

**HIRAYAMA**

**HICLAVE**

**HV-25**

**HV-50**

**HV-85**

**HV-110**

**SERVICE MANUAL**

# Introduction

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- This manual was created to support smooth service of the HV autoclave series (HV-25, 50, 85 and 110). Use the manual as a reference in addition to the operation manual.
- Some tools are required (screw drivers, digital multimeter, and clamp meter) when replacing and making adjustment. Also, required tools are stated for particular works.

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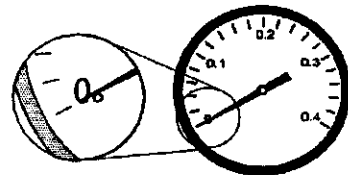
## Read Carefully Before Using

- In this manual the following headings are applied to items to which great attention should be given:

- ⚠ **WARNING :** Precaution indicating an imminent dangerous situation which if not avoided may lead to death or serious injury.
- ⚠ **CAUTION:** Precaution indicating a dangerous situation which if not avoided may lead to moderate or slight injury.
- ⓘ **IMPORTANT:** Indicates items you are strongly advised to obey.

### ⚠ **WARNING:**

- Check that the pressure is below "0Mpa" before opening the lid.



### ⚠ **CAUTION:**

- Wait until the body has cooled sufficiently to perform maintenance and service work.
- Wait until the water in the bottle has cooled sufficiently to take out the exhaust bottle.
- Do not take out the exhaust bottle or drain the working chamber when the interior of the chamber is under pressure. Otherwise, boiling water and steam will gush out, and you may burn yourself.
- Be careful not to cut fingers when cleaning the bottom of chamber or heater. The heater attaches a temperature sensor and fixing clips that corners may cut your fingers.
- Do not incinerate used batteries. Incineration may cause the batteries to explode.
- Be sure to securely tighten the heater holding nuts when replacing the heater. Water may leak and cause short circuits if the nuts are loose.
- Be sure to securely tighten terminal holding nut A when replacing the heater. Heat may be generated from the terminal and burn damage may result if the nut is loose.

# How to Read this Manual

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This manual consists of the following sections covering the information required for proper maintenance of the HV-25/50/85/110 autoclaves.

## **Chapter 1. Maintenance and Adjustment**

This section describes the maintenance procedures for the unit as well as the methods for replacing and adjusting the main parts.

## **Chapter 2. Troubleshooting Chart**

This section describes the items to check and measures to take when a problem occurs.

## **Chapter 3. Product Description**

This section describes the operations and internal structural parts of the product.

## **Chapter 4. Operation Check Procedure**

This section describes the method for checking the operation of electrical parts using the check programs.

## **Chapter 5. Main Parts List**

The code numbers for the main parts are listed in the table here.

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# Chapter 1. Maintenance and Adjustment

## CAUTION:

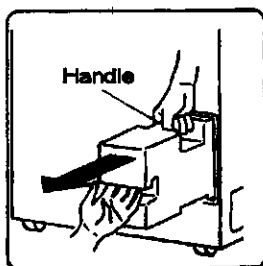
- Wait until the body has cooled sufficiently before performing maintenance and adjustment.
- Perform maintenance and adjustment after turning the power switch off.

## 1. Draining Water from the Exhaust Bottle

Since the water level in the exhaust bottle increases with continued operation, water must be drained using the procedure below when water reaches the HIGH level.

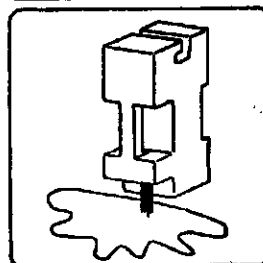
## CAUTION:

- Wait until the water in the bottle has cooled sufficiently to take out the exhaust bottle.



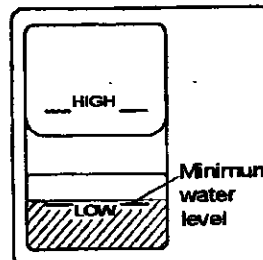
- (1) Remove the exhaust bottle from the body.

Pull the bottle out until the handle can be grasped then hold and remove.



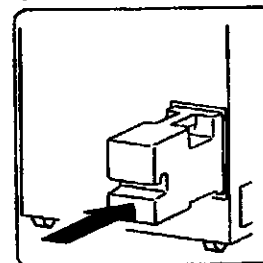
- (2) Place the drain/supply port face down in a level sink.

Excess water will drain out until the LOW level is reached.



- (3) Confirm that the water is at the LOW level.

Since steam cools in the exhaust bottle, be sure to leave the water at the LOW level.



- (4) Replace the exhaust bottle in the housing area.

If the bottle is not pushed completely into the housing, an error (ErE) will occur when operation starts.

## 2. Draining the Chamber

Drain water using the following procedure after confirming that the inside of the chamber has cooled sufficiently.

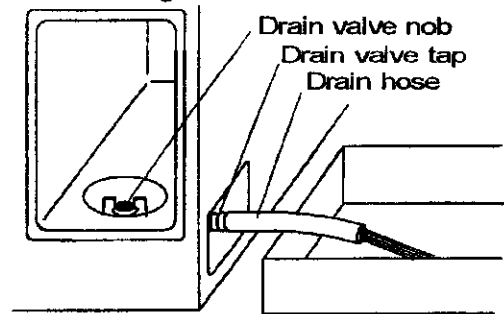
### CAUTION:

- Do not unload the exhaust bottle or drain the chamber when the chamber is under pressure. Boiling water or steam may gush out causing burns.

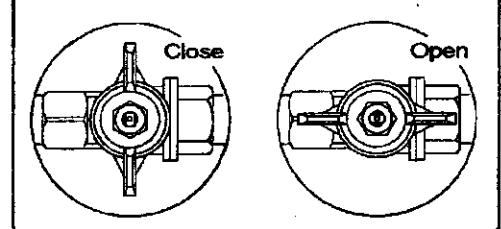
- (1) Open the lid.
- (2) Connect one end of the accessory drain hose to the tap of the drain valve located at the lower part of the right side of the body.
- (3) Put the other end of the hose in a container.
- (4) Remove the exhaust bottle from the body.
- (5) Turn the drain valve knob, located at the bottom of the exhaust bottle housing area, counterclockwise to open.
- (6) Check that draining of the working chamber is complete.
- (7) Turn the knob clockwise to close the drain valve.

Be sure the exhaust valve is closed.

Bottle housing area



Drain valve



### When drain pipes are clogged

- Connect the drain port and water pipe stopper using a pressure-resistant hose, open the exhaust valve on the body, and gradually open the water pipe stopper. Foreign matter clogging the exhaust piping will then flow into the working chamber. Remove the foreign matter and drain the chamber.
- If the clog is not removed by the above procedure, disassemble the piping and clean.
- If the clog is not removed by the above procedure, disassemble the piping and clean.



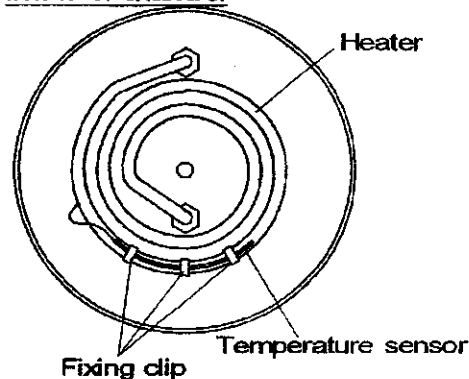
### 3. Cleaning the Chamber

**! CAUTION:**

- The heater is provided with a temperature sensor with clips. Be careful not to hurt your fingers when cleaning.

- (1) Remove the heater cover to see if the bottom of the chamber or the surface of the heater is dirty. After draining the chamber, clean these areas with a soft brush or the like while applying water and keeping the drain valve open.
- (2) Reattach the fixing clip of the temperature sensor if it has come off or is loose. Attach the clip so that the temperature sensor comes into close contact with the heater.

Inside of chamber



### 4. Cleaning the Body

**! IMPORTANT:**

- Do not use benzine or thinner to clean the body. Also, make sure that volatile substances such as insecticides do not come into contact with the body as these may cause deterioration and stripping of the paint.

- (1) Gently wipe stains with a soft cloth. To remove stubborn stains, wipe with a cloth soaked in solution of neutral detergent. Wipe off any remaining moisture with a dry cloth.

## 5. Cleaning the Cooling Unit Filter (For Cooling Unit option only)

An air filter is attached within the cooling unit. Clean the fan once a year according to the following procedure.

- (1) Remove the screws holding the fan case and remove the fan case.

The filter is mounted inside the fan case

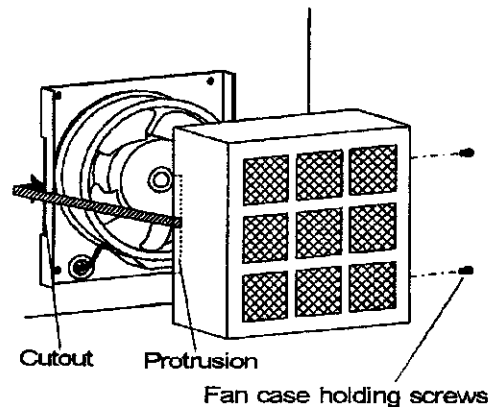
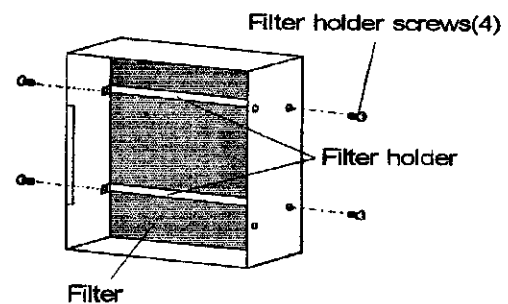
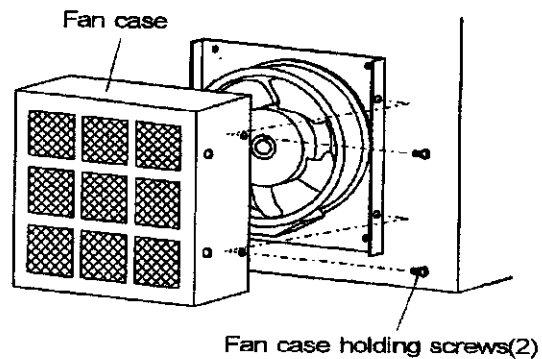
- (2) Remove the filter holder screws and remove the filter.
- (3) Soak and gently wash the filter in neutral detergent diluted in water.

Avoid volatile detergents as these may cause discoloration or deformation.

- (4) Sufficiently dry the filter.
- (5) Reattach the filter in the filter case.

Replace the filter if flawed or broken.

- (6) Match the protruding part of the fan case with the cutout part of the base plate and secure with the holding screws.



## 6. Lid Gasket Replacement

- Lid gasket with a whitened edge may cause steam leakage. Replace the lid gasket, if moistened with neutral detergent diluted with water, and wipe off the stains with it. Wipe off any moisture with a dry cloth.

- ① Open the lid
- ② Apply the minus (–) screwdriver to the underside of the gasket band, and pry it up. Pull out the old gasket.

- ③ Using a waste cloth wipe any dirt off the portion of the chamber with which the lid gasket was in contact.

- ④ Remove the gasket band from the old gasket, and using a waste cloth wipe any dirt off the gasket band.

- ⑤ Attach the gasket band to the new gasket:

- (1) Place the new gasket on a flat surface, and push in the gasket band until it hits against the bottom of the groove.

- (2) Insert the cord which prevents the gasket band from coming off.

- ⑥ Install the new gasket in the chamber:

- (1) Push in the gasket until the entire projected portion of the gasket hits against the rim of the chamber. Gradually and evenly insert the entire gasket while pressing your palm on the gasket.

If the gasket band starts to come off, press the wooden stick against it to shove the band into the groove in the gasket while taking care not to damage to the gasket.

- (2) Push in the gasket until it hits against the metal surface.

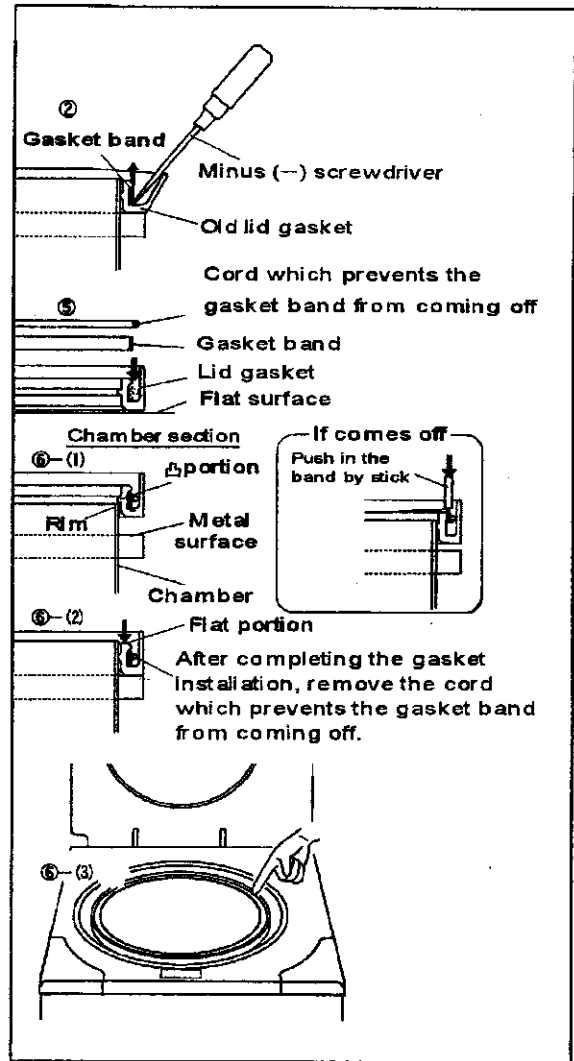
When the gasket is completely pushed in, the flat portion is positioned at a level slightly lower than the rim of the chamber.

- (3) In addition, run your finger along the flat portion of the gasket to eliminate any irregularities on the gasket surface.

An uneven gasket surface makes the lid difficult to close.

- ⑦ Pull out the cord. [Ref. ⑤ (2)]

- ⑧ Follow the ordinary operating procedure to start operation and make sure of no leakage through the lid gasket.



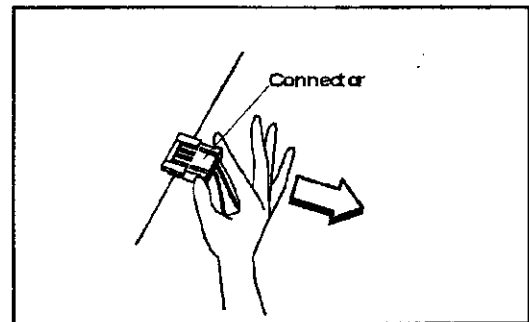
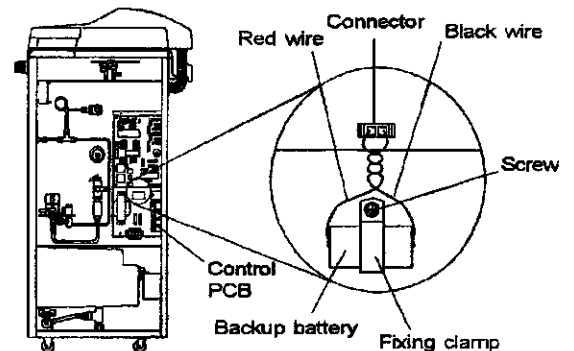
## 7. Backup Battery Replacement

- When the **CLOCK** display flickers, replace the backup battery in accordance with the following procedure.

### **CAUTION:**

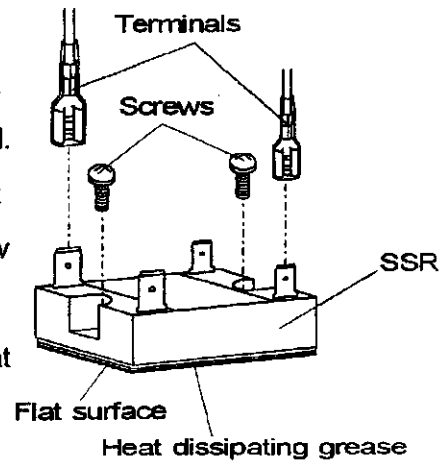
- Connecting the battery with its polarities reversed may cause heating, explosion or ignition.
- Do not dispose of used batteries in fire; they may explode.

- ① Hold both the ends of the connector for the backup battery between your fingers, and pull the connector out of the switch board.
- ② Remove the screw from the clamp.
- ③ Attach the clamp to a new battery, and screw the clamp on the switch board.
- ④ Insert the battery connector to the control PCB, with twist wires several times, with care of its correct direction.
- ⑤ Correct the clock following the operation manual.
  - When the correction of the clock is complete, the **CLOCK** display goes out.



## 8. Solid State Relay (SSR) Replacement

- (1) Pull out the terminals from the solid state relay (SSR).
- (2) Remove the SSR by unscrewing from the switchboard.
- (3) Wipe off the trace of heat dissipating grease and dust adhering to the switchboard in the vicinity of the screw holes.
- (4) Clean the flat surface of the new SSR, then apply heat dissipating grease evenly on it.
- (5) Fit the SSR to the switchboard and plug in the terminals.

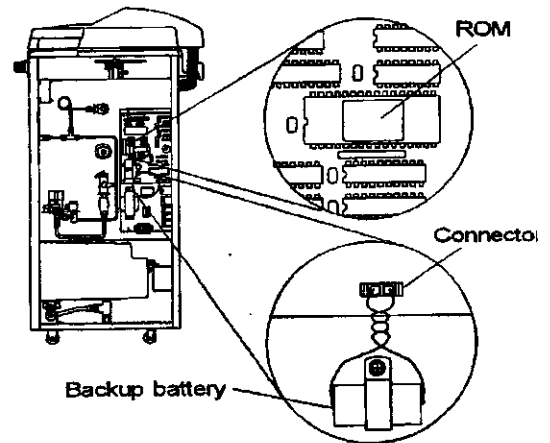


Since the IN side of the SSR has +/- polarity, be sure to connect in the original position.

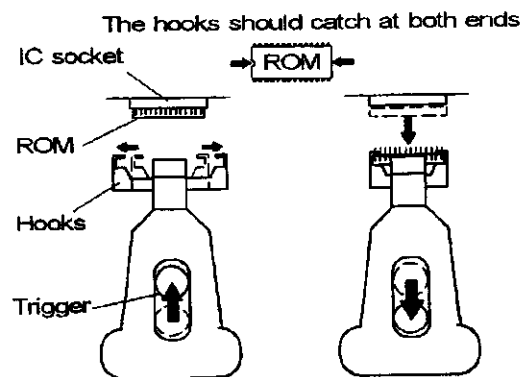
## 9. ROM Replacement

### ! IMPORTANT:

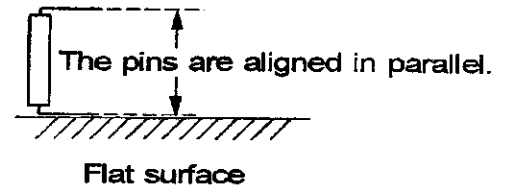
- When replacing the ROM, use a special too to avoid damaging the control PCB or the new ROM.
- The PCB or ROM can be damaged if touched or brought into contact with people or clothing having a static electricity charge. Touch a metal object or take other measures to discharge static electricity before performing these operations.



- (1) Follow the procedure below to remove the ROM from the IC socket using a ROM puller
  - Push the trigger on the puller to open the hooks.
  - Set the ends of the hooks to catch on the bottom of the ROM.
  - Pull the trigger to remove the ROM.

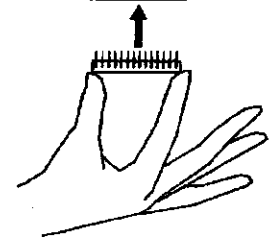


- (2) Make sure that the pins on the new ROM are aligned in parallel. If pins are bent outward, use a flat surface to realign them.

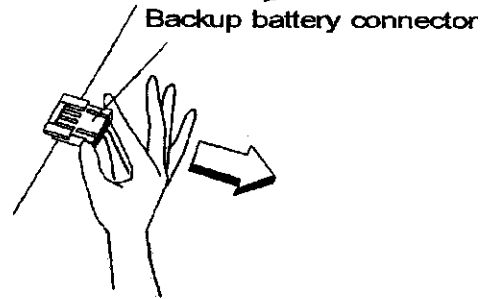


- (3) Insert the new ROM into the IC socket to the correct direction. (The notch to the left).

Insert with the notch to the left.



- (4) Grasp both ends of the backup battery connector to pull out and disconnect, and after a few seconds, reinsert the connector.



- By disconnecting the backup battery, the data on the old ROM will be erased. Reset the time in accordance with Operation Manual.

## 10. Heater Replacement

### CAUTION:

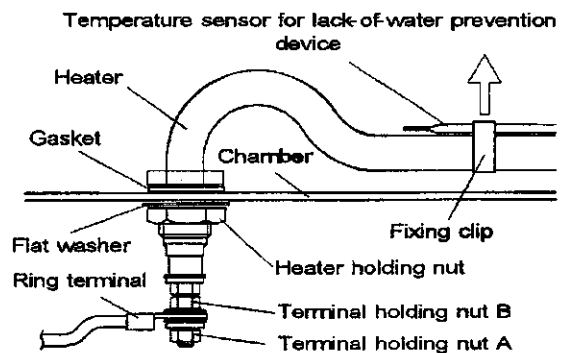
- Be sure to securely tighten the heater holding nuts when replacing the heater. Water may leak and cause short circuits if the nuts are loose.
- Be sure to securely tighten terminal holding nut A when replacing the heater. Heat may be generated from the terminal and burn damage may result if the nut is loose.

#### ■ Required tools

- Monkey wrench (with maximum opening width of 23mm or more)
- Spanner (7mm span for the heaters of HV-25/50; and 8mm for HV-85/110)

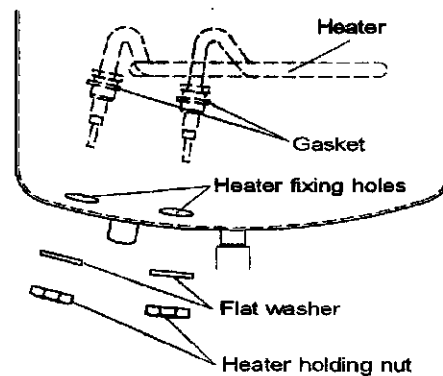
#### Removing the old heater

- (1) Open the lid and turn the power switch off.
- (2) Drain water from the chamber.
- (3) Remove the blank plate (or the optional cooling unit) fitted on the rear panel.
- (4) Remove the temperature sensor (for lack-of-water prevention) from the fixing clips on the heater. (The fixing clips for HV-25L/50L are small pipes welded to the heater, and those for HV-85L/110L are of flexible spring.)
- (5) Loosen the terminal holding nut A and remove the ring terminal.
- (6) Remove the heater holding nuts.
- (7) Remove the heater from the chamber.
- (8) Remove any scale or stains from the area around the heater fixing holes.

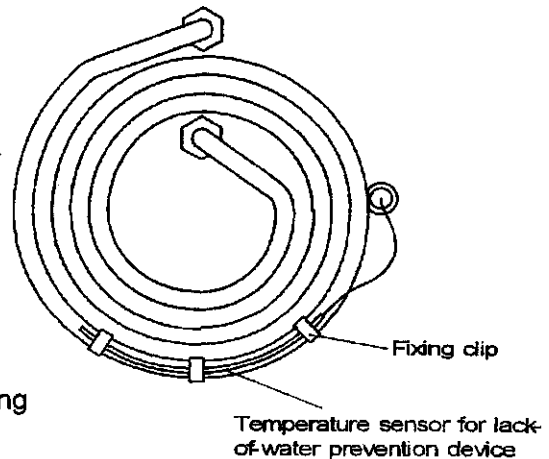


#### Fixing the new heater

- (9) Remove the heater holding nuts and flat washers attached to the new heater.

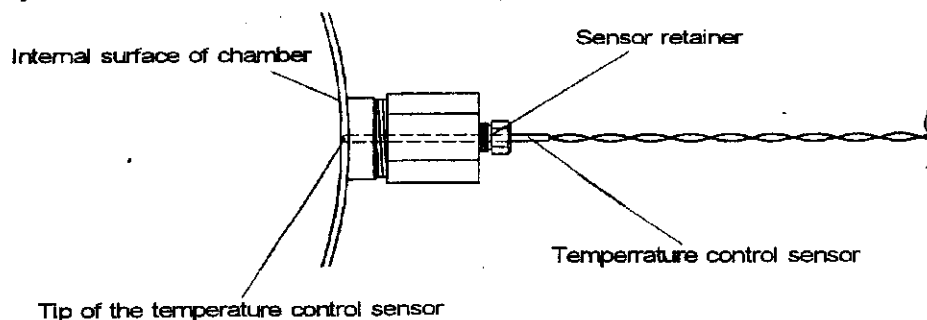


- (10) Pass both ends of the heater through the fixing holes at the bottom of the chamber, with care so that the gaskets do not drop.
- (11) Attach the flat washers, then tighten the heater holding nuts.
- (12) Remove terminal holding nut A from the newly attached heater.
- (13) Fit the ring terminal and tighten the terminal holding nut A, while securing the terminal holding nut B with a wrench.
- (14) Affix the temperature sensor to the heater with or through the fixing clips.
- (15) Pour water in the chamber and make sure of no leakage from the area around the heater.
- (16) Turn the power switch on, start normal operations, and make sure of no leakage of water from the area around the heater while the pressure rises.
- (17) Turn the power switch off and fix the blank plate (or the optional cooling unit) on the rear panel.



## 11. Temperature Control Sensor Replacement

- (1) Loosen the temperature sensor retainer.
- (2) Pull the temperature sensor from the sensor port.
- (3) Insert the new sensor through the sensor port, until the tip of the sensor comes to the same level of the internal surface of the chamber, and firmly tighten the sensor retainer using the fingers only. Never use a tool such as a monkey wrench.





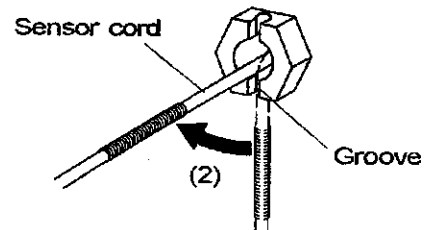
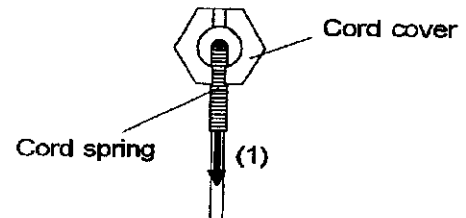
## 12. Floating Sensor (Option) Replacement

### ■ Required tools

- Monkey wrench (with maximum opening width of 24mm or more)

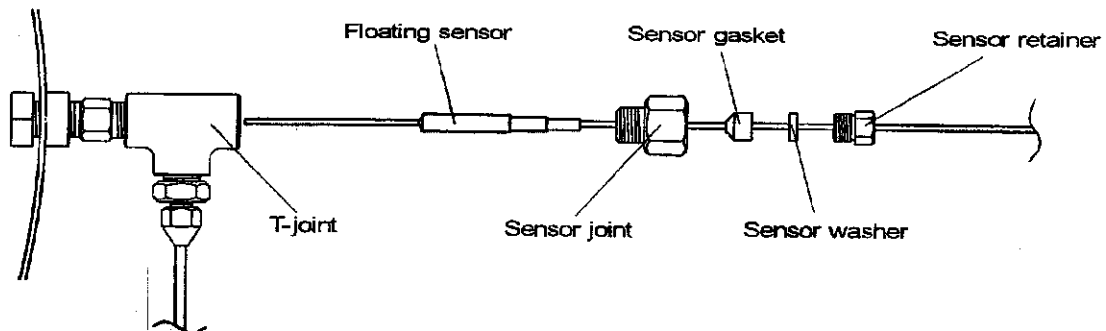
- (1) Pull the cord spring down and remove from the cord cover.
- (2) Remove the cord from the cord cover groove.
- (3) Loosen the sensor retainer and remove the sensor from the joint.
- (4) Remove the sensor joint from the T-joint.
- (5) Pull the sensor out from the T-joint hole.
- (6) Insert the new floating sensor into the chamber through the T-joint hole and pull inward to the length shown below.

Inside of the chamber



HV-25L:  $\geq 450\text{mm}$ , HV-50L & HL-85L:  $\geq 600\text{mm}$ , HV-110L:  $\geq 780\text{mm}$

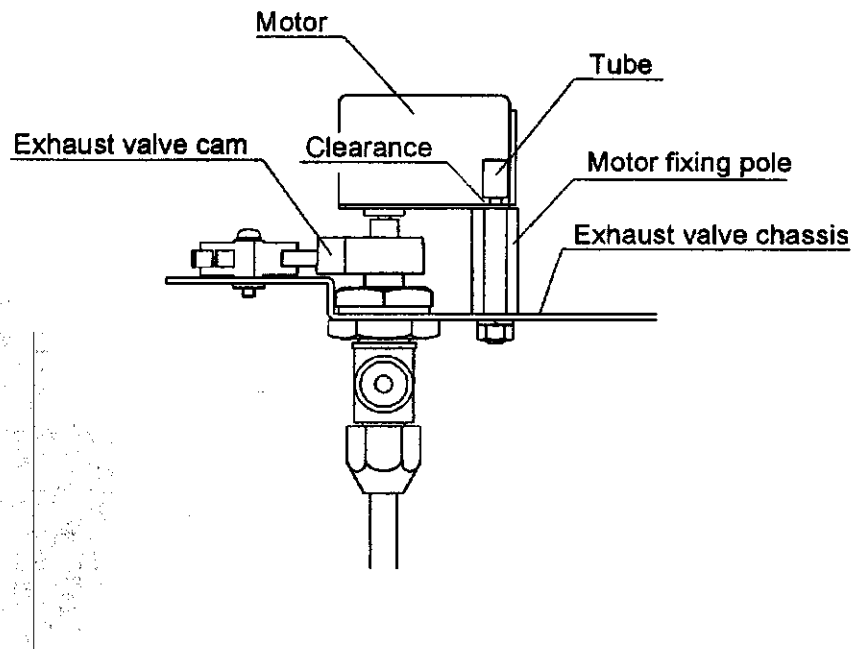
- (7) Attach the sensor joint to the T-joint.
- (8) Attach the sensor gasket, sensor washer, and sensor retainer to the sensor joint. (firmly tighten the sensor retainer using the fingers only. Never use a tool such as a monkey wrench.)



- (9) Pass the cord downward into the cord cover groove, and then, insert the cord spring into the cord cover groove.

### 13. Motor Replacement

- (1) Disconnect the wires attached to the motor.
- (2) Remove the tube.
- (3) Pull the motor out from the exhaust valve cam.
- (4) Mount new motor on the motor fixing pole.
- (5) Turn in and insert the shaft of the new motor into the hole of the exhaust valve cam.
- (6) Insert the tube into the motor fixing pole until it reaches the gap of motor fixing pole.  
[Confirm there is a clearance for the motor movable up and down.]
- (7) Rewire the motor.
- (8) Power on the autoclave and confirm the performance.



## 14. Exhaust Valve Replacement

### ■ Required tools

- Monkey wrench (maximum opening width of 24mm or more) X 1
- Plus (+) screwdrivers (for M3 screw) X 1

(1) Refer to steps (2) ~ (3) of "13. Motor Replacement" and remove the motor from the exhaust valve cam.

(2) Remove the piping attached to the exhaust valve.

(3) Loosen the fixing screws of limit switch.

(4) Remove the exhaust valve cam from the exhaust valve.

(5) Loosen the exhaust valve fixing nut, and remove the exhaust valve from the exhaust valve chassis by turning the valve.

(6) Remove the retaining nut from the new valve and tighten the exhaust valve fixing nut all the way to the end.

[The new exhaust valve should be tightened by a torque wrench before used.]

(7) Attach the toothed washer to the retaining nut and place them on exhaust valve chassis and exhaust valve. [The exhaust valve chassis is in between the retaining nut and the exhaust valve.] Tighten firmly the retaining nut.

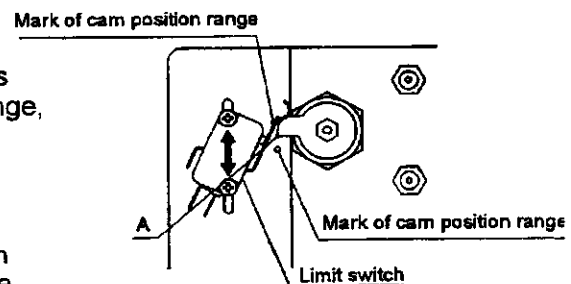
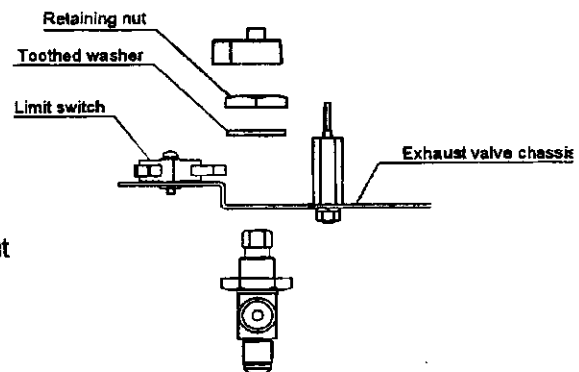
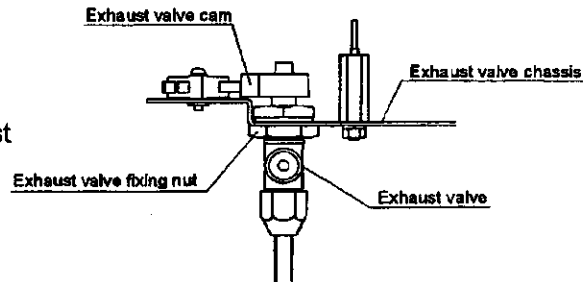
(8) Tighten the exhaust valve fixing nut firmly with steadying the exhaust valve chassis.

(9) Place exhaust valve onto the exhaust valve tentatively.

(10) Turn the exhaust valve cam to the right until the exhaust valve is completely closed.

(11) If the position "A" of the exhaust valve cam is out of the range of marks of cam position range, refix the exhaust valve cam "A" comes in between marks of cam position range.

(12) Turn the exhaust valve cam to the exhaust valve close (clockwise,) and slide limit switch with pressing lever of the limit switch until the limit switch clicks.



(13) Refer to steps (4) ~ (6) of "13. Motor Replacement" and fix the motor.

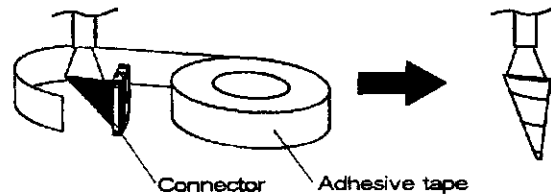
(14) Start operating with the normal procedure and make sure that steam does not come out from the exhaust valve hose port while the chamber is pressurized. If steam comes out too much, adjust the exhaust valve with reference to "16. Exhaust Valve Adjustment."

## 15. Display Board Replacement

### ■ Required tools

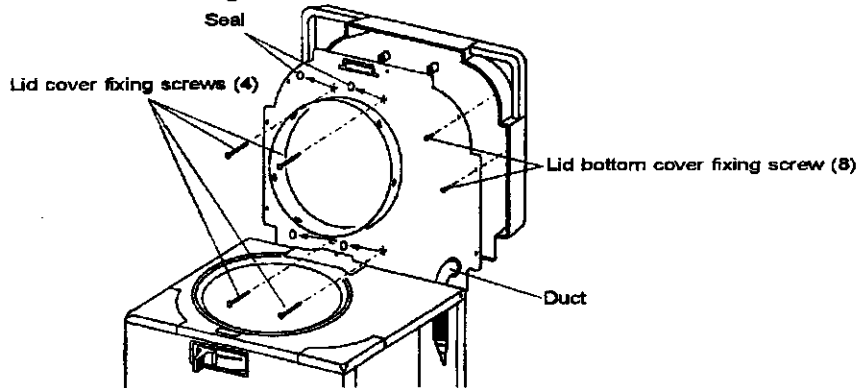
- Plus ( + ) screwdrivers 2 ( 1 each for M5 and M3 screws)
- Vinyl adhesive tape
- Sealing tape (glass cloth impregnated with P.T.F.E.)

- (1) Disconnect the connector from CN1 on the control PCB.  
Bind the connector and the ribbon cable together with vinyl adhesive tape so as to facilitate passing through the duct



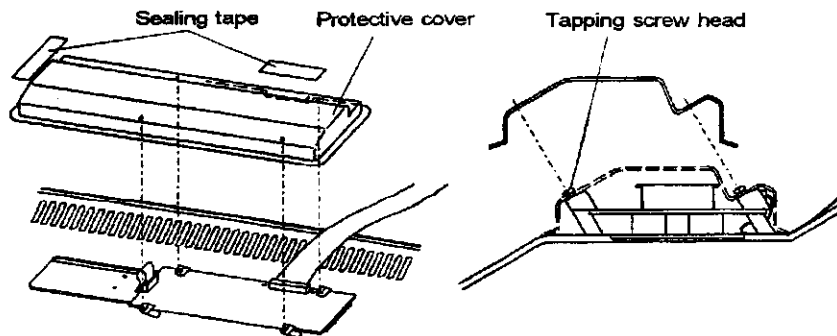
- (2) Open the lid and unscrew the lid bottom cover fixing screws.

- (3) Peel the seals covering the holes for the lid cover fixing screws and unscrew them.

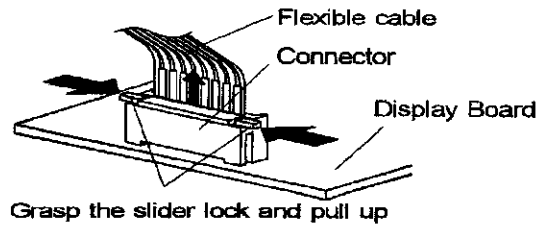


- (4) Pass the ribbon cable of the display board through the duct and remove the lid cover.

- (5) Peel the sealing tapes (PTFE impregnated glass cloth) of the protective plastic cover, and remove the cover by unhooking from tapping screws.



(6) Remove the flexible cable (printed film) connected to the display board.

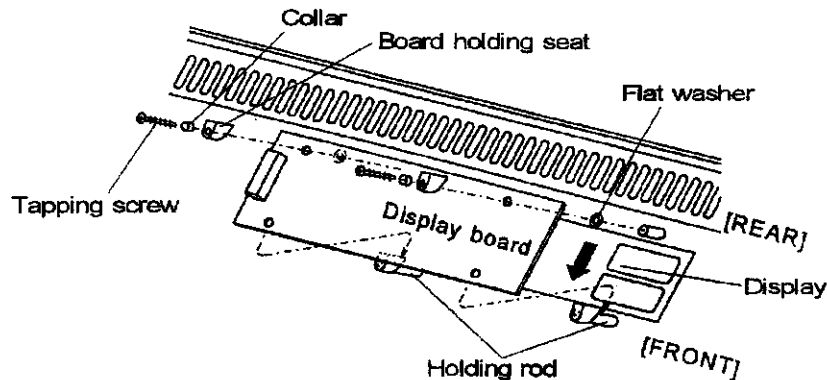


(7) Unscrew the 2 [REAR]-side tapping screws, and remove the display board.

(8) Loosen slightly (1 turn or 2) the 2 [FRONT]-side tapping screws.

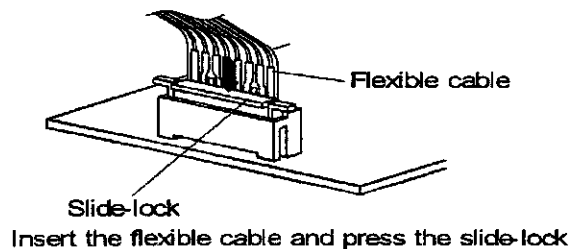
(9) Push the display to [FRONT]-side. Put the new display board in contact with the holding rods. Pass each of the 2 tapping screws on [REAR]-side, through a collar, a board holding seat, a display board fixing hole and a flat washer (M4), and fix to the lid cover.

(10) Tighten the [FRONT]-side tapping screws.



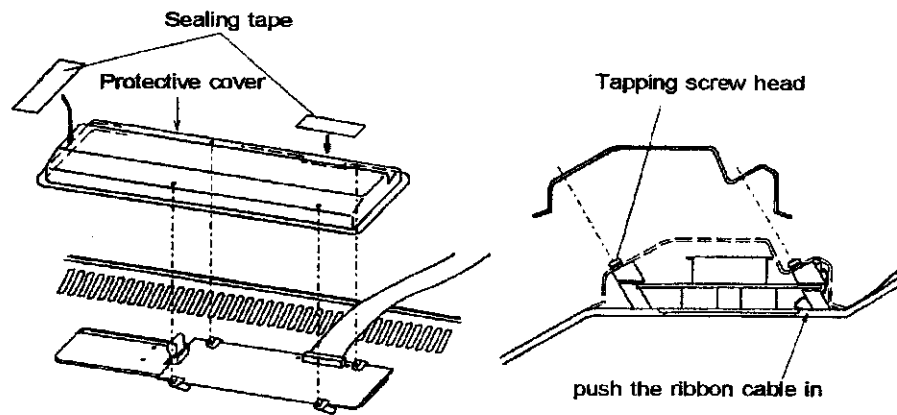
(11) Look at the display from outside of the lid cover and make sure that the character window is aligned with the LED. If not aligned, loosen the tapping screws and realign.

(12) Connect the flexible cable to the connector of the display board.



(13) Push the other end of the ribbon cable in between the display board and the lid cover.

(14) Put the tapping screw heads in the holes of the protective cover, and seal the two places of the protective cover with the sealing tape, i.e. the ribbon cable outlet and the end on the membrane switch side.



- (15) Bind the connector and ribbon cable together with vinyl adhesive tape, and pass them through the duct.
- (16) Fix the lid cover with the corresponding screws.
- (17) Fix the lid bottom cover with the corresponding screws and seal the screw holes.
- (18) Remove the vinyl adhesive tape [ref. the above (15)], and connect the connector to CN1 on the control PCB.

## 16. Exhaust Valve Adjustment

### ■ Required tools

- Plus (+) screwdriver (for M3 screws)

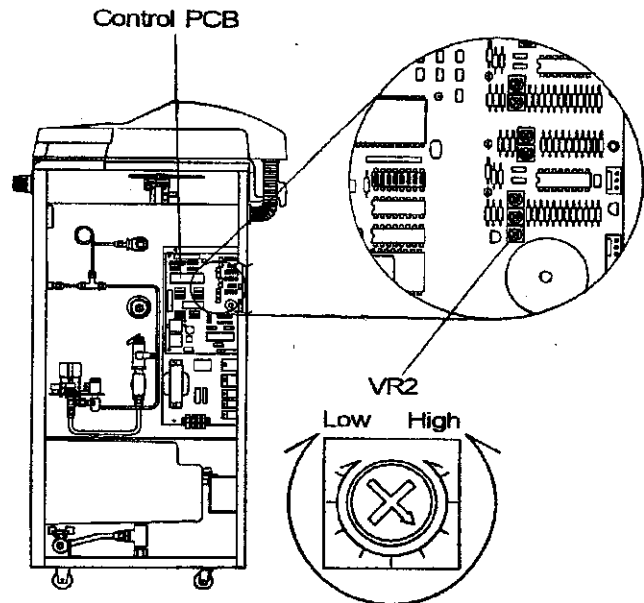
- (1) Refer to steps (2) ~ (3) of "13. Motor Replacement" and remove the motor from the exhaust valve cam.
- (2) Loosen the fixing screws of limit switch, and slide the limit switch to side "B".
- (3) Turn the exhaust valve cam to the right by hand, and make the valve completely closed.
- (4) If the position "A" of the exhaust valve cam is out of the range of marks of cam position range, refix the exhaust valve cam "A" comes in between marks of cam position range.
- (5) Turn the exhaust valve cam to the exhaust valve close (clockwise,) and slide limit switch with pressing lever of the limit switch until the limit switch clicks.
- (6) Refer to steps (4) ~ (6) of "13. Motor Replacement" and fix the motor.
- (7) Power on the autoclave and confirm the performance.

## 17. Alarm Volume Adjustment

### ■ Required tools

- Minus (-) screwdriver (2~2.5mm blade width)

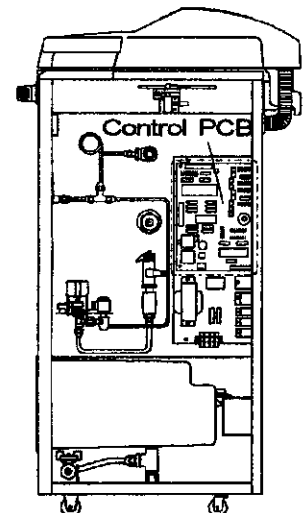
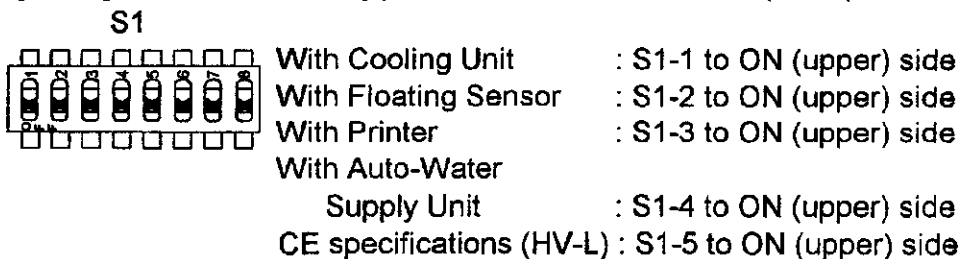
- (1) Turn the VR2 adjusting screw on the control PCB with a minus screwdriver. Turn to the right to lower the volume and to the left to raise the volume.



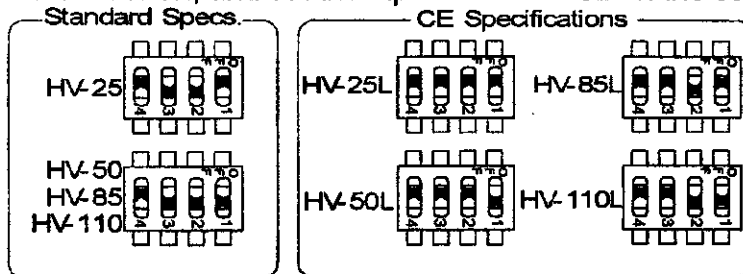
## 18. Switchboard Replacement

- Check the items below before turning the power on after replacing the switchboard.

- (1) Check whether or not the unit is equipped with the option i.e. Cooling Unit, Floating Sensor, Printer or Automatic Water Supply Unit, then set the dip switches S1 on the control PCB. [Change S1-1-4 accordingly, and S1-6~8 must be OFF (lower) side all the time.]



- (2) Check the model, and set the dip switches of S2 on the control PCB.



- (2) Remove the ROM from the control board to be replaced and mount it on the new board.
  - Unless otherwise specified, replace the ROM in accordance with [9. ROM Replacement].

## Chapter 2. Troubleshooting Chart

### 1. Error Detection (Alarms)

| Display   | Cause  | Items to check  | Remedy  |
|---|--|---|---|
| <b>E r 1</b><br><br>(Lack-of-water alarm)                             | (1) Water was not placed in the chamber  | User check  | User instruction  |
|   | (2) Water was not replenished during continuous operation                                  | User check  | User instruction  |
|   | (3) Contact point failure of the lack-of-water prevention device                           | Check contact/open activation distance  | Lack-of-water prevention device replacement               |
|   | (4) Input circuit failure for the lack-of-water prevention device on the control PCB       | Check using the check program "c4"  | Control PCB replacement                                   |
|   | (5) Wiring contact failure between the lack-of-water prevention device and the control PCB | Check wiring circuit  | Wiring repair   |
|   | (6) The bag is placed directly in the chamber.   | Ask the user.   | Advise to use wire basket                                 |
| <b>E r 2</b><br><br>(Wire breakage on temperature sensor for control) | (1) Temperature sensor failure   | Measure temperature sensor resistance value (at normal temperature: resistance between white and yellow wires is 79 - 156K $\Omega$ ) | Replace sensor  |
|   | (2) Input circuit failure of the temperature control sensor on the control PCB             | Check using the check program "c7" (display of 0 and 47 - 91 is normal at normal temperatures)  | Replace control PCB                                       |
|   | (3) Temperature in the chamber falls below freezing point.                                 | Advise the user.  | Adjust room temperature of installation site to 5 - 35°C. |
| <b>E r 3</b><br><br>(Excessive temperature alarm)                     | (1) Failure of output circuit of the solid state relay (SSR) on the control PCB            | Check using the check program "c3"  | Replace control PCB                                       |
|   | (2) SSR failure  | Check contact/open activation Distance.   | Replace SSR.  |
| <b>E r 4</b><br><br>(Excessive cooling alarm)                         | (1) Heater failure   | Refer to trouble shooting measures to take when the temperature in the chamber will not rise.   |   |
|   | (2) Failure of temperature sensor for control  | Measure temperature sensor resistance value (at 100°C: resistance between white and yellow wires is about 63K $\Omega$ )              | Replace the sensor  |
|   | (3) Failure of input circuit for the temperature control sensor on the control PCB         | Check using the check program "c7" (a display value of 92 and 255 is normal at 100°C)   | Replace the control PCB                                   |



| Display   | Cause  | Items to check   | Remedy                       |
|---|--|--|------------------------------|
| <b>Er5</b><br><br>(Excessive pressure alarm)                  | (1) Exhaust valve failure  | Refer to trouble shooting measures to take when the air in the chamber will not purge                        |                              |
|   | (2) Pressure sensor failure  | Measure pressure sensor output voltage (at 0.12MPa, terminal No. 4 of connector CN6 should be about DC+2.1V) | Replace the pressure sensor  |
|   | (3) Input circuit failure of the pressure sensor on the control PCB          | Check using the check program "c11" (a display value of "107" is normal at 0.12MPa)                          | Replace the control PCB      |
|   | (4) The bag is placed directly in the chamber                                | Ask the user.  | Advise to use wire basket    |
| <b>Er6</b><br><br>(Lid malfunction alarm)                     | (1) Lock plate is loosely fitted.  | Check looseness of the lock plate fixing screws  | Tighten the screws           |
|   | (2) LSW2 limit switch is loosely fitted.                                     | Check looseness of LSW2 limit switch fixing screws.  | Tighten the screws           |
|   | (3) LSW2 limit switch failure  | Check contact/open activation distance   | Replace the limit switch     |
|   | (4) Failure of input circuit for LSW2 limit switch on the control PCB        | Check using the check program "c4"   | Replace the control PCB      |
| <b>Er7</b><br><br>(Exhaust valve malfunction alarm)           | (1) LSW3 limit switch is loosely fitted.                                     | Check looseness of the limit switch LSW3 fixing screws.  | Tighten the screws           |
|   | (2) LSW3 limit switch failure  | Check contact/open activation distance   | Replace the limit switch     |
|   | (3) Failure of input circuit for LSW3 limit switch on the control PCB        | Check using the check program "c4"   | Replace the control PCB      |
|   | (4) Failure of the motor or 2X relay.  | Check using the check program "c3"   | Replace the failed parts     |
| <b>Er8</b><br><br>(Auto- water supply unit malfunction alarm) | (1) The water tap is not open  | User check   | User instruction             |
|   | (2) Failure of SV1 solenoid or 2X relay.                                     | Check using the check program "c5"   | Replace defective parts      |
|   | (3) Failure of FSW water level detector                                      | Check contact/open activation distance   | Replace water level detector |
|   | (4) Failure of input circuit for FSW water level detector on the control PCB | Check using check program "c5"   | Replace the control PCB      |
| <b>Er9</b><br><br>(Sterilization heater malfunction alarm)    | Same as "Er4."   |  |                              |

| Display   | Cause  | Items to check   | Remedy                   |
|---|--|--|--------------------------|
| <b>E r L</b><br><br>(Open/Close lever lock malfunction alarm) | (1) LSW2 limit switch is loosely fitted  | Check looseness of LSW2 limit switch fixing screws   | Tighten screws           |
|   | (2) LSW2 limit switch failure  | Check contact/open activation distance   | Replace the limit switch |
|   | (3) Failure of input circuit for LSW2 limit switch on the control PCB                                    | Check using the check program "c4"   | Replace the control PCB  |
|   | (4) Solenoid is loosely fitted   | Check looseness of the solenoid  | Tighten screws           |
|   | (5) Failure of the solenoid or 4X relay  | Check using the check program "c3"   | Replace the failed parts |
| <b>E r E</b><br><br>(Exhaust bottle malfunction alarm)        | (1) Exhaust bottle was removed during operation or while the pressure in the chamber was 0.01MPa or more | User check   | User instruction         |
|   | (2) LSW4 limit switch is loosely fitted  | Check looseness of LSW4 limit switch   | Tighten screws           |
|   | (3) Limit switch LSW4 failure  | Check contact/open activation distance   | Replace the limit switch |
|   | (4) Failure of input circuit for LSW4 limit switch on the control PCB                                    | Check using the check program "c4"   | Replace the control PCB  |
| <b>E r F</b><br><br>(Wire breakage on floating sensor)        | (1) Failure of the floating sensor   | Measure the resistance of the floating sensor (resistance between blue and white wires should be 79 - 156k $\Omega$ at normal temperature) | Replace the sensor       |
|   | (2) Failure of input circuit for the floating sensor on the control PCB                                  | Check using the check program "c8" (Display of 0 and 47 - 91 is normal at normal temperature)  | Replace the control PCB  |

## 2. Early Trouble Shooting

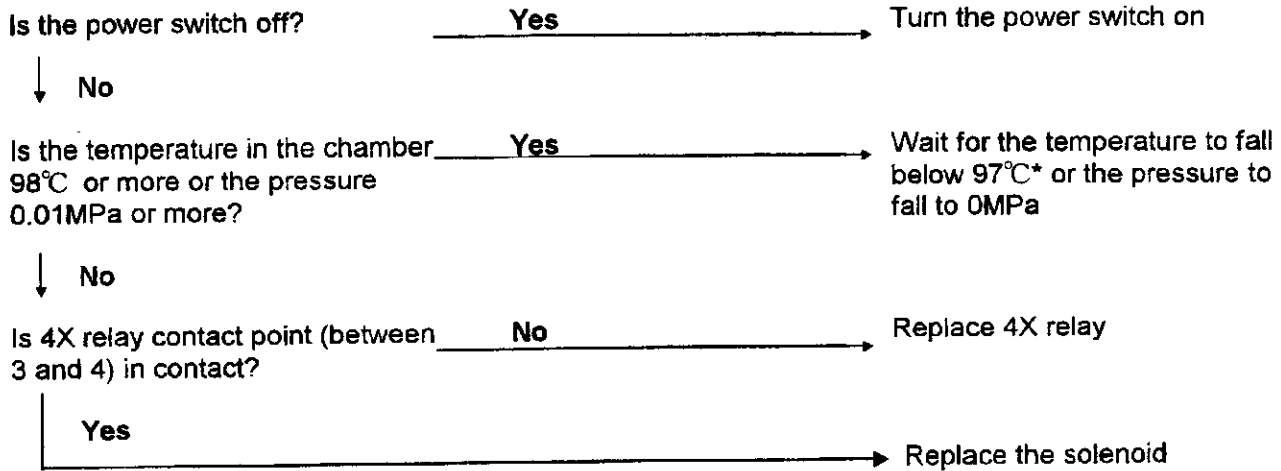
| Condition                             | Cause                                   | Items to check                      | Remedy                             |
|---------------------------------------|---|-------------------------------------|------------------------------------|
| Air in the chamber is not purged      | (1) Refer to Section 3. Troubleshooting |                                     |                                    |
| Pressure in the chamber does not rise | (1) Safety valve failure                | Leak from safety valve              | Repair or replace the safety valve |
|                                       | (2) Pressure gauge failure              | Pressure gauge needle               | Replace the pressure gauge         |
|                                       | (3) Piping loose or damaged             | Steam leaks from piping             | Repair leakage                     |
|                                       | (4)                                     | Refer to Section 3. Troubleshooting |                                    |

| Condition   | Cause  | Items to check  | Remedy  |
|---|--|---|---|
| One digit on the LED display does not light                         | (1) Circuit failure  | Soldered part of LED  | Repair by soldering again   |
|   | (2) LED failure  | LED breakage  | Replace LED   |
| Displays do not light when the power switch (breaker) is turned on. | (1) Poor connection or contact malfunction of terminals and connectors                 | Power plug connection<br>Breaker (power switch) connection<br>Tab terminal connection<br>Connection of CN9 connector on the control PCB<br>Connection of CN1 connector on the control PCB | Repair or replace the failed parts                                    |
|   | (2) No power   | Power socket (rated voltage)  | Rectify the power supply facilities                                   |
|   | (3) Power cord breakage  | Power input to the breaker (rated voltage)  | Replace the power cord  |
|   | (4) Breaker failure  | Power output from the breaker (rated voltage)   | Replace the breaker   |
|   | (5) Transformer failure  | Between terminals 1 and 2 on connector CN9 of the control PCB (AC14V)   | Replace the transformer   |
|   | (6) Failure of parts on the control PCB  | Between terminals TP7 and TP9 on the control PCB (DC+12V)   | Check the short-circuit parts, and repair or replace the failed parts |
|   | (7) Failure of parts on the control PCB  | Between terminals TP7 and TP8 on the control PCB (DC+5V)  | Replace the control PCB   |
|   | (8) Blown fuse F1 on the control PCB   | Check visually  | Remove the cause for the blown fuse, and replace the fuse             |
|   | (9) Blown fuse F3 on the control PCB   | Check visually  | Remove the cause for the blown fuse, and replace the failed parts     |
| No response to the membrane switch                                  | (1) Dew formation inside the switch  | Check leakage from the lid gasket   | Replace the membrane switch and the lid gasket                        |
| Steam leak from the lid gasket                                      | (1) Aging or damage of the gasket  | Check visually deterioration and damage of the gasket   | Replace the lid gasket  |
|   | (2) Improper installation of the gasket  | Check visually installation of the gasket   | Install the gasket evenly   |
|   | (3) Foreign matter adhering  | Check visually foreign matter adhering to the lid or lid gasket   | Remove contaminants   |
| Open/Close lever does not slide                                     | (1) Refer to Section 3. Troubleshooting  |   |   |
| Lid cannot be lifted / lowered                                      | (1) Open / Close lever does not slide smoothly<br>Check the lever position (right end) |   | Slide the lever up to the right end                                   |

| Condition  | Cause   | Items to check   | Remedy  |
|--|---|--|---|
| Alarm sounds after pressing start switch.  | (1) Unconfirmed of Door locking   | Confirm Open / Close lever to close  | Slide the lever up to the left end                        |
| Leakage of water from the bottom of the body   | (1) Leak from the area of the heater fixing nuts                          | Looseness of the heater fixing nuts<br>Gasket deterioration                | Tighten the nuts<br>Replace the gasket                    |
|  | (2) Leak from the area of the lack-of-water sensor fixing nut             | Looseness of the lack-of-water sensor fixing nuts                          | Tighten the nuts  |
|  | (3) Leak from piping  | Piping loose connection  | Tighten piping  |
|  | (4) Leak from the exhaust bottle  | Breakage of the exhaust bottle<br>Gasket improperly fitted or deteriorated | Replace the exhaust bottle<br>Refit or replace the gasket |
|  | (5) Leak from exhaust hose  | Cracks in exhaust hose   | Replace exhaust hose                                      |
|  | (6) Leak from the drain port as the drain valve was not closed by mistake | State of the drain valve   | Close the drain valve                                     |
| Exhaust is too busy during sterilization cycle (1) Under the display temp. higher than the set temp. (2) Under the set temp. | (1) SSR failure   | (1) State of ON/OFF of the heater circuit                                  | (1) Replace SSR   |
|  | (2) Overpressure exhaust due to remaining air in the chamber              | (2) State of containing of the substance<br>Check visually                 | (2) User instruction                                      |
| No action of both the solenoid and the exhaust valve   | F2 fuse on the switch board is broken                                     |  | Replace the fuse after removing the cause of breakage     |

### 3. Troubleshooting

#### **Open/close lever does not slide**



#### **Pressure in the chamber does not rise**

Turn the power switch on



Refer to Operation Manual and start operation



Does the temperature in the chamber rise? No → Refer to **Temperature in the chamber does not rise** below



Yes

3 min. (HV-25/50) or 6 min. (HV-85/110) after 97°C is displayed, the exhaust valve cam rotates toward "close" direction and stops

No

No

→ 2X relay activates

→ Replace 2X relay

Yes

Replace the motor



Yes

Cam fixing nut is loose

Yes

Refer to Chapter 16. Exhaust Valve Adjustment



No

Cam position adjustment is wrong

Yes

Refer to Chapter 16. Exhaust Valve Adjustment

## Temperature in the chamber does not rise

Turn the power switch off

↓

Remove the heater wiring and measure the resistance. Is the value  $\infty \Omega$ ? Yes → Replace the heater

↓ No

Restore the heater wiring

↓

Remove the wiring on connection point side (NO, COM) of 1X relay, and start operation according to Operation Manual

↓

Measure the resistance of 1X relay connection point (between NO and COM). Is the value  $\infty \Omega$ ? Yes → Replace 1X relay

↓ No → Replace the solid state relay (SSR)

## Air in the chamber is not purged

Turn the power switch on

↓

The exhaust valve cam rotates toward "open" direction and stops No → 3X relay activates → No → Replace 3X relay

↓ Yes → Yes → Replace the motor

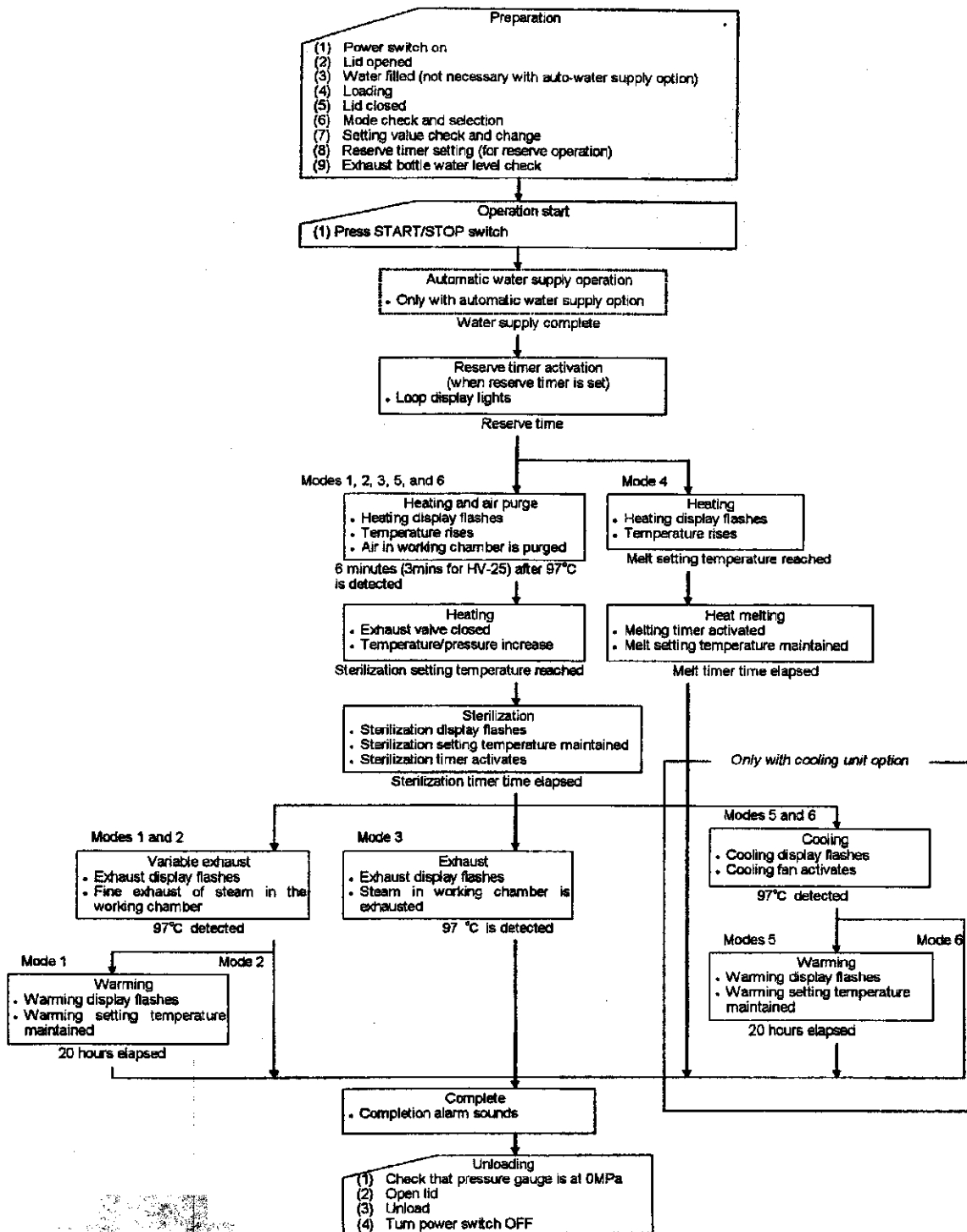
Cam fixing nut is loose Yes → Refer to Chapter 1 16. Exhaust Valve Adjustment

↓ No

Piping is clogged Yes → Remove the clog

# Chapter 3. Product Description

## Operation Sequence/Procedure Flow Chart



# Error Monitoring Charts

## • Mode 1 (Sterilization - Variable exhaust - Warming)

| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Air purge | Heating | Sterilization | Variable exhaust | Warming | Complete |
|---------|---|-----------|-------------|------------------------|---------|-----------|---------|---------------|------------------|---------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |           |         |               |                  |         |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |           |         |               |                  |         |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |           |         |               |                  |         |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |           |         |               |                  |         |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |           |         |               |                  |         |          |
| Er4     | Over cooling  | Internal  |             |                        |         |           |         |               |                  |         |          |
| Er5     | Over pressure   | Internal  |             |                        |         |           |         |               |                  |         |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |           |         |               |                  |         |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |           |         |               |                  |         |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |           |         |               |                  |         |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |           |         |               |                  |         |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | *3          |                        |         |           |         |               |                  |         |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |           |         |               |                  |         |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | *3          |                        |         |           |         |               |                  |         |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |           |         |               |                  |         |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |           |         |               |                  |         |          |

## • Mode 2 (Sterilization - Variable exhaust)

| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Air purge | Heating | Sterilization | Variable exhaust | Complete |
|---------|---|-----------|-------------|------------------------|---------|-----------|---------|---------------|------------------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |           |         |               |                  |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |           |         |               |                  |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |           |         |               |                  |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |           |         |               |                  |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |           |         |               |                  |          |
| Er4     | Over cooling  | Internal  |             |                        |         |           |         |               |                  |          |
| Er5     | Over pressure   | Internal  |             |                        |         |           |         |               |                  |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |           |         |               |                  |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |           |         |               |                  |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |           |         |               |                  |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |           |         |               |                  |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | *3          |                        |         |           |         |               |                  |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |           |         |               |                  |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | *3          |                        |         |           |         |               |                  |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |           |         |               |                  |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |           |         |               |                  |          |



• Mode 3 (Sterilization - Exhaust)

| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Air purge | Heating | Sterilization | Forced exhaust | Complete |
|---------|---|-----------|-------------|------------------------|---------|-----------|---------|---------------|----------------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |           |         |               |                |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |           |         |               |                |          |
| Er4     | Over cooling  | Internal  |             |                        |         |           |         |               |                |          |
| Er5     | Over pressure   | Internal  |             |                        |         |           |         |               |                |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |           |         |               |                |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |           |         |               |                |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |           |         |               |                |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |           |         |               |                |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | *3          |                        |         |           |         |               |                |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |           |         |               |                |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | *3          |                        |         |           |         |               |                |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |           |         |               |                |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |           |         |               |                |          |

• Mode 4 (Melting - Warming)

| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Heating | Heating and melting | Warming | Complete |
|---------|---|-----------|-------------|------------------------|---------|---------|---------------------|---------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |         |                     |         |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |         |                     |         |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |         |                     |         |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |         |                     |         |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |         |                     |         |          |
| Er4     | Over cooling  | Internal  |             |                        |         |         |                     |         |          |
| Er5     | Over pressure   | Internal  |             |                        |         |         |                     |         |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |         |                     |         |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |         |                     |         |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |         |                     |         |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |         |                     |         |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | *3          |                        |         |         |                     |         |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |         |                     |         |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | *3          |                        |         |         |                     |         |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |         |                     |         |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |         |                     |         |          |

• Mode 5 (Sterilization - Forced cooling - Warming)

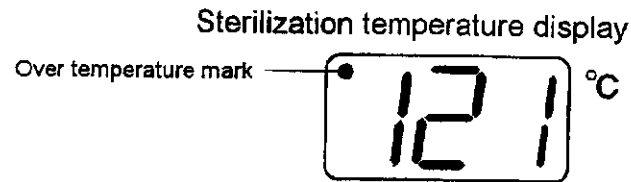
| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Air purge | Heating | Sterilization | Forced cooling | Warming | Complete |
|---------|---|-----------|-------------|------------------------|---------|-----------|---------|---------------|----------------|---------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |           |         |               |                |         |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |           |         |               |                |         |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |           |         |               |                |         |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |           |         |               |                |         |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |           |         |               |                |         |          |
| Er4     | Over cooling  | Internal  |             |                        |         |           |         |               |                |         |          |
| Er5     | Over pressure   | Internal  |             |                        |         |           |         |               |                |         |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |           |         |               |                |         |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |           |         |               |                |         |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |           |         |               |                |         |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |           |         |               |                |         |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | .....*3     |                        |         |           |         |               |                |         |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |           |         |               |                |         |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | .....*3     |                        |         |           |         |               |                |         |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |           |         |               |                |         |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |           |         |               |                |         |          |

• Mode 6 (Sterilization - Forced cooling)

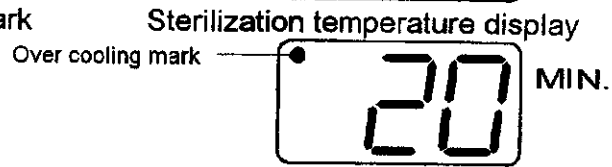
| Display | Name  | Detection | Preparation | Automatic water supply | Reserve | Air purge | Heating | Sterilization | Forced cooling | Complete |
|---------|---|-----------|-------------|------------------------|---------|-----------|---------|---------------|----------------|----------|
| Er1     | Lack-of-water alarm                                     | EGO       |             |                        |         |           |         |               |                |          |
| Er2     | Control temperature sensor wire broken                  | CN2       |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (upper limit temperature +3°C or more) | Internal  |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (setting +5°C for 10 seconds)          | Internal  |             |                        |         |           |         |               |                |          |
| Er3     | Over temperature (setting +10°C for 15 minutes)         | Internal  |             |                        |         |           |         |               |                |          |
| Er4     | Over cooling  | Internal  |             |                        |         |           |         |               |                |          |
| Er5     | Over pressure   | Internal  |             |                        |         |           |         |               |                |          |
| Er6     | Lid abnormal  | LSW1      |             |                        |         |           |         |               |                |          |
| Er7     | Automatic exhaust valve abnormal                        | LSW3      |             |                        |         |           |         |               |                |          |
| Er8     | Automatic water supply abnormal                         | FSW       |             |                        |         |           |         |               |                |          |
| Er9     | Heater abnormal   | Internal  |             |                        |         |           |         |               |                |          |
| ErL     | Open/close knob lock abnormal                           | LSW2      | .....*3     |                        |         |           |         |               |                |          |
| ErF     | Floating sensor wire broken                             | CN3       |             |                        |         |           |         |               |                |          |
| ErE     | Exhaust bottle abnormal                                 | LSW4      | .....*3     |                        |         |           |         |               |                |          |
| *1      | Over temperature (setting +2°C or more)                 | Internal  |             |                        |         |           |         |               |                |          |
| *2      | Over cooling (setting -1°C or less)                     | Internal  |             |                        |         |           |         |               |                |          |

(Refer to the following page for \*1, \*2 and \*3)

\*1: Over temperature mark



\*2: Over cooling mark

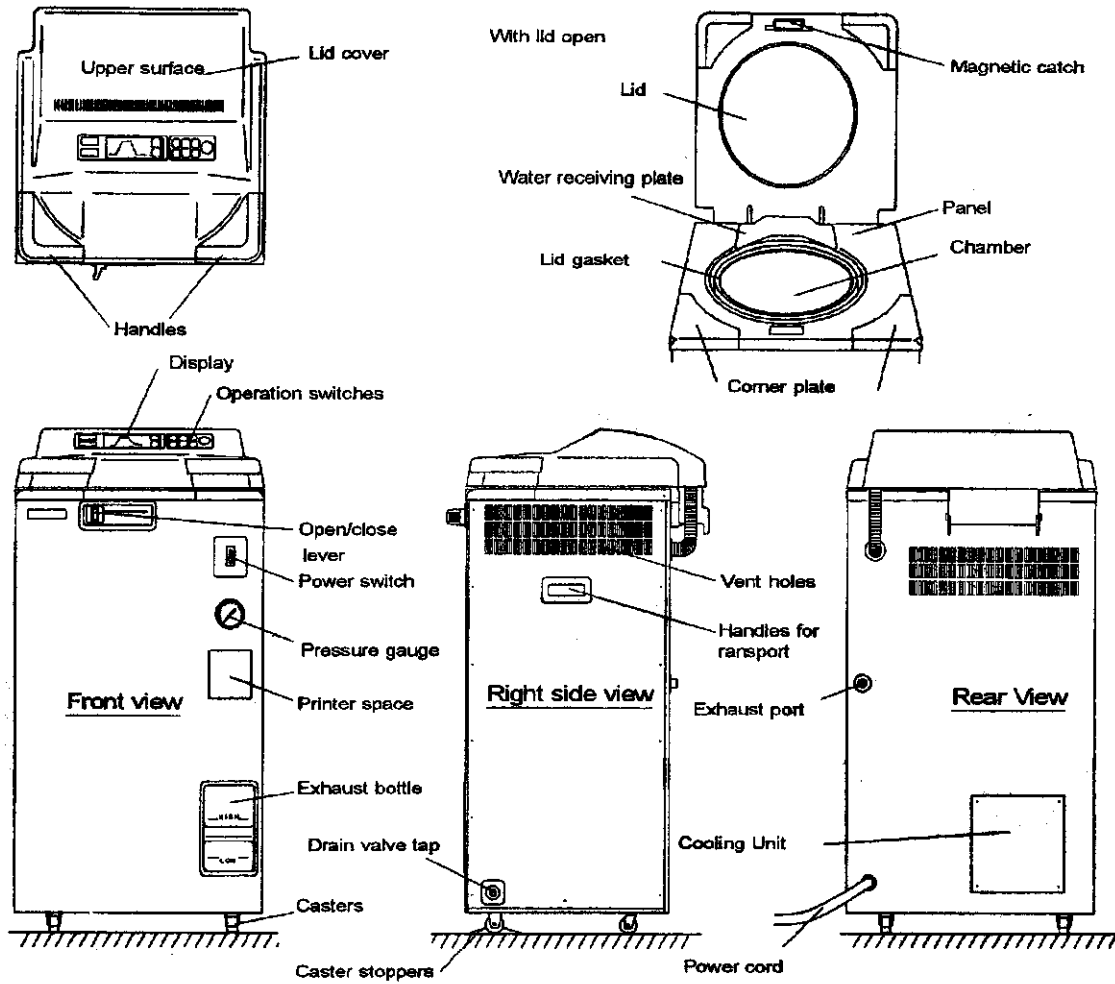


\*3: Detected when the pressure in the chamber is 0.01MPa or more or the temperature is 98°C or more.

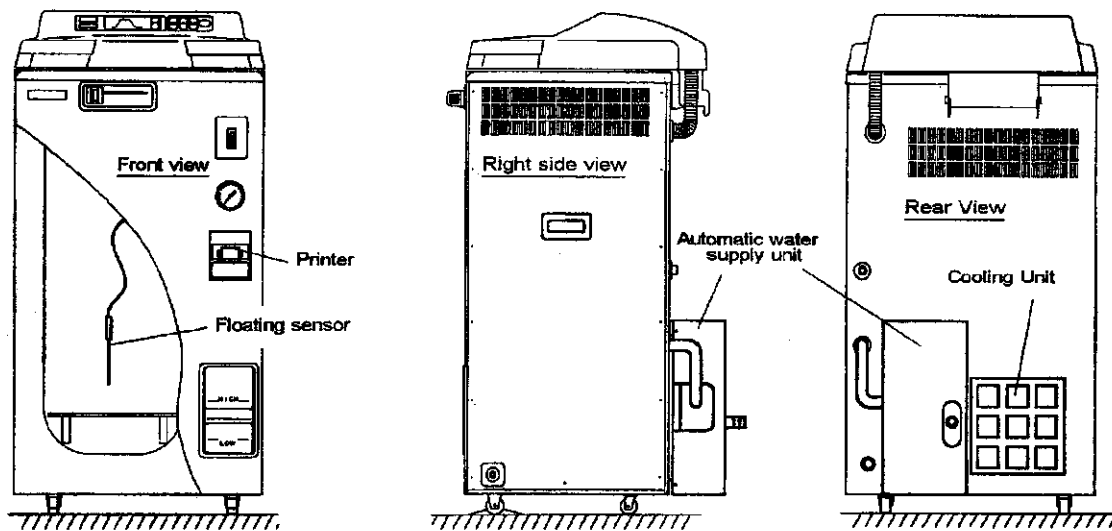
■ Other

- Modes 5 and 6 can only be used with units having the cooling unit option.
- "ErF" monitoring is only for units having the floating sensor option.
- "The automatic water supply cycle" and "Er8" monitoring are only for units having the automatic water supply unit option.

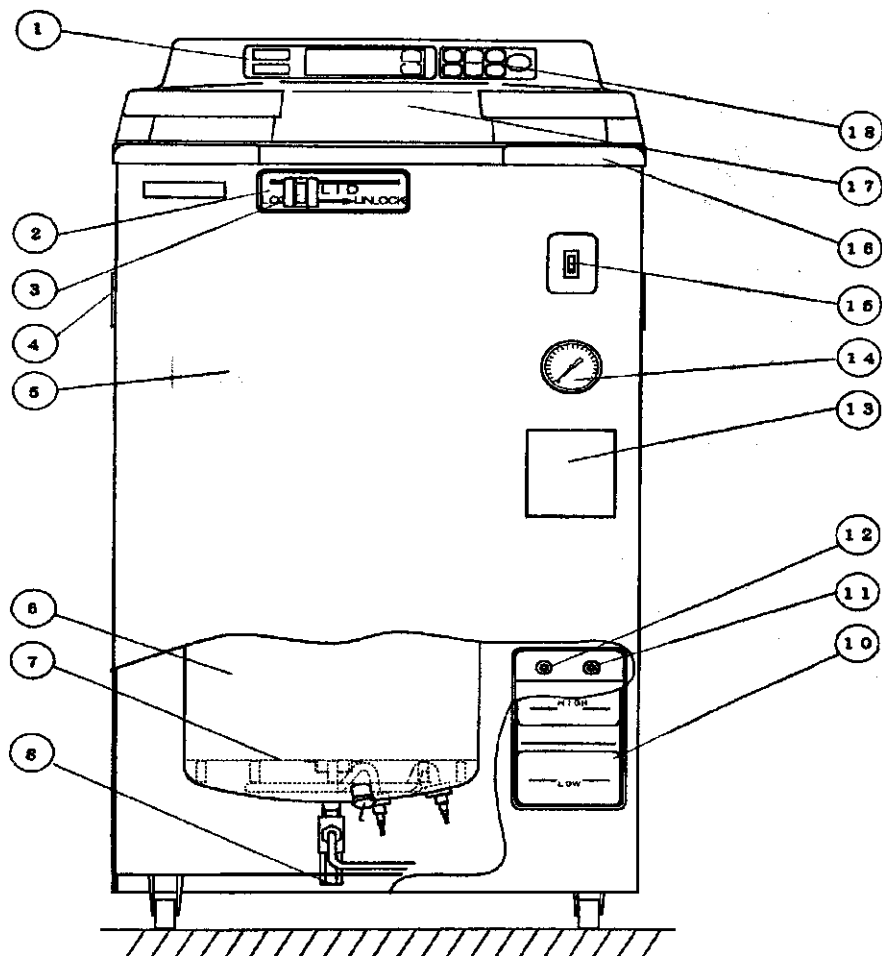
# External Appearance



[External view with options attached]



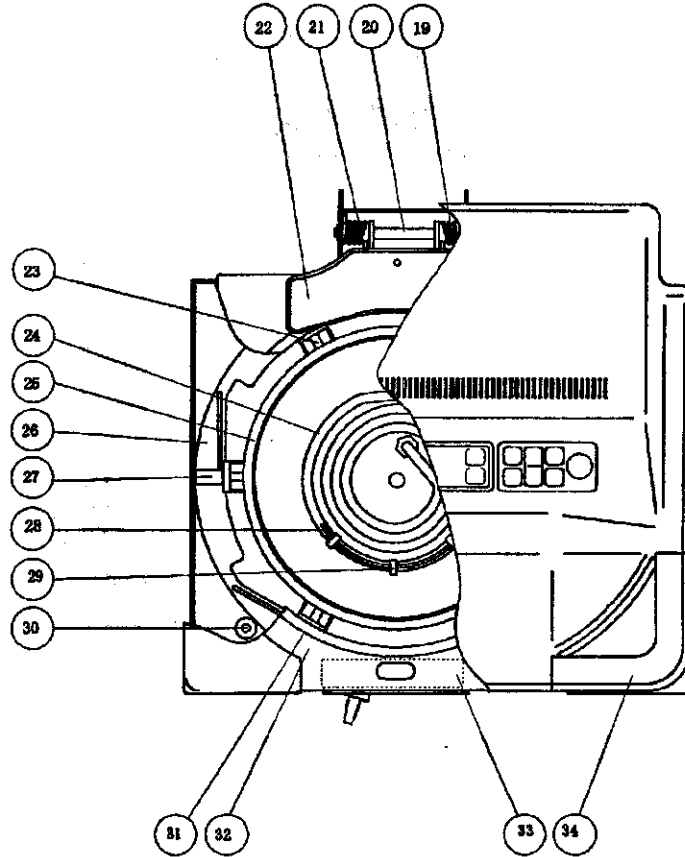
## Assembly Diagram (Front)



| No. | Part name                   |
|-----|-----------------------------|
| 8   | Hexagon blank stud          |
| 7   | Heater cover (Bottom plate) |
| 6   | Chamber                     |
| 5   | Body                        |
| 4   | Transporting handles        |
| 3   | Open/close lever            |
| 2   | Knob case                   |
| 1   | Display                     |

| No. | Part name                   |
|-----|-----------------------------|
| 18  | Operation switch [SW2]      |
| 17  | Lid cover                   |
| 16  | Corner plate                |
| 15  | Power switch [SW1]          |
| 14  | Pressure gauge [P]          |
| 13  | Blank cover (Printer space) |
| 12  | Bottle connection gasket B  |
| 11  | Bottle connection gasket A  |
| 10  | Exhaust bottle              |

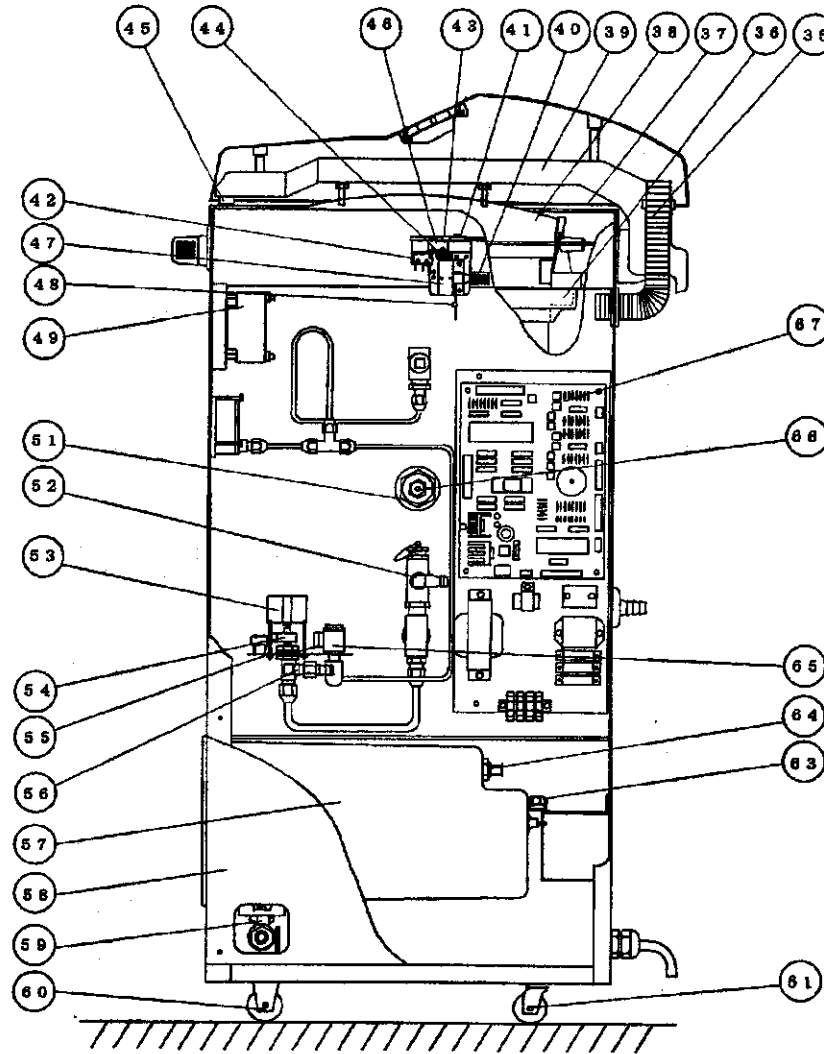
# Assembly Diagram (Top)



| No. | Part name             |
|-----|-----------------------|
| 26  | Surrounding plate     |
| 25  | Lid gasket            |
| 24  | Heater [H]            |
| 23  | Pin                   |
| 22  | Water receiving plate |
| 21  | Right lid spring      |
| 20  | Hinge axis            |
| 19  | Left lid spring       |

| No. | Part name  |
|-----|--|
| 34  | Handle   |
| 33  | Reinforcement fixture                                  |
| 32  | Top panel  |
| 31  | Panel gasket   |
| 30  | Bearing  |
| 29  | Fixing clip  |
| 28  | Temperature sensor for Lack-of-water prevention device |
| 27  | Pin guide  |

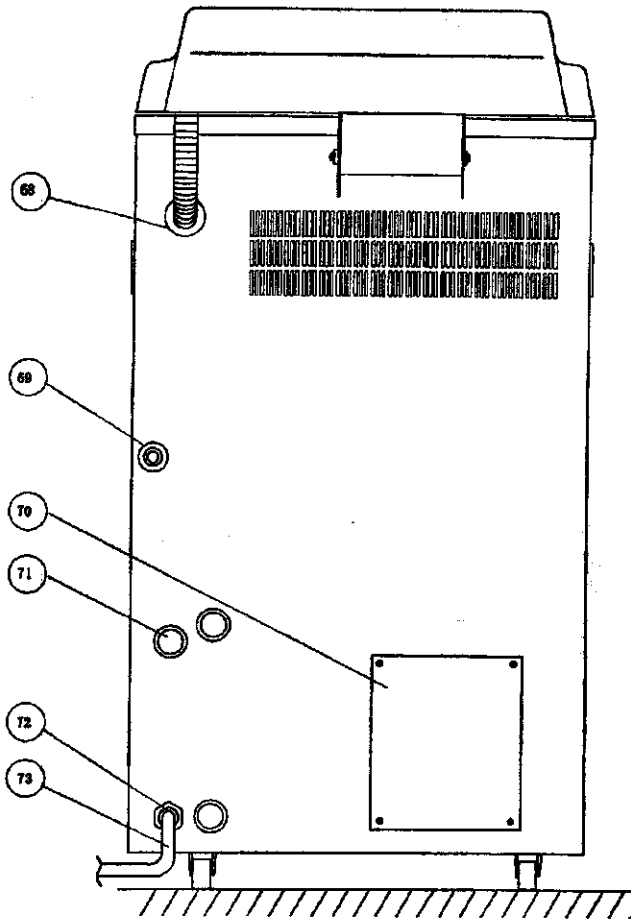
# Assembly Diagram (Right)



| No. | Part name                      |
|-----|--------------------------------|
| 49  | Electric leakage breaker [ELB] |
| 48  | Diode [D]                      |
| 47  | Solenoid [SL]                  |
| 46  | Limit switch [LSW1]            |
| 45  | Magnetic catch                 |
| 44  | Solenoid spring                |
| 43  | Plunger                        |
| 42  | Limit switch [LSW1]            |
| 41  | Lock plate                     |
| 40  | Electrolytic capacitor [C1]    |
| 39  | Lid holder                     |
| 38  | Lid                            |
| 37  | Lid bottom cover               |
| 36  | Water resistant gasket         |
| 35  | Duct                           |

| No. | Part name                       |
|-----|---------------------------------|
| 67  | Switchboard                     |
| 66  | Temperature control sensor [S1] |
| 65  | Pressure sensor [PS]            |
| 64  | Bottle connection hose port     |
| 63  | Limit switch [LSW4]             |
| 61  | Swivel caster                   |
| 60  | Fixed caster                    |
| 59  | Drain valve                     |
| 58  | Side panel                      |
| 57  | Exhaust bottle case             |
| 56  | Exhaust valve                   |
| 55  | Exhaust valve chassis           |
| 54  | Exhaust valve cam               |
| 53  | Motor [M]                       |
| 52  | Safety valve                    |
| 51  | Sensor joint                    |

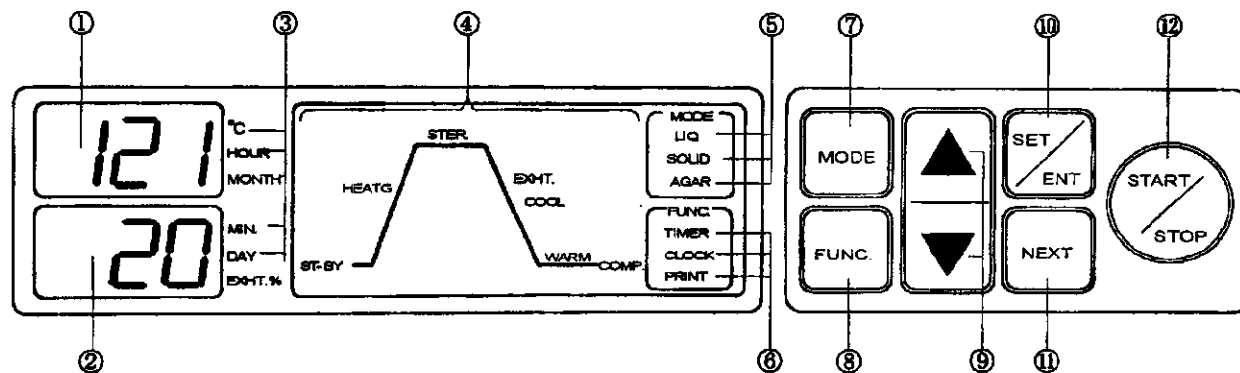
## Assembly Diagram (Back)



| No. | Part name               |
|-----|-------------------------|
| 73  | Power cord              |
| 72  | Cable gland             |
| 71  | Grommet with membrane   |
| 70  | Blank plate (Fan space) |
| 69  | Grommet (for exhaust)   |
| 66  | Grommet                 |



# Detailed Display and Operation Switch Diagram



① Digital display  
 • Temperature - SEG1, SEG2, SEG3

② Digital display  
 • Time - SEG4, SEG5, SEG6

③ Unit display  
 • °C - LED1  
 • HOUR - LED2  
 • MONTH - LED3  
 • MIN. - LED4  
 • DAY - LED5  
 • EXHT. % - LED6

④ Cycle display  
 • ST-BY - LED7  
 • HEATG - LED8  
 • STER. - LED9  
 • EXHT. - LED10  
 • COOL - LED11  
 • WARM - LED12  
 • COMP. - LED14

⑤ Mode display  
 • LIQ. - LED15  
 • SOLID - LED16  
 • AGAR - LED17

⑥ Function display  
 • TIMER - LED18  
 • CLOCK - LED19  
 • PRINT - LED20

⑦ MODE switch

⑧ FUNC. switch

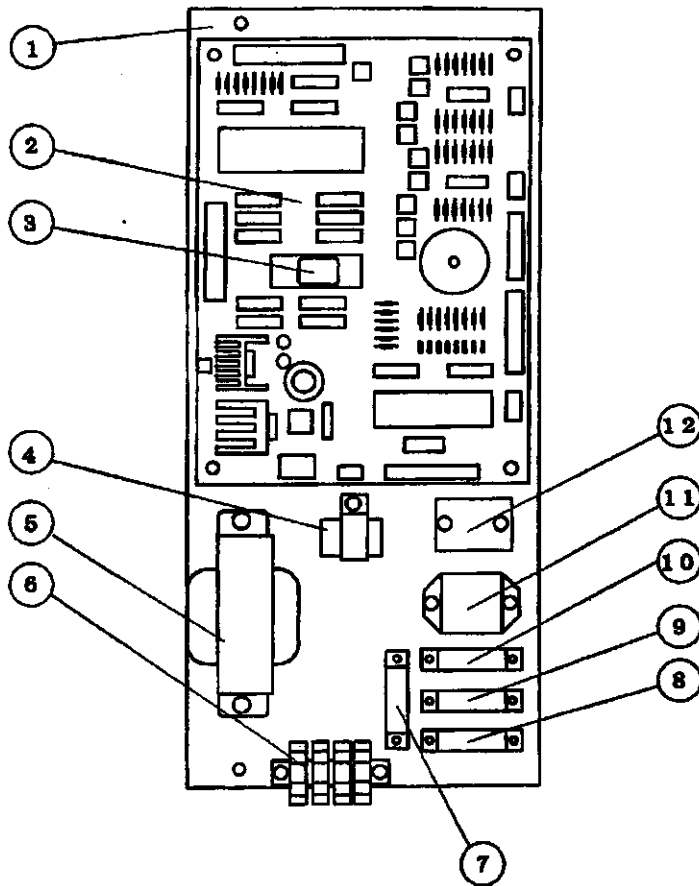
⑨ Setting value increase/decrease switches  
 (▲, ▼)

⑩ SET/ENT switch

⑪ NEXT switch

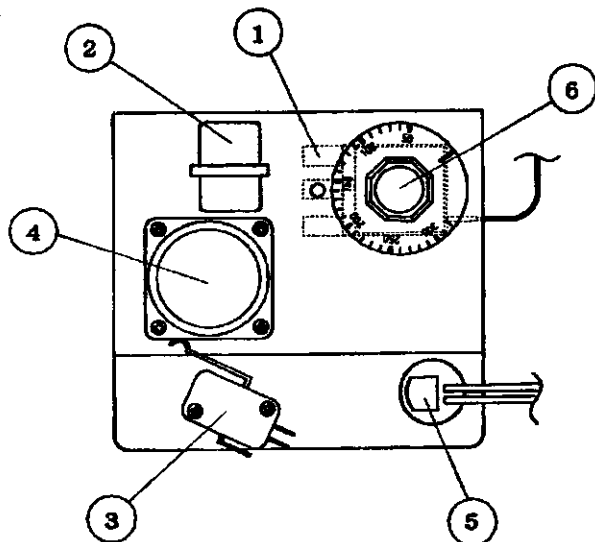
⑫ START/STOP switch

## Switchboard Diagram



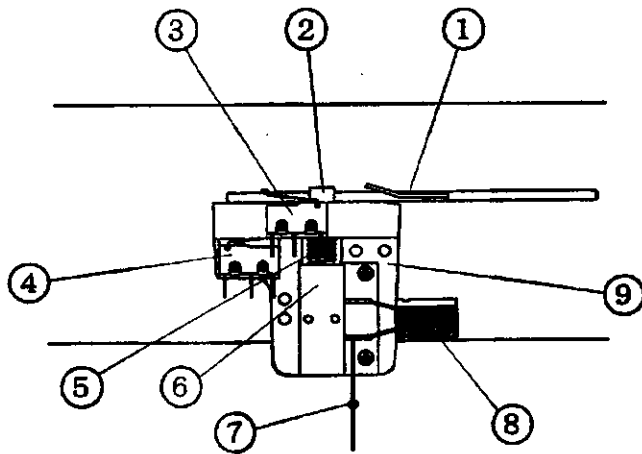
| No. | Part name                     | Symbol |
|-----|-------------------------------|--------|
| 15  | Fuse (250mA 250V)             | F3     |
| 14  | Fuse (630mA 250V)             | F2     |
| 13  | Fuse (1.6A 250V)              | F1     |
| 12  | Solid state relay             | SSR    |
| 11  | Relay                         | 1X     |
| 10  | Relay                         | 2X     |
| 9   | Relay                         | 3X     |
| 8   | Relay                         | 4X     |
| 7   | Relay (only for cooling unit) | 5X     |
| 6   | Tab terminals                 |        |
| 5   | Transformer                   | TR     |
| 4   | Backup battery                | B      |
| 3   | ROM                           |        |
| 2   | Control PCB                   | CP     |
| 1   | Switchboard chassis           |        |

## Exhaust Valve Area Diagram



| No. | Part name                       | Symbol |
|-----|---------------------------------|--------|
| 6   | EGO dial                        |        |
| 5   | Pressure sensor                 | PS     |
| 4   | Motor                           | M      |
| 3   | Limit switch                    | LSW3   |
| 2   | Motor capacitor                 | C2     |
| 1   | Lack-of-water prevention device | EGO    |

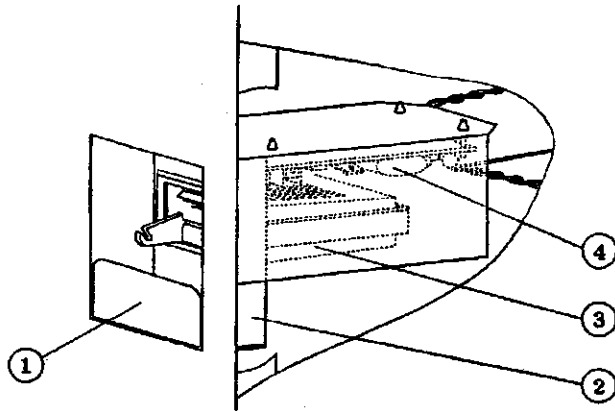
# Solenoid Area Diagram



| No. | Part Name              | Symbol |
|-----|------------------------|--------|
| 9   | Solenoid casing        |        |
| 8   | Electrolytic capacitor | C1     |
| 7   | Diode                  | D      |
| 6   | Solenoid               | SL     |
| 5   | Solenoid spring        |        |
| 4   | Limit switch           | LSW2   |
| 3   | Limit switch           | LSW1   |
| 2   | Plunger                |        |
| 1   | Lock plate             |        |

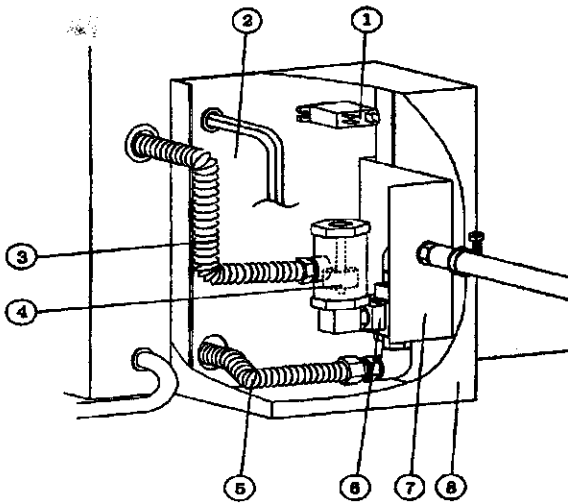
## Optional Accessories Diagrams

### ■ Printer



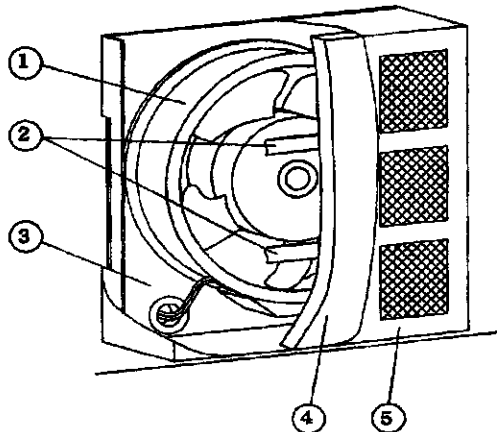
| No. | Part name       | Symbol |
|-----|-----------------|--------|
| 4   | Switching power | SR     |
| 3   | Printer         | P      |
| 2   | Printer case    |        |
| 1   | Printer holder  |        |

### ■ Automatic water supply unit



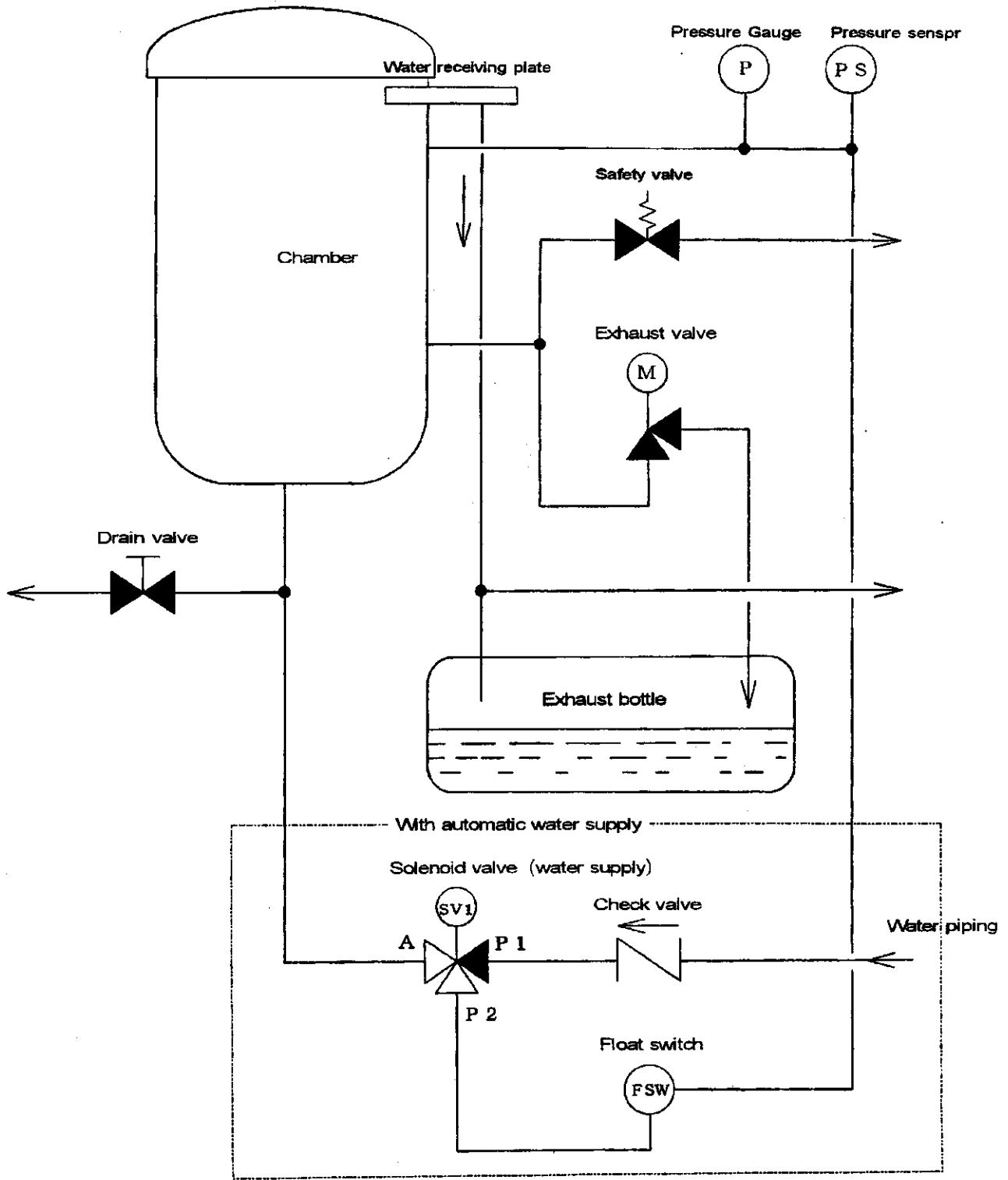
| No. | Part name                           | Symbol |
|-----|-------------------------------------|--------|
| 8   | Unit casing                         |        |
| 7   | Piping holder                       |        |
| 6   | Solenoid valve                      | SV1    |
| 5   | Flexible tube (short)               |        |
| 4   | Float switch (water level detector) | FSW    |
| 3   | Flexible tube (long)                |        |
| 2   | Unit fitting plate                  |        |
| 1   | Relay                               | 6X     |

### ■ Cooling unit



| No. | Part name         | Symbol |
|-----|-------------------|--------|
| 5   | Fan casing        |        |
| 4   | Filter            |        |
| 3   | Fan fitting plate |        |
| 2   | Filter holder     |        |
| 1   | Fan               | FAN    |

# Piping Diagram





## Connector Table

### ■ Control PCB

|                              | Connector No. | Terminal No. | Terminal function                | Connected part                      | Connected part function                              |
|------------------------------|---------------|--------------|----------------------------------|-------------------------------------|--|
| Display PCB input and output | CN1           | 1 -26        | LED output                       | DP display PCB                      | LED lighting   |
|                              |               |              | Operation switch input           |                                     | Operation switch operations                          |
| Temperature input            | CN2           | 1            | High temp. side Thermistor input | S1 Temperature control sensor       | Temperature detection in the chamber                 |
|                              |               | 2            | Low temp. side Thermistor input  |                                     |  |
|                              |               | 3            | Common                           |                                     |  |
| Temperature input            | CN3 (option)  | 1            | High temp. side Thermistor input | S2 Floating sensor                  | Temperature detection for substance being sterilized |
|                              |               | 2            | Low temp. side Thermistor input  |                                     |  |
|                              |               | 3            | Common                           |                                     |  |
| External input               | CN 4          | 1            | +12V                             | None                                |  |
|                              |               | 2            | Input                            | EGO lack-of-water prevention device | Lack-of-water detection                              |
|                              |               | 3            | +12V                             | LSW1 Limit switch                   | Lever open/close detection                           |
|                              |               | 4            | Input                            |                                     |  |
|                              |               | 5            | +12V                             | LSW2 Limit switch                   | Lever lock detection                                 |
|                              |               | 6            | Input                            |                                     |  |
|                              |               | 7            | +12V                             | LSW3 Limit switch                   | Exhaust valve full close detection                   |
|                              |               | 8            | Input                            |                                     |  |
|                              |               | 9            | +12V                             | LSW4 Limit switch                   | Exhaust bottle correct position detection            |
|                              |               | 10           | Input                            |                                     |  |
| External input and output    | CN5 (option)  | 1            | +12V                             | 6X Relay                            | SV1 Solenoid valve (water supply) activation         |
|                              |               | 2            | Output (-)                       |                                     |  |
|                              |               | 3            | +12V                             |                                     |  |
|                              |               | 4            | Output (-)                       |                                     |  |
|                              |               | 5            | +12V                             | None                                |  |
|                              |               | 6            | Output (-)                       |                                     |  |
|                              |               | 7            | +12V                             |                                     |  |
|                              |               | 8            | Output (-)                       |                                     |  |
|                              |               | 9            | +12V                             | FWS Water level detector            | Water level (in the chamber) detection               |
|                              |               | 10           | Input                            |                                     |  |
|                              |               | 11           | +12V                             | None                                |  |
|                              |               | 12           | Input                            |                                     |  |

|                          | Connector No. | Terminal No. | Terminal function           | Connected part        | Connected part function                   |
|--------------------------|---------------|--------------|-----------------------------|-----------------------|---|
| Pressure input           | CN6           | 1            | +12V                        | None                  | Pressure (in the chamber) detection       |
|                          |               | 2            | +5V                         |                       |   |
|                          |               | 3            | GND                         | PS                    |   |
|                          |               | 4            | Pressure data input         | Pressure sensor       |   |
| External output          | CN 7          | 1            | +5V                         | SSR Solid state relay | H Heater control                          |
|                          |               | 2            | +12V                        | None                  |   |
|                          |               | 3            | Output (-)                  | SSR Solid state relay | Same as terminal No. 1                    |
|                          |               | 4            | +12V                        | 1X relay              | H Heater control                          |
|                          |               | 5            | Output (-)                  |                       |   |
|                          |               | 6            | +12V                        | 2X relay              | M Motor operation (exhaust valve closing) |
|                          |               | 7            | Output (-)                  |                       |   |
|                          |               | 8            | +12V                        | 3X Relay              | M Motor operation (exhaust valve opening) |
|                          |               | 9            | Output (-)                  |                       |   |
|                          |               | 10           | +12V                        | 4X Relay              | SL Solenoid operation                     |
|                          |               | 11           | Output (-)                  |                       |   |
|                          |               | 12           | +12V                        | 5X Relay (option)     | FAN Fan operation                         |
|                          |               | 13           | Output (-)                  |                       |   |
| Backup battery input     | CN 8          | 1            | 0V input                    | B Backup battery      | Data-backup battery                       |
|                          |               | 2            | +3V input                   |                       |   |
| Power input              | CN 9          | 1            | AC14V input                 | TR Transformer        | PCB power                                 |
|                          |               | 2            | AC14V input                 |                       |   |
|                          |               | 3            | GND                         |                       |   |
| Printer power input      | CN10 (option) | 1            | +5V input                   | SR Switching power    | Printer power source                      |
|                          |               | 2            | 0V input                    |                       |   |
| Printer input and output | CN11 (option) | 1 - 34       | Print data input and output | P Printer             | Data printing                             |

■ Display PCB

|                              | Connector No. | Terminal No. | Terminal function      | Connected part      | Connected part function                  |
|------------------------------|---------------|--------------|------------------------|---------------------|--|
| Control PCB input and output | CN 1          | 1 - 26       | LED output             | CP Control PCB      | LED control                              |
|                              |               |              | Operation switch input |                     | Detection of operation switch operations |
| Operation switch input       | CN 2          | 1 - 8        | Operation switch input | SW Operation switch | Operation switch operations              |



# Chapter 4. Operation Check Procedure

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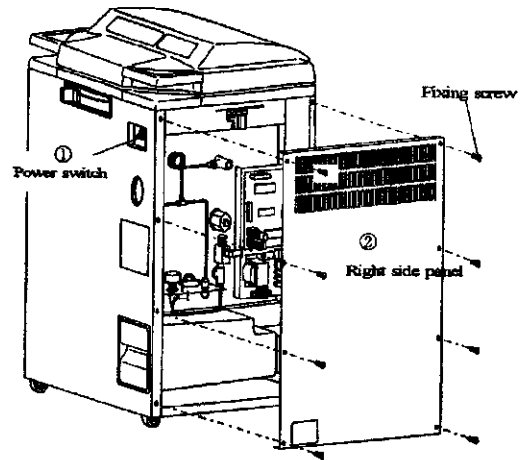
- HV series autoclaves contain a check program to ensure that the electronic parts operate properly.

## 1. Check Program Outline

|  |   |
|--|---|
| <b>c1:</b> Display PCB check:                | Checks LED lighting on the display PCB                                    |
| <b>c2:</b> Operation switch check            | Checks input of operation switches  |
| <b>c3:</b> External output check:            | Checks operation of relays (2X, 3X, 4X, and 5X), motor, solenoid and fan  |
| <b>c4:</b> External input check:             | Checks operation of lack-of-water prevention device and each limit switch |
| <b>c5:</b> External input and output check:  | Checks operation of water level detector, relay (6X), and solenoid valve. |
| <b>c6:</b> DIP switch check:                 | Checks operation of DIP switches on control PCB                           |
| <b>c7:</b> Temperature control sensor check: | Checks input of temperature control sensor                                |
| <b>c8:</b> Floating sensor check:            | Checks input of floating sensor   |
| <b>c9:</b> Printer check:                    | Checks printer operation  |
| <b>c10:</b> Clock function check:            | Checks the clock function on the control PCB                              |
| <b>c11:</b> Pressure sensor check:           | Checks input of pressure sensor   |

## 2. Check Program Startup

- ① Turn the power switch off.
- ② Remove the right side panel.
- ③ Turn on No. 4 of DIP switch S2 on the control PCB.
- ④ Turn the power switch on.
- ⑤ Check program c1 will startup.



- During the check program, the items of check program are changed over as shown below by pressing the START/STOP switch,

c1 → c2 → c3 ..... c11 → c1 ...

- When the operation check is completed, turn the power switch off and return No. 4 of DIP switch S2 to OFF.

① Power switch

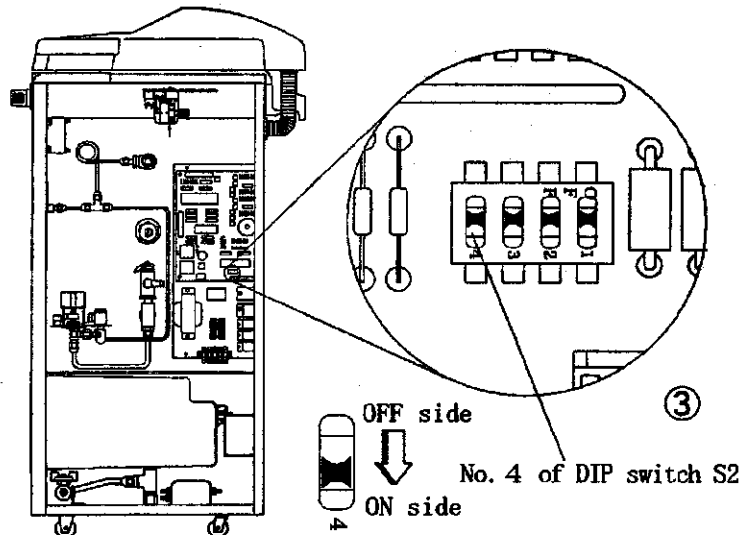
Fixing screws

② Right side panel

OFF side

ON side

③ No. 4 of DIP switch S2



### 3. Check Programs

#### ■ c1: Display PCB check

The 7 segment LEDs will light in the following order.

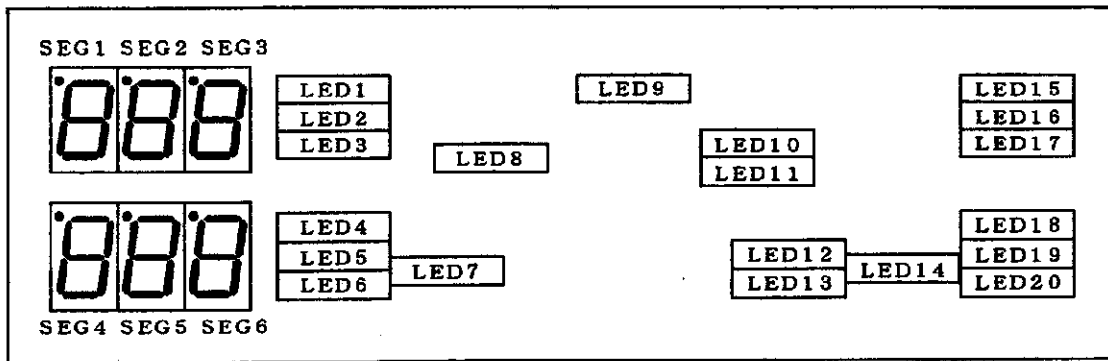
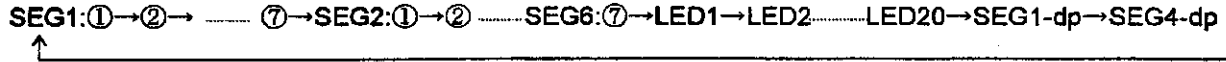
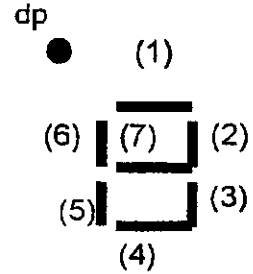
"c 1" will be displayed in SEG1 and 2 for 2 seconds



All LEDs on the display PCB will light (except SEG2, 3, 5 and 6-dp) (2.5seconds)



The LED will light in the following sequence

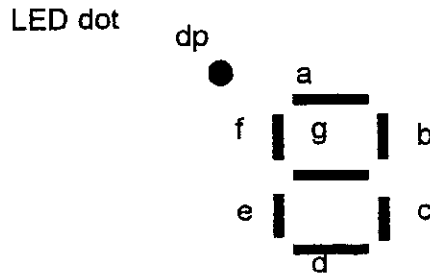


#### ■ c2: Operation switch check

"c 2" will be displayed in SEG1 and 2



When an operation switch is pressed the corresponding 7 segment LED dot will light (excluding the START/STOP switch).



| Operation switch | Lit up dot |
|------------------|------------|
| [MODE]           | SEG4 a dot |
| [▲]              | SEG5 a dot |
| [SET/ENT]        | SEG6 a dot |
| [FUNC.]          | SEG4 d dot |
| [▼]              | SEG5 d dot |
| [NEXT]           | SEG6 d dot |

■ **c3: External output check**

“c 3” will be displayed in SEG1 and 2



The part corresponding to the operation switch will operate (excluding SSR and 1X).

| Operation switch | Moving part-1 | Moving part-2                   |
|------------------|---------------|---------------------------------|
| [MODE]           | 2X relay      | M Motor (exhaust valve closing) |
| [NEXT]           | 3X relay      | M Motor (exhaust valve opening) |
| [▼]              | 4X relay      | SL Solenoid                     |
| [FUNC.]          | 5X relay      | FAN Fan                         |

→ Only for cooling unit option

■ **c4: External input check**

“c 4” will be displayed in SEG1 and 2



The dots of the 7 segment LED will light according to the external input.

| External input  | Lit up dot |
|---|------------|
| Lack-of-water prevention device (lack-of-water detection)     | SEG4 a dot |
| Limit switch LSW1 (lever open/close detection)                | SEG5 a dot |
| Limit switch LSW2 (lever lock detection)                      | SEG6 a dot |
| Limit switch LSW3 (exhaust valve full close detection)        | SEG4 d dot |
| Limit switch LSW4 (exhaust bottle correct position detection) | SEG5 d dot |

- Setting values for lack-of-water prevention device

| Models        | HV-25 | HV-50 | HV-85 | HV-110 |
|---------------|-------|-------|-------|--------|
| Setting value | 160°C | 170°C | 160°C | 160°C  |

■ **c5: External input and output check (only for automatic water supply unit option)**

“c 5” will be displayed in SEG1 and 2



The part will move depending on the operation switch.

The dots of the 7 segment LED will light according to each external input.

| Operation switch | Activated part-1 | Activated part-2              |
|------------------|------------------|-------------------------------|
| [SET/ENT]        | 6X relay         | Solenoid valve (water supply) |

| External input  | Lit up dot |
|---|------------|
| FSW Water level detector (water level detection in the chamber) | SEG4 a dot |

■ **c6: DIP switch check**

"c 6" will be displayed in SEG1 and 2



The dots of the 7 segment LED will light according to the S1 and S2 DIP switch input within the control PCB.

| DIP switch | Lit up dot    |
|------------|---------------|
| S1-①       | SEG6 b dot    |
| S1-②       | SEG6 f dot    |
| S1-③       | SEG5 b dot    |
| S1-④       | SEG5 f dot    |
| S1-⑤       | SEG4 b dot    |
| S1-⑥       | SEG4 f dot    |
| S1-⑦       | Not connected |
| S1-⑧       | Not connected |

| DIP switch | Lit up dot |
|------------|------------|
| S2-①       | SEG6 c dot |
| S2-②       | SEG6 e dot |
| S2-③       | SEG5 c dot |
| S2-④       | SEG5 e dot |

- DIP switch S2 settings  
(Settings other than those below are not possible)  
(④ is used to start the check program)

| Model                                | HV-25 | HV-50 | HV-85 | HV-110 |
|--------------------------------------|-------|-------|-------|--------|
| DIP switch setting<br>For each MODEL |       |       |       |        |
| OFF                                  |       |       |       |        |
| ON                                   |       |       |       |        |

- DIP switch S1 settings  
(⑥ is used for over pressure exhaust check)  
(Normally, ⑤ is ON while ⑦⑧ are OFF.)

|     |  |  |
|-----|--|--|
| ON  |  | <ul style="list-style-type: none"> <li>① Cooling unit</li> <li>② Floating sensor</li> <li>③ Printer</li> <li>④ Automatic water supply unit</li> <li>⑤ CE specifications</li> </ul> |
| OFF |  | <ul style="list-style-type: none"> <li>ON = Option installed</li> <li>OFF = Option not installed</li> </ul>  |

■ **c7: Temperature control sensor check**

"c 7" will be displayed in SEG1 and 2 for 2 seconds.



When the temperature in the chamber is 25°C: "0" is displayed in SEG1 - 3  
"75"±1 is displayed in SEG4 - 6

When the temperature in the chamber is 121°C: "175"±1 is displayed in SEG1 - 3  
"255" is displayed in SEG4 - 6

■ **c8: Floating sensor check**

"c 8" will be displayed in SEG1 and 2 for 2 seconds.



When the temperature in the chamber is 25°C: "0" is displayed in SEG1 - 3

"75"±1 is displayed in SEG4 - 6

When the temperature in the chamber is 121°C: "175"±1 is displayed in SEG1 - 3

"255" is displayed in SEG4 - 6

■ **c9: Printer check**

"c 9" will be displayed in SEG1 and 2



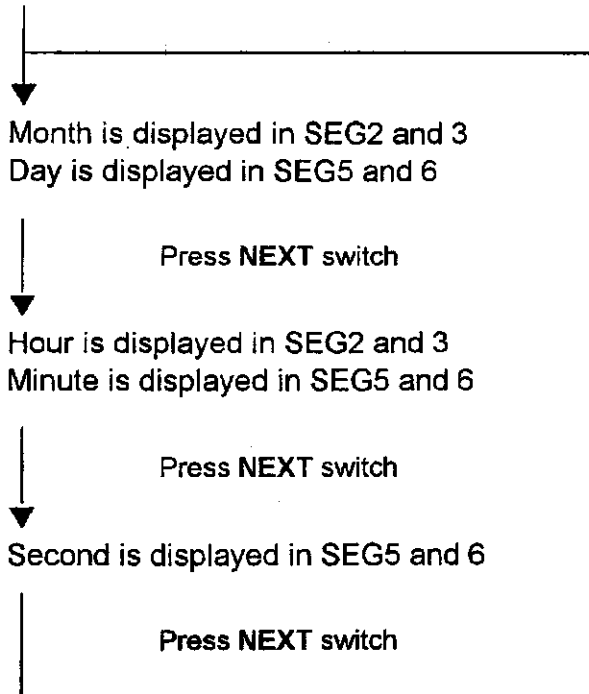
The following data will be printed out when an operation switch is pressed (excluding the START/STOP switch).

**Print output data**

```
*HIRAYAMA MFG CORP*
-----
Date:
-----
Time:
-----
Name:
-----
Cycle Count: 0001
*** Setting ***
Mode:1      Liquid
Ster.Temp: 121 ° C
Ster.Time: 20min.
Warm Temp: 50 ° C
Exhaust %: 10%
*** Cycle Start ***
|Time|Temp|Press|Stat|
```

■ **c10: Clock operation check**

"c 10" will be displayed in SEG1, 2, and 3 for 2 seconds.



■ **c11: Pressure sensor check**

"c 1 1" will be displayed in SEG1, 2, and 3



When the pressure in the chamber is 0 MPa : "2 6" is displayed in SEG4 - 6.

When the pressure in the chamber is 0.12 MPa : "1 0 7" is displayed in SEG4 - 6.

## ■ Reference Table for Floating Sensor and Temperature Control Sensor

(Low temperature side: between white and yellow for temperature control sensor and between white and blue for floating sensor)

| Temperature (°C) | Thermistor resistance value (kΩ) | TP3, 5 voltage (V) | Check program display value | Reference HEX value |
|------------------|----------------------------------|--------------------|-----------------------------|---------------------|
| 0                | 329.5                            | .342               | 17                          | 11H                 |
| 1                | 312.7                            | .373               | 19                          | 13H                 |
| 2                | 297.0                            | .406               | 20                          | 14H                 |
| 3                | 282.2                            | .439               | 22                          | 16H                 |
| 4                | 262.2                            | .474               | 24                          | 18H                 |
| 5                | 255.0                            | .510               | 26                          | 1AH                 |
| 6                | 242.5                            | .547               | 27                          | 1BH                 |
| 7                | 230.6                            | .586               | 29                          | 1DH                 |
| 8                | 219.5                            | .625               | 31                          | 1FH                 |
| 9                | 208.9                            | .666               | 33                          | 21H                 |
| 10               | 198.9                            | .708               | 36                          | 24H                 |
| 11               | 189.4                            | .751               | 38                          | 26H                 |
| 12               | 180.5                            | .796               | 40                          | 28H                 |
| 13               | 172.0                            | .842               | 42                          | 2AH                 |
| 14               | 164.0                            | .889               | 45                          | 2DH                 |
| 15               | 156.3                            | .937               | 47                          | 2FH                 |
| 16               | 149.1                            | .986               | 50                          | 32H                 |
| 17               | 142.3                            | 1.037              | 52                          | 34H                 |
| 18               | 135.8                            | 1.089              | 55                          | 37H                 |
| 19               | 129.6                            | 1.142              | 58                          | 3AH                 |
| 20               | 123.8                            | 1.197              | 61                          | 3DH                 |
| 21               | 118.2                            | 1.252              | 63                          | 3FH                 |
| 22               | 112.9                            | 1.309              | 66                          | 42H                 |
| 23               | 107.9                            | 1.366              | 69                          | 45H                 |
| 24               | 103.2                            | 1.424              | 72                          | 48H                 |
| 25               | 98.63                            | 1.484              | 75                          | 4BH                 |
| 26               | 94.33                            | 1.545              | 78                          | 4EH                 |
| 27               | 90.24                            | 1.607              | 81                          | 51H                 |
| 28               | 86.35                            | 1.670              | 85                          | 55H                 |
| 29               | 82.65                            | 1.734              | 88                          | 58H                 |
| 30               | 79.13                            | 1.798              | 91                          | 5BH                 |
| 31               | 75.77                            | 1.863              | 95                          | 5FH                 |
| 32               | 72.58                            | 1.930              | 98                          | 62H                 |
| 33               | 69.53                            | 1.996              | 101                         | 65H                 |
| 34               | 66.64                            | 2.063              | 105                         | 68H                 |
| 35               | 63.84                            | 2.131              | 108                         | 6CH                 |
| 36               | 61.24                            | 2.200              | 112                         | 70H                 |
| 37               | 58.73                            | 2.269              | 115                         | 73H                 |
| 38               | 56.33                            | 2.339              | 119                         | 77H                 |
| 39               | 54.05                            | 2.409              | 122                         | 7AH                 |
| 40               | 51.87                            | 2.479              | 126                         | 7EH                 |
| 41               | 49.79                            | 2.549              | 129                         | 81H                 |
| 42               | 47.80                            | 2.620              | 133                         | 85H                 |
| 43               | 45.91                            | 2.691              | 137                         | 89H                 |
| 44               | 44.09                            | 2.762              | 140                         | 8CH                 |
| 45               | 42.53                            | 2.833              | 144                         | 90H                 |
| 46               | 40.71                            | 2.904              | 148                         | 94H                 |
| 47               | 39.13                            | 2.975              | 151                         | 97H                 |
| 48               | 37.62                            | 3.046              | 155                         | 9BH                 |
| 49               | 36.17                            | 3.117              | 158                         | 9EH                 |

| Temperature (°C) | Thermistor resistance value (kΩ) | TP3, 5 voltage (V) | Check program display value | Reference HEX value |
|------------------|----------------------------------|--------------------|-----------------------------|---------------------|
| 50               | 34.79                            | 3.187              | 162                         | A2H                 |
| 51               | 33.47                            | 3.257              | 166                         | A6H                 |
| 52               | 32.20                            | 3.327              | 169                         | A9H                 |
| 53               | 30.99                            | 3.396              | 173                         | ADH                 |
| 54               | 29.83                            | 3.465              | 176                         | B0H                 |
| 55               | 28.72                            | 3.534              | 180                         | B4H                 |
| 56               | 27.66                            | 3.602              | 183                         | B7H                 |
| 57               | 26.64                            | 3.669              | 187                         | BBH                 |
| 58               | 25.66                            | 3.736              | 190                         | BEH                 |
| 59               | 24.73                            | 3.802              | 193                         | C1H                 |
| 60               | 23.83                            | 3.868              | 197                         | C5H                 |
| 61               | 22.97                            | 3.932              | 200                         | C8H                 |
| 62               | 22.15                            | 3.997              | 203                         | CBH                 |
| 63               | 21.36                            | 4.060              | 207                         | CFH                 |
| 64               | 20.60                            | 4.123              | 210                         | D2H                 |
| 65               | 19.87                            | 4.184              | 213                         | D5H                 |
| 66               | 19.17                            | 4.254              | 216                         | D8H                 |
| 67               | 18.18                            | 4.305              | 219                         | D8H                 |
| 68               | 17.86                            | 4.363              | 222                         | DEH                 |
| 69               | 17.24                            | 4.422              | 225                         | E1H                 |
| 70               | 16.64                            | 4.480              | 228                         | E4H                 |
| 71               | 16.07                            | 4.536              | 231                         | E7H                 |
| 72               | 15.52                            | 4.591              | 234                         | EAH                 |
| 73               | 15.00                            | 4.645              | 236                         | ECH                 |
| 74               | 14.49                            | 4.699              | 239                         | EFH                 |
| 75               | 14.00                            | 4.752              | 242                         | F2H                 |
| 76               | 13.54                            | 4.803              | 244                         | F4H                 |
| 77               | 13.09                            | 4.853              | 247                         | F7H                 |
| 78               | 12.65                            | 4.903              | 250                         | FAH                 |
| 79               | 12.24                            | 4.952              | 252                         | FCH                 |
| 80               | 11.83                            | 5.000              | 255                         | FFH                 |
| 81               | 11.45                            |                    |                             |                     |
| 82               | 11.08                            |                    |                             |                     |
| 83               | 10.72                            |                    |                             |                     |
| 84               | 10.37                            |                    |                             |                     |
| 85               | 10.04                            |                    |                             |                     |
| 86               | 9.723                            |                    |                             |                     |
| 87               | 9.414                            |                    |                             |                     |
| 88               | 9.118                            |                    |                             |                     |
| 89               | 8.832                            |                    |                             |                     |
| 90               | 8.556                            |                    |                             |                     |
| 91               | 8.290                            |                    |                             |                     |
| 92               | 8.033                            |                    |                             |                     |
| 93               | 7.786                            |                    |                             |                     |
| 94               | 7.548                            |                    |                             |                     |
| 95               | 7.317                            |                    |                             |                     |
| 96               | 7.095                            |                    |                             |                     |
| 97               | 6.881                            |                    |                             |                     |
| 98               | 6.674                            |                    |                             |                     |
| 99               | 6.475                            |                    |                             |                     |





■ Pressure Sensor Reference Table

| Pressure (MPa) | Sensor output voltage (V) | Check program display value | Reference HEX value |
|----------------|---------------------------|-----------------------------|---------------------|
| 0              | 0.50                      | 26                          | 1AH                 |
| 0.01           | 0.63                      | 32                          | 20H                 |
| 0.02           | 0.76                      | 39                          | 27H                 |
| 0.03           | 0.90                      | 46                          | 2EH                 |
| 0.04           | 1.03                      | 53                          | 35H                 |
| 0.05           | 1.16                      | 60                          | 3CH                 |
| 0.06           | 1.30                      | 66                          | 42H                 |
| 0.07           | 1.43                      | 73                          | 49H                 |
| 0.08           | 1.56                      | 80                          | 50H                 |
| 0.09           | 1.70                      | 87                          | 57H                 |
| 0.10           | 1.83                      | 94                          | 5EH                 |
| 0.11           | 1.96                      | 100                         | 64H                 |
| 0.12           | 2.10                      | 107                         | 6BH                 |
| 0.13           | 2.23                      | 114                         | 72H                 |
| 0.14           | 2.36                      | 121                         | 79H                 |
| 0.15           | 2.50                      | 128                         | 80H                 |
| 0.16           | 2.63                      | 134                         | 86H                 |
| 0.17           | 2.76                      | 141                         | 8BH                 |
| 0.18           | 2.90                      | 148                         | 94H                 |
| 0.19           | 3.03                      | 155                         | 9BH                 |
| 0.20           | 3.16                      | 162                         | A2H                 |
| 0.21           | 3.30                      | 168                         | A8H                 |
| 0.22           | 3.43                      | 175                         | AFH                 |
| 0.23           | 3.56                      | 182                         | B6H                 |
| 0.24           | 3.70                      | 189                         | BDH                 |
| 0.25           | 3.83                      | 196                         | C4H                 |
| 0.26           | 3.96                      | 202                         | CAH                 |
| 0.27           | 4.10                      | 209                         | D1H                 |
| 0.28           | 4.23                      | 216                         | D8H                 |
| 0.29           | 4.36                      | 223                         | DFH                 |
| 0.30           | 4.50                      | 230                         | E6H                 |