

**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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- (3) This document has been carefully compiled. If you have any questions or require information not covered in the manual, please contact :

Amerex Instruments, Inc.  
P.O. Box 787  
Lafayette, CA 94549  
U.S.A.  
Tel: (925) 299-0743  
Fax: (925) 299-0745  
E-mail: [marketing@amerexinst.com](mailto:marketing@amerexinst.com)

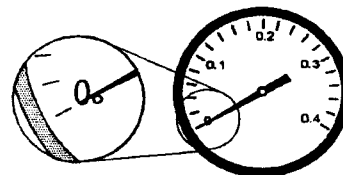
## Read Carefully Before Using

- 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**

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:

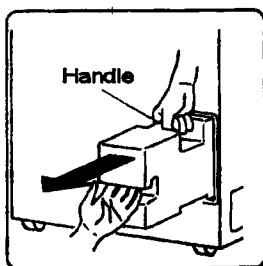
- Wait until the body has cooled sufficiently before performing maintenance and adjustment.
- Perform maintenance and adjustment after turning the power switch off.

## 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.

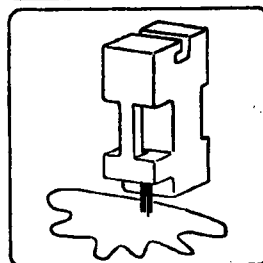
## CAUTION:

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



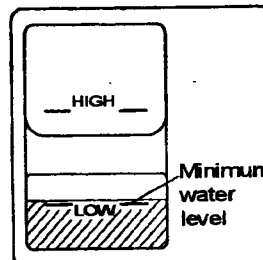
- (1) Remove the exhaust bottle from the body.

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



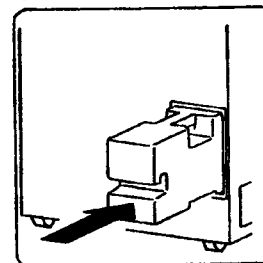
- (2) Place the drain/supply port face down in a level sink.

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.



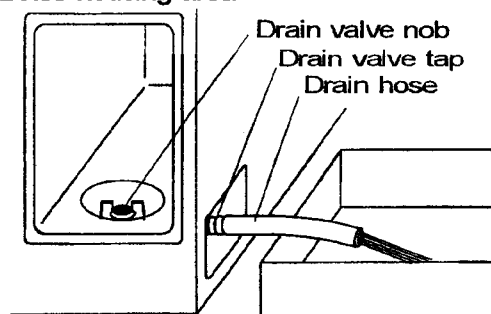
### CAUTION:

- 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.

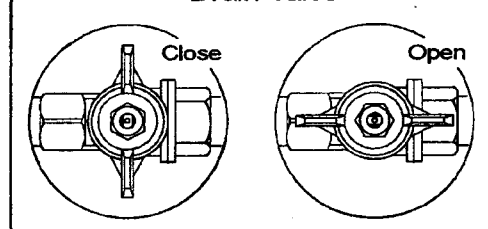
- (1) Open the lid.
- (2) Connect one end of the accessory drain hose to the tap of the drain valve located at the lower part of the right side of the body.
- (3) Put the other end of the hose in a container.
- (4) Remove the exhaust bottle from the body.
- (5) Turn the drain valve knob, located at the 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

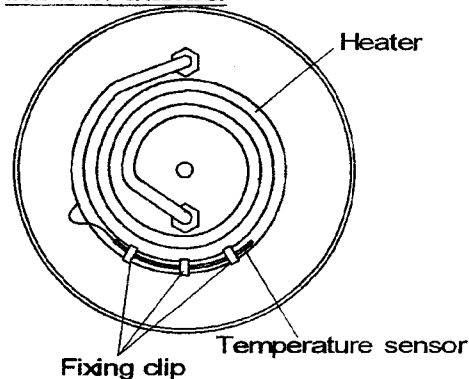


#### **CAUTION:**

- 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

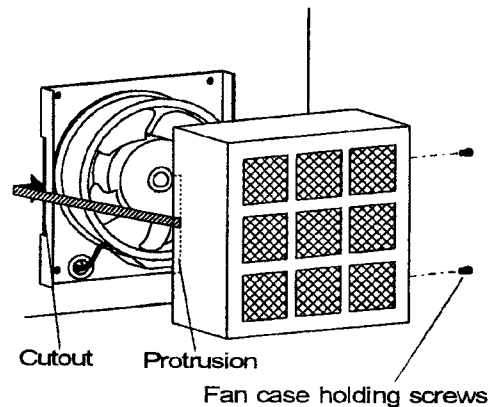
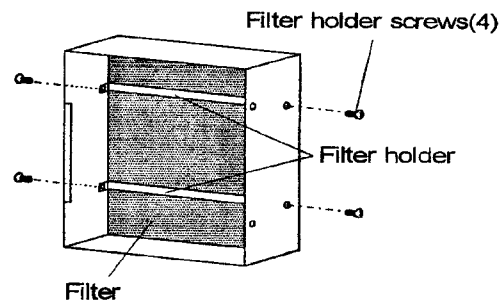
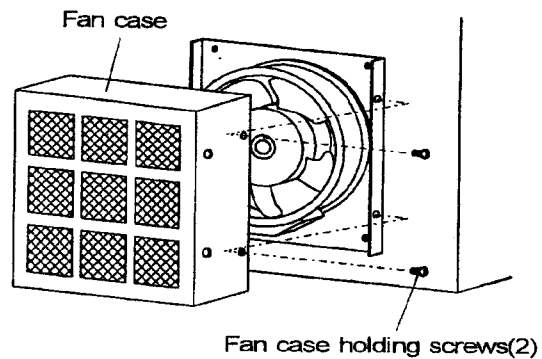
- (2) Remove the filter holder screws and remove the filter.
- (3) Soak and gently wash the filter in neutral detergent diluted in water.

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.

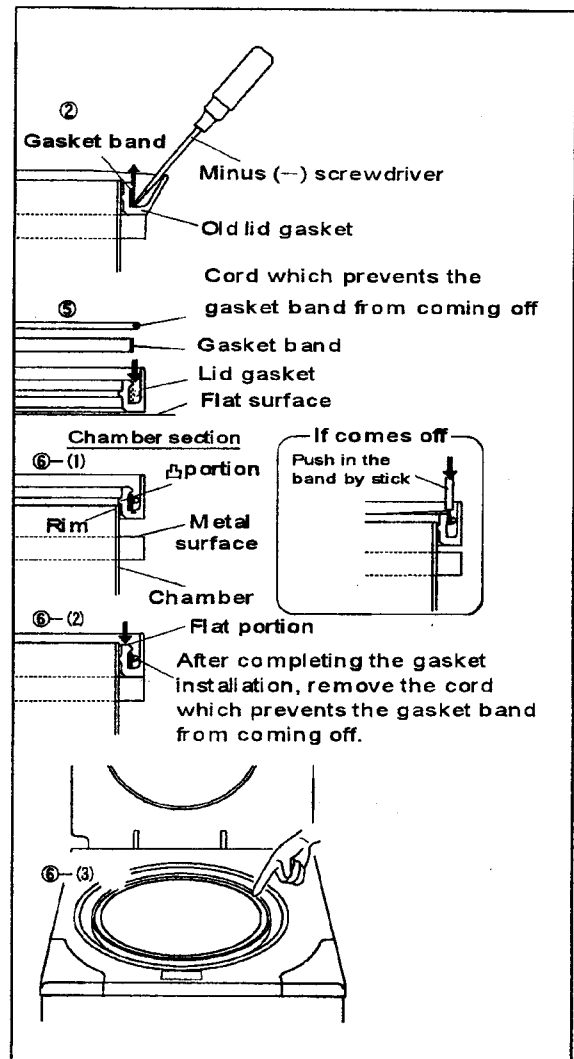
When the gasket is completely pushed in, the flat portion is positioned at a level slightly lower than the rim of the chamber.

- (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

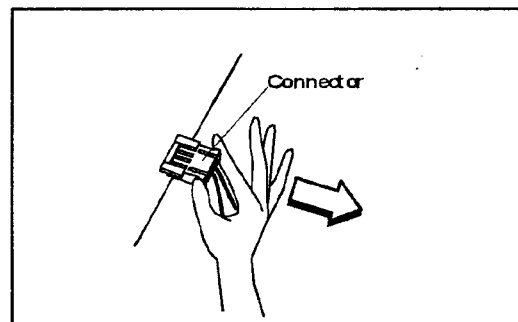
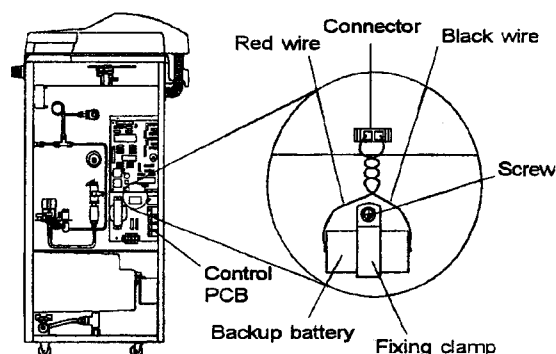
- When the **CLOCK** display flickers, replace the backup battery in accordance with the following procedure.



### CAUTION:

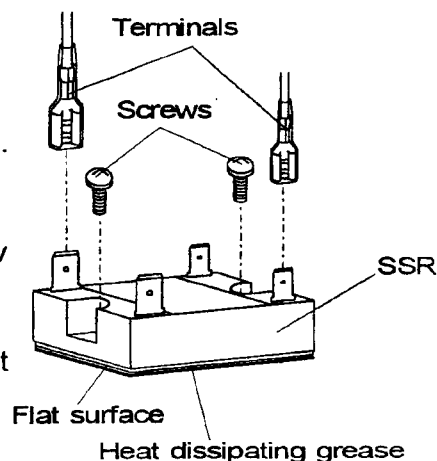
- Connecting the battery with its polarities reversed may cause heating, explosion or ignition.
- Do not dispose of used batteries in fire; they may explode.

- 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.

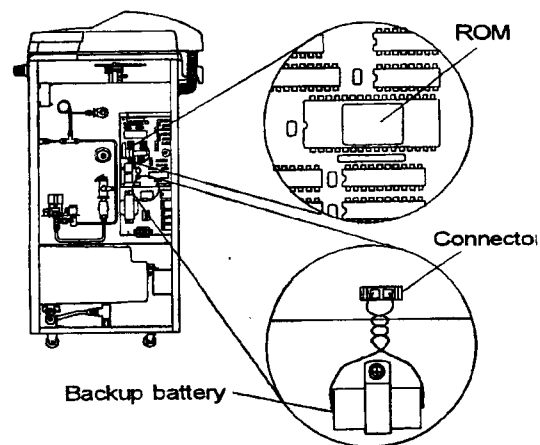


Since the IN side of the SSR has +/- polarity, be sure to connect in the original position.

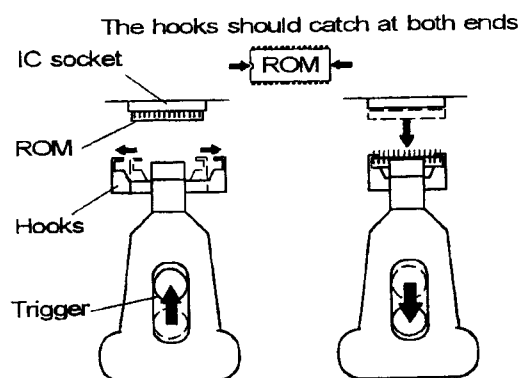
## 9. ROM Replacement

### ! IMPORTANT:

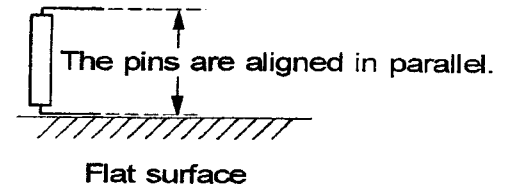
- When replacing the ROM, use a special too to avoid damaging the control PCB or the new ROM.
- The PCB or ROM can be damaged if touched or brought into contact with people or clothing having a static electricity charge. Touch a metal object or take other measures to discharge static electricity before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

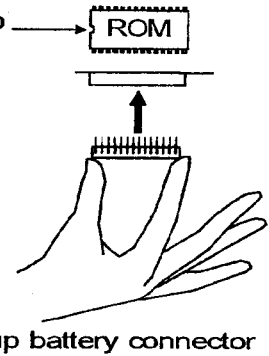


- (2) Make sure that the pins on the new ROM are aligned in parallel. If pins are bent outward, use a flat surface to realign them.



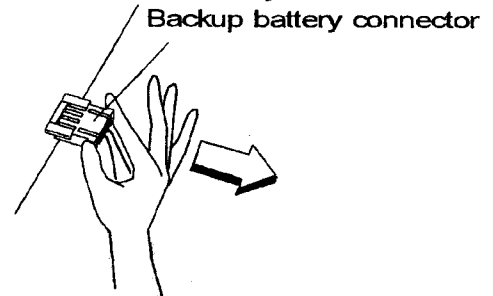
- (3) Insert the new ROM into the IC socket to the correct direction. (The notch to the left).

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:

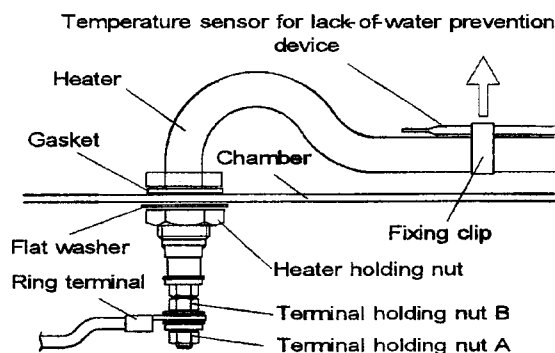
- Be sure to securely tighten the heater holding nuts when replacing the heater. Water may leak and cause short circuits if the nuts are loose.
- Be sure to securely tighten terminal holding nut A when replacing the heater. Heat may be generated from the terminal and burn damage may result if the nut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

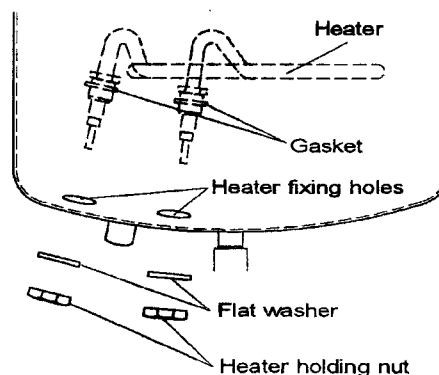
#### Removing the old heater

- (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.

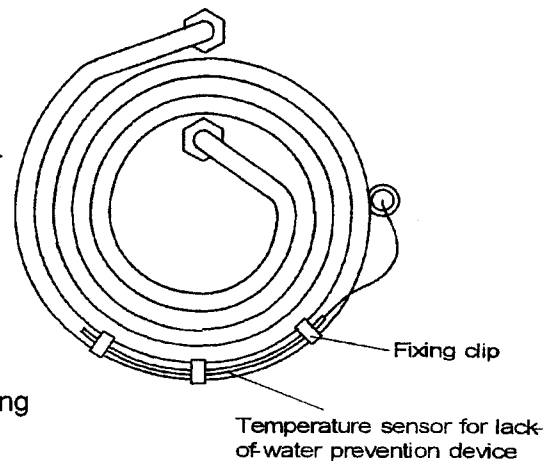


#### Fixing the new heater

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

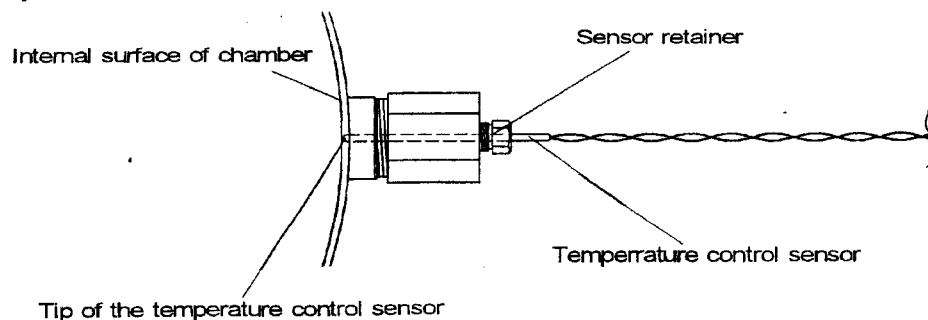


- (10) Pass both ends of the heater through the fixing holes at the bottom of the chamber, with care so that the gaskets do not drop.
- (11) Attach the flat washers, then tighten the heater holding nuts.
- (12) Remove terminal holding nut A from the newly attached heater.
- (13) Fit the ring terminal 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.



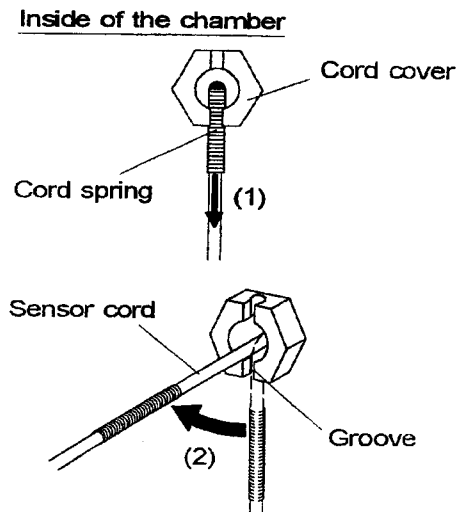


## 12. Floating Sensor (Option) Replacement

### ■ Required tools

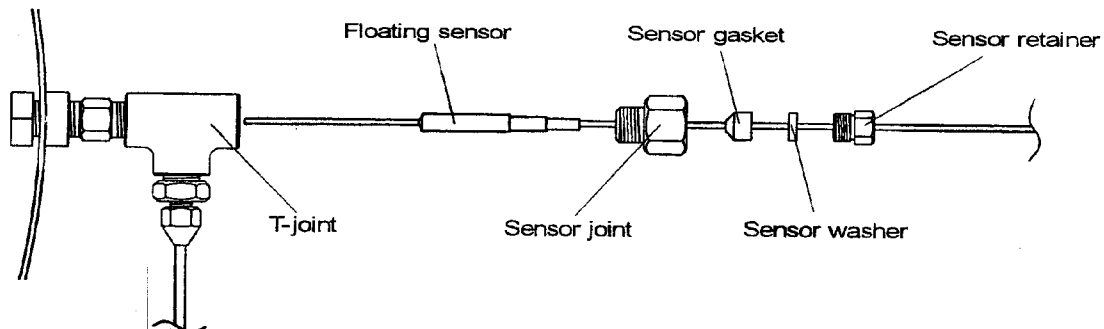
- Monkey wrench (with maximum opening width of 24mm or more)

- (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.



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

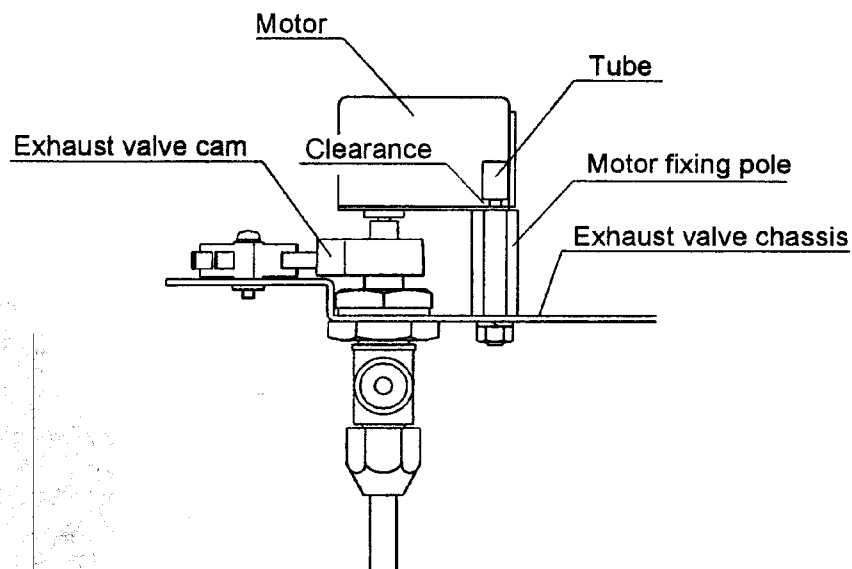
- (7) Attach the sensor joint to the T-joint.
- (8) Attach the sensor gasket, sensor washer, and sensor retainer to the sensor joint. (firmly tighten the sensor retainer using the fingers only. Never use a tool such as a monkey wrench.)



- (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 tighten 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.

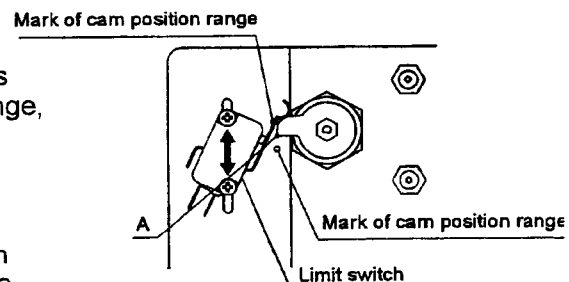
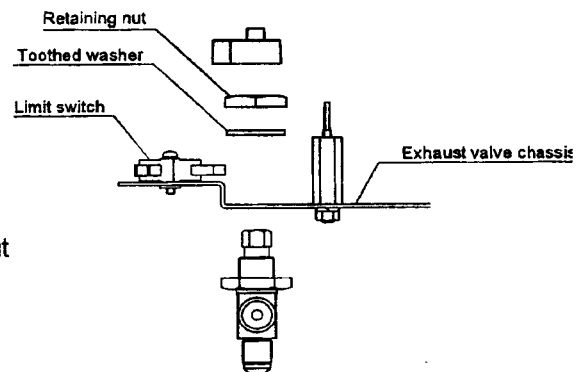
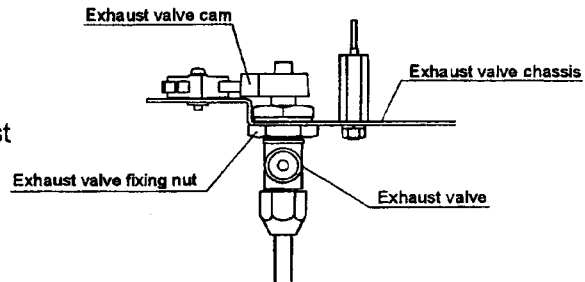
(8) Tighten the exhaust valve fixing nut firmly with steadying the exhaust valve chassis.

(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.

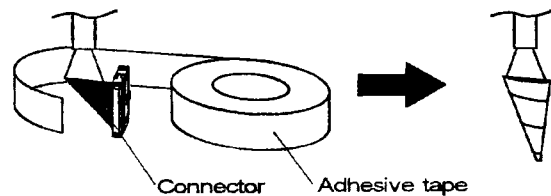
(14) Start operating with the normal procedure and make sure that steam does not come out from the exhaust valve hose port while the chamber is pressurized. If steam comes out too much, adjust the exhaust valve with reference to "16. Exhaust Valve Adjustment."

## 15. Display Board Replacement

### ■ Required tools

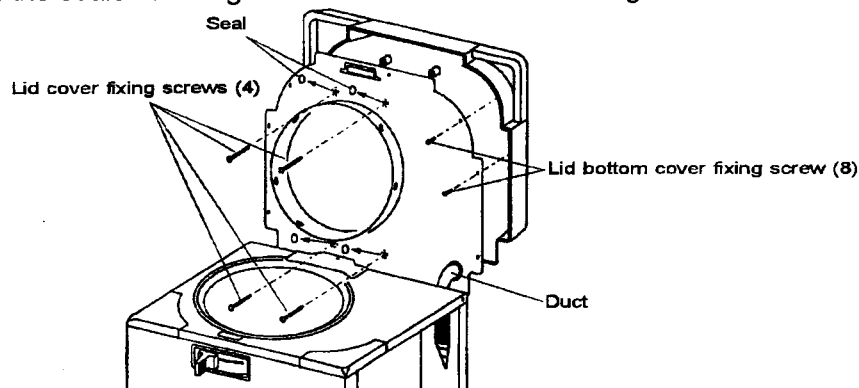
- Plus ( + ) screwdrivers 2 ( 1 each for M5 and M3 screws)
- Vinyl adhesive tape
- Sealing tape (glass cloth impregnated with P.T.F.E.)

- (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



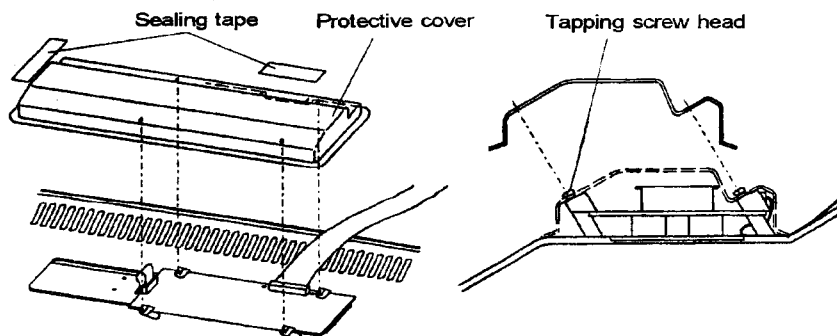
- (2) Open the lid and unscrew the lid bottom cover fixing screws.

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

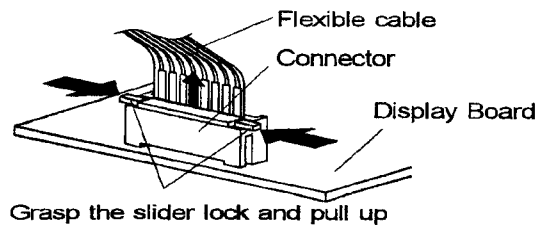


- (4) Pass the ribbon cable of the display board through the duct and remove the lid cover.

- (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.

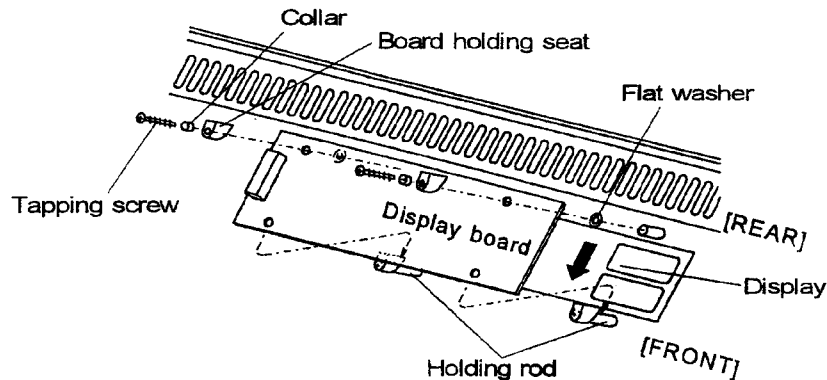


- (7) Unscrew the 2 [REAR]-side tapping screws, and remove the display board.

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

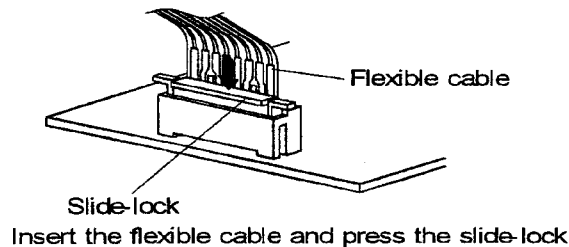
- (9) Push the display to [FRONT]-side. Put the new display board in contact with the holding rods. Pass each of the 2 tapping screws on [REAR]-side, through a collar, a board holding seat, a display board fixing hole and a flat washer (M4), and fix to the lid cover.

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



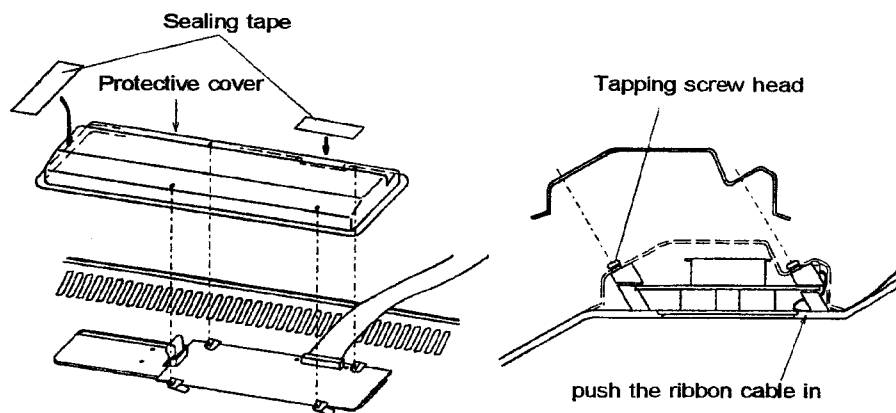
- (11) Look at the display from outside of the lid cover and make sure that the character window is aligned with the LED. If not aligned, loosen the tapping screws and realign.

- (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)

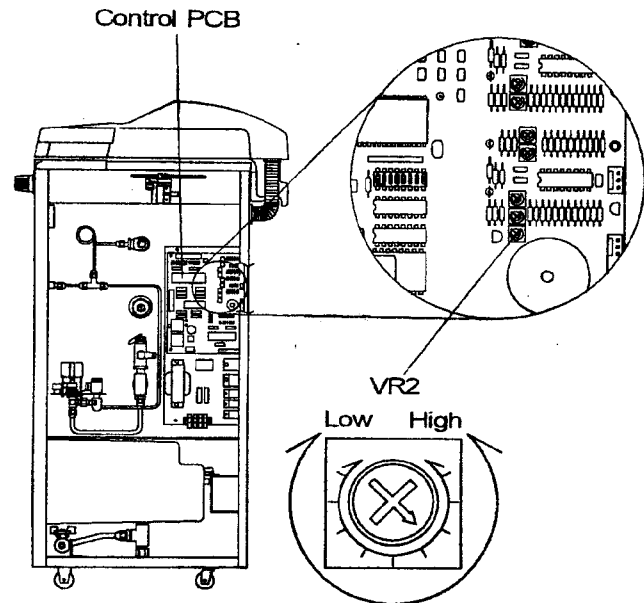
- (1) Refer to steps (2) ~ (3) of "13. Motor Replacement" and remove the motor from the exhaust valve cam.
- (2) Loosen the fixing screws of limit switch, and slide the limit switch to side "B".
- (3) Turn the exhaust valve cam to the right by hand, and make the valve completely closed.
- (4) If the 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)

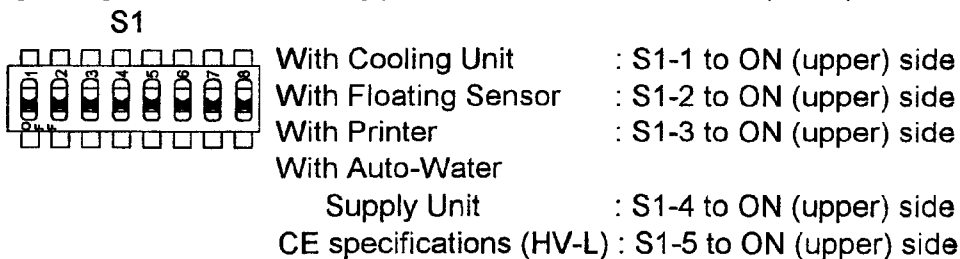
- (1) Turn the VR2 adjusting screw on the control PCB with a minus screwdriver.  
Turn to the right to lower the volume and to the left to raise the volume.



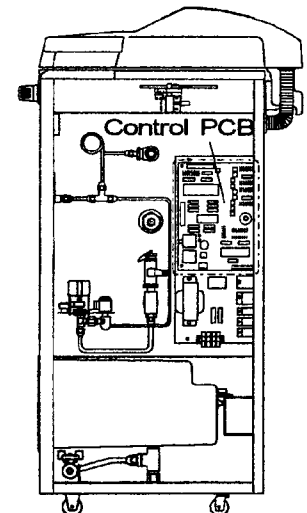
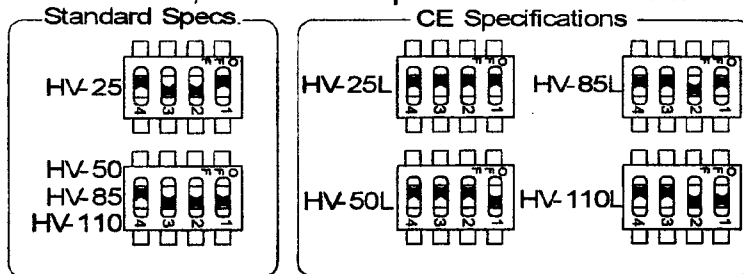
## 18. Switchboard Replacement

- 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>  (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>  (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>  (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>  (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>E r 5</b>  (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>E r 6</b>  (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>E r 7</b>  (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>E r 8</b>  (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>E r 9</b>  (Sterilization heater malfunction alarm)	Same as "Er4."		

Display	Cause	Items to check	Remedy
<b>E r L</b>  (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>  (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>  (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

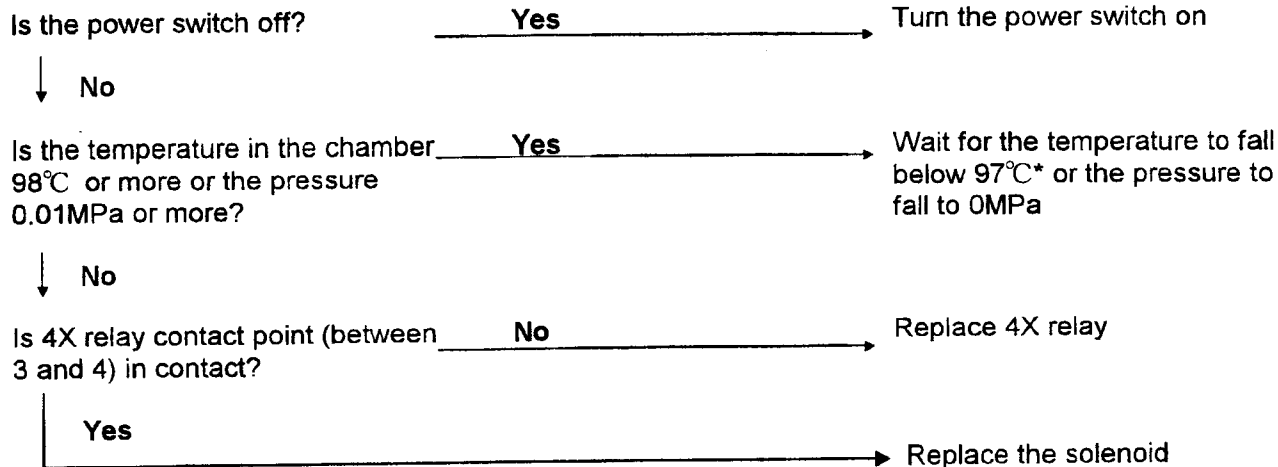
Condition	Cause	Items to check	Remedy
Air in the chamber is not purged	(1) Refer to Section 3. Troubleshooting		
Pressure in the chamber does not rise	(1) Safety valve failure	Leak from safety valve	Repair or replace the safety valve
	(2) Pressure gauge failure	Pressure gauge needle	Replace the pressure 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 Breaker (power switch) connection Tab terminal connection Connection of CN9 connector on the control PCB 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 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  Gasket deterioration	Tighten the nuts  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 Gasket improperly fitted or deteriorated	Replace the exhaust bottle 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  (2) Overpressure exhaust due to remaining air in the chamber	(1) State of ON/OFF of the heater circuit  (2) State of containing of the substance Check visually	(1) Replace SSR  (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 1 16. Exhaust Valve Adjustment



No

Cam position adjustment is wrong Yes

→ Refer to Chapter 1 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

→ Replace the motor

Cam fixing nut is loose Yes

→ Refer to Chapter 1 16. Exhaust Valve Adjustment

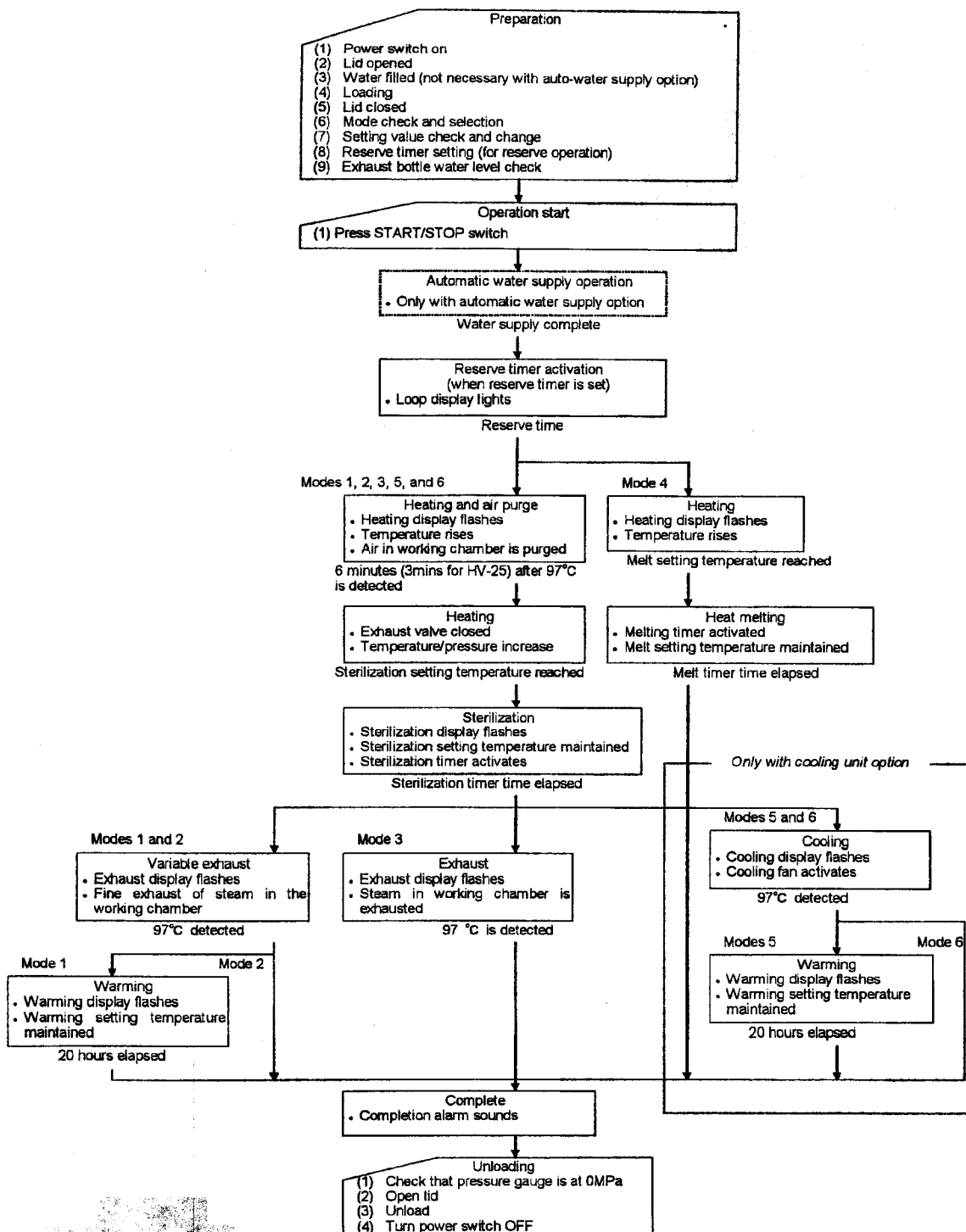
↓ No

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)

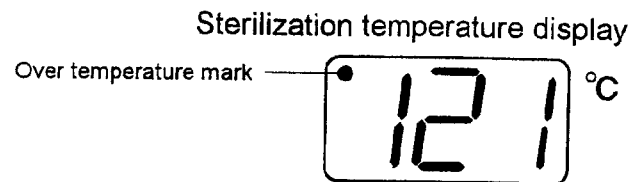
Display	Name	Detection	Preparation	Automatic water supply	Reserve	Air purge	Heating	Sterilization	Forced cooling	Warming	Complete
Er1	Lack-of-water alarm	EGO									
Er2	Control temperature sensor wire broken	CN2									
Er3	Over temperature (upper limit temperature +3°C or more)	Internal									
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)

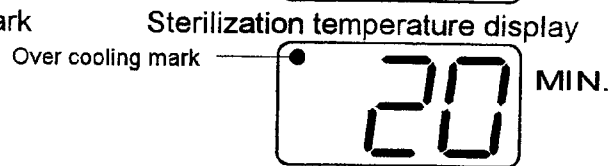
Display	Name	Detection	Preparation	Automatic water supply	Reserve	Air purge	Heating	Sterilization	Forced cooling	Complete
Er1	Lack-of-water alarm	EGO								
Er2	Control temperature sensor wire broken	CN2								
Er3	Over temperature (upper limit temperature +3°C or more)	Internal								
Er3	Over temperature (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

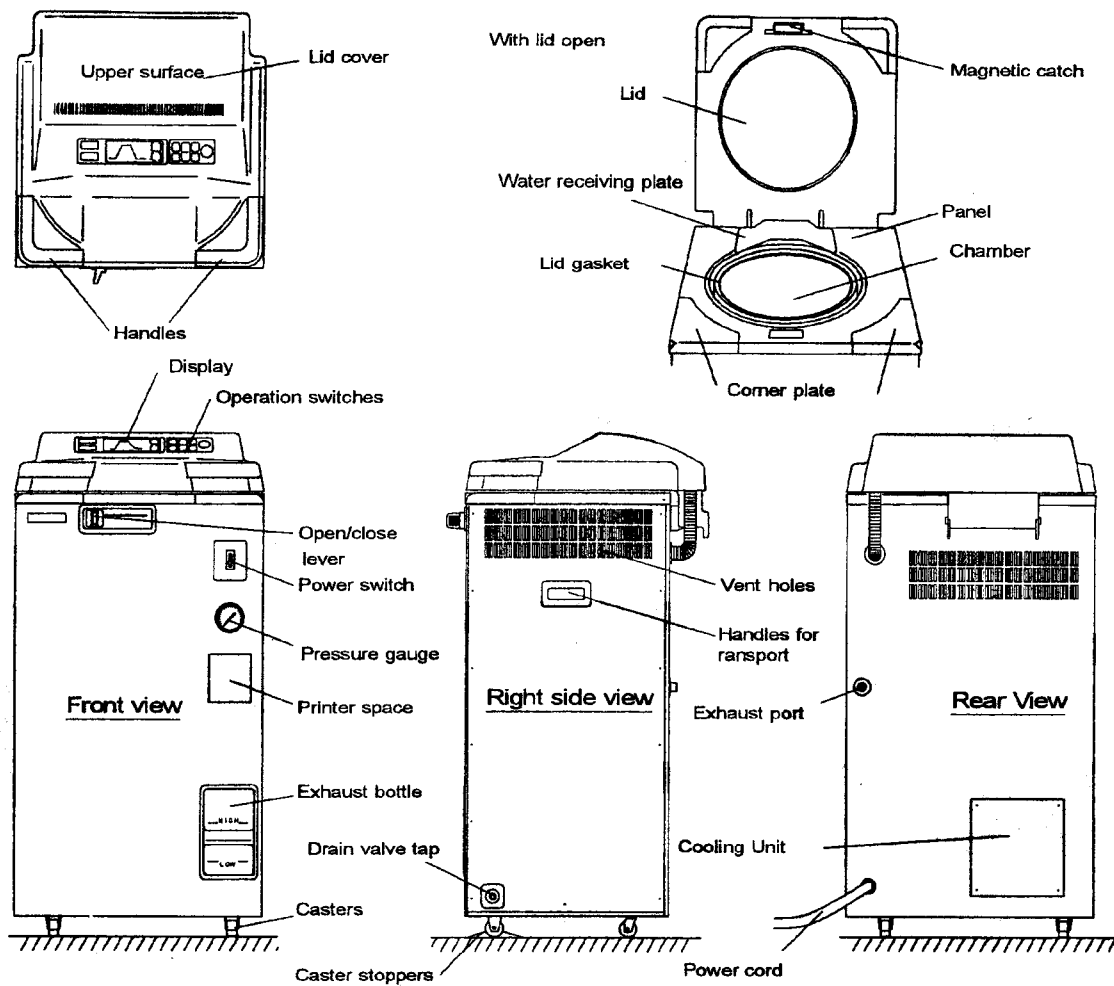


\*3: Detected when the pressure in the chamber is 0.01MPa or more or the temperature is 98°C or more.

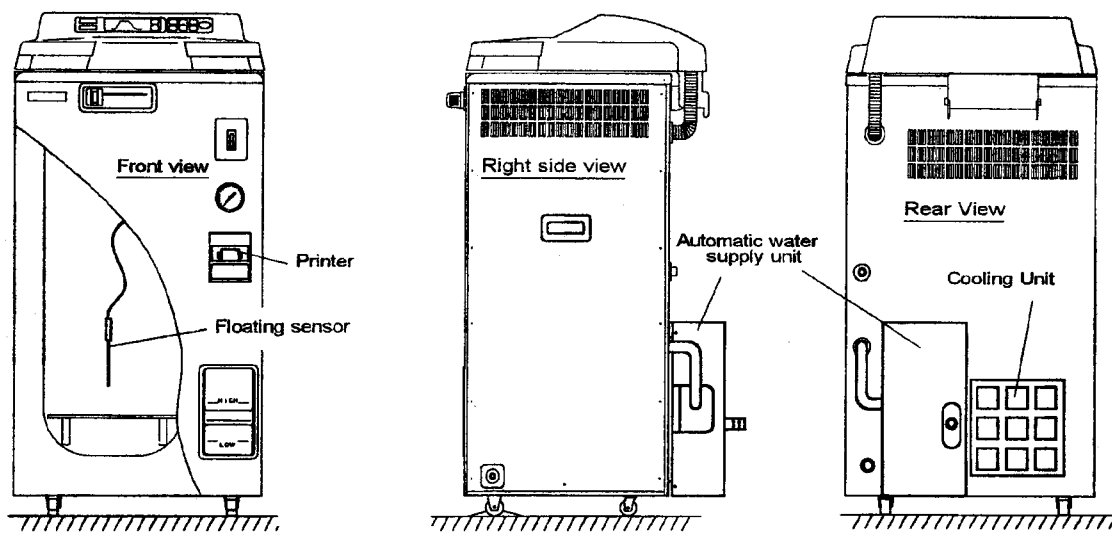
■ Other

- 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.

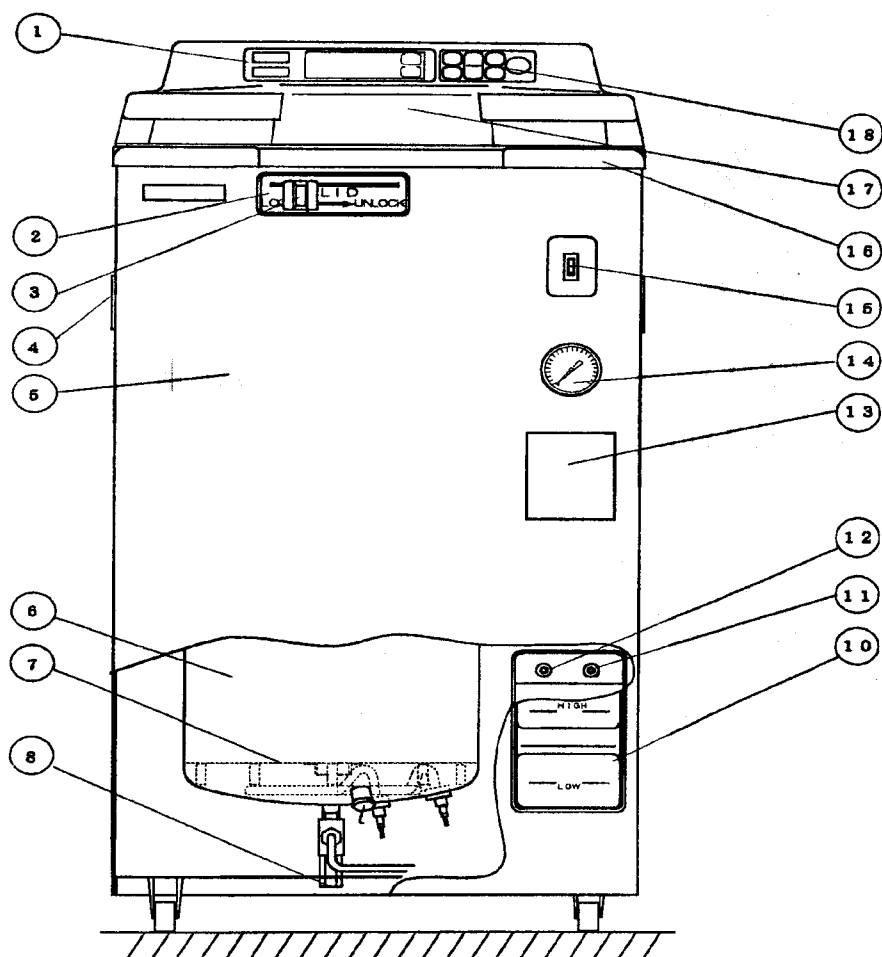
## External Appearance



[External view with options attached]



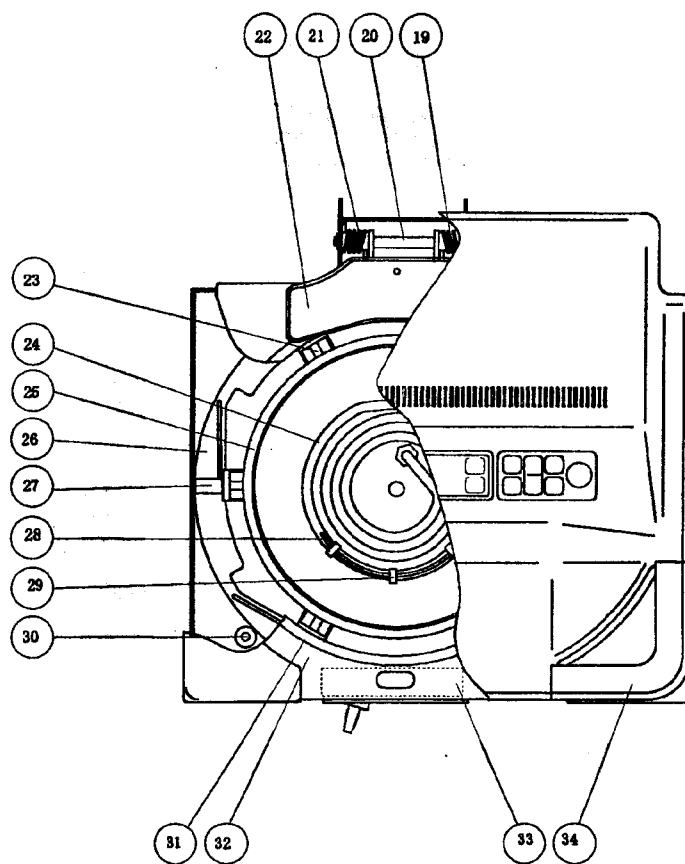
## Assembly Diagram (Front)



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

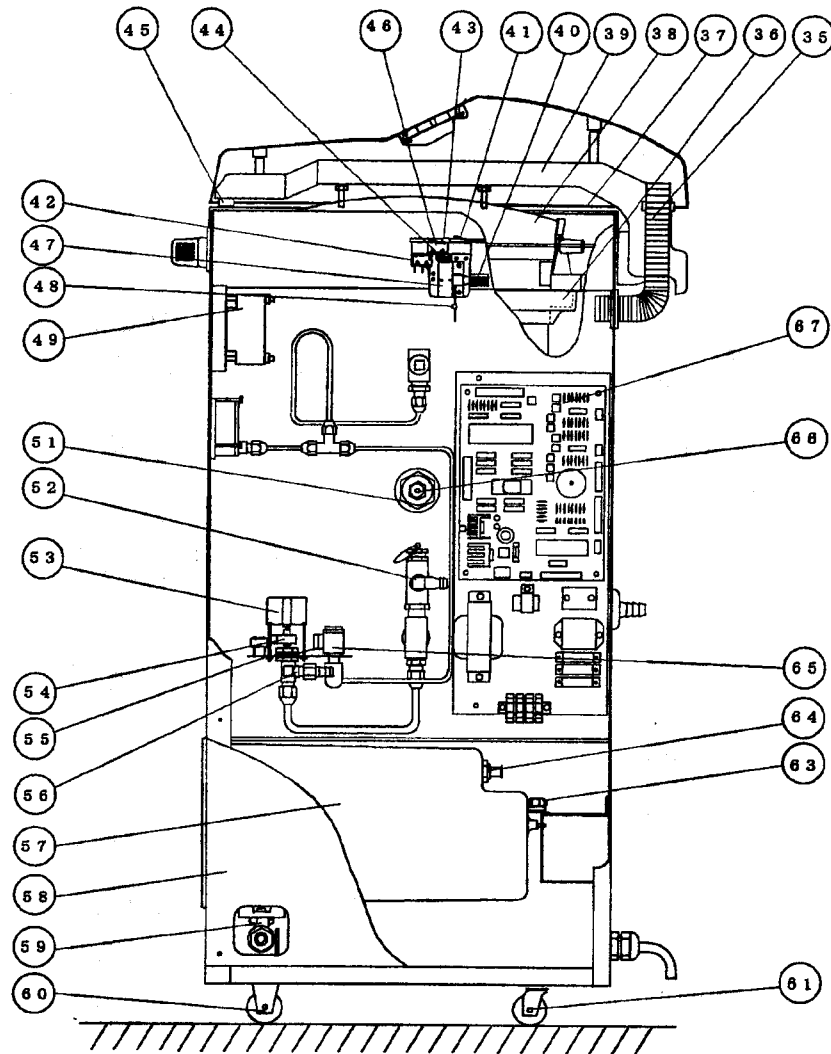
## Assembly Diagram (Top)



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

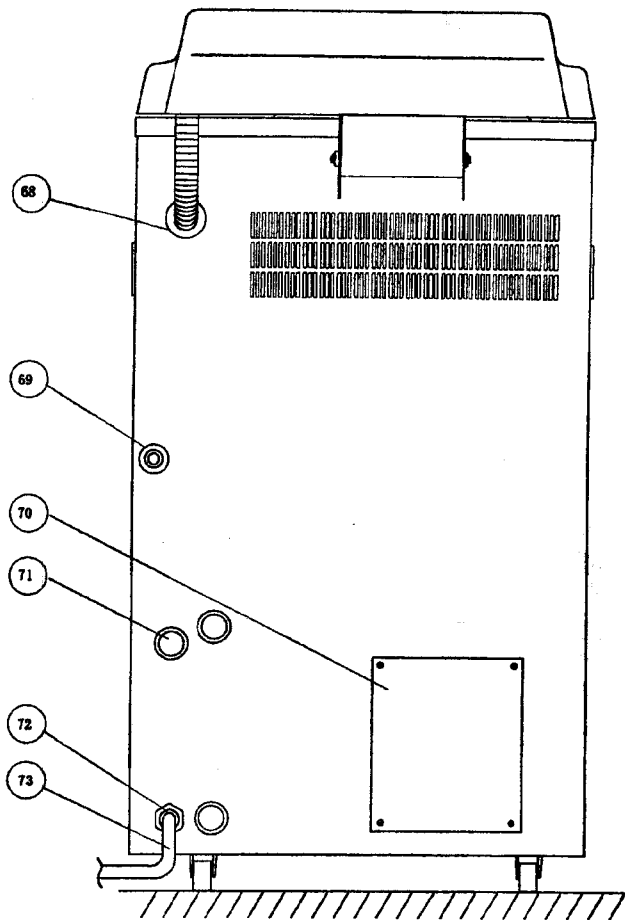
## Assembly Diagram (Right)



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

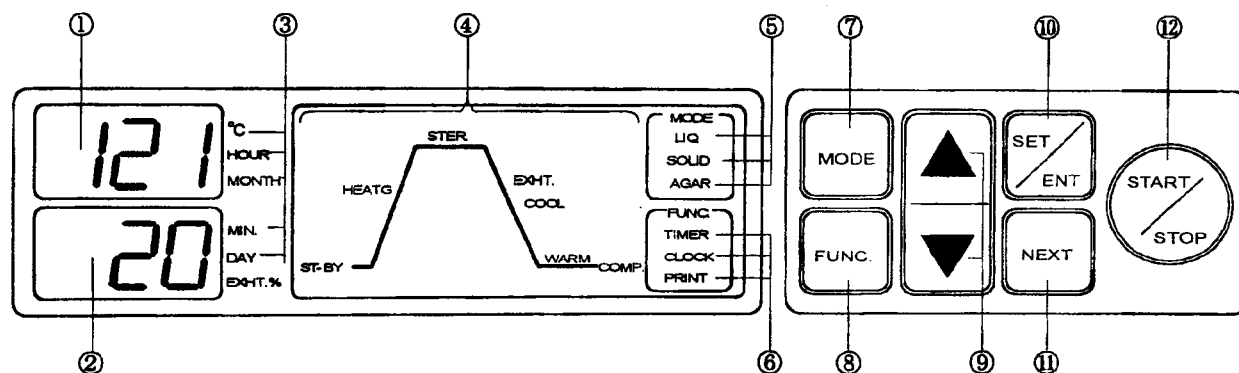
## Assembly Diagram (Back)



No.	Part name
73	Power cord
72	Cable gland
71	Grommet with membrane
70	Blank plate (Fan space)
69	Grommet (for exhaust)
68	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

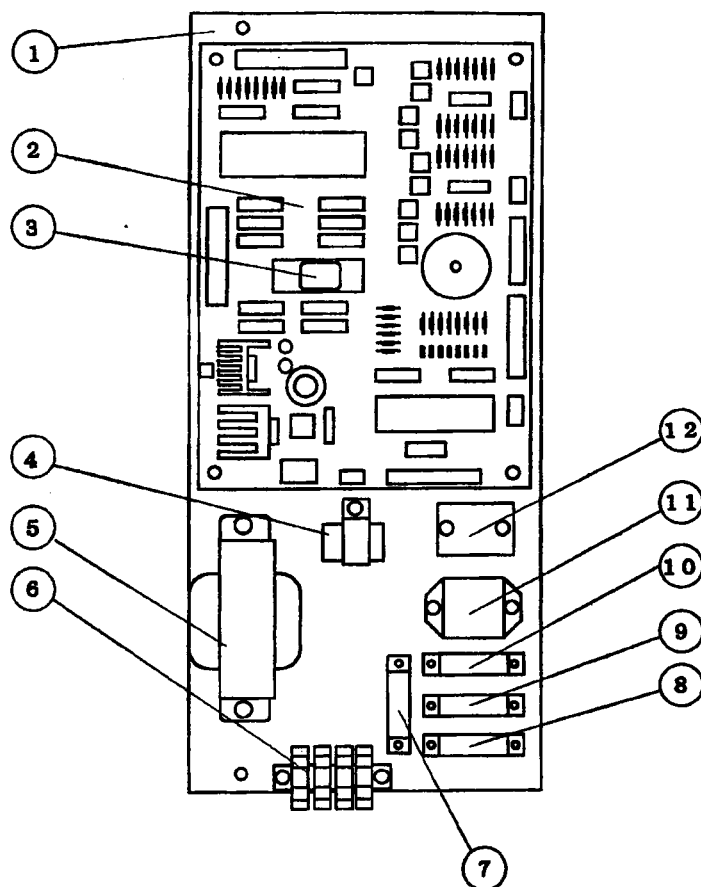
### ⑨ Setting value increase/decrease switches (▲, ▼)

### ⑩ SET/ENT switch

### ⑪ NEXT switch

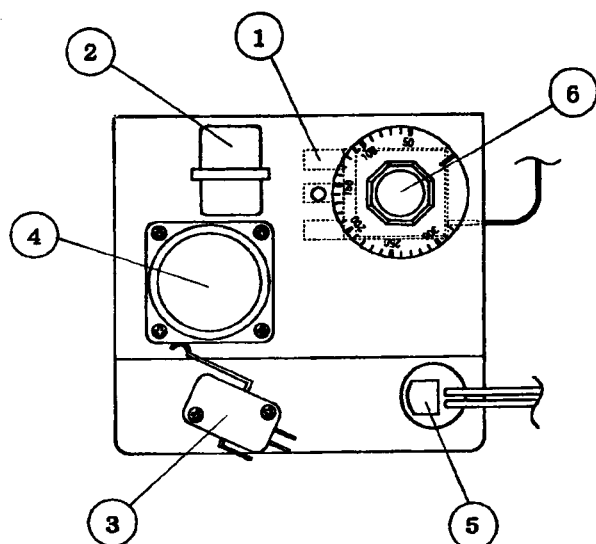
### ⑫ START/STOP switch

## Switchboard Diagram



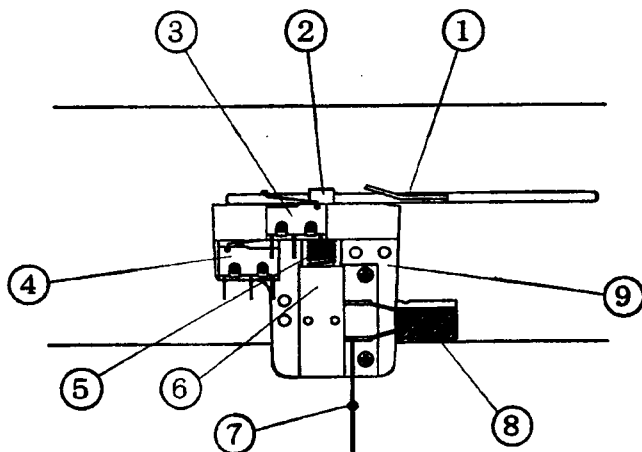
No.	Part name	Symbol
15	Fuse (250mA 250V)	F3
14	Fuse (630mA 250V)	F2
13	Fuse (1.6A 250V)	F1
12	Solid state relay	SSR
11	Relay	1X
10	Relay	2X
9	Relay	3X
8	Relay	4X
7	Relay (only for cooling unit)	5X
6	Tab terminals	
5	Transformer	TR
4	Backup battery	B
3	ROM	
2	Control PCB	CP
1	Switchboard chassis	

## 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

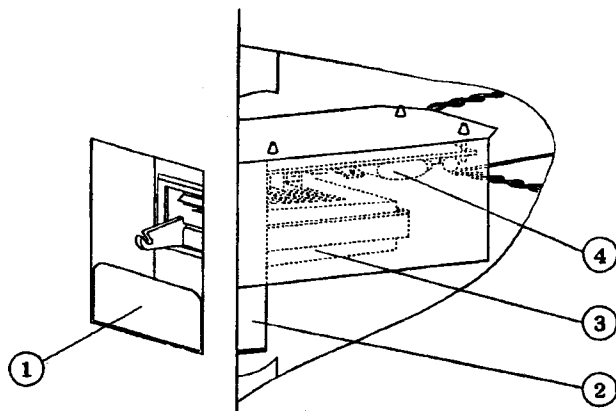
## Solenoid Area Diagram



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	

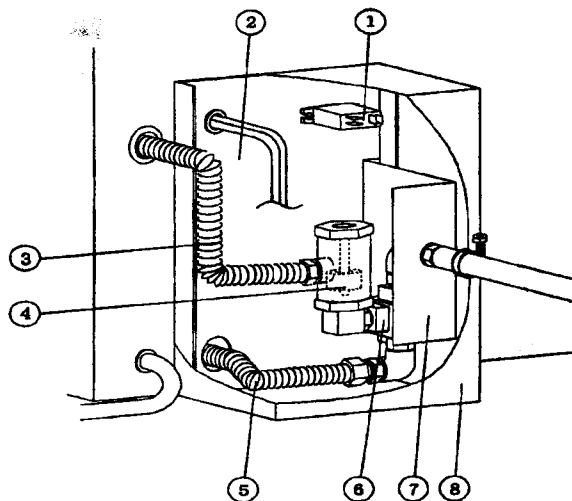
## Optional Accessories Diagrams

### ■ Printer



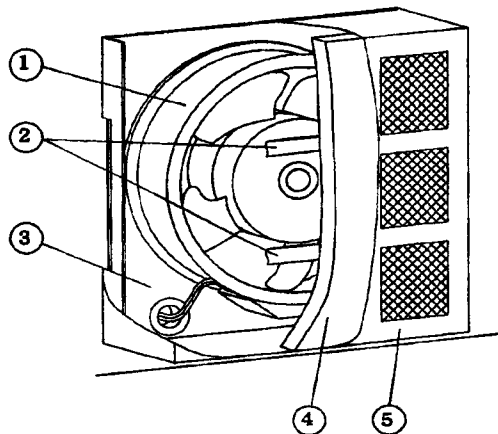
No.	Part name	Symbol
4	Switching power	SR
3	Printer	P
2	Printer case	
1	Printer holder	

### ■ Automatic water supply unit



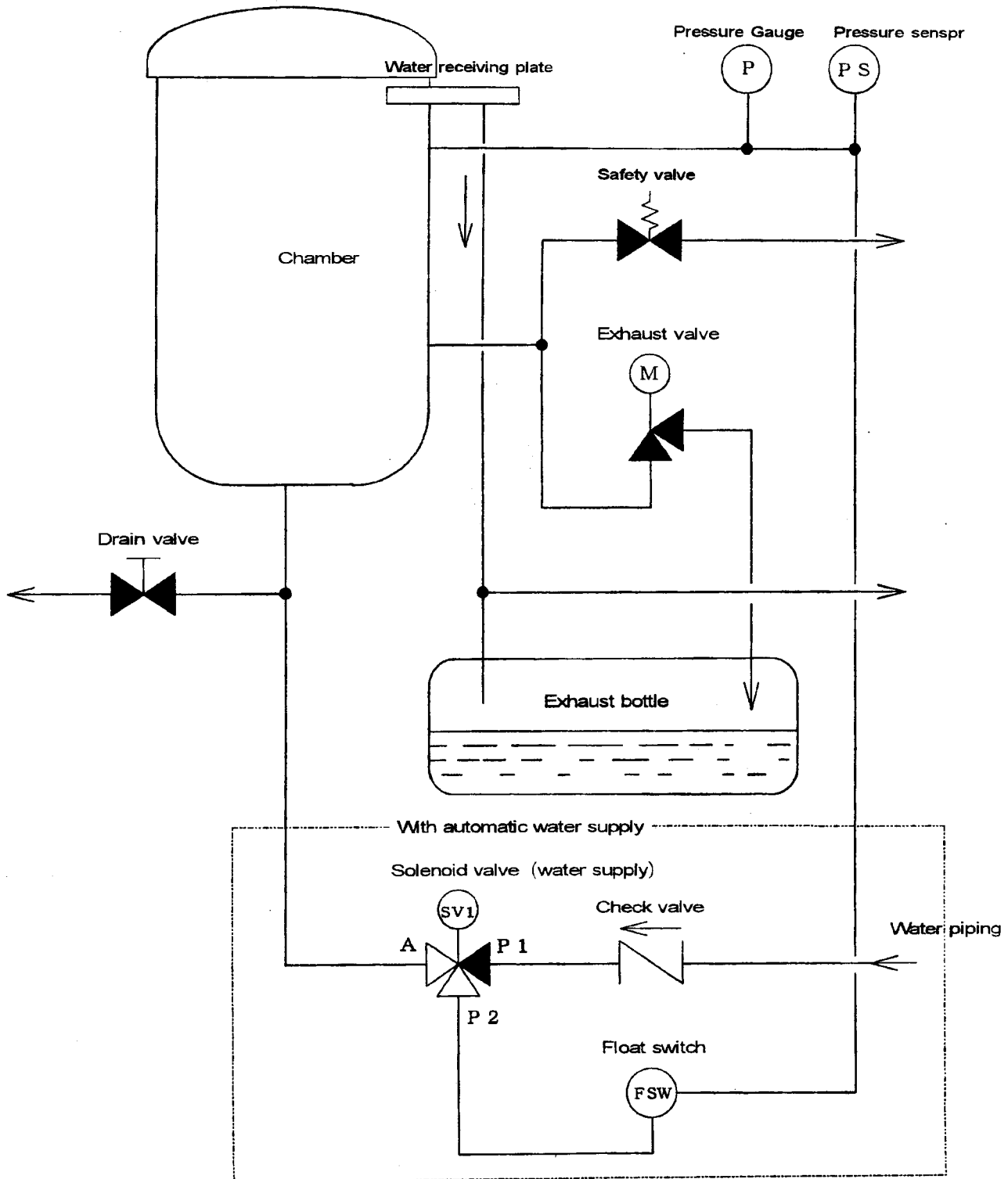
No.	Part name	Symbol
8	Unit casing	
7	Piping holder	
6	Solenoid valve	SV1
5	Flexible tube (short)	
4	Float switch (water level detector)	FSW
3	Flexible tube (long)	
2	Unit fitting plate	
1	Relay	6X

### ■ Cooling unit

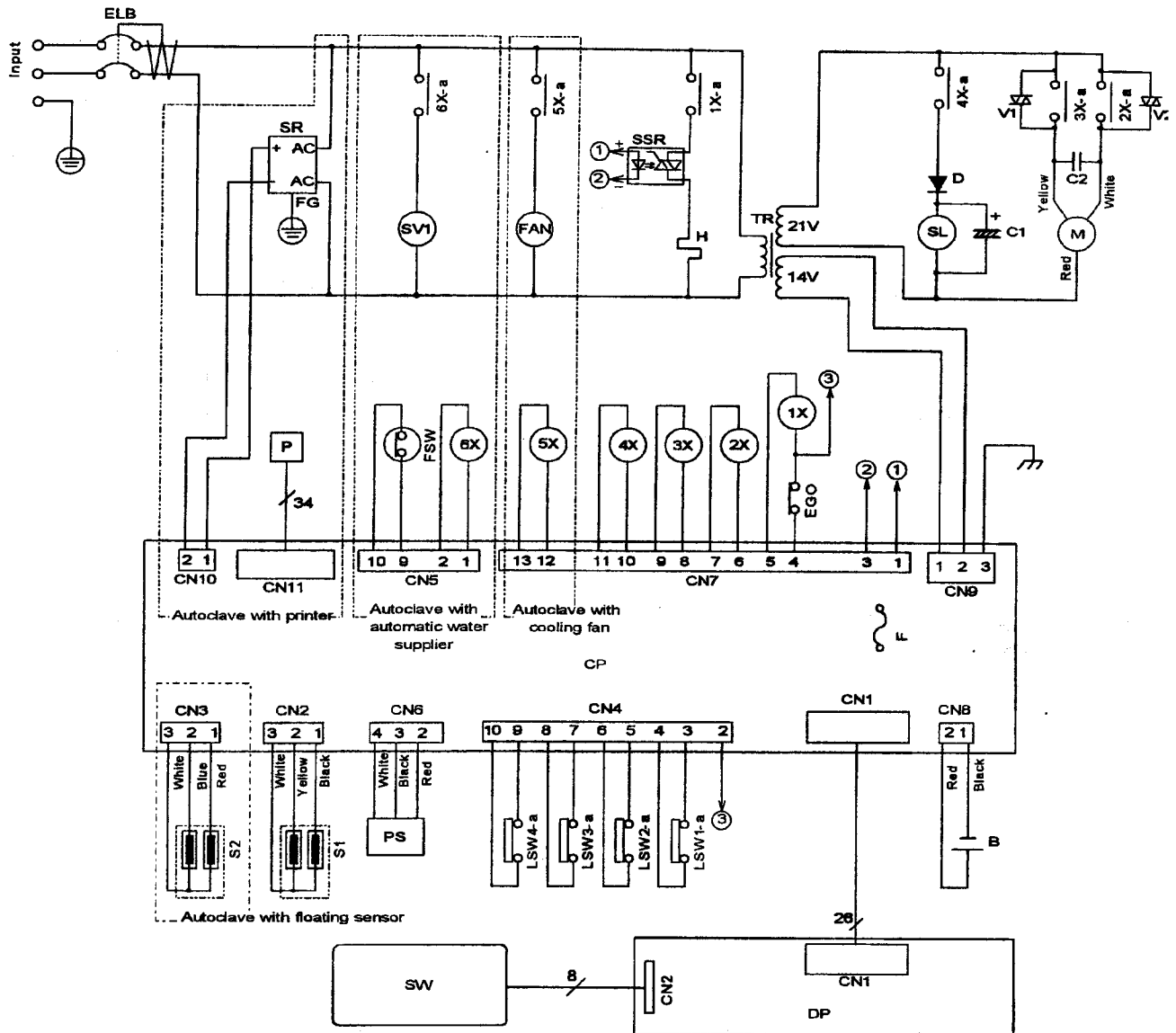


No.	Part name	Symbol
5	Fan casing	
4	Filter	
3	Fan fitting plate	
2	Filter holder	
1	Fan	FAN

# Piping Diagram



# Wiring Diagram



DP	Display printed circuit board	S1	Temperature sensor for control
CP	Control printed circuit board	S2	Floating sensor
SW	Operation switch	PS	Pressure sensor
ELB	Circuit Brecker	EGO	Lack-of-water operation prevention device
C3	Film capacitor	LSW1	Limit switch (lever open/cloce)
TR	Transformer	LSW2	Limit switch (lever lock)
F	Fuse	LSW3	Limit switch (exhaust valve full close)
M	Motor	LSW4	Limit switch (bottle housing)
C2	Capacitor for motor	FSW	Water level sensor
SL	Solenoid	SSR	Solid state relay
D	Diode	1X	Relay(heater)
C1	Electrolytic capacitor	2X	Relay(exhaust valve closing)
SV1	Solenoid valve(controls water supply)	3X	Relay(exhaust valve opening)
FAN	Fan	4X	Relay(solenoid)
H	Heater	5X	Relay(fan)
B	Backup battery	6X	Relay(for water supply solenoid valve)
V1	Varistor	P	Printer
V2	Varistor	SR	Switching power supply

## 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 Operation switch input	DP display PCB	LED lighting 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 PS Pressure sensor	Pressure (in the chamber) detection
		2	+5V		
		3	GND		
		4	Pressure data input		
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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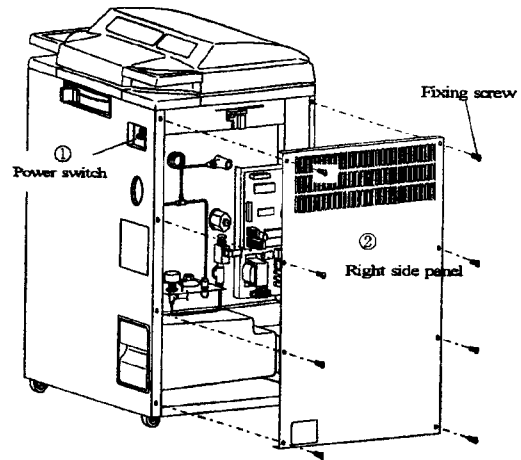
- HV series autoclaves contain a check program to ensure that the electronic parts operate properly.

## 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

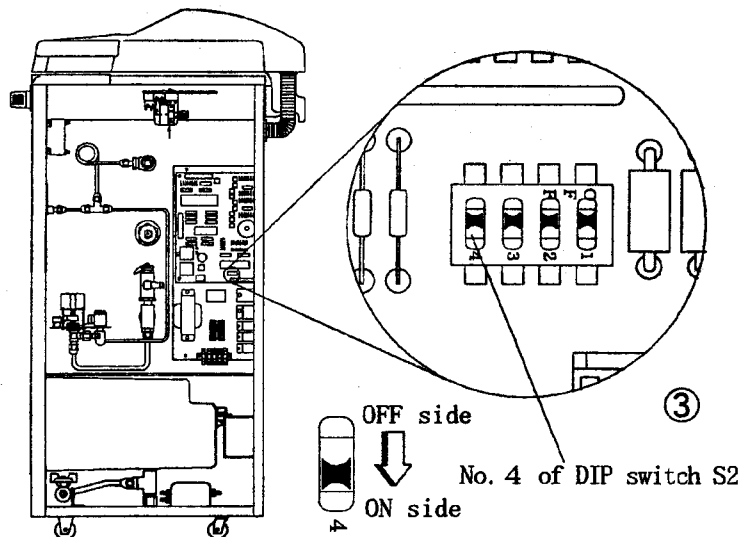
Fixing screws

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.

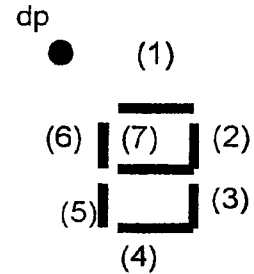
"c 1" will be displayed in SEG1 and 2 for 2 seconds



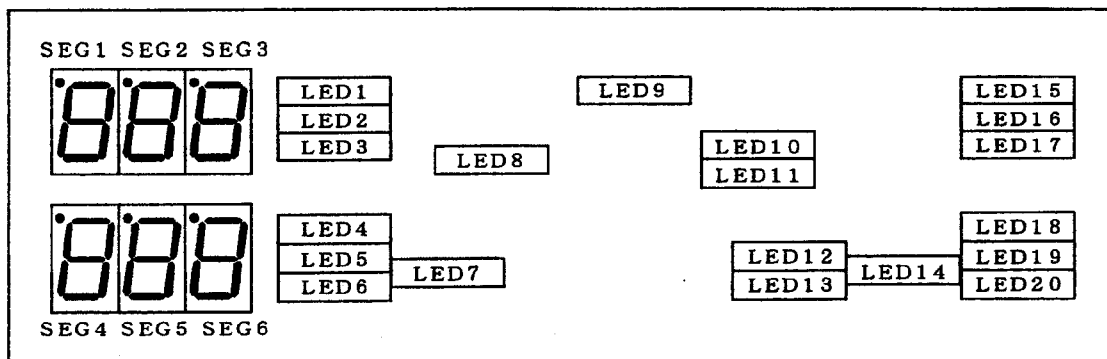
All LEDs on the display PCB will light (except SEG2, 3, 5 and 6-dp) (2.5seconds)



The LED will light in the following sequence



SEG1:①→②→ ..... ⑦→SEG2:①→② ..... SEG6:⑦→LED1→LED2.....LED20→SEG1-dp→SEG4-dp

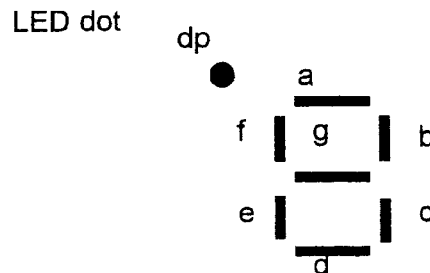


#### ■ c2: Operation switch check

"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 For each MODEL				
OFF	4 3 2 1 		4 3 2 1 	
ON				

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

	1 2 3 4 5 6 7 8	① Cooling unit
ON		② Floating sensor
OFF		③ Printer
		④ Automatic water supply unit
		⑤ CE specifications
		ON = Option installed
		OFF = Option not installed

■ **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  
"7 5" ± 1 is displayed in SEG4 - 6

When the temperature in the chamber is 121°C: "1 7 5" ± 1 is displayed in SEG1 - 3  
"2 5 5" 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

"**7 5**" ± 1 is displayed in SEG4 - 6

When the temperature in the chamber is 121°C: "**1 7 5**" ± 1 is displayed in SEG1 - 3

"**2 5 5**" 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

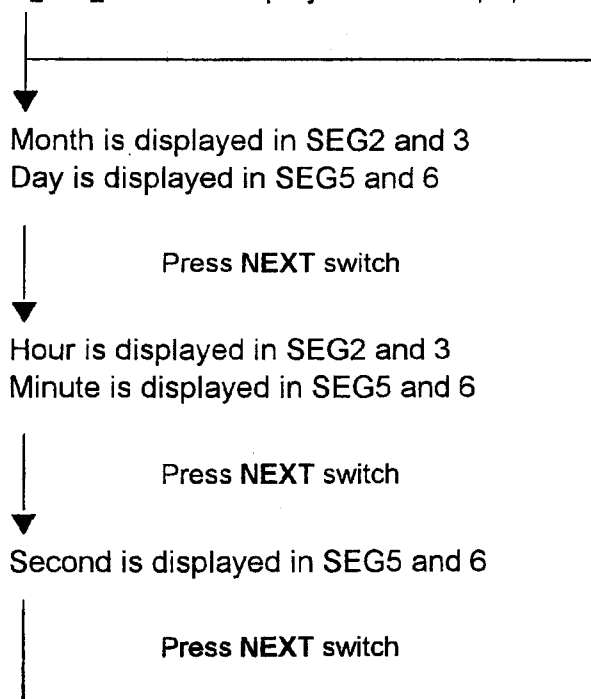
Exhaust %: 10%

\*\*\* 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 11" will be displayed in SEG1, 2, and 3



When the pressure in the chamber is 0 MPa : "26" is displayed in SEG4 - 6.

When the pressure in the chamber is 0.12 MPa : "107" 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			



(High temperature side: between white and black for temperature control sensor and between white and red for floating sensor)

Temperature (°C)	Thermistor resistance value (kΩ)	TP4, 6 voltage (V)	Check program display value	Reference HEX value
70	189.2			
71	181.9			
72	175.0			
73	168.3			
74	162.0			
75	155.9	.278	14	EH
76	150.0	.327	17	11H
77	144.4	.376	19	13H
78	139.1	.425	22	16H
79	133.9	.477	24	18H
80	129.0	.530	27	1BH
81	124.3	.583	30	1EH
82	119.8	.638	33	21H
83	115.4	.694	36	24H
84	111.3	.751	38	26H
85	107.3	.807	41	29H
86	103.4	.867	44	2CH
87	99.75	.927	47	2FH
88	96.22	.988	51	33H
89	92.83	1.049	54	36H
90	89.58	1.112	57	39H
91	86.45	1.176	60	3CH
92	83.45	1.241	64	40H
93	80.56	1.307	67	43H
94	77.79	1.373	70	46H
95	75.12	1.441	74	4AH
96	72.56	1.509	77	4DH
97	70.10	1.579	81	51H
98	67.73	1.649	84	54H
99	65.45	1.719	88	58H
100	63.26	1.791	92	5CH
101	61.15	1.863	95	5FH
102	59.12	1.936	99	63H
103	57.17	2.010	103	67H
104	55.29	2.084	107	6BH
105	53.48	2.159	111	6FH
106	51.74	2.235	114	72H
107	50.06	2.311	118	76H
108	48.44	2.387	122	7AH
109	46.89	2.464	126	7EH
110	45.39	2.542	130	82H
111	43.94	2.619	134	86H
112	42.55	2.698	138	8AH
113	41.20	2.776	142	8EH
114	39.91	2.855	146	92H
115	38.66	2.934	150	96H
116	37.45	3.013	154	9AH
117	36.29	3.092	158	9EH
118	35.17	3.171	162	A2H
119	34.09	3.252	166	A6H

[illegible]

■ 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