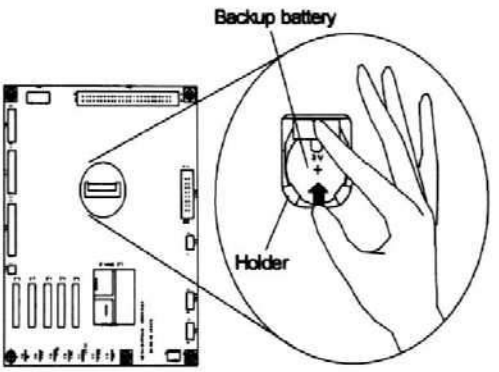
●Do not throw the used battery into the flames. It can burst.

①Slide aside the backup battery mounted on the control board and remove it from the holder

- Discard the removed backup battery after insulating it with an insulation tape.

②Install the backup battery on the holder with the + side facing up

③Referring to the operation manual, correct the clock

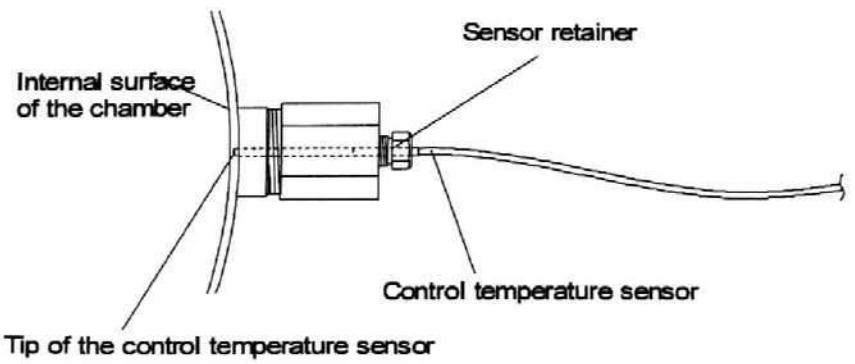



## 4. Replacing the Control Temperature Sensor

①Loosen the sensor retainer.

②Pull out the temperature sensor from the sensor retainer hole.

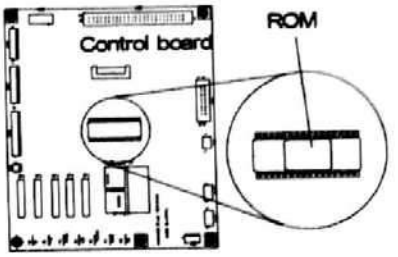
③Insert the new sensor through the sensor retainer hole until the sensor tip comes to the same position as the internal surface of the chamber, and firmly tighten the sensor retainer using only fingers. Never use a tool such as an adjustable wrench.



## 5. Replacing the ROM

**IMPORTANT**

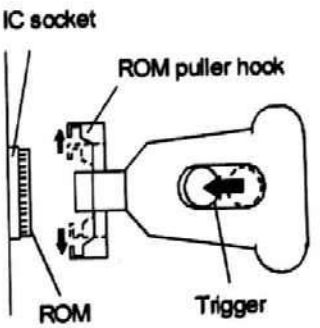
- When replacing the ROM, use a specialized tool to avoid damage to the control board or the ROM.
- PCB or ROM can be damaged when it touches the static electricity collected in a person and a cloth. Before replacing the ROM, touch a metal or the like to discharge static electricity.



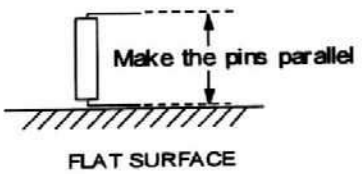

■Required tools: ROM puller

①Pull the ROM out of the IC socket with a ROM puller as described below.

- Press the trigger of the ROM puller to open the hooks.
- Grip the bottom of the ROM with the hooks.
- Pull the trigger to remove the ROM.



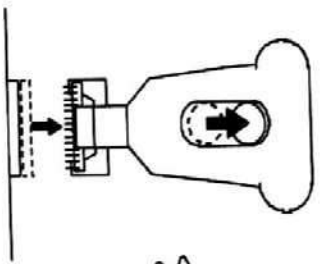

②Check if the pins of the new ROM are parallel. If the pins bend outward, correct them on the flat table so that they become parallel.





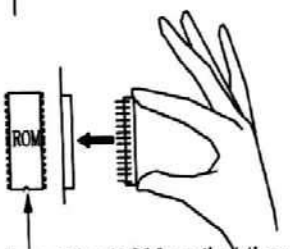
Grip the both ends of ROM with hooks

③Insert the new ROM into the IC socket with care to the direction of ROM.



④Turn on the main power supply switch while pressing the POWER key of the operation panel.

- The old ROM data is deleted.

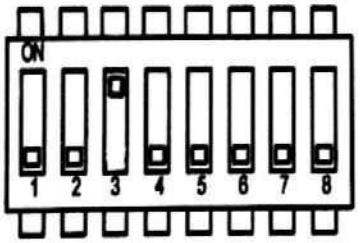



Insert the ROM so that the notch of the ROM comes to the same direction as the notch of the IC socket

## 6. Cautions when replacing the Control Board (Switchboard)

(1) When the control board (switchboard) is replaced, perform the following procedure before turning on the power supply.

①After confirming the model name, check if the optional floating sensor is installed, and set the S1 dip switch of the control board as follows.



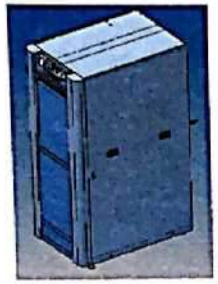

| | |
|---|---|
| With a floating sensor | Set S1-3 to ON (to the upper position) |

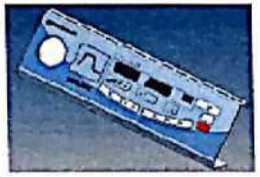
- The special specification program may be installed. If the version number of the ROM used by the old control board is 3-digit, the program specification needs to be identified because the program is a specially made specification.

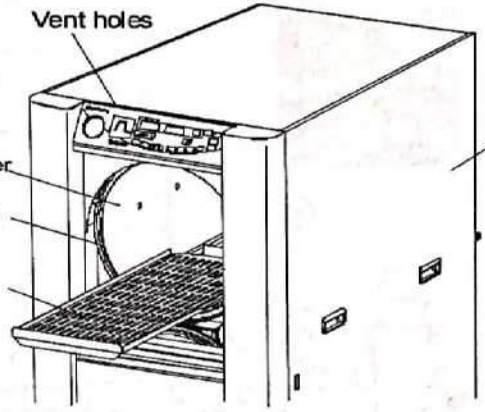
②Turn on the main power supply switch while pressing the POWER key of the operation panel.
- The data of the new control board is initialized.

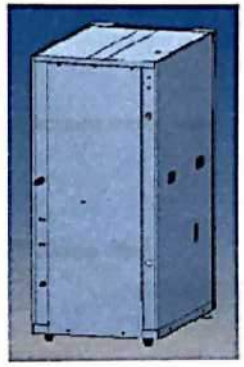
# Chapter 3. Reference Drawings

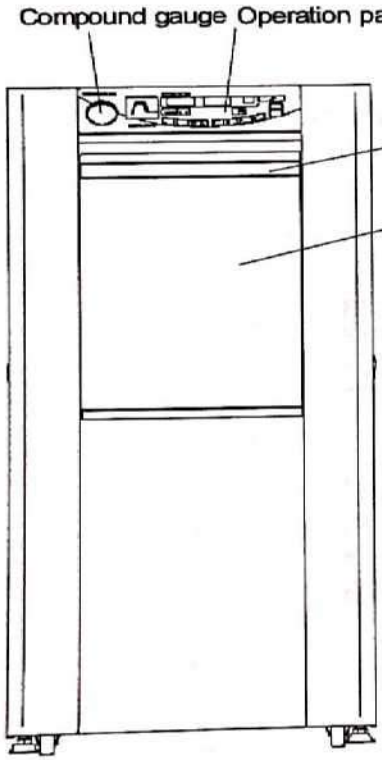
## ●External view

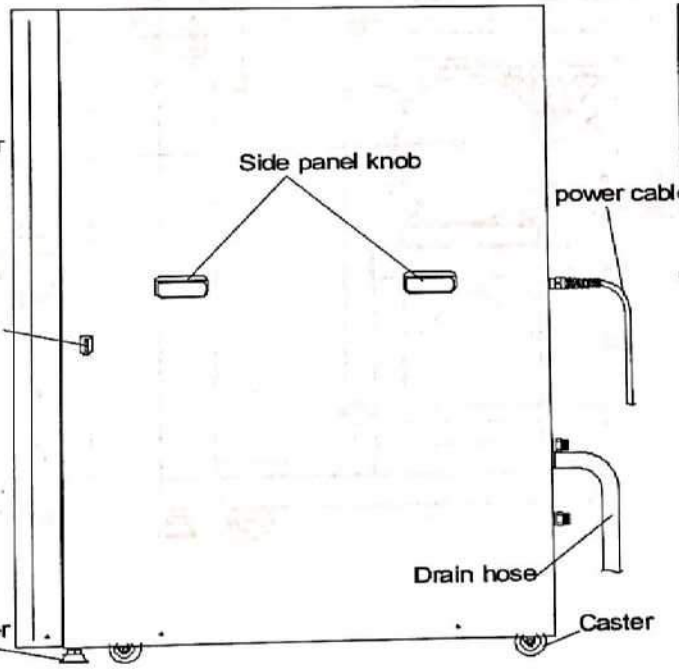


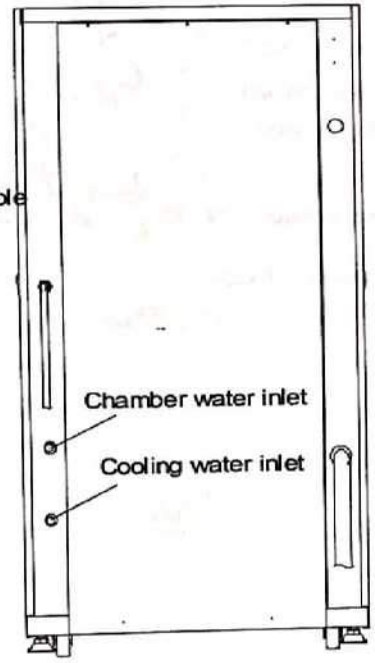




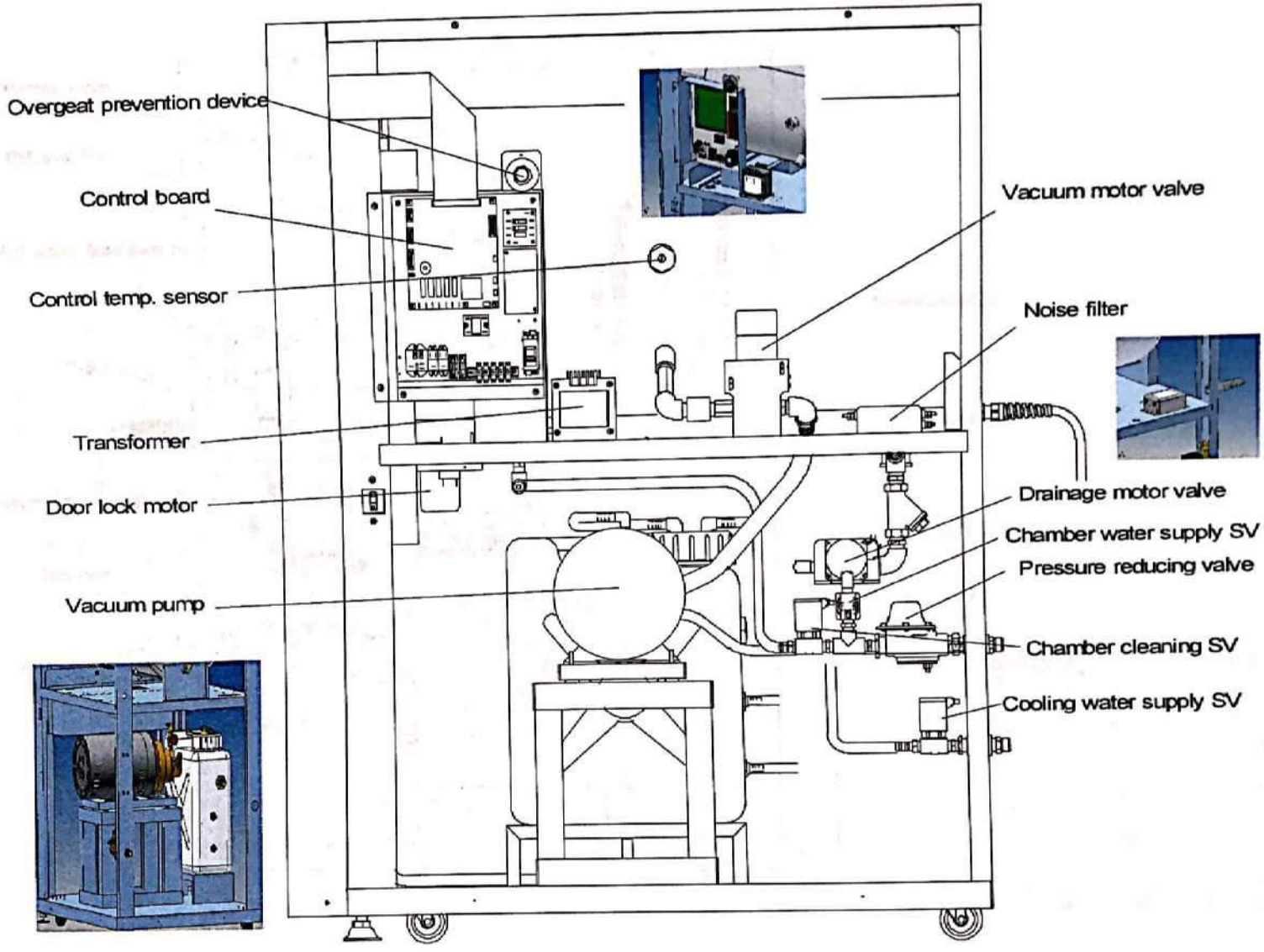





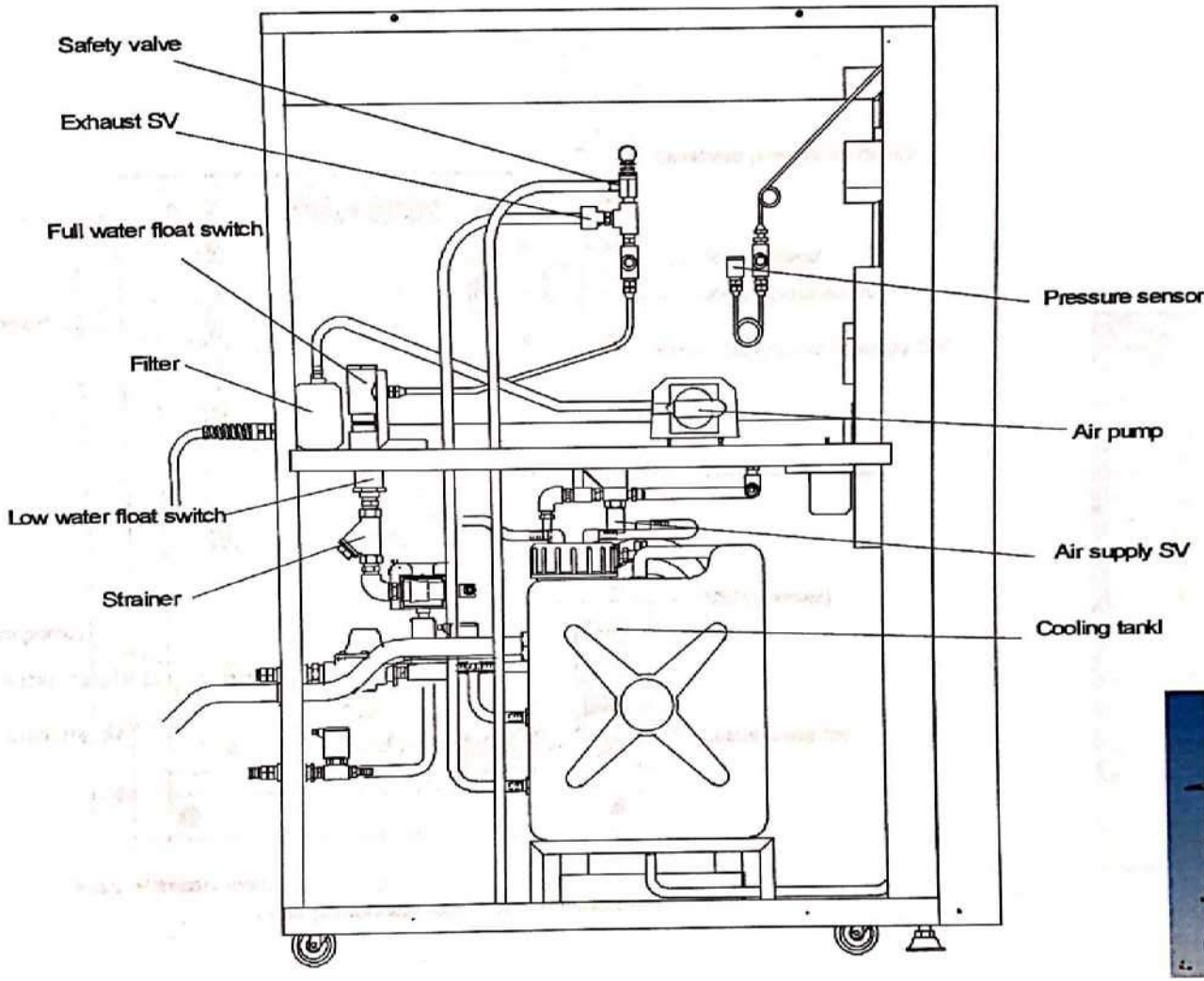



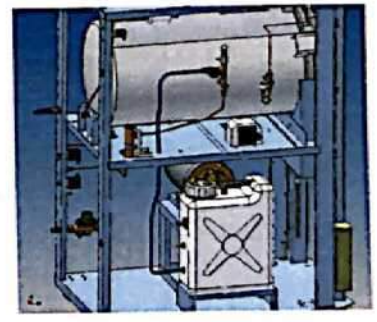



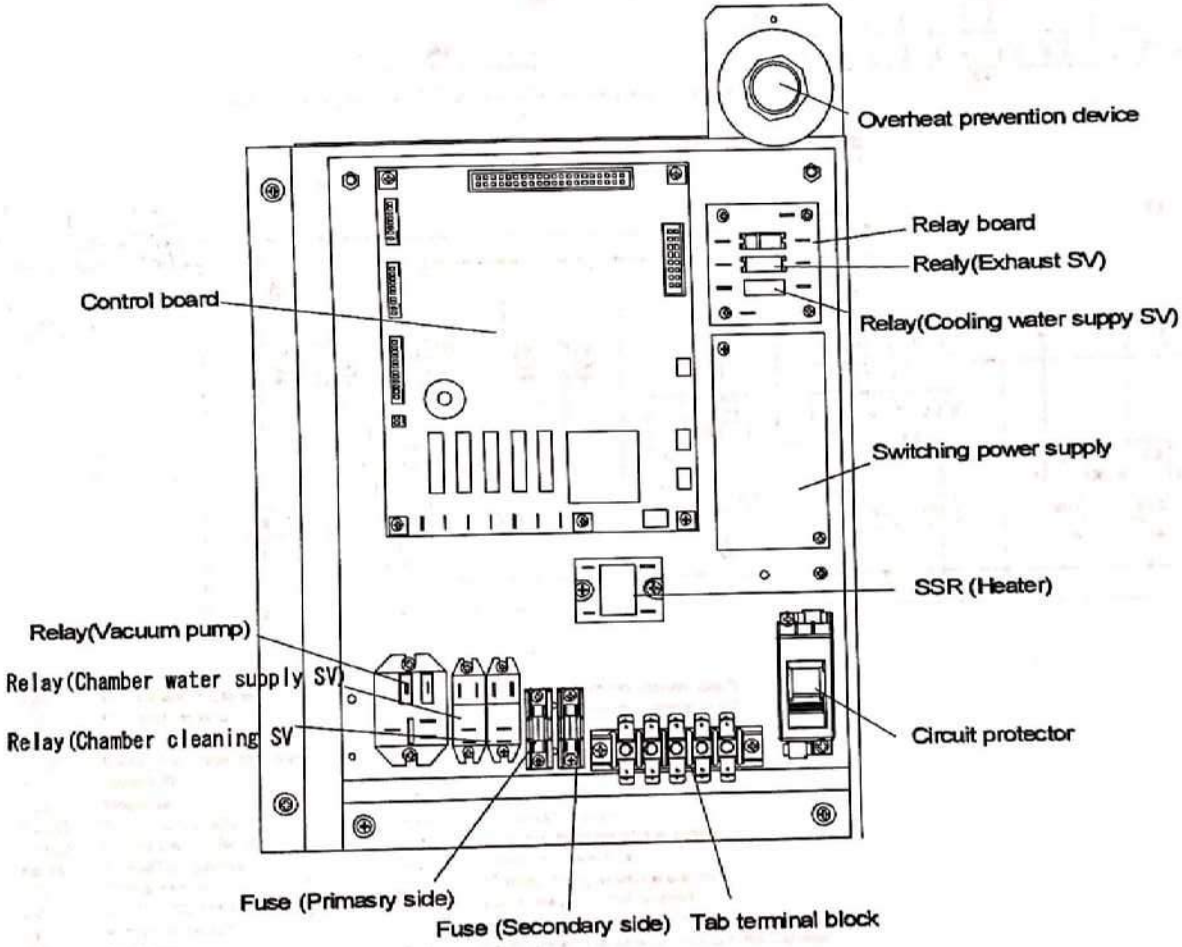
## ●Right side view

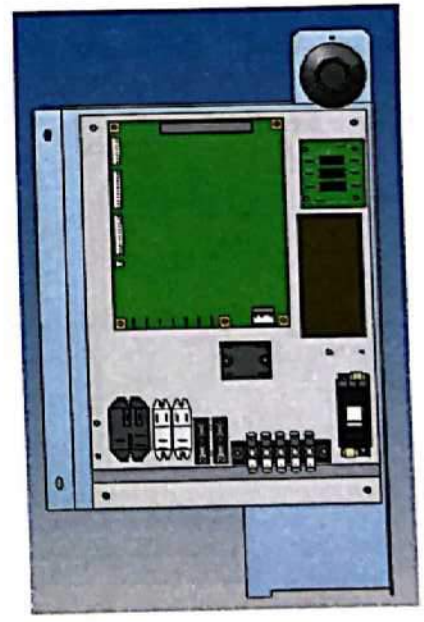


## ●Left side view

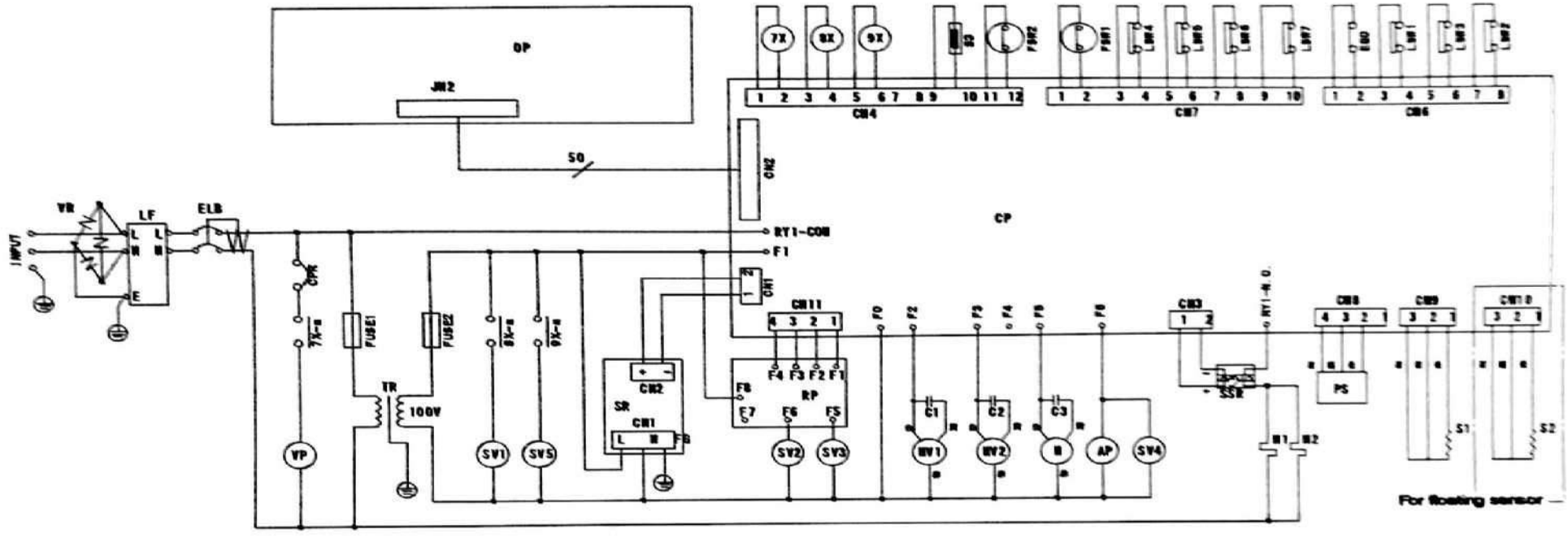



Overheat prevention device
Relay board
Realy(Exhaust SV)
Relay(Cooling water suppy SV)
Control board
Switching power supply
SSR (Heater)
Relay(Vacuum pump)
Relay(Chamber water supply SV)
Relay(Chamber cleaning SV)
Circuit protector
Fuse (Primasry side)
Fuse (Secondary side)
Tab terminal block



## ●Wiring diagram

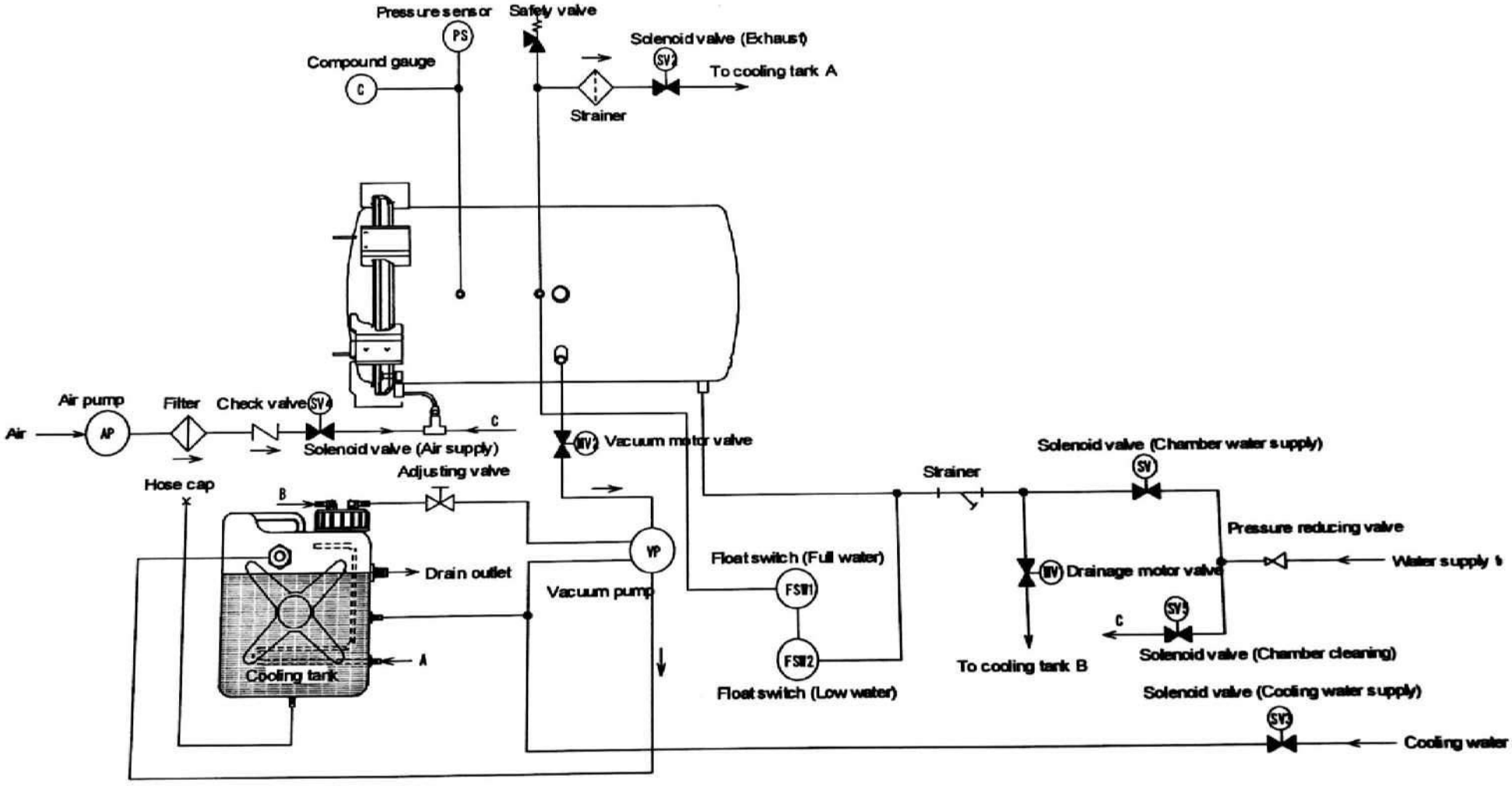



| | |
|---|---|
| OP | Operation panel |
| CP | Control board |
| RP | Relay board |
| ELB | Earth leakage breaker |
| LF | Noise filter |
| VR | Varister |
| FUSE1 | Fuse (2A 250V T) |
| FUSE2 | Fuse(2A 250V T) |
| CPR | Circuit protector |
| TR | Transformer |
| SR | Switching power supply |
| VP | Vacuum pump |
| AP | Air pump |
| MV1 | Motor valve (drainage) |
| MV2 | Motor valve (vacuum) |
| M | Motor (door lock) |
| C1~C3 | Condensor for motor |
| SV1 | SV (Soft water supply) |
| SV2 | SV (Exhaust) |
| SV3 | SV (cool water supply) |
| SV4 | SV (air supply) |
| SV5 | SV (chamber cleaning) |

| | |
|---|---|
| H1 | Heater (chamber lower part) |
| H2 | Heater (chamber upper part) |
| SSR | SSR (heater) |
| 7X | Relay (vacuum pump) |
| 8X | Relay (soft water supply) |
| 9X | Relay (exhaust SV) |
| PS | Pressure sensor |
| S1 | Control temperature sdensor |
| S2 | Floating saersor |
| S3 | Heater temperature sensor |
| FSW1 | Float switch (full water) |
| FSW2 | Float switch (low water) |
| EGO | Overheat prevention device for heater |
| LSW1 | Limit switch (door close) |
| LSW2 | Limit switch (door lock) |
| LSW3 | Limit switch (door unlock) |
| LSW4 | Limit switch (drain motor valve open) |
| LSW5 | Limit switch (drain motor valve close) |
| LSW6 | Limit switch (vacuum/exhaust motor valve open) |
| LSW7 | Limit switch (vacuum/exhaust motor valve close) |

• SV : Solenoid Valve

## ●Piping diagram



# Chapter 4. Operation Check Programs

●This chapter describes the way to perform the hardware check of the HRG-112 and HRG-140 autoclaves

## 1. Outline

| | | |
|---|---|---|
| C1 | Checking if the LEDs light | All LEDs on the operation panel board are lit and each LED lights up sequentially. |
| C2 | Checking the switch input | LEDs corresponding to the switches (SW1-16) of the operation panel board or corresponding to the S1 dip switch of the control board are lit. |
| C3 | Checking the contact input | LEDs corresponding to the input of CN4, CN6 and CN7 connectors light up. |
| C4 | Checking the relay output | A relay output is activated by pressing an operation switch. |
| C5 | Checking or adjusting the input of the CN9 control temperature sensor | The input value of the CN9 control temperature sensor is converted into temperature and the temperature is displayed. |
| C6 | Checking or adjusting the input of the CN10 floating sensor | The input value of the CN10 floating sensor is converted into temperature and the temperature is displayed. |
| C7 | Checking the input of the CN8 pressure sensor | The input value of the CN8 pressure sensor is converted into pressure and the pressure is displayed. |
| C8 | Checking the input of the CN4-10 heater temperature sensor | The input value of the CN4-10 heater temperature sensor is converted into temperature and the temperature is displayed. |

## 2. Startup method

(1) Set the S1-⑧ of the dip switch in the control PCB to ON.

(2) Turn on the main power supply switch then press the POWER key.

## 3. Items to check beforehand

●Measure the voltage of the control board.

Measure the voltage between TP1 terminal (Circuit voltage) and TP2 terminal (GND): DC + 5V ±0.25V

# Operation test

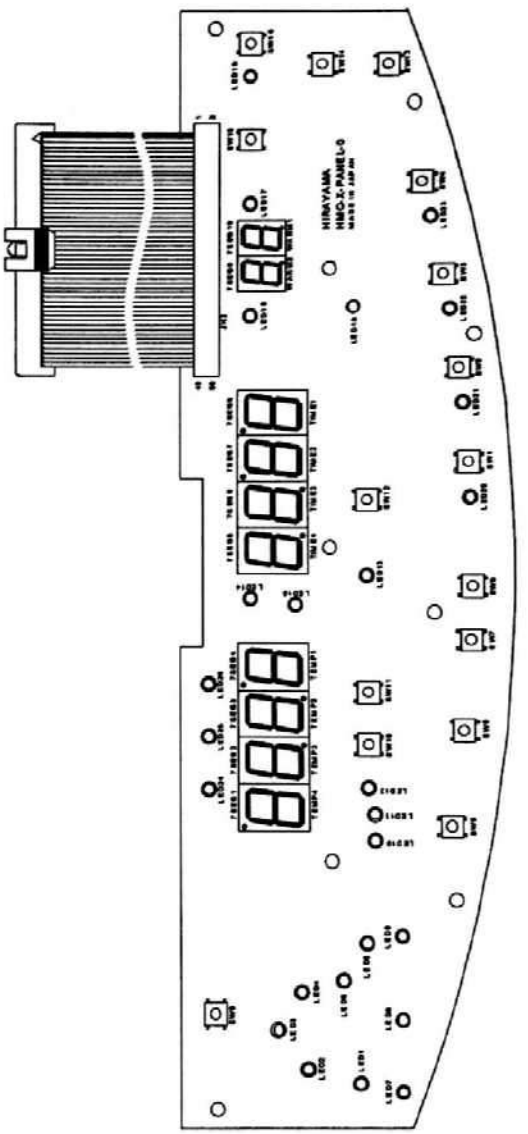
## C1: Checking if LEDs light

- " I" is displayed on the 7SEG10 for two seconds. All LEDs on the operation panel board are lit for 4 seconds. Then, each LED is lit in sequence as shown below.

  ·When all LEDs are lit, the LED 18 and 19 turn to yellow after they light in red for two seconds.
  ·The 7SEG9 and ⑧ of 7SEG10 do not light up.

Lighting sequence of 7-segment LED

7SEG1-①
↓
7SEG1-②
↓
:
7SEG1-⑧
↓
7SEG2-①
↓
7SEG2-②
↓
:
7SEG10-⑦
↓
LED1
↓
LED2
↓
:
LED17
↓
LED18 (Red)
↓
LED19 (Red)
↓
LED20
↓
:
LED23
↓
LED18 (Yellow)
↓
LED19 (Yellow)
↓
LED24
↓
LED25
↓
LED26
↓
Returning to 7SEG1-①

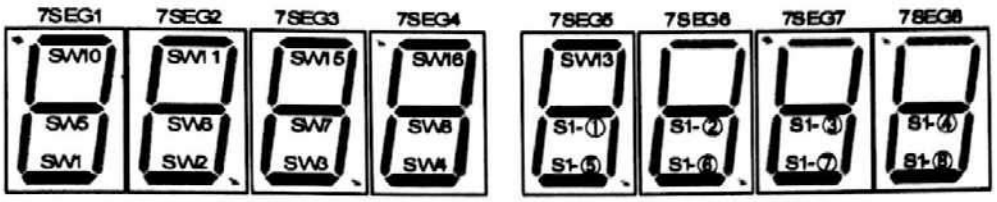


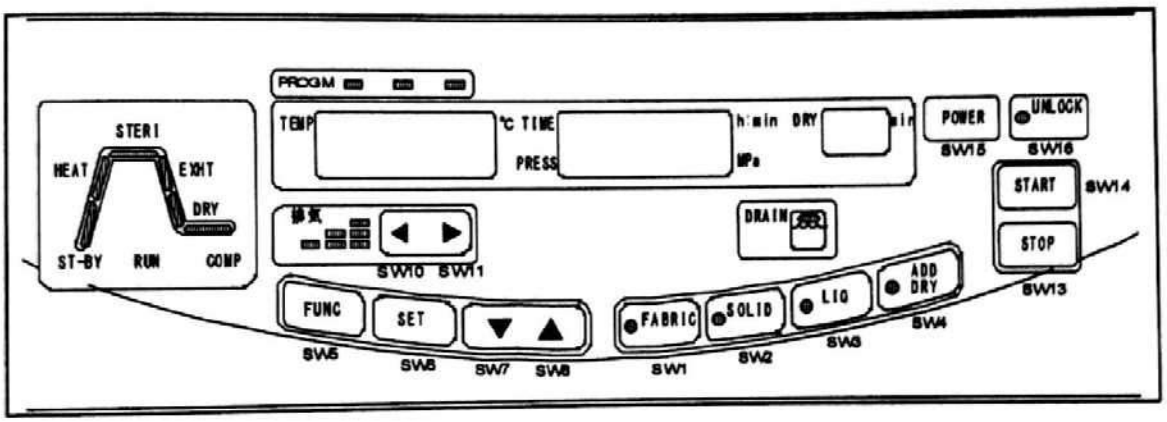
- Pressing the SW14 switch advances the operation test program to C2.

● "2" is displayed on the 7SEG10. A segment of LED which corresponds to the SW1-SW16 switches of the operation panel board or a segment of LED which corresponds to ON/OFF input of the S1 dip switch of the control board is lit.

- The switch input of SW14 is not confirmed with this program, because the SW14 operation switch is used to change the mode.
- When an operation switch is pressed a LED lights up, and when the operation switch is released the LED is turned off.
- When a dip switch is ON, a LED lights up, and when the dip switch is OFF, the LED does not light up.
- After checking the dip switch, restore the ON/OFF setting of the dip switch to a previous state.

Correlation between a switch and a lit segment of LED



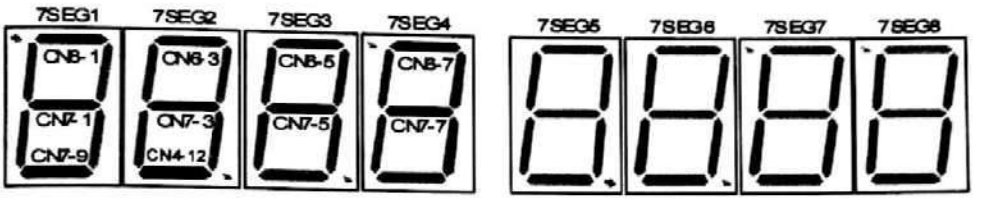

● Pressing the SW14 switch advances the operation test program to C3 .

## C3: Checking the contact input

● "3" is displayed on the 7SEG10. A segment of LED which corresponds to the contact input of the CN4, CN6 or CN7 connectors mounted on the control board is lit.

·When the contact opens, the LED segment lights up , and when the contact closes, it does not light up .

Correlation between the contact input and a lit segment of LED




● Pressing the SW14 switch advances the operation test program to C4 .

## C4: Checking the relay output

● "4" is displayed on the 7SEG10. When an operation switch is pressed, the relay corresponding to the operation switch operates.

·When an operation switch is pressed a relay operates , and when the operation switch is released the relay stops.

Correlation between a switch and a relay output

| SWITCH | OUTPUT CONNECTOR | RELAY | OUTPUT TERMINAL | ACTIVATED PARTS |
|---|---|---|---|---|
| SW5 (Function) | CN3-2 | SSR | - | H1,H2 (Heater) |
| SW6 (Setup) | - | RY1 | - | H1,H2 (Heater) |
| SW7 (▼) | - | RY2 | F2 | MV1 (Drainage motor valve) |
| SW8 (▲) | - | RY3 | F3 | MV2 (Vacuum motor valve) |
| SW1 (FABRIC) | - | RY5 | F5 | M (Door lock motor) |
| SW2 (SOLID) | - | RY6 | F6 | AP,SV4 (Air pump, Air supply solenoid valve) |
| SW3 (LIQ) | CN4-2 | 7X | - | VP (Vacuum pump) |
| SW4 (ADD DRY) | CN4-4 | 8X | - | SV1 (Chamber water supply solenoid valve) |
| SW10 (◀) | CN4-6 | 9X | - | SV5 (Chamber cleaning solenoid valve) |
| SW11 (▶) | CN11-2 | RL2 | - | SV3 (Cooling water supply solenoid valve) |
| SW15 (Power supply) | CN11-3 | RL3 | - | SV2 (Exhaust solenoid valve) |

● Pressing the SW14 switch advances the operation test program to C5 .

### C5: Checking or adjusting the input of the CN9 control temperature sensor

- "5" is displayed on the 7SEG10 and the temperature detected by the CN9 control temperature sensor is displayed on the 7SEG1-7SEG4.

  - When temperature is normal, adjust the input of the CN9 control temperature sensor with a VR1 trimmer potentiometer mounted on the control board.
  - When temperature is 121°C, adjust the input of the CN9 control temperature sensor with a VR2 trimmer potentiometer mounted on the control board.

- Pressing the SW14 switch advances the operation test program to C6.

### C6: Checking or adjusting the input of the CN10 floating sensor

- "6" is displayed on the 7SEG10 and the temperature detected by the CN10 floating sensor is displayed on the 7SEG1-7SEG4.

  - When temperature is normal, adjust the input of the CN9 control temperature sensor with a VR3 trimmer potentiometer mounted on the control board.
  - When temperature is 121°C, adjust the input of the CN9 control temperature sensor with a VR4 trimmer potentiometer mounted on the control board.

- Pressing the SW14 switch advances the operation test program to C7.

### C7: Checking the input of the CN8 pressure sensor

- "7" is displayed on the 7SEG10 and the pressure detected by the CN8 pressure sensor is displayed on the 7SEG5-7SEG8.

- Pressing the SW14 switch advances the operation test program to C8.

### C8: Checking the input of the CN4-10 heater temperature sensor

- "8" is displayed on the 7SEG10 and the temperature detected by the CN4-10 heater temperature sensor is displayed on the 7SEG1-7SEG4.

- Pressing the SW14 switch returns the operation test program to C1.

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