No. S01G-003-C

HIRAYAMA

HIRAYAMA AUTOCLAVE

HICLAVE

HVE-50

OPERATION MANUAL

WARNING:

- Be sure to read this operation manual carefully and handle it properly.

11-JUL-03

Introduction

Refer to Page 7 for Contents

- This manual covers the operation and basic maintenance procedure for the Autoclave HVE-25 and Autoclave HVE-50. Proper handling will allow the autoclave to demonstrate its full performance and ensure a long lifetime for the instrument.
- Please confirm that this product conforms to your order, and confirm that it was not damaged during transport. In the event of damaged or broken equipment, please contact our authorized distributor in your region.
- Be sure to fill out and mail the enclosed warranty registration card.

(1) No part of this document may be reproduced without permission.

(2) The contents of this document are subject to change without notice.

(3) This document has been carefully compiled. If you have any questions or require information not covered in the manual, please contact our authorized distributor in your region.

Revisions

No.	Date	Description of revision
1	27- Jan-97	Instructions under "Replacing Lid Packing" in Chapter 4: Maintenance and Service revised. Instructions for "Operation with a Waste Disposal Bag" added. Instructions for "Successive Operations with the Product" added.
2	24-Apr-98	Additions and revisions to WARNING, CAUTION and NOTE.
3	8-Dec-98	Explanations of "Display Saver" added.
4	26- Apr-99	Explanations of Lid Open/Close operation added.
5	5-Nov-99	Change of Pressure Indication to MPa
6	12-Apr-00	Addition of Drain Bottle, and omission of Check Valve and copper pipe (in Exhaust Bottle)
7	04-July-01	Change of Parts name to Heater cover from Bottom plate. Change of Power cord terminals.

Read Carefully Before Using

- Set the operation responsibility person of this product.
- 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: *Items the operator is strongly advised to obey.*

NOTE: *Items that will aid in proper operation of the equipment.*

⚠ WARNING:

- Never use the autoclave to sterilize any of the following hazardous materials or substances with alkali content. Sterilization of such objects can cause explosion, corrosion of the chamber piping, and deterioration of gaskets.

List of Hazardous Materials
(Ref.: Workers Safety and Sanitation Law, Appendix Table 1, Hazardous Materials)

(1) Explosive substances

Nitroglycol, nitroglycerin, nitrocellulose, and other explosive nitric esters.

Trinitrobenzene, trinitrotoluene, picric acid, and other explosive nitro compounds.

Peracetic acid, methyl ethyl ketone peroxide, benzoyl peroxide, and other organic peroxides.

(2) Ignitable substances

Metallic lithium, potassium, sodium, yellow phosphorous, phosphorus sulfide, and red phosphorus.

Celluloids, calcium carbide (carbide), lime phosphide, and magnesium powder

Aluminum powder, magnesium powder, and metallic powders other than aluminum powder

Sodium dithionite (or sodium hydrosulfite)

(3) Oxidizing agents

Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates

Potassium perchlorate, sodium perchlorate, ammonium perchlorate, and other perchlorates.

Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides

Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates

Sodium chlorite and other chlorites

Calcium hypochlorite and other hypochlorites

(4) Flammable substances

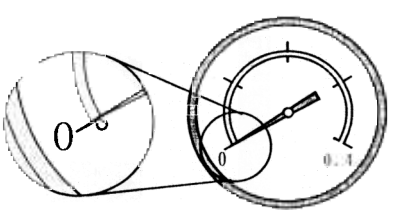
Ethyl ether, gasoline, acetaldehyde, propylene oxide, carbon disulfide, and other substances whose flash points range from -30 to 0°C.

Methanol, ethanol, xylene, benzyl acetate (or amyl acetate), and other substances whose flash points range from 0 to 30°C.

Kerosene, gas oil, turpenine oil, isopentyl alcohol (or isoamyl alcohol), acetic acid, and other substances whose flash points range from 30 to 65°C.

(5) **Flammable gas** (hydrogen, acetylene, ethylene, methane, ethane, propane, butane, and other substances that are gases at a temperature of 15°C under 1atm of pressure.)

- When liquid with salt water and much salinity of salt agar etc. spills in the chamber, blowing, discharge water in the chamber and wipe up drop of water around the lid gasket beautifully. It causes the corrosion of the chamber and the piping when leaving just as it is.
- Check that the pressure is below "0Mpa" before opening the lid.



Pressure gauge

- Absolutely do not attempt to remodel or alter this product.

⚠ CAUTION

- Foreign matter (metals, liquid) may enter through the vent hole. Operating the equipment with such foreign matter inside may cause trouble with the equipment, fire or electric shock.
- Do not forcibly bend, twist, tie or extend the power cord. Do not place heavy objects on the cord. A damaged cord or exposed wire can cause fire or electric shock.
- Never connect the power cord to a power supply other than one of the rated voltage. Connection to such a power supply can cause fire or electric shock.
- If grounded socket is unavailable, ground the equipment using a separate ground wire before connecting the power cord to the power source.
- Never ground to a gas pipe or vinyl chloride water service pipe.
- Raise the lid slowly. When an impact is added to the lid, there is fear which the hinge of the lid damages.
- Close the lid after confirming that no foreign matter is adhering to the section contacting the lid gasket. Foreign matter in this section can cause vapor leaks.
- When using a waste processing bag or other kind of bag and disinfecting, place the bag in the metal mesh holder and then insert it into the working chamber. Using the bag "as is" can cause excessive temperatures, pressures, lack-of-water, etc.
- Be careful not to pinch your hands when closing the lid.
- Do not put your face or hands close to the working chamber when lifting the lid after operations are complete; steam will gush out of the chamber.
- The working chamber and panel are extremely hot immediately after operation. Burns can result if the equipment is touched.
- Put on heat insulating gloves before removing a substance from the working chamber. Do not put hands into the chamber until the steam has been vented.
- Some time is required for liquids to cool. Be sure to check that the temperature has dropped sufficiently before unloading a liquid from the working chamber or burns can result.
- Do not unload the exhaust bottle or drain the working chamber when the chamber is under pressure. Boiling water or steam may gush out causing burns.
- Do not remove the exhaust bottle before water in the bottle has sufficiently cooled.
- If any abnormality occurs (e.g. abnormal sounds, smells, smoke), immediately shut the power off. After checking to see that the abnormal condition does not continue, call our authorized distributor in your region.

- If the display reading changes between the steps, turn the POWER switch off then on again. If the problem continues, turn the power switch off and call our authorized distributor in your region..
- If the equipment is installed in a location 800m or higher above sea level (i.e. under low pressure in mountainous areas), the "over pressure" prevention device and the air vent device require setting changes. In this case, be sure to contact our authorized distributor in your region. Do not attempt to use the equipment without changing these settings.
- When transporting the equipment, close the lid and slide the open/close lever to LOCK side (left end) to prevent the lid from opening.
- When moving the lid, do not hold it by the handle, otherwise the lid may become difficult to close.
- Do not use the autoclave for the purpose other than sterilization and agar preparation (dissolution).
- Do not pour anything except for water.

How to Read this Manual

- This operation manual consists of the following sections covering the information required for proper operation of the Autoclave HVE-25/50:

Chapter 1. What is the Autoclave HVE-25/50?

This section describes the uses and features of the product, and the names and functions of its parts.

Chapter 2. Installation

This section explains where the equipment should be installed and how to install it. The product incorporates precision parts, so be sure to follow the instructions covered in this chapter.

Chapter 3. Operation Method

This section illustrates how to change various set values, and describes operations before starting the equipment and after automatic operation. This section also covers the display and performance of the equipment during automatic operation.

Chapter 4. Maintenance and Service

This section explains the methods for draining water from the exhaust bottle or chamber, servicing the body of the equipment, and parts replacement.

Chapter 5. Specifications

This section includes dimensions, power consumption, working range, and piping and wiring diagrams of the product. Refer to this section as required.

Chapter 6. Troubleshooting

This section covers troubleshooting procedures for the product. If you encounter a problem, read this section first.

Appendix

This section contains information on the temperature-pressure conversion table for saturated steam in autoclave and a glossary of terms that appear in the manual.

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Chapter 1. What is the Autoclave HVE-25/50?

1. Product Uses

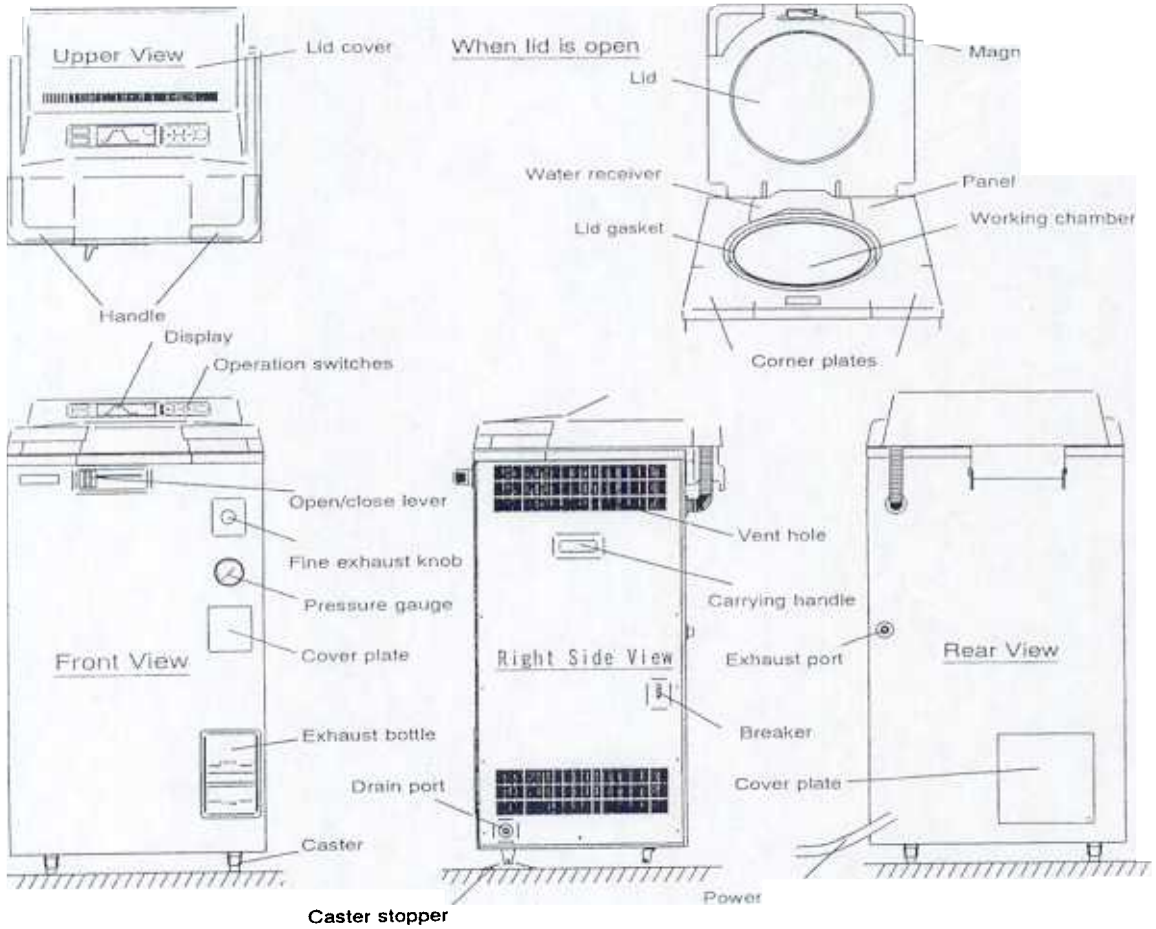
- The product is used to sterilize substances which can withstand high temperature and/or high pressure steam such as tools of glass, ceramic, metal or rubber, water, media, and reagents.

2. Product Features

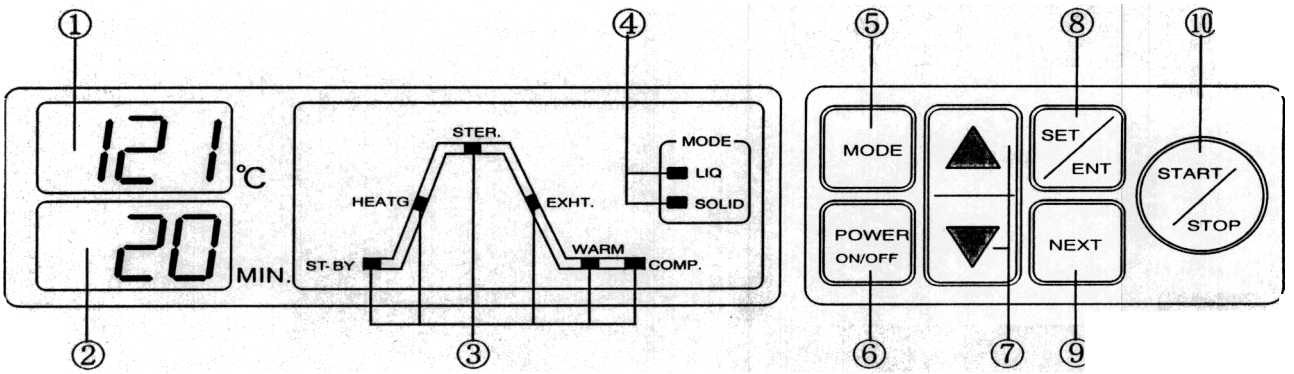
- The product is equipped with a lid cover to protect personnel from the high temperatures reached by the lid during use.
- The product is provided with a sterilization-warming mode to prevent coagulation of sterilized media that are not immediately removed from the Autoclave chamber.
- The product can execute fine purging (pulse purging) automatically after sterilization by setting the exhaust pattern.

3. Names and Functions of Parts

Outer View of Body



Display and Operation Switches



Digital Display (Temperature, Error)
The digital display indicates the set temperature when the equipment is in standby and the temperature in the working chamber during operation. When a problem occurs and an error is detected, the display indicates the error.

② **Digital Display (Time, Exhaust Pattern)**
The digital display indicates the set time and the set exhaust pattern when the equipment is in standby and the time remaining before completion of sterilization during operation.

Cycle Display (ST-BY, HEATG, STER., EXHT., WARM, COMP.)
All the steps included in the selected mode illuminate and the current step flashes.

Mode Display (LIQ, SOLID)
The operation/action of the selected mode lights.

⑤ **MODE Switch**
Selects a mode or checks a set temperature, time, or exhaust pattern.

POWER ON/OFF Switch
Turns the power on or off.

⑦ **Set Value Increase/Decrease Switches (▲, ▼)**
Increase or decrease the set values.

⑧ **SET/ENT Switch**
Used to change a set value.

⑨ **NEXT Switch**
Selects the item for which the setting will be changed.

⑩ **START/STOP Switch**
Used to start or stop operation.

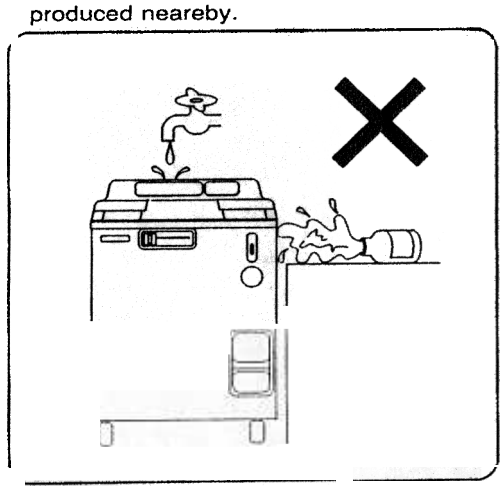
Chapter 2. Installation

⚠ *CAUTION :*

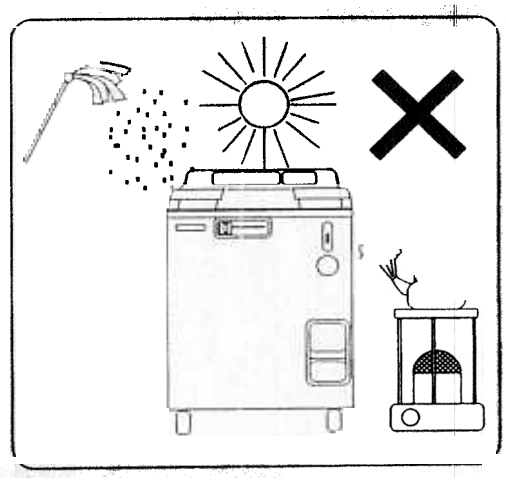
- If the equipment is installed in a place which is 800m or higher than sea level (i.e. under low pressure in mountainous areas), the settings must be changed. In this case, be sure to contact our authorized distributor in your region. Do not use the equipment before changing.
- When transporting the equipment, close the lid and slide the open/close lever to **LOCK** side (left end) to prevent the lid from opening.
- When moving the lid, do not hold it by the handle, otherwise the lid may become difficult to close.

1. Installation instructions

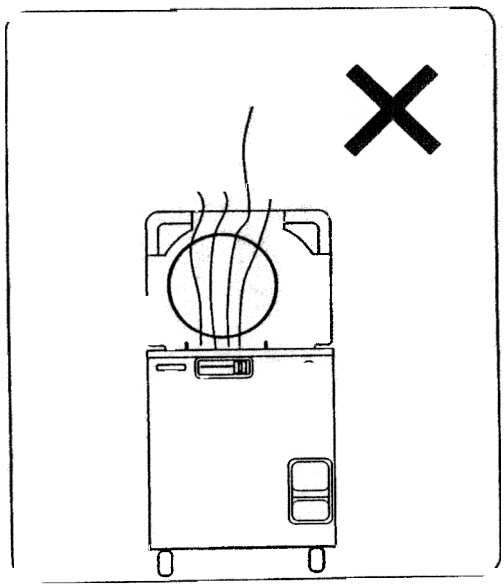
① Avoid installing the equipment in a place where its body may be exposed to water or chemicals, or where corrosive and explosive gases may be produced neareby.



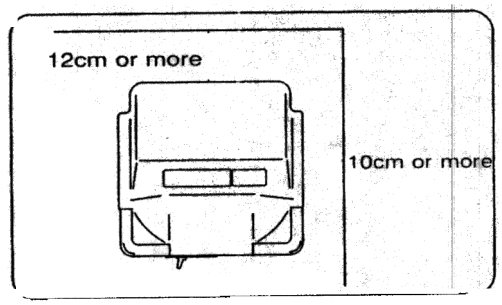
② Avoid installing the equiopment in a place which is exposed to hight humidity, direct sunlight or much dust.



③ Avoid placing the equipment directly under a fire detector. If you open the lid immediately after completion of operation, steam comes out of the working chamber, and may activate the detector.



④ Arrange the equipment with a clearance of 10 cm or wider on the right side and 12 cm or wider on the rear side to prevent the vent hole from being blocked.



⑤ Avoid installing the equipment with its rear side located near outlets or electrical appliances as steam comes out of the exhaust port on the rear.

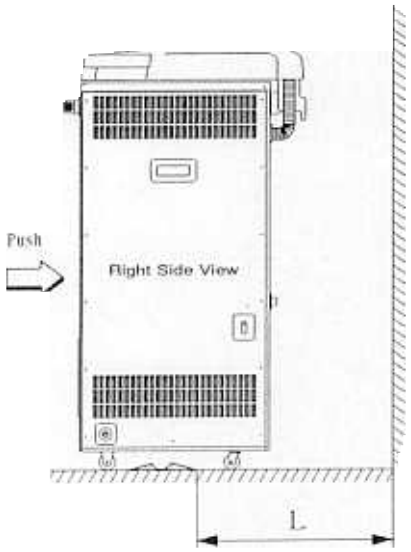
⑥ Avoid an installation place which is subject to impact or vibration.

⑦ Place the unit in a level, firm place.

⑧ Avoid installing in a place which is subjected to a room temperature of 5 ℃ or below or 35 ℃ or above.

2. Installation Procedure

Put the body on the caster stoppers to prevent it from accidentally moving
Anchor the body as described in the following.



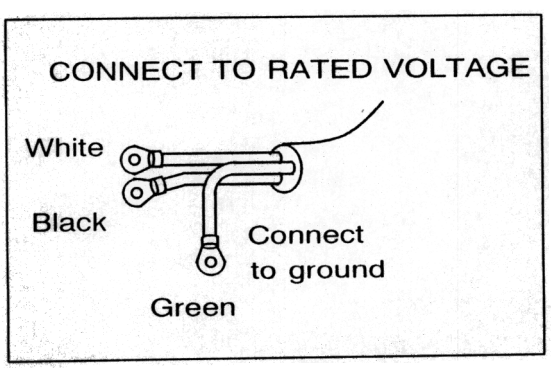
(1) Set the stopper the specified distance from walls.
Specified distance L = **HVE-25**.....49cm or more
HVE-50.....55cm or more

(2) Push the body until the front casters roll onto the stopper

Connect the power cord to a rated power supply.
・Reliably ground the grounding cable.

⚠ *WARNING:*

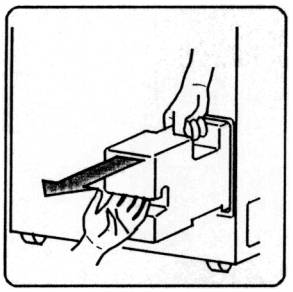
- Do not forcibly bend, twist, tie, or extend the power cord. Do not place heavy objects on the cord. A damaged cord or exposed wire may cause fire or electric shock.
- Never connect the power cord to a power supply with a voltage other than the rated voltage. Connection to such a power supply may cause fire or electric shock.
- If not plugging the sterilizer into a grounded socket, ground the equipment separately before connecting it to the power source.
- Never ground to a gas pipe or vinyl chloride water service pipe.



Model	AC110V	AC120V	AC220/230/240V
HVE-25	14A or more	13A or more	7A or more
HVE-50	19A or more	17A or more	9A or more

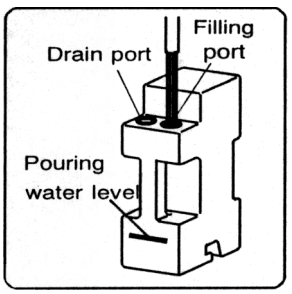
③ Pour water into the exhaust bottle.

- Add water to the exhaust bottle as described below.

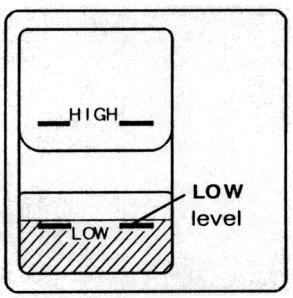


(1) Unload the exhaust bottle from the body.

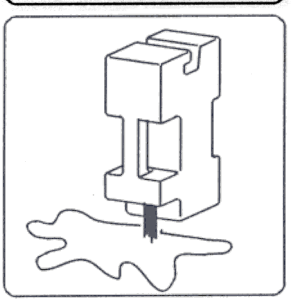
Pull the bottle outwards until the top handle can be grabbed securely. Lift the bottle out of the autoclave using this handle.



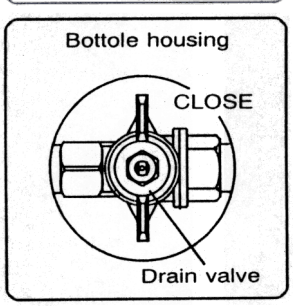
(2) Pour water into the bottle through the water filling port. Fill water to the reference line level.



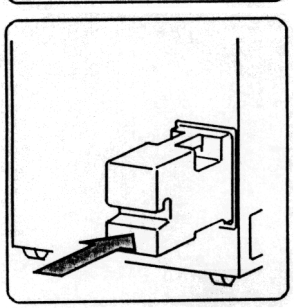
(3) Check to make sure that the water level is at **LOW** level (the lowest water level).



If too much water has been poured in, then place the bottle in a level sink with the side of the water filling and drain ports facing downwards.
Any excessive water is drained automatically until the water level is lowered to the **LOW** level.



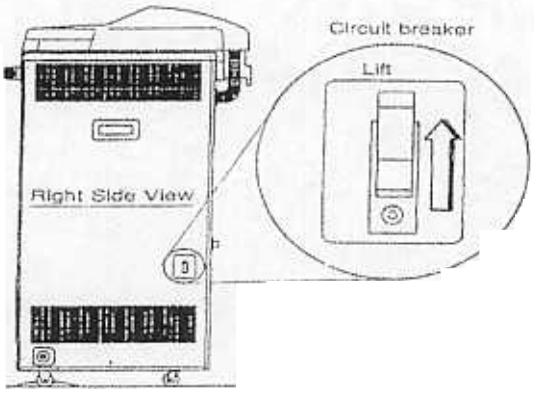
(4) Check to see that the drain valve, located at the bottom of the exhaust bottle housing area, is closed.



(5) Load the bottle into the area.

Be sure to push the bottle to the end, or else an error (**E r E**) will occur.

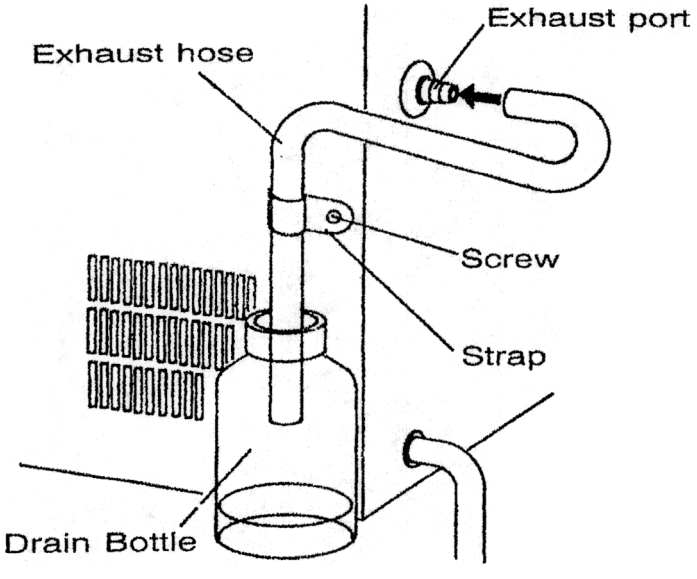
④ Turn the breaker ON.
Lift the circuit breaker lever on the right side of the main body.



⑤ Referring to **"Chapter 3, Operation Method"**, open the lid and take out the accessories.

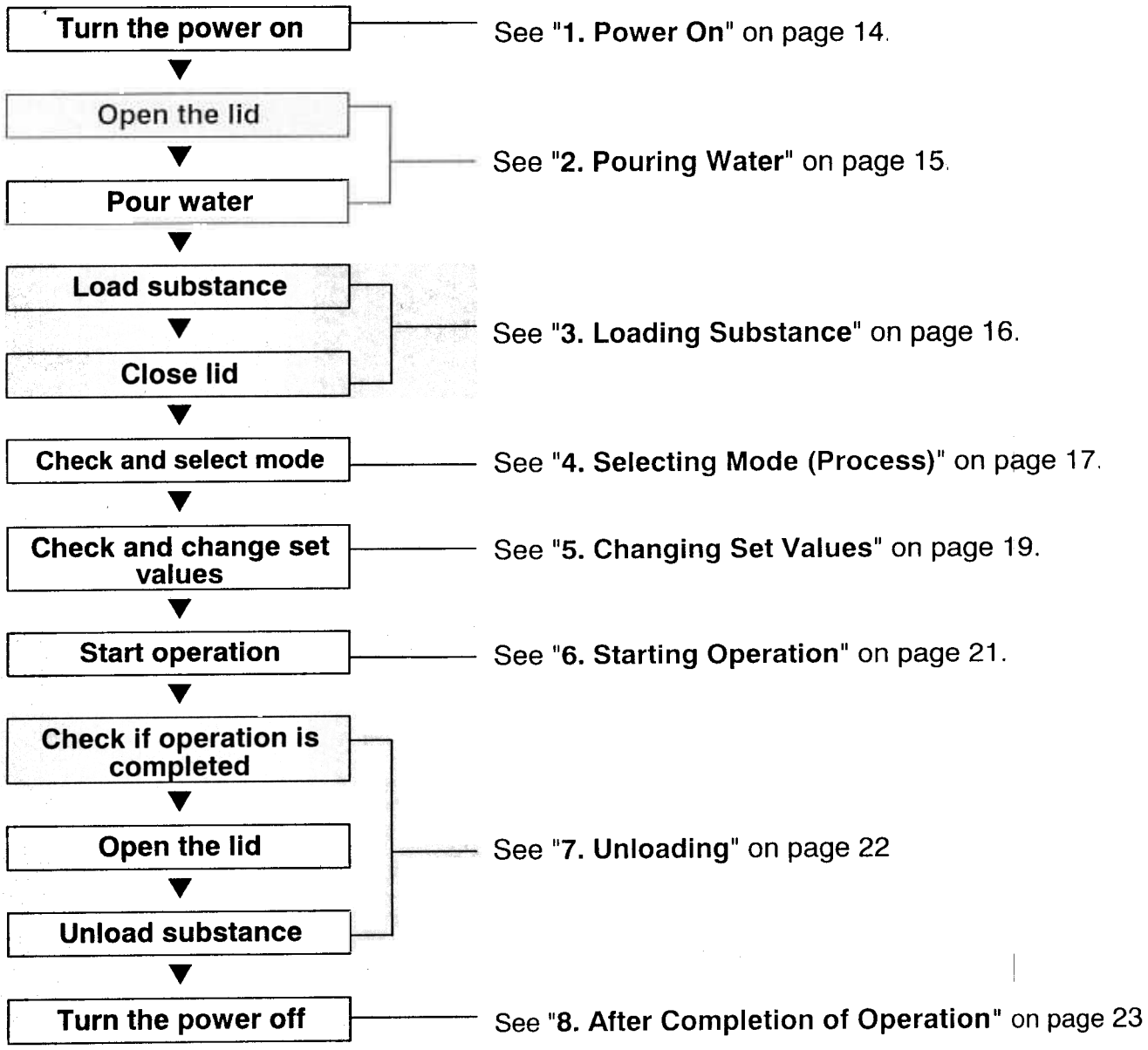
⑥ Place the bottom plate in the chamber.

⑦ During an autoclave cycle, steam exhausts out of the exhaust port located at the rear. Connect the exhaust hose to the exhaust port. Fill the large carboy that is provided with water to a depth of about 1 inch. Insert the hose about 7 inches into the carboy. To prevent water from sucking back into the chamber at the end of the cycle, empty the carboy before the water level covers the tip of the exhaust hose.



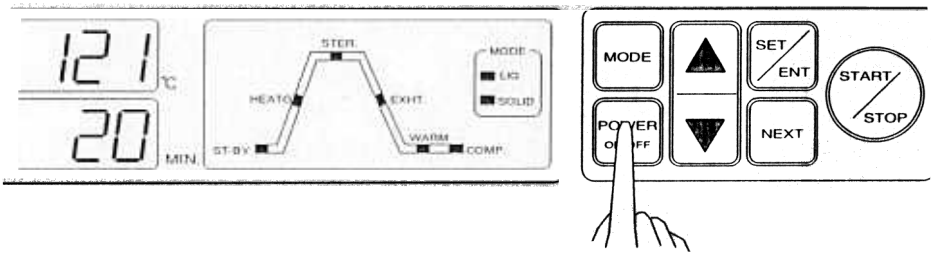
Chapter 3. Operation Method

Basic Operation Method



1. Power On

① Press the POWER ON/OFF switch at the front of the body.
When the open/close lever is set to "**LOCK**" (left side), settings light up on the display. The autoclave is ready in this state. When the open/close lever is set to "**UNLOCK**" (anywhere other than on the left side), "Lid" and "Temperature in the working chamber" are shown alternately on the display.



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NOTE:

- If the operation switches and the lock / unlock lever are left un-operated for **30 minutes**, the power saving function starts to work so that the display board blackens except for dots blinking at the temperature zone. For reviving the display, please press any of the operation switches.

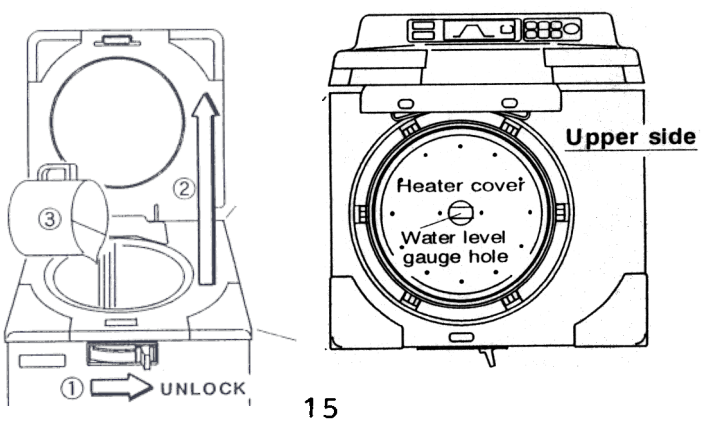
2. Pouring Water

IMPORTANT:

- In operation of **UNLOCK/LOCK** lever, never fail to put **POWER** switch **ON**

① Slide the open/close lever to the **UNLOCK** side (right end).
② Grab the handle and lift the lid as shown in the figure below.
③ Pour water through the opening of the chamber until you can see water through the hole at the center of the Heater cover.

- The **HVE-25** requires **1.5 liter** of water and the **HVE-50** requires **2.0 liters** of water.



3. Loading Substance

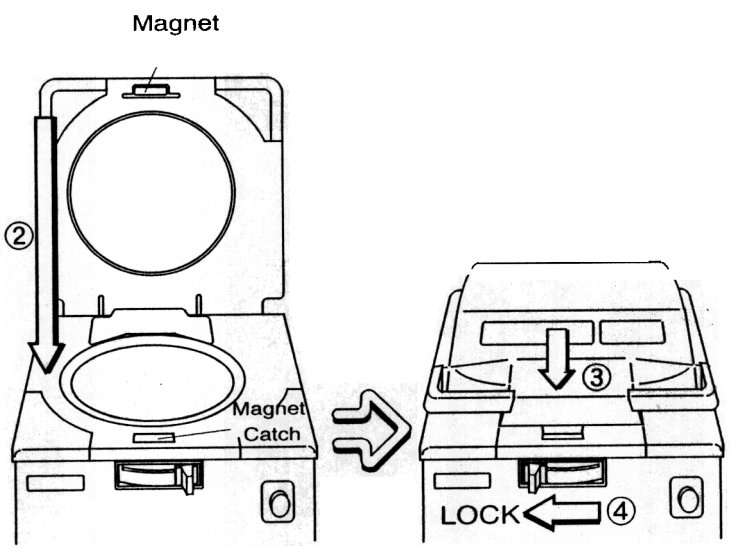
CAUTION:

- Be careful not to pinch hands when closing the lid.
- Close the lid after confirming that no foreign matter is adhering to the section contacting the lid gasket. Foreign matter in this section may cause vapor leaks.
- When using a waste processing bag or other kind of bag and disinfecting, place the bag in the metal mesh holder and insert it into the working chamber. Using the bag "as is" can cause excessive temperatures, pressures, lack-of -water, etc.

(!) IMPORTANT :

- Keep the lid open for 15 minutes or more between operations when the equipment is operated continuously. Check to see that the temperature in the chamber is 50°C or below before starting the next operation (operating the open/close lever).
- Be sure to use the Heater cover.

① Place the substance to be sterilized into the chamber.
② While having the handles, lid down the lid.
③ Press the front-center portion of the lid down until the magnet catch is attracted to the magnet.
④ While pressing the lid, slide the open/close lever to the **LOCK** side (the left end).

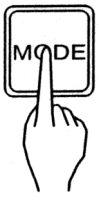


NOTE:

- When sterilizing an empty deep container, lay the container on its side in the chamber so that it will be permeated with steam. An upright position may cause insufficient sterilization.
- If a waste disposal bag is used in sterilization, open the bag far enough that the bag is not in contact with the inside surface of the chamber. Insufficient sterilization may be caused if the bag is closed during sterilization. When the bag is opened excessively, steam is prevented from circulating in the chamber. This may also result in insufficient sterilization.
- Do not pile specimens on top of one another. When the chamber is overly packed, steam fails to penetrate to all points, resulting in incomplete sterilization.
- In sterilizing liquids such as chemicals and media, pay attention to the quantity of the liquid in relation to its container. For an Erlenmeyer flask, the amount of chemical should be approx. 3/4 of the capacity of the container; for a test tube, the appropriate quantity of chemical is approx. half of the capacity of the container. Too much chemical may result in overflow from the container during the temperature rising or cooling process.
- Use container caps that are loose fitting and allow the passage of air. Containers may break if venting is not possible.
- Use the DURHAM TEST TUBE (Sample tube) with 6mm caliber or more. At the DURHAM TEST TUBE (Sample tube) with less than 6 mm caliber, air bubble sometimes remains.

4. Selecting Mode (Process)

- The following modes are programmed in the microcomputer. Select an appropriate mode.



① Press the **MODE** switch.
Each time the switch is pressed, the current mode repeatedly changes from Mode 1 to Mode 2, 3, 1... in sequence.

Mode	Application
1	Sterilization of agar medium (warmed for the prevention of coagulation after sterilization).
2	Sterilization of liquids, such as water, media, reagents, and liquid medicines, that withstand high temperature, high pressure steam.
3	Sterilization of tools of glass, ceramic, metal or rubber that withstand high temperature, high pressure steam and abrupt depressurization during the exhaust process.

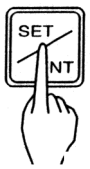
	Step Display	Initial Value				Mode Display
		Sterilization Temperature	Sterilization Time	Warming Temperature	Exhaust %	
Mode 1	**HEATG → STER. → EXHT.** (pulse) **→ WARM**	121℃	20 minutes	50℃	P - 0	**LIQ**

	Step Display	Initial Value				Mode Display
		Sterilization Temperature	Sterilization Time	Warming Temperature	Exhaust %	
Mode 2	**HEATG → STER. →EXHT.** (pulse)	121℃	20 minutes	—	P - 0	**LIQ**

	Step Display	Initial Value				Mode Display
		Sterilization Temperature	Sterilization Time	Warming Temperature	Exhaust %	
Mode 3	**HEATG → STER. → EXHT.**	121℃	20 minutes	—	—	**SOLID**

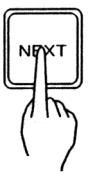
5. Changing Set Values (Registering of Values by Customer)

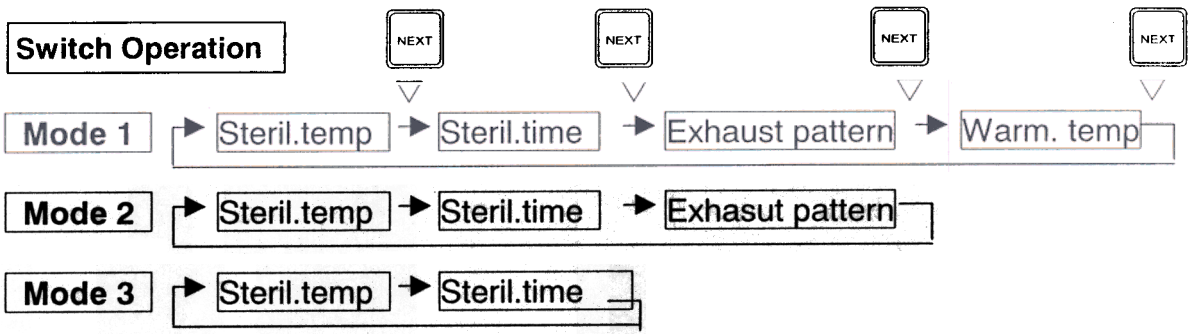
● Follow the steps below to change set values (sterilization temperature, sterilization time, warming temperature, and exhaust pattern). Settings cannot be changed during operation (after starting).



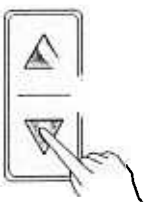
① Press the **SET/ENT** switch.
- The display of the set sterilization temperature will blink indicating that the value is now changeable.

② Press the **NEXT** switch to select an item to change.
- Each time the switch is pressed, the item to set will change in the sequence shown below.





③ Change the displayed value using the setting increase/decrease switches (▲,▼)
- Each time the switches are pressed, the displayed value increases or decreases as follows:



Sterilization temperature: (In increments of 1℃ within a range of:)
HVE-25: 105~126℃
HVE-50: 105~135℃
Sterilization time : 1 minute increments within a range of 1 - 250 minutes
Exhaust pattern : Units of 1 within a range of 0 - 2
Warming temperature: 1℃ increments within a range of 45 - 60℃

If a switch is held down, the displayed value increases or decreases in 10 unit increments. When the displayed value exceeds the upper limit (lower limit), it returns to the lower limit (upper limit).

④ Press the **SET/ENT** switch.
- The changed value is stored and the display stops blinking and lights up. This completes the setting operation.

Canceling Setting Value Changes

●To cancel setting changes during the change operation, press the **MODE** switch. The changed values will not be stored and the equipment will return to the standby state.

⚠ NOTE:

- For sterilization of liquids, set a sterilization time longer than desired, taking a delay time into account according to the table below.

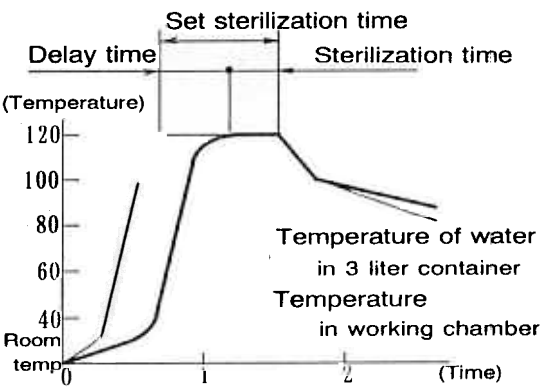
Example)

When there is 3 liters of water in a flask, it takes nearly 30 minutes (delay time) for the temperature of the water to reach a set sterilization temperature after the temperature in the chamber reaches the set value. The sterilization time should therefore be set 30 minutes longer than desired in order to deal with this time delay. The sterilization time is therefore set at 50 minutes.

Set sterilization time (50 minutes)
= Delay time (30 minutes) + desired sterilization time (20 minutes)

HVE-50 Reference Values of Delay Time (per flask)

Liquid Volume	Delay Time
3 liters	30 minutes
2 liters	25 minutes
1 liter	20 minutes
500cc	15 minutes



HVE-50 Delay Time Reference Data

If steam is abruptly exhausted after sterilization of a liquid, the liquid may gush out. To prevent this, change the exhaust pattern setting depending on the container. When purging manually using the fine exhaust knob, change the setting to P-0.

P-0: Exhaust pattern is not executed and equipment is left to sit.
P-1: Pulse exhaust is executed (fine exhaust volume)
P-2: Pulse exhaust is executed (small exhaust volume)

- The mode, temperature, time, and exhaust pattern are recorded even if the power is cut off by the **POWER ON/OFF** switch. When the power is cut by the breaker, a power outage, or a temporary loss of power, the settings will return to the initial settings of mode 1. Reset the setting values as desired when this occurs.

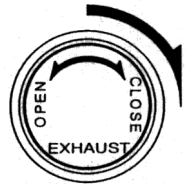
6. Starting Operation

Ascertain that the water level in the exhaust bottle is between the **HIGH** and **LOW** levels.

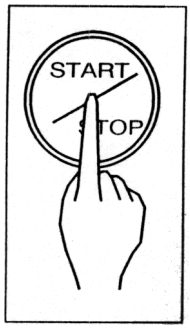
If above the **HIGH** level: See "**1. Draining Exhaust Bottle**" on page 27.
If below the **LOW** level: See "**2. Installation Procedure (3)**" on page 11

② Ascertain that the water level in the drain bottle is low enough not to touch the tip of the exhaust hose.
[N.B.] Pour out the water from the drain bottle so that the hose tip does not touch the water.

Confirm that the fine exhaust knob is closed.

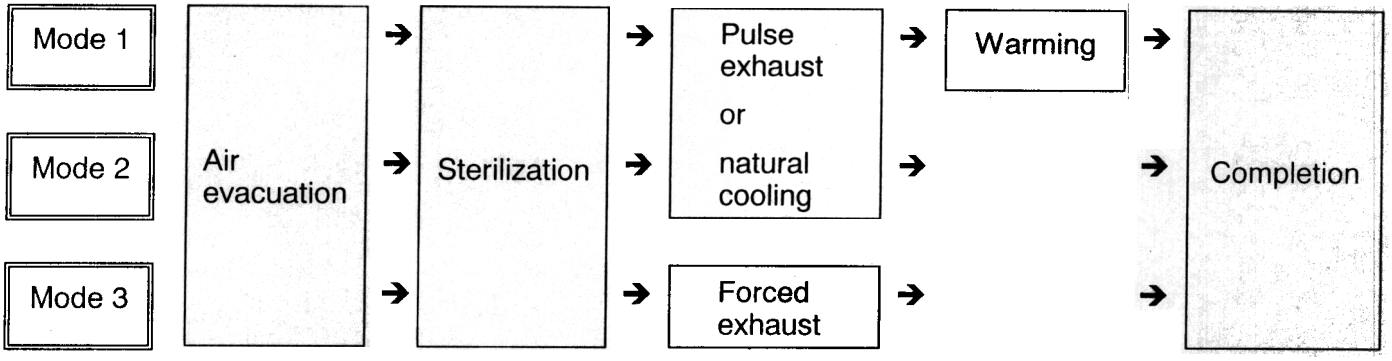


Fine exhaust knob



④ Press the **START/STOP** switch

The open/close lever is locked and the lid can not be opened. Thereafter, one of the following processes is executed depending on the chosen mode of operation. For details on each specific mode, see "**11 Operation of Cycles**" on page 24.



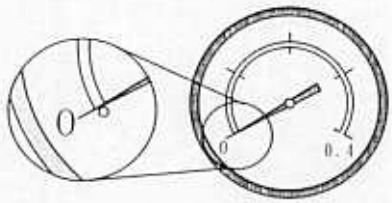
Checking the Set Values during Operation

- To check the set values for temperature, time, or exhaust pattern during operation, press the **MODE** switch. The set value remains on the display while the switch is held down. Set values are not changeable.

7. Unloading

⚠ *WARNING:*

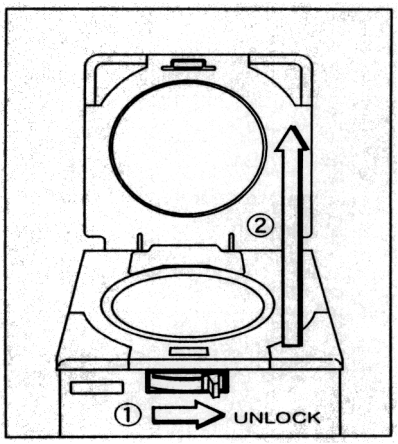
- Confirm that the gauge for pressure in the chamber reads "0MPa".



Pressure gauge

⚠ *CAUTION:*

- Keep the face and hands away from the chamber when lifting the lid after operation is complete; steam will gush out of the opening of the chamber.
- When operation is complete, the lid, chamber and panel are hot. To prevent burns, do not touch these areas with bare hands.
- A long time is required for a liquid to cool. Be sure to check that the temperature has dropped sufficiently before unloading a liquid from the chamber or a burn may result.
- Put on heat insulation gloves before removing a substance from the chamber. Do not put hands into the chamber until the steam has been vented.



① Slide the open/close lever to the **UNLOCK** side (to right end)
② Lift the lid
③ Take the sterilized substance out of the chamber.

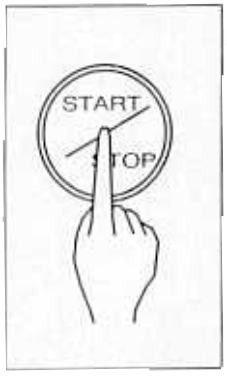
8. After Completion of Operation

① Turn off the power switch after the completion of daily operations
② If the fine exhaust knob is open, turn it until closed.

! ***IMPORTANT :***

- To prevent clogging of the piping, refer to "**Draining Chamber**" and change the water within the chamber once per day.

9. Canceling Operation



① Press the **START/STOP** switch

The process currently being executed will be interrupted and the equipment will return to the standby state (state before operation)

- When removing the sterilized substance from the chamber, follow the instructions described in "**7. Unloading**." (When the chamber temperature drops below 97℃, the pressure drops to 0MPa. In this state, the open/close lever is unlocked.)

10. When Power Supply is Cut during Operation

- If the power supply is cut due to power failure or other problem, operation is interrupted. When the power supply is restored, the equipment will revert to the standby state (state before operation). In this case, repeat operations from the beginning.

NOTE :

- If the power supply is cut due to power failure or other problem, the open/close lever is locked for safety. To open or close the lid, follow the instructions described in "**7. Unloading**" on page 22 after the power supply has been restored.

11. Operation of Cycles

■ Air Evacuation Cycle Common to all modes

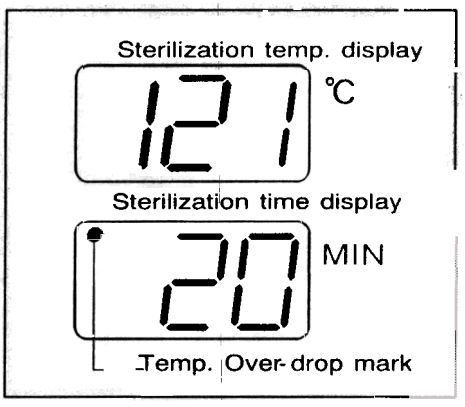
The **ST-BY** display stops flashing and lights up and the **HEATG** display starts blinking The temperature in the chamber is displayed in the digital temperature display section.

Any air remaining in the working chamber makes the temperature distribution in the chamber uneven. This hinders temperature increases (sterilization). To deal with this problem, a microcomputer-controlled automatic exhaust valve vents virtually 100% of the air.

Temperature increases until the set sterilization temperature (pressure) is reached

After the set sterilization temperature is attained, the **HEATG** display stops flashing and lights up. Operation then proceeds to the next cycle.

■ Sterilization Cycle Common to all modes



The **STER.** display goes out and starts blinking.
The set sterilization time is shown in the digital display upon activation of the sterilization timer.

A constant temperature (pressure) is maintained during the set sterilization time period.

If the temperature in the chamber drops 1℃ or more from the set value due to any trouble, the temp. over-drop mark appears on the digital display, and the digital timer operation is interrupted. When the set temperature is regained, the timer restarts operation.

The digital timer displays the remaining time during the sterilization cycle. Refer to "***Checking Set Values during Operation***" on page 21 for the method of checking the set time during operation.

When the preset sterilization time has passed, the **STER**. display stops blinking and lights up, and operation proceeds to the next cycle.

NOTE:

- In sterilization of petri dishes or empty containers, the air remaining in the container expands and may increase the pressure remarkably within the chamber. If the pressure in the chamber exceeds the saturated steam pressure, the automatic exhaust valve opens and discharges the air in the chamber into the exhaust bottle.
- The chamber temperature is somewhat high to prevent the internal temperature from falling below the sterilization setting temperature.

■ **Pulse Exhaust Cycle --- Modes 1 and 2**

The **EXHT** display will start to flash.

When the exhaust pattern is set to P-1 or P-2, the solenoid value opens independently and pulse exhaust is executed. When the exhaust pattern is set to P-0, the solenoid valve does not open and the working chamber cools naturally.

NOTE :

- If steam is abruptly exhausted after sterilization of a liquid, the liquid may gush out. To prevent this, change the exhaust pattern setting depending on the container. When purging manually using the fine exhaust knob, change the setting to P-0.

  P-0: Exhaust pattern is not executed and equipment is left to sit.
  P-1: Pulse exhaust is executed (fine exhaust volume)
  P-2: Pulse exhaust is executed (small exhaust volume)

When the chamber temperature falls below 79℃, the **EXHT** display stops blinking and lights up. Operation then proceeds to the next cycle.

■ **Forced Exhaust Cycle --- Mode 3**

The **EXHT** display flashes and the solenoid valve opens.

When the temperature in the working chamber falls below 97℃ the **EXHT** stops blinking and lights up. Operation then proceeds to the next cycle.

■ **Warming Cycle --- Mode 1**

The **WARM** display starts blinking.

When the temperature in the chamber falls to the set incubation temperature, the electronic alarm gives a beeping sound.

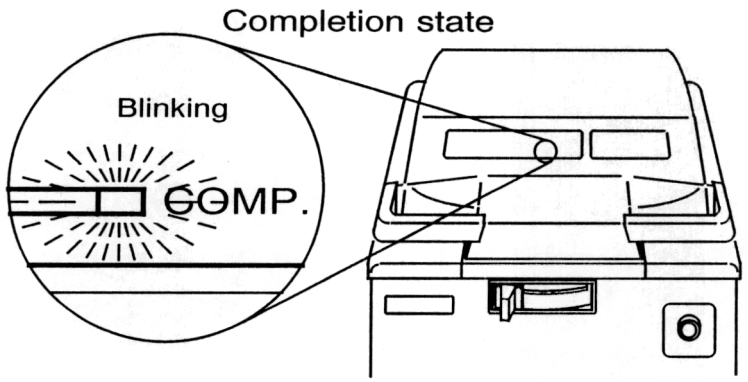
- When 20 hours (fixed) has elapsed after the temperature dropped to the set incubation temperature, the **WARM** display stops flashing and lights up. Operation then proceeds to the next cycle.

NOTE :

- After the warming time (20 hours) has elapsed, the chamber is not heated; temperature in the chamber falls to room temperature, and the remaining agar medium, if any, in the chamber will coagulate.
- When removing a sterilized substance from the chamber during the warming cycle, press the **START/STOP** switch to stop operation. Refer to "**7. Unloading**" on age 22 for further operations.

■ Completion Cycle --- Common to all modes

When all cycles of a mode are complete, the electronic alarm indicates the completion by beeping 3 times. The **COMP** display then starts blinking.



NOTE:

- If the operation switches and the lock / unlock lever are left un-operated for 30 minutes, the power saving function starts to work so that the display board blackens except for dots blinking at the temperature zone. For reviving the display, please press any of the operation switches.

Chapter 4. Maintenance and Service

⚠ *WARNING:*

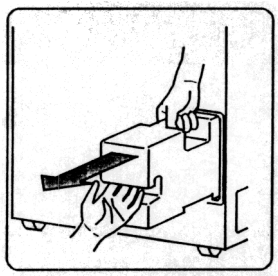
- Be sure to start maintenance or service work after the main body has been sufficiently cooled.

1. Draining Exhaust Bottle

Water collects in the exhaust bottle as operations are repeated. If the water is above the **HIGH** level (allowable highest water level), drain the bottle in accordance with the following procedures.

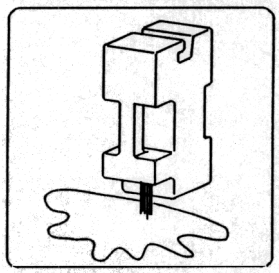
⚠ *CAUTION:*

- Do not unload the exhaust bottle before water in the bottle has been sufficiently cooled



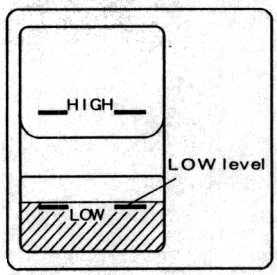
① Remove the exhaust bottle from the body.

- Pull the bottle outward until the top handle can be grabbed securely.



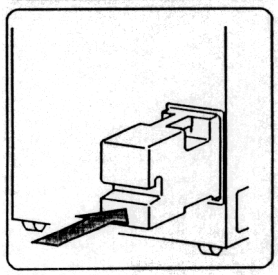
② Place the bottle in a level sink with the water filling and drain ports facing downwards.

- Excessive water is drained automatically until the water level is lowered to the **LOW** level (lowest allowable water level).



③ Be sure that the water level is at **LOW** level.

- Ensure that water is left at the **LOW** level (lowest allowable level), which is required for sufficiently cooling the steam.



④ Loading the exhaust bottle into the bottle housing area.

- Be sure to push the bottle to the end, or else an error (**ErE**) will occur.

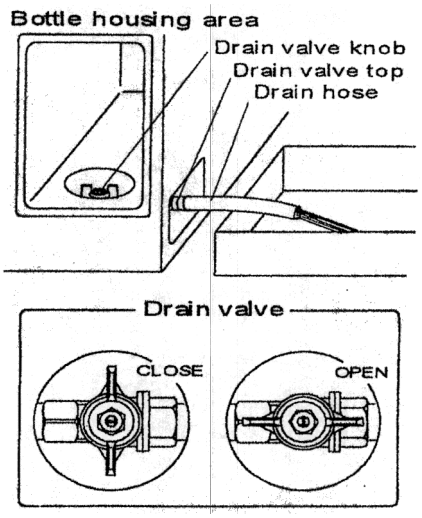
2. Draining Chamber

- Drain the chamber once a week and whenever there is spillage into the chamber.
- When planning to put the equipment out of service for a long time, be sure to drain the chamber to prevent pipe clogging. After checking that the chamber has been sufficiently cooled, drain the chamber in accordance with the following procedure.

⚠ 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 attached 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 if draining of the chamber is complete.
⑦ Turn the knob clockwise to close the drain valve.
  • Be sure the exhaust valve is closed.



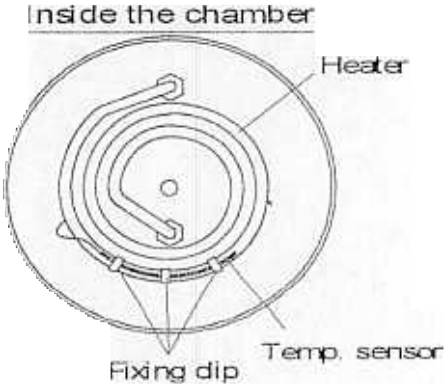
3. Cleaning Chamber

⚠ CAUTION :

- The heater is provided with a temperature sensor, be careful not to damage this sensor when cleaning.

① Take out the bottom plate 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 other tool while applying water and keeping the drain valve open.

② If the temperature sensor comes loose from the fixing clip, reattach it.



4. Cleaning the Body

! *IMPORTANT :*

- Do not use benzine or thinner to clean the body. Also make sure that the volatile substances such as insecticides do not come into contact with the body as these substances may deteriorate the body or strip its paint.

① Gently wipe stains from the body with a soft cloth. To remove stubborn stains, wring a cloth moistened with neutral detergent diluted with water, and wipe off the stains with it. Wipe off any moisture with a dry cloth.

5. Replacing Lid Gasket

● 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

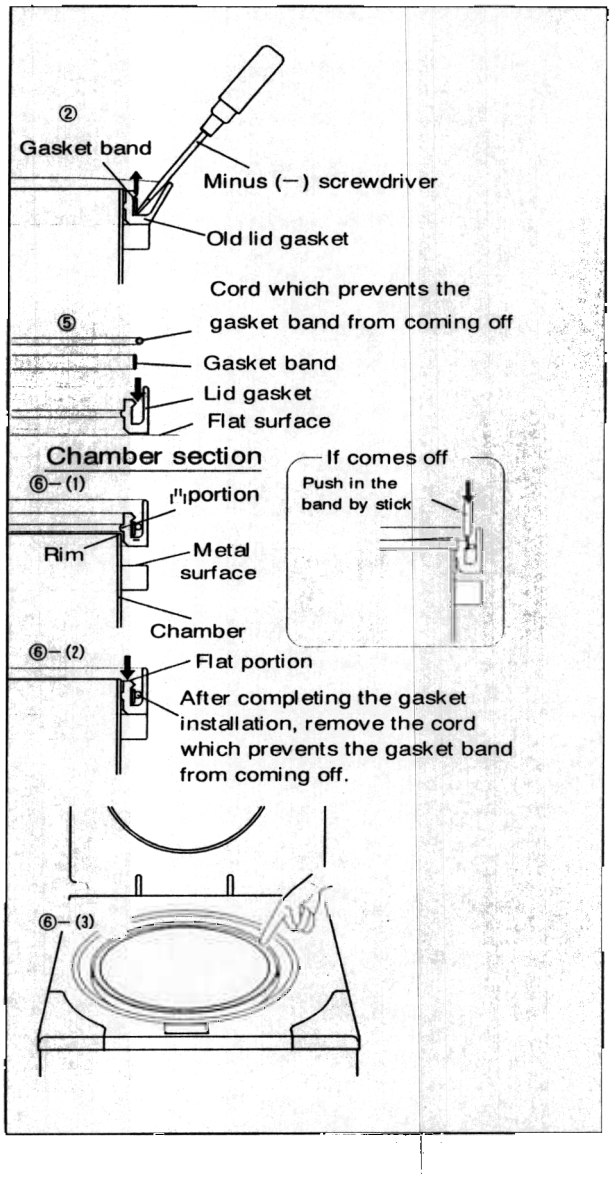
② Apply the minus (−) screwdriver to the underside of the gasket band, and pry it up. Pull out the old gasket.

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 down the flat portion of the gasket to eliminate any irregularities on the gasket surface.
・ An uneven gasket surface makes the lid difficult to close.



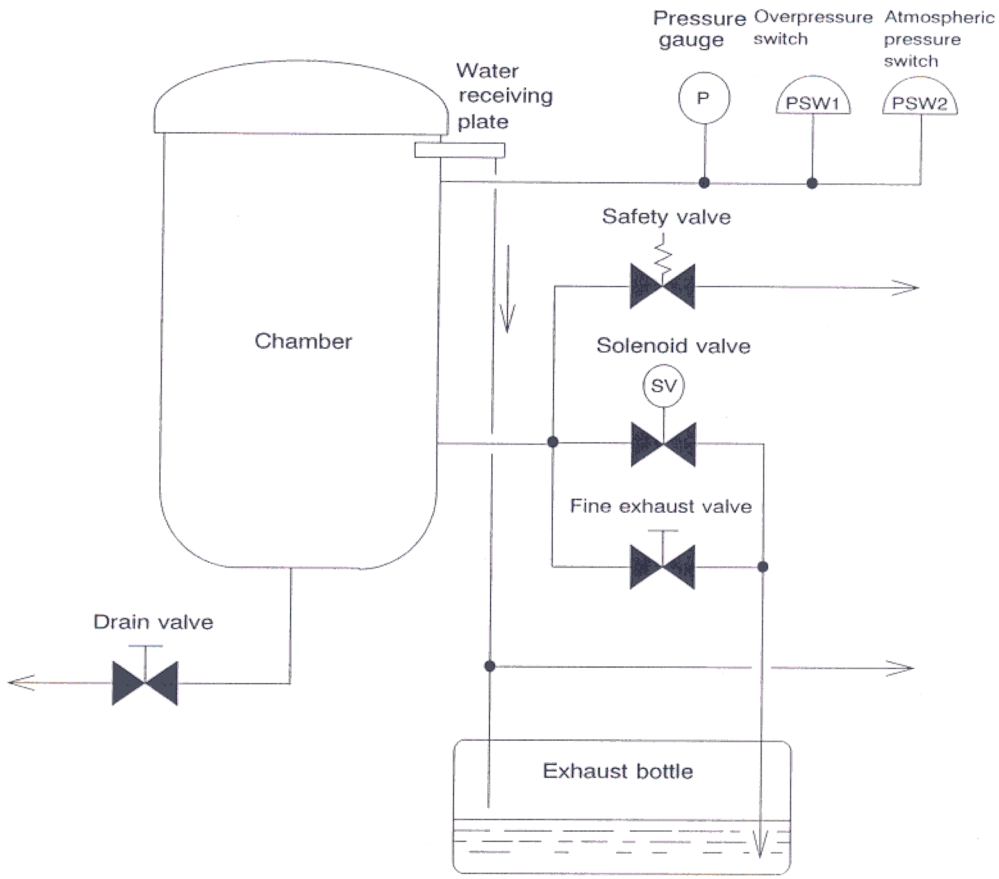
⑦ Pull out the cord which prevents the gasket band from coming off.

⑧ Follow the ordinary operating procedure to start operation and check the lid gasket for any leakage.

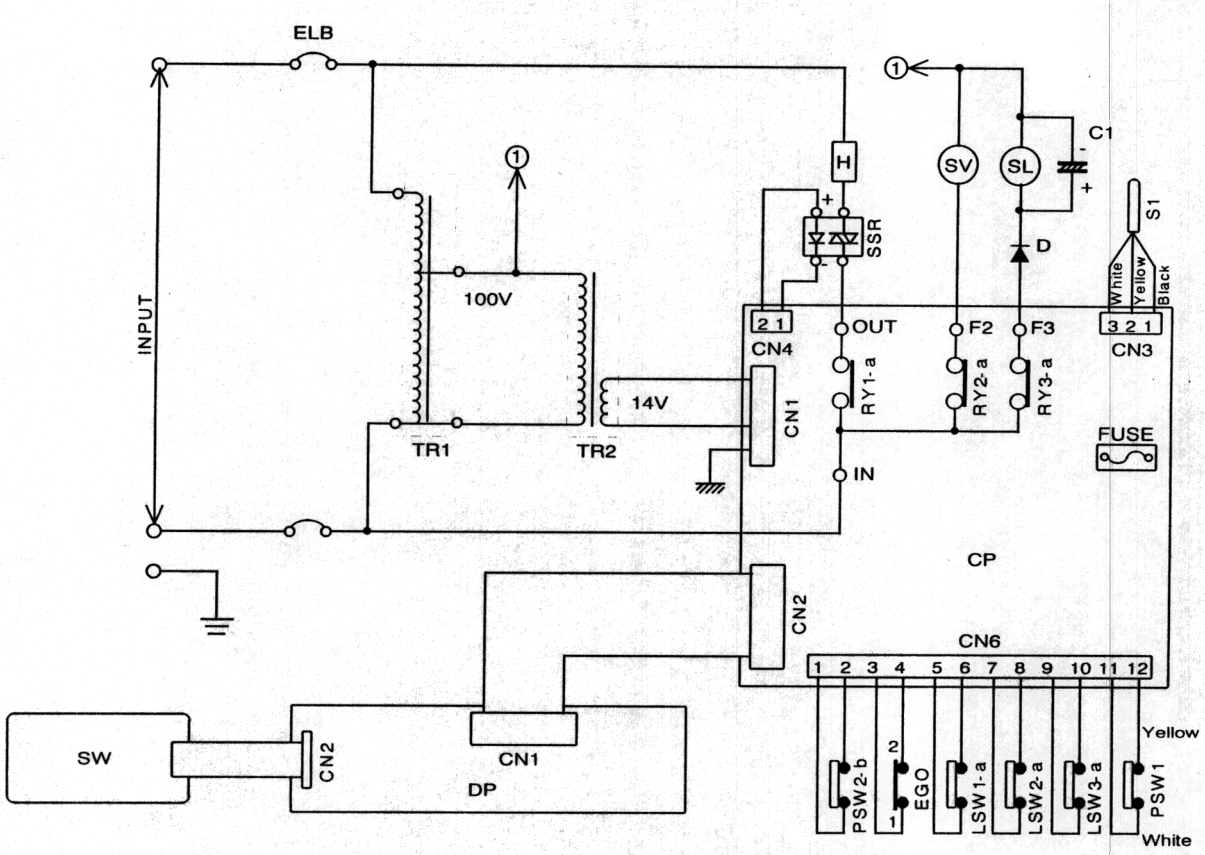
Chapter 5. Specifications

Model	HVE-25	HVE-50
External dimensions	48W × 95H × 46D cm	54W × 104H × 53D cm
Internal dimensions	24Ø × 55D cm (Effective: 25 *l*)	30Ø × 71D cm (Effective: 50*l*)
Power source	AC____V±10% Single-phase 50/60Hz (____A or greater)	AC____V±10% Single-phase 50/60Hz (____A or greater)
Temperature and humidity conditions	5~35℃, 10~85%RH (No condensation)	
Power consumption	1.5KW (____A)	2.0KW (____A)
Net Weight (approx.)	41kg	57kg
Pressure vessel type	Miniature pressure vessel	Small sized pressure vessel
Working chamber material	SUS304 (stainless steel)	
Sterilization temperature range	105~126℃ variable	105~135℃ variable
Sterilization timer	1~250 minutes, remaining time displayed	
Warming temperature range	45 ~ 60℃ variable	
Exhaust pattern setting	3 patterns (including natural cooling)	
Maximum operating pressure	0.186MPa	0.255MPa
Thermometer	Digital display, 5~128℃	Digital display, 5~137℃
Pressure gauge	Analog display, 0~0.4MPa	
Safety devices/ Warning alarm	Pressure safety valve, Circuit breaker, Lack-of-water prevention device, Error display (Lack-of-water, Temperature sensor wire breakage, Over temperature, Over cooling, Overpressure, Open/close lever locking failure)	
Accessories	Exhaust bottle (1 pc) Bottom plate (1 pc) Drain hose 50 cm (1 pc) Exhaust hose 50 cm (1 pc) Drain bottle (1 pc) Strap (1 pc) Guarantee card (1 pc) Operation manual (1 pc) Caster stoppers (2 pcs)	Exhaust bottle (1 pc) Bottom plate (1 pc) Drain hose 50 cm (1 pc) Exhaust hose 50 cm (1 pc) Drain bottle (1 pc) Strap (1 pc) Guarantee card (1 pc) Operation manual (1 pc) Caster stoppers (2 pcs)

Piping Diagram



Wiring Diagram



DP	Display PCB	S1	Temperature sensor for control
CP	Control PCB	PSW1	Overpressure prevention switch
SW	Operation switch	PSW2	Atmospheric pressure switch
ELB	Circuit breaker	EGO	Lack-of-water prevention switch
TR1	Transformer	LSW1	Limit switch (lever open/close)
TR2	Transformer	LSW2	Limit switch (lever lock)
FUSE	Fuse	LSW3	Limit switch (bottle housing)
SV	Solenoid valve	SSR	Solid state relay
SL	Solenoid	RY1	Relay (Heater)
D	Diode	RY2	Relay (Solenoid valve)
C1	Electrolytic capacitor	RY3	Relay (Solenoid)
H	Heater		

Chapter 6. Troubleshooting

1. Error Detection (Alarms)

Should any malfunction occur in the autoclave, the error detection circuit will be triggered to assure safety. Once the circuit is activated, an error number appears on the digital display and the electronic alarm sounds, indicating the problem. To stop the alarm sound, press the START/STOP switch. If an alarm occurs, check the error number and turn off the power switch.

Error Number	Problem	Remedy
E r 1 (Lack-of-water alarm)	• Lack-of-water	• Check to see that the pressure is at "0MPa" and then open the lid. After the heater has been cooled, pour in a sufficient quantity of water, and repeat operations from the beginning.
	• Piping is clogged by a bag such as the waste disposal bag.	• Whenever a bag, such as a waste disposal bag, is used for sterilization. put it in the wire mesh basket and place the basket in the working chamber.
E r 2 (Temperature sensor wire breakage)	• Temperature in the working chamber falls below the freezing point.	• Adjust room temperature at the installation site to 5 - 35°C.
	• Disconnection of temperature sensor for control.	• Contact our authorized distributor in your region.
E r 3 (Excessive temperature alarm)	• Temperature in the working chamber exceeded the upper limit of the working temperature range by +3℃ or more. • A temperature + 5℃ or more above the set temperature continued for 10 seconds during sterilization. • A temperature +10℃ or more above the set temperature continued for 15 minutes during warming	
E r 4 (Excessive cooling alarm)	• A temperature of 102℃ or less continued for 10 seconds during sterilization.	

Error Number	Problem	Remedy
E r 5 (Excessive pressure alarm)	• The pressure of the saturated steam at the set temperature was 0.16MPa or above for HVE-25, 0.24MPa or above for HVE-50 continued in the chamber for 15 seconds.	• Contact our authorized distributor in your region..
	• Piping is clogged by a bag such as the waste disposal bag.	• Whenever a bag, such as a waste disposal bag, is used for sterilization, put it in the wire mesh basket and place the basket in the working chamber.
E r 6 (Lid open alarm)	• The open/close lever was moved to the **UNLOCK** side during operation.	• Contact our authorized distributor in your region.
E r 9 (Sterilization heater alarm)	• Temperature in the chamber has not reached a set sterilization temperature after 4 hours has elapsed from operation startup.	• Reduce the quantity of substance to be sterilized and repeat perations from the beginning.
E r L (Open/close level locking failure alarm)	• The open/close lever is unlocked during operation.	• Contact our authorized distributor in your region. When contacting the distributor, be sure to have model and serial number information.
E r E (Exhaust bottle anomaly alarm)	• The exhaust bottle has moved out of place during operation.	• Push the exhaust bottle into the housing area as far as it will go and repeat operations from the beginning.

2. Early Troubleshooting

Symptom	Cause	Remedy
Display remains off after power is turned on.	Check the plug and outlet first. (1) The plug is not properly inserted or is insufficiently tightened. (2) Disconnection in the power cord. (3) Defective display.	(1) Properly insert the plug and retighten any loose parts. (2) (3) Contact the authorized sales distributor from which the unit was purchased.
No air exhausted from the working chamber.	(1) Defective automatic exhaust valve.	(1) Contact our authorized distributor in your region.
Pressure gauge reading remains low.	(1) Defective safety valve. (2) Defective pressure gauge. (3) Disconnection in the heater. (4) Defective automatic exhaust valve. (5) Steam leakage.	(1)-(4) Replace the defective part (Contact the authorized sales distributor from which the unit was purchased). (5) For steam leakage from piping, retighten or seal joints.
Steam leakage from lid gasket	(1) Deterioration of lid gasket (2) Improperly installed lid gasket. (3) Foreign matter under the gasket.	(1) Replace the lid gasket. (2) Press on the gasket to remove any unevenness. (3) Remove the foreign matter.
Water leakage from the bottom of the body.	(1) Deterioration of the heater seal packing due to lack of water or other problem. (2) The drain valve is open.	(1) Contact our authorized distributor in your region. (2) Close the valve.
Open/close lever cannot slide	(1) Temperature in the working chamber has exceeded 80℃ or the pressure has exceeded 0.01MPa. (2) The power switch is off.	(1) Wait until the temperature in the working pressure falls below 79℃ or the pressure is reduced to 0kgf/cm^2. (2) Turn on the Power ON/OFF switch.
Lid cannot be opened or closed	(1) The open/close lever has not slid completely to the UNLOCK side.	(1) Slide the lever completely to the UNLOCK side.
Displayed temperature exceeds set temperature and exhaust is repeated frequently during the sterilization cycle.	(1) Defect in the heater circuit.	(1) Contact our authorized distributor in your region.

- This table of early troubleshooting describes the causes and remedies of simple problems. If you are unable to fix or repair the problem, Contact our authorized distributor in your region and provide the following information.

(1) Model and serial number of the autoclave.
(2) Defective point(s) and symptom(s) (error number if applicable).
(3) Number of days of operation (date of purchase).
(4) Operating conditions (including substances being sterilized).

Appendix

Temperature-Pressure Conversion Table for Saturated Steam in Autoclave

The following data are approximate values for practical use in all autoclaves:

Temperature		Pressure Gauge Reading	
(°C)	(°F)	kg/cm	lb/inch
109	228	0.35	5.0
110	230	0.5	7.1
115	239	0.7	10.0
120	248	1.0	14.2
121	250	1.1	15.6
126	260	1.5	22.0
132	270	1.9	27.0
135	243	2.1	30.0

SPARE PARTS FOR HV- AND HVE-SERIES AUTOCLAVES

Catalog No.	Description
ATA-25LG	Lid gasket for HV/HVE-25
ATA-50LG	Lid gasket for HV/HVE-50
ATA-85LG	Lid gasket for HV-85/110
ATA-25H	Heater for HV/HVE-25, 1.5KW (specify 120V or 220V)
ATA-50H	Heater for HV/HVE-50, 2KW (specify 120V or 220V)
ATA-85H	Heater for HV-85, 3KW, 220V
ATA-110H	Heater for HV-110, 4KW, 220V
ATA-HVEGO	Low water power cut-off device, includes sensor and thermostat for HV and HVE series
ATA-HVEROM	EPROM including extractor for HVE-series
ATA-HVESV	Solenoid valve for HVE-series
ATA-HVROM	EPROM including extractor for HV-series
ATA-HVPB	Plastic exhaust bottle for HV/HVE series
ATA-MTS	Thermistor sensor for MW, HV, & HVE series
ATA-MWSSR	Solid state relay for MW, HV, & HVE series
ATA-PS	Pressure sensor for HV-series
ATA-SVA	Solenoid valve assembly for HV-series
ATA-TRTP	Thermal paper for digital recorder, 9 rolls