

OPERATOR'S MANUAL

AUTOCLAVE FLS-1000

- Please read this Operator's Manual thoroughly and understand the contents before operating FLS-1000.
- This equipment is used for the handling of microorganisms, such as bacteria and viruses, which can exert adverse health effects on human beings or other living things, therefore, must be used by personnel with enough knowledge and experience.
- Be sure to keep this Operator's Manual handy for future reference.

FOR RESEARCH USE

TOMY

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1. PRECAUTION FOR USE



The TOMY Autoclave For Laboratory Use FLS-1000 has an inner vessel which is subject to very high temperature and pressure during the operation. If this FLS-1000 is installed or operated improperly, it may cause death or serious injury to the operator or people around, or cause severe damage to FLS-1000 or other property. Be sure to read this Operator's Manual thoroughly before use, and follow its instructions and procedures for the proper use of FLS-1000.

1-1. About the Symbols

This Operator's Manual uses certain words and symbols to call attention to important safety and operational information. Safety indications are classified into "Warnings" and "Cautions", depending on the level of potential injury to personnel or damage to the equipment.

 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to laboratory personnel.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to laboratory personnel or damage to the product and surrounding property.

<Symbols>

	Denotes general ban or prohibition. The specific instruction is described as an illustration or in a statement near the symbol.
	Denotes general mandatory action. The specific instruction is described as an illustration or in a statement near the symbol.

1-2. Warnings and Cautions

WARNING



Do not modify or alter the FLS-1000 or any parts of the FLS-1000.

Failure to do so may cause serious accident or malfunction.



Do not use accessories or parts other than those specified by the manufacturer.

Failure to do so may cause serious accident or malfunction.



Do not allow such foreign objects as pieces of metal, combustible materials, water or other liquids to enter the interior of the FLS-1000 through its vents or other openings.

Failure to do so may cause short circuit, fire or malfunction.



Do not remove the outer panel of the FLS-1000.

Contact with the inner parts of FLS-1000 may cause electric shock, burns, fire or malfunction.



Do not touch the power plug with a wet hand.

Failure to do so may cause electric shock.



Do not use any damaged power cord, plug or loose outlet.

Failure to do so may cause accidental fire, short circuit or malfunction.



Do not allow the power cord to be pinched by or caught between heavy objects.

Failure to do so may cause accidental fire, short circuit or malfunction.



Do not unplug by pulling on the cord.

Stress to the cord may cause a loose connection in the plug and result in fire or burnout of the cord.



When leaving the FLS-1000 out of use for a long time, be sure to unplug the power plug of the FLS-1000 from the outlet.

Failure to do so may allow insulation to deteriorate, thereby causing electric shock, short circuit or fire. For models with no power plug provided, the power circuit breaker to which the power plug is connected should be turned off.



Do not install the FLS-1000 in a place where chemicals that are likely to generate flammable or corrosive gases or fumes are stored.

Failure to do so may cause fire. Electric components can corrode and cause short circuit or electric shock.



Avoid installing the FLS-1000 in a place where there is a lot of dust or moisture.

Failure to do so may cause short circuit of electric components or fire.



Avoid installing the FLS-1000 in or near a sink or tap where there is a risk of it being splashed with water.

Failure to do so may cause short circuit or electric shock.



Install the FLS-1000 on a sturdy and level surface such as concrete floors that can support its weight.

Failure to do so may cause FLS-1000 to fall over, thereby resulting in personal injury or physical damage.

⚠️ WARNING



Connect the FLS-1000 to a power outlet of the voltage specified as correct for FLS-1000. Do not connect it to a shared outlet.

Failure to do so may cause accidental fire, short circuit or malfunction.



Do not use extension cords or power strips.

Failure to do so may cause accidental fire, short circuit or malfunction.



Make sure that the FLS-1000 is properly grounded.

Failure to do so may cause explosion, electric shock or malfunction.



Never ground the FLS-1000 through a water pipe or a gas pipe.

Failure to do so may cause explosion, electric shock or malfunction.



Do not touch the power switch with a wet hand.

Failure to do so may cause electric shock.



Never attempt to open the lid until the chamber pressure returns to 0MPa.

If the lid is opened while pressure remains in the chamber, articles to be sterilized or steam may gush out, thereby resulting in death or serious injury.



Be extremely careful of steam coming out of the chamber when opening the chamber lid.

Steam coming out of the chamber is very hot and can cause burns or injury.



Avoid leaving any foreign materials between the chamber lid gasket and the chamber.

Failure to do so may cause steam leak, thereby resulting in burns.



When the pressure gauge is not working properly, stop operation.

Otherwise, abnormality inside the chamber, if any, cannot be found, thereby causing serious accident. If pressure gauge malfunction is suspected, please contact your dealer or our local representative.



Do not bend the exhaust hose.

If exhaust venting is not carried out smoothly, the chamber pressure may become abnormally high, thereby causing damage to parts. Broken parts may scatter and cause burns, injury or serious accident.



Do not use the FLS-1000 to sterilize flammable or explosive articles.

Failure to do so may cause fire or explosion.



Do not use the FLS-1000 to sterilize corrosive articles.

Otherwise, the chamber may corrode and explode or burst while pressure rises, thereby causing death, injury or serious accident.



Do not use the FLS-1000 to sterilize sealed articles.

Sealed articles may explode or burst when they are removed from the chamber, thereby causing burns, injury or serious accident. The chamber pressure may become abnormally high, thereby causing damage to parts. Broken parts may scatter and cause burns, injury or serious accident.



Do not sterilize any cracked or damaged glassware.

Damaged glassware may explode or burst when it is removed from the chamber, thereby causing burns, injury or serious accident.

WARNING



Make sure that holes inside the chamber are not blocked by articles to be sterilized.

If the vent hole is blocked by such items as sterilization bags, the chamber pressure cannot be controlled, thereby causing serious accident such as explosion of the chamber. Make sure that articles to be sterilized are placed in a container, such as a basket provided with the FLS-1000 to prevent the vent hole and its surrounding area from being blocked.



Stop operation immediately when the pressure gauge pointer is over the red line.

Otherwise, parts can be damaged and broken parts may scatter, resulting in burns, injury or serious accident. In this case, stop operation immediately and contact your dealer or our local representative.



Use special caution when handling the articles to be sterilized that may be very hot after the operation.

Handling hot articles can cause burns.



Use special caution when handling the hot liquid that may suddenly boil over.

The sterilized liquid inside the chamber is cooled down slowly than the chamber and may boil over suddenly on any shocks. This bumping may cause burns or unexpected accident.



Do not leave any contamination inside the chamber or in the sterilizing water.

Failure to do so may cause corrosion or damage on the chamber. It may also cause malfunction of the water level sensor, which may hamper the empty heating prevention function, resulting in fire.



Be sure to unplug the FLS-1000 before performing maintenance procedures.

Failure to do so may cause electric shock. For models with no power plug provided, the power circuit breaker to which the power plug is connected should be turned off.



Do not operate the FLS-1000 if any corrosion, damage, deformation or loose connections are found on its chamber, chamber lid, hinges, hinge shafts, retaining rings, lid hooks, or lid hook catches.

Otherwise, explosion may occur while the pressure rises, resulting in death, injury or serious accident. If any abnormality is found, please contact your dealer or our local representative.



Do not operate the FLS-1000 if any crack, deformation or damage is found on its chamber lid gasket.

Otherwise, steam leak may occur, resulting in burns. If any abnormality is found, please contact your dealer or our local representative.



Do not operate the FLS-1000 if the chamber lid handle is deformed or damaged.

Failure to do so may cause burns or injury. If any abnormality is found, please contact your dealer or our local representative.



After replacing the chamber lid gasket, be sure to make a test run.

If the chamber lid gasket is not installed properly, steam may leak and cause burns.



Unplug and inspect the power plug regularly.

Failure to do so may cause fire or burnout.



Do not attempt to open the drain cock unless the pressure gauge reads 0MPa.

If the drain cock is opened when pressure still remains in the chamber, hot water may spurt out, causing death, injury or serious accident.

WARNING



When returning FLS-1000 or any parts of FLS-1000 for replacement or repair, FLS-1000 or the parts must be appropriately decontaminated before shipping it in any of the following cases:

- 1: In cases where FLS-1000 or any parts of FLS-1000 has been exposed to infectious and hazardous or radioactive substances.
- 2: In cases where FLS-1000 or any parts of FLS-1000 has any residue of blood or other chemicals and has been identified as hazardous.



When disposing or transferring FLS-1000 or its parts, FLS-1000 or the parts must be appropriately decontaminated before shipping it in any of the following cases:

- 1: In cases where FLS-1000 or any parts of FLS-1000 has been exposed to infectious and hazardous or radioactive substances.
- 2: In cases where FLS-1000 or any parts of FLS-1000 has any residue of blood or other chemicals and has been identified as hazardous.

CAUTION



Do not place hands on the top plate.

Otherwise, fingers or hands may get caught in the chamber lid, resulting in injury.



Be careful of steam coming out of the steam exhaust vent and its surrounding area during the operation.

Hot steam may cause burns.



Allow sterilizing water to cool down sufficiently before draining water from the chamber.

Water in the chamber or the exhaust tank may be very hot after the operation, causing burns.



Allow chamber to cool down sufficiently before performing maintenance work.

Otherwise, high temperature inside the chamber may cause burns.



Do not attempt to touch the exhaust tank during the operation.

Failure to do so may cause burns.



Do not put hands into the top edge of the rear panel.

Otherwise, fingers or hands may get caught in the hinge area of the lid, resulting in injury.



Make sure that there is no foreign material in and around the lid gasket.

Otherwise, steam leak may occur, resulting in burns. If any abnormality is found, please contact your dealer or our local representative.



Keep away from the FLS-1000 while it is in operation.

Failure to do so may cause burns. Please keep at least 50 cm away from all four corners of the FLS-1000 while it is in operation.



Do not attempt to touch the outer panel of the FLS-1000 during or immediately after the operation.

Failure to do so may cause burns.



Be careful of the chamber or its surrounding area after the operation because it is very hot.

Failure to do so may cause burns.

2. GENERAL INFORMATION

Autoclave or “High Pressure Steam Sterilizer” is an apparatus used to sterilize articles by subjecting them to saturated steam under pressure above atmospheric pressure.

2-1. Operating Principles

When the FLS-1000 starts operation, sterilizing water inside the chamber is heated up by the element heater at the bottom of the chamber to generate steam.

The steam generated from heated water drives air out from the chamber and warms up the interior of the chamber. When the temperature sensor inside the chamber detects that the set sterilization temperature is reached, the set temperature is maintained for the set period of time. The air remained inside the chamber is removed during this process. When the set time has elapsed, the valve closes to start heating.

When the temperature sensor detects that the set temperature is reached, the timer starts to maintain the set temperature. When the set sterilizing time has elapsed, the heater stops. The sterilizing action is determined by the three elements: temperature, humidity and time that are applied to articles to be sterilized during this process of the sterilization cycle.

When the chamber temperature drops, the valve opens to allow the pressure inside the chamber to fall back to the atmospheric level. When the temperature sensor detects that the chamber temperature falls to the set value for the lid interlock release temperature, the buzzer sounds and the indicator turns on to indicate that the operation is completed.

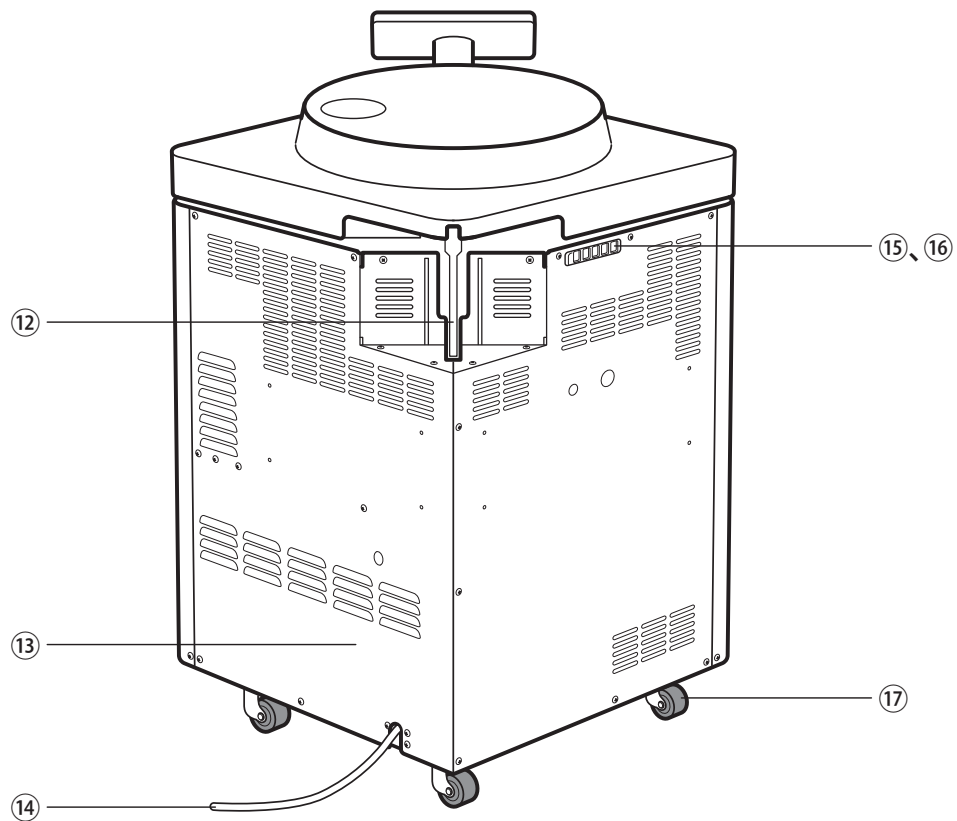
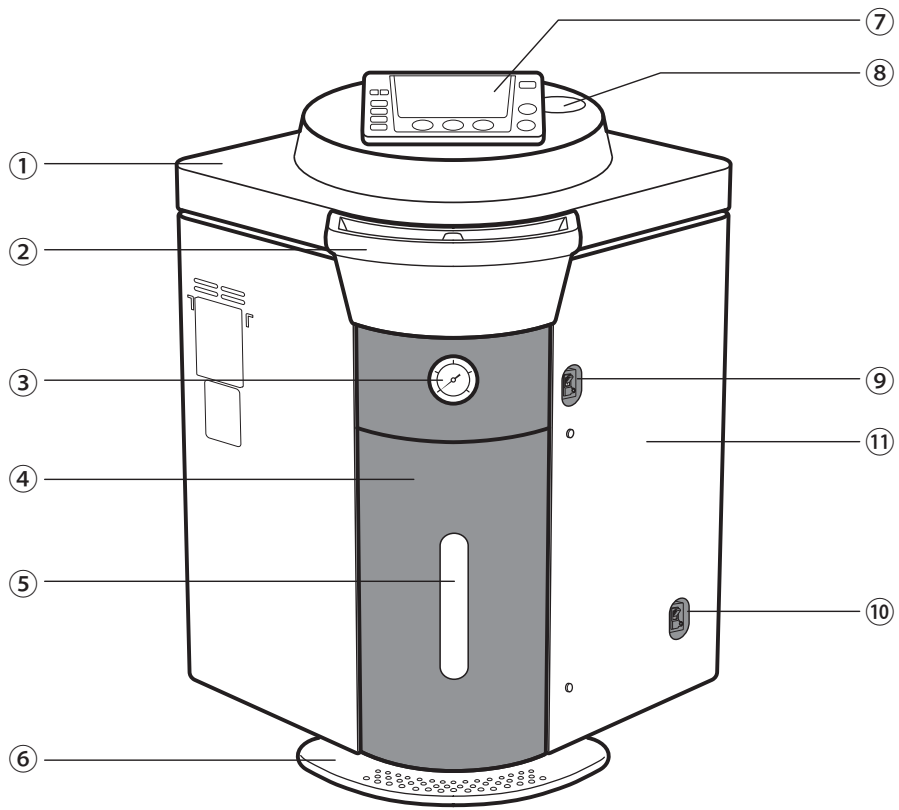
If any abnormality occurs during the operation, the FLS-1000 enters safe mode, the display shows an error code and the buzzer sounds.

During the sterilization process the temperature is maintained within $+2^{\circ}\text{C}$ of the set temperature. When the temperature drops below the set value, the timer countdown stops. When the temperature exceeds the set value, the timer countdown starts again.

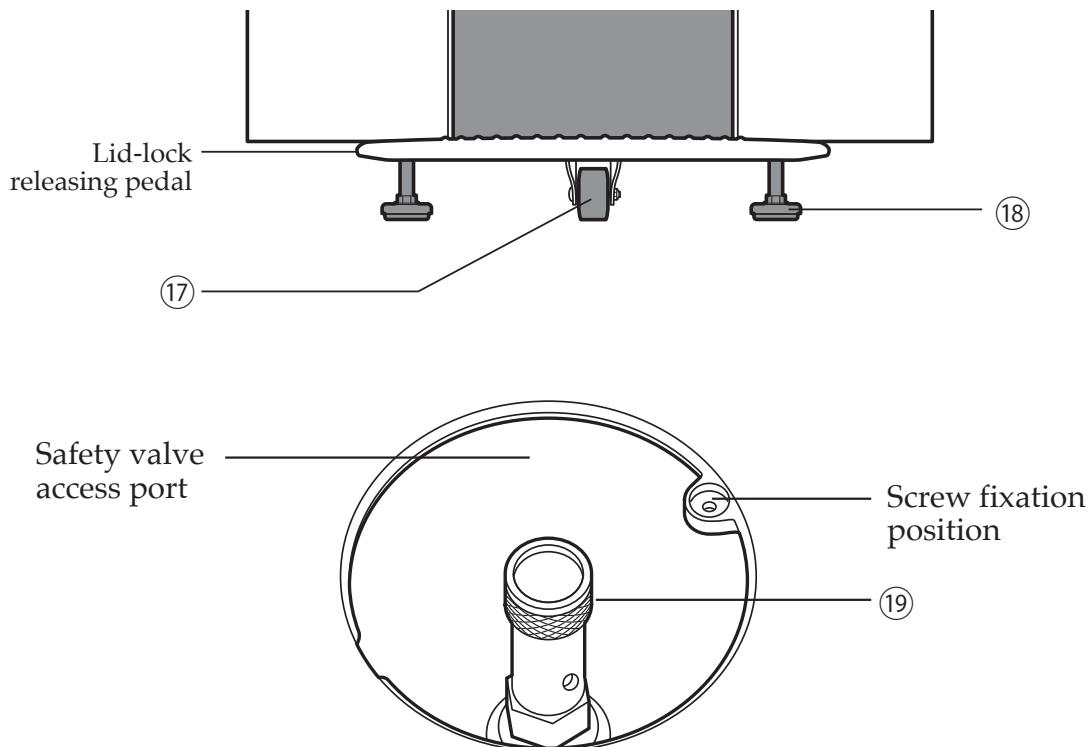
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2-2. Parts Identifications

<FLS-1000 Main Unit>



- ① **Chamber lid**
It comprises an internal chamber lid, a lid handle and an outer covering including a control panel. Open or close this lid to place or remove articles to be sterilized.
- ② **Chamber lid handle**
It is used to open or close the chamber lid
- ③ **Pressure gauge**
It displays the pressure reading inside the chamber.
<Pressure display range>
0 ~ 0.4 MPa
- ④ **Drain access cover**
Door for access to the drain outlet.
- ⑤ **Exhaust tank**
Steam exhausted from the chamber is collected into this exhaust tank. When the water level in the exhaust tank is between adequate levels, it turns on blue. If the water level is over maximum level, it turns on red. It stays turned on blue during the operation regardless of the water level.
- ⑥ **Lid-lock releasing pedal**
It releases the lock of the chamber lid.
- ⑦ **Control panel**
It is used to set or select settings.
- ⑧ **Safety valve access port**
This opening/closing cover provides access to the safety valve for inspection.
- ⑨ **Power supply switch**
It is used to turn on or off the power to FLS-1000.
- ⑩ **Leakage breaker**
It is a safety device and kept on during normal operation.
- ⑪ **Accessory case mounting hole**
It is provided to mount the accessory case for storing the operator's manual.
- ⑫ **Main nameplate**
- ⑬ **Product Label**
- ⑭ **Power cord**
- ⑮ **Steam exhaust vent**
The steam is discharged from this vent after it passes through the exhaust tank and trap bottle.
- ⑯ **Trap bottle**
Exhaust steam is trapped in this bottle.
- ⑰ **Caster**
One fixed caster is mounted in the corner on the side where the chamber lid handle is attached, and three swivel casters in other three corners.
- ⑱ **Level adjustment bolt**
This bolt is mounted in both sides of the lid-lock releasing pedal. It is used to fix FLS-1000 in the horizontal position.
- ⑲ **Safety valve**
This valve is provided to relieve excess pressure in the chamber.



⑳ Top plate

㉑ Lid hook

It locks the chamber lid in the closed position.

㉒ Lid hook boot

㉓ Lid interlock switch

It activates the lid interlock.

㉔ Lid hook catch

㉕ Chamber lid

㉖ Chamber lid gasket

It maintains air-tightness of the pressure vessel.

㉗ Lid fixing nut

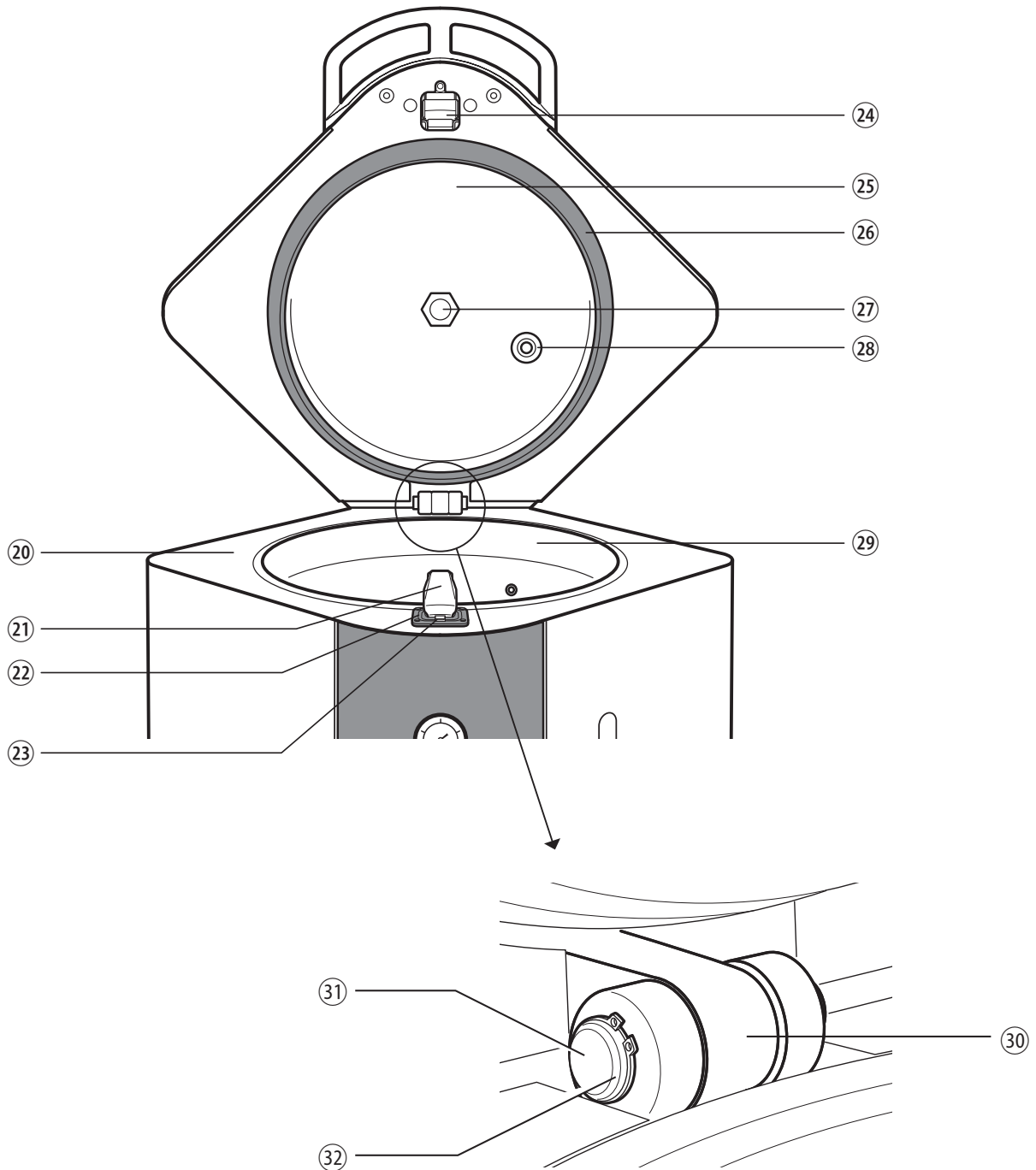
㉘ Safety valve hole

㉙ Chamber

㉚ Hinge

㉛ Hinge shaft

㉜ Retaining ring



③③ **Magnetic catch**

③④ **Exhaust tank water level sensor**

It detects the water level of the exhaust tank.

③⑤ **Exhaust tank**

Air and steam exhausted from the chamber is collected into this exhaust tank.

③⑥ **Exhaust tank drain hose cap**

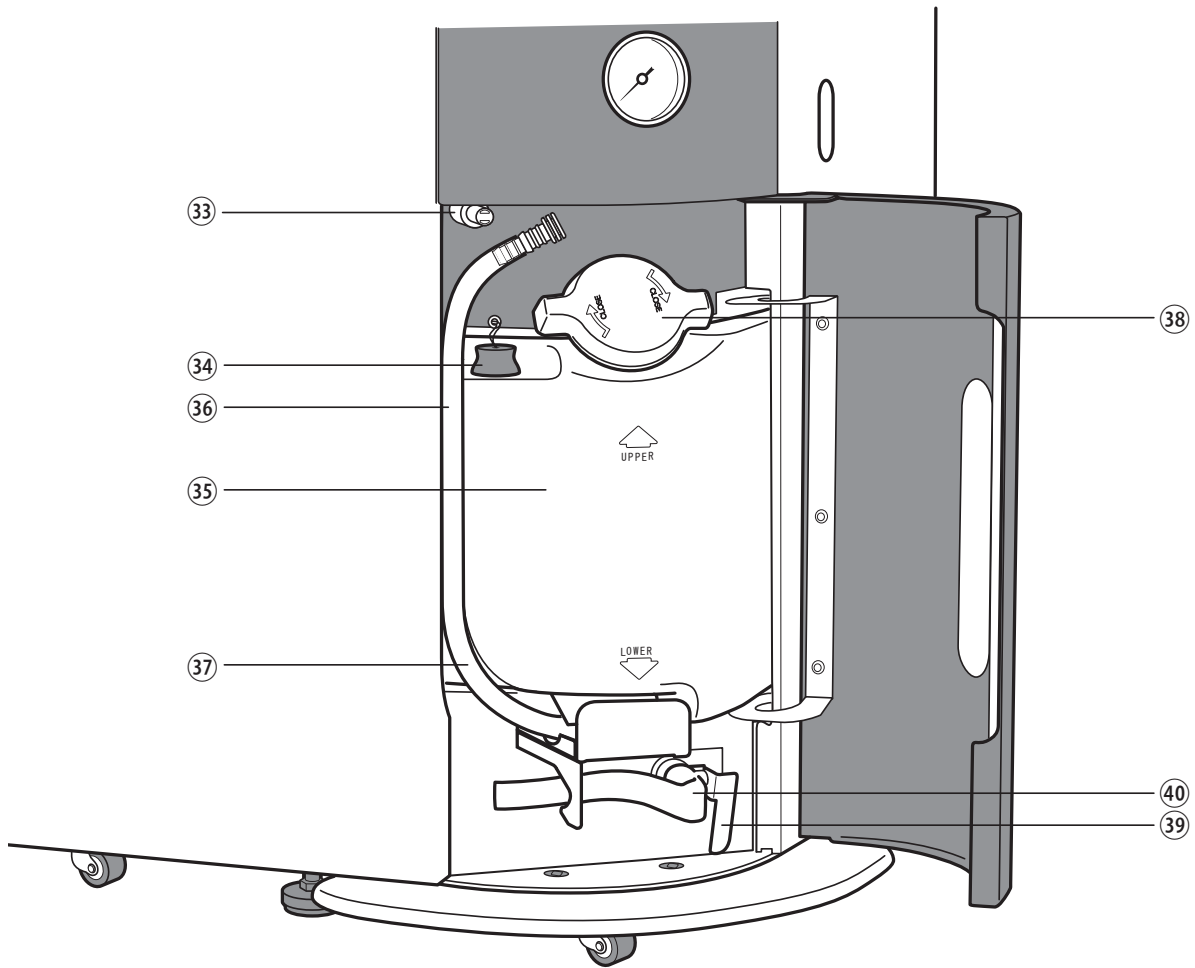
③⑦ **Drain hose for exhaust tank**

It allows water to drain from the exhaust tank.

③⑧ **Exhaust tank cap**

③⑨ **Drain cock**

④① **Drain hose for chamber**



<Chamber Interior>

① **Access port**

The temperature sensor for articles to be sterilized or the external temperature sensor can be installed into the chamber through this port.

② **Temperature sensor**

It detects the temperature inside the chamber.

③ **Heating element (heater)**

It heats the sterilizing water.

④ **Vent hole**

Air is discharged from the chamber through this hole. The hole leads to the exhaust tank, the trap bottle, and the steam exhaust vent.

⑤ **Water level sensor**

It detects the level of sterilizing water in the bottom of the chamber.

⑥ **Drain hole**

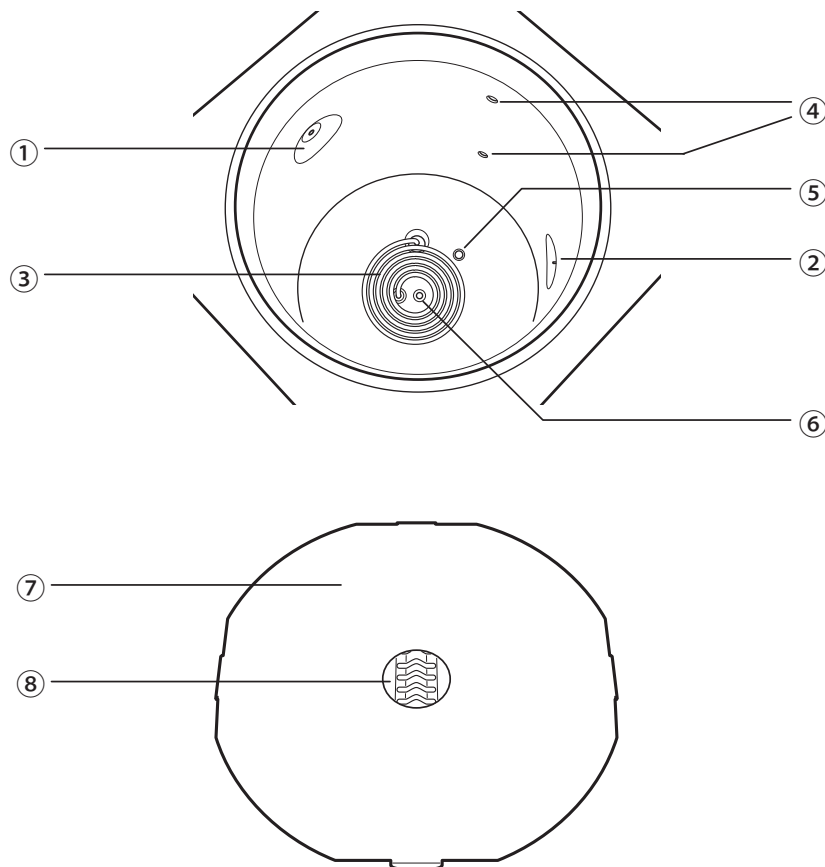
Sterilizing water in the chamber is drained through this hole. The hole leads to the drain port.

⑦ **Chamber bottom plate**

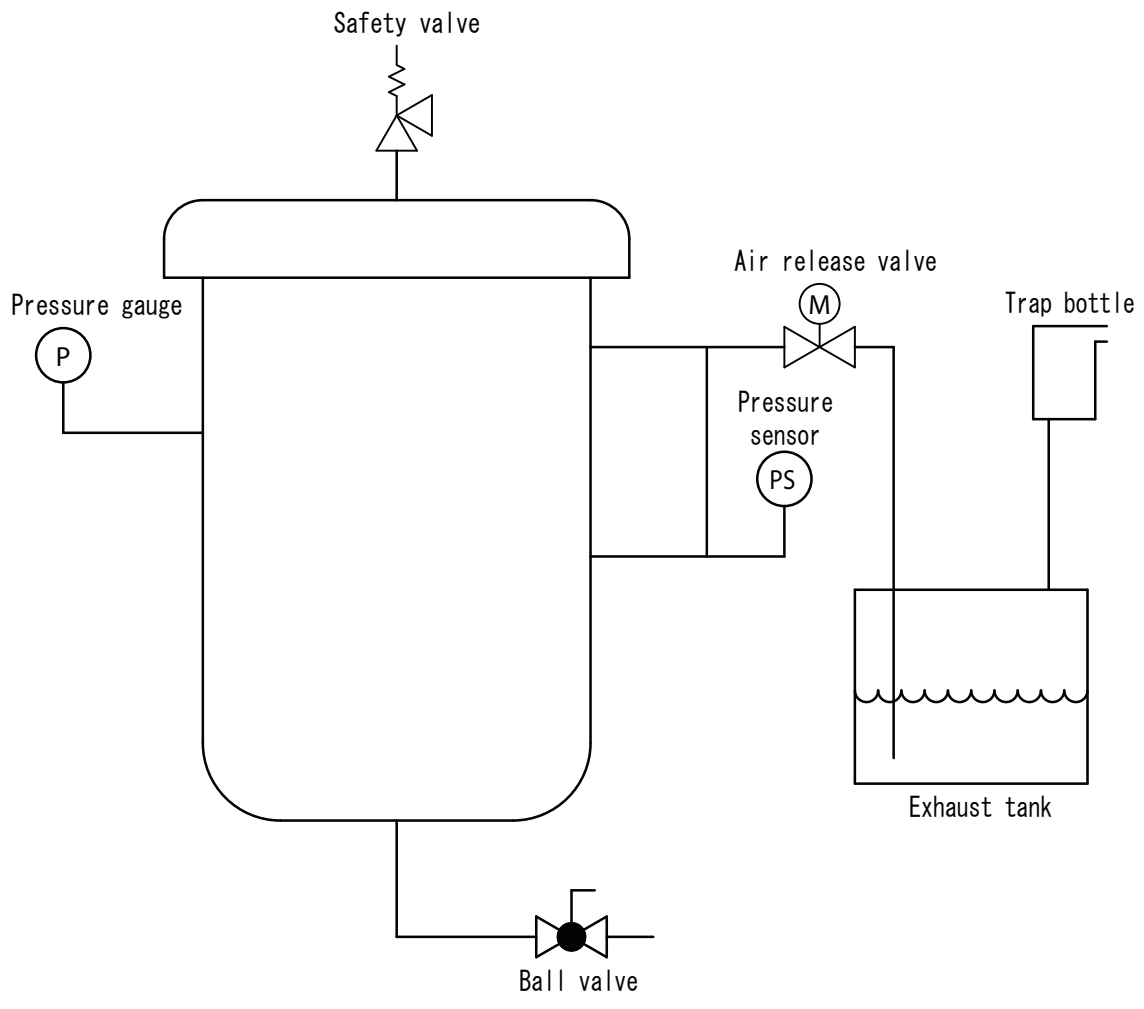
It is provided to prevent articles to be sterilized from contacting with a heater at the bottom of the chamber.

⑧ **Water level indicator**

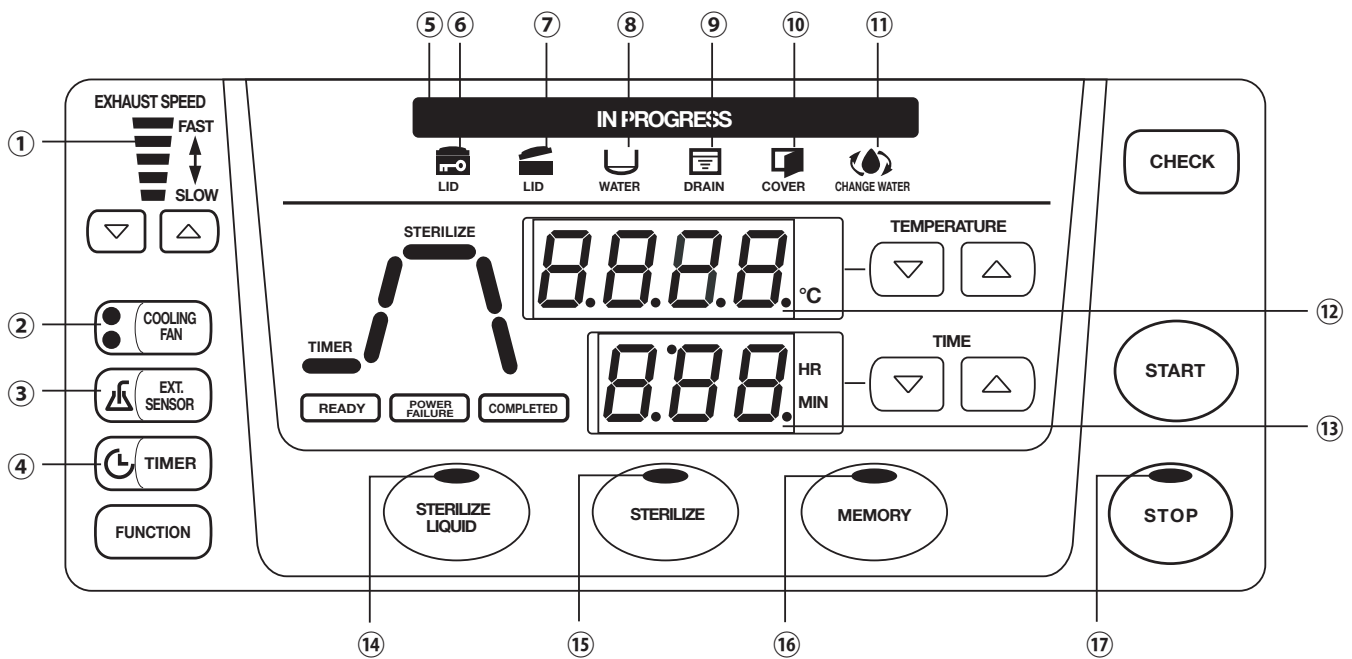
It is provided to check the water level in the chamber.



<Piping Diagram>

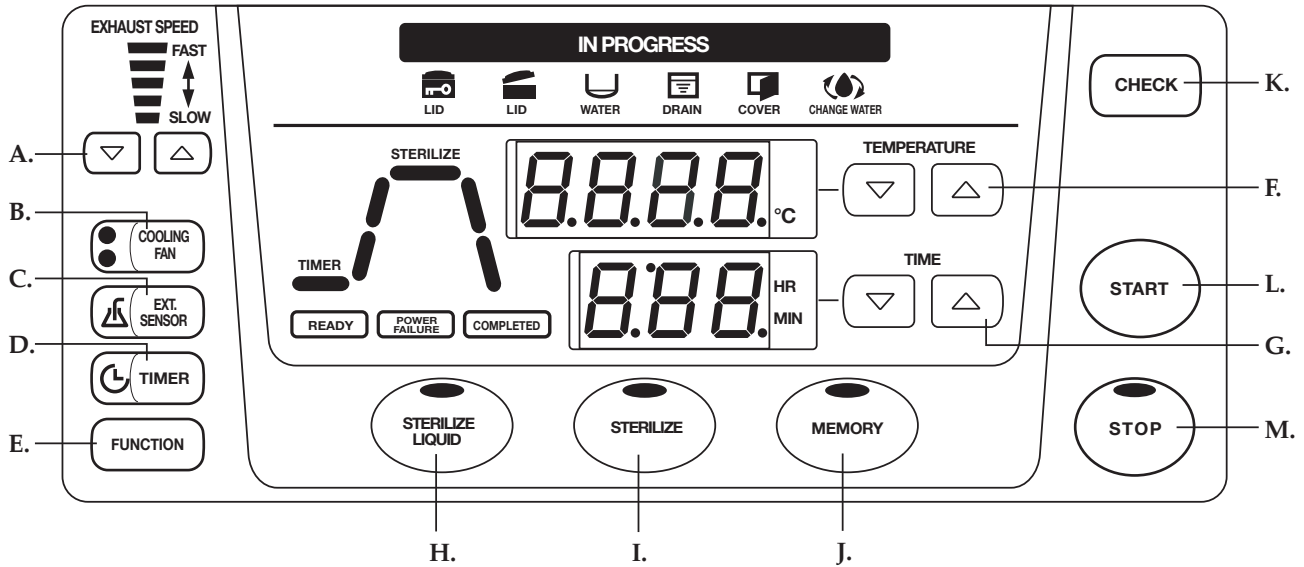


<Control Panel>



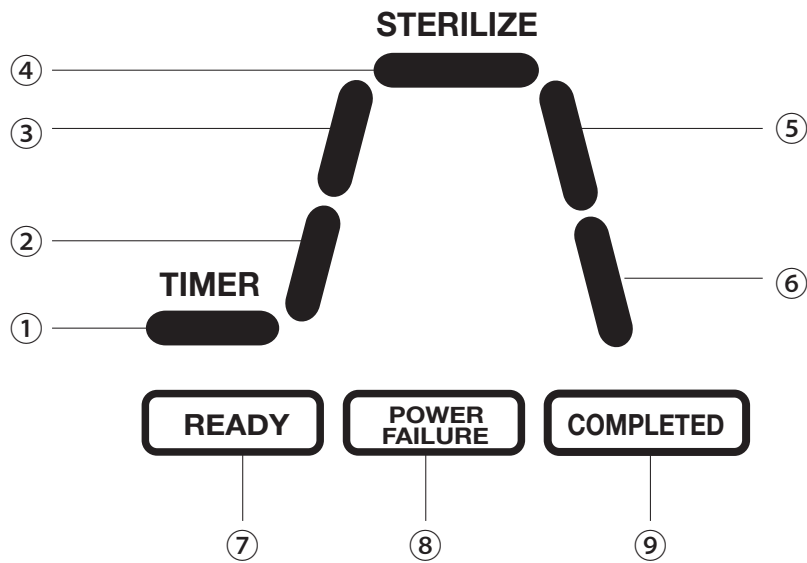
- ① **Exhaust speed level display**
The exhaust speed level during the temperature and pressure falling process is indicated by the number of turned on bars. As more bars are turned on, the exhaust valve opens wider and the exhaust speed increases. When it is not turned on, the exhaust valve is closed.
- ② **Cooling fan display**
It displays the setting of the cooling fan to cool down the chamber during the temperature and pressure falling process. The number of turned on indicators is equivalent to the number of fans that are operating.
- ③ **External temperature sensor indicator**
It is used when the external sensor for articles to be sterilized is connected.
- ④ **Timer indicator**
It turns on when timer is set.
- ⑤ **IN PROGRESS indicator**
It turns while the FLS-1000 is in operation. It lights up in red when the chamber pressure exceeds atmospheric pressure, and in yellow when it falls below atmospheric pressure.
- ⑥ **Lid interlocked indicator**
It turns on when the lid is closed and locked. The lid cannot be opened while it is on.
- ⑦ **Lid open indicator**
It turns on when the lid is opened or the lid opening/closing detection function does not detect the lid position. The FLS-1000 cannot be started while it is on.
- ⑧ **Low sterilizing water level indicator**
It turns on when the level of water inside the chamber is low. The FLS-1000 cannot be started while it is on.
- ⑨ **Drain indicator**
It turns on when the exhaust tank is full and must be drained. The FLS-1000 cannot be started while it is on.
- ⑩ **Drain access cover open indicator**
It turns on when the drain access cover at the front of the main body is opened. The FLS-1000 cannot be started while it is on.
- ⑪ **Sterilizing water change indicator**
It turns on when the water in the sterilization chamber should be replaced. Please refer to "6-10. Sterilizing Water Change Alert Function".
- ⑫ **Temperature display**
It indicates the set temperature for the sterilization course while the FLS-1000 is in standby mode, and the chamber temperature while it is in operation.
- ⑬ **Time display**
It indicates the set time for the sterilizing course while the FLS-1000 is in standby mode, and the remaining operation time of the course while it is in operation.
- ⑭ **STERILIZE LIQUID indicator**
It turns on when the liquid sterilization course is selected.
- ⑮ **STERILIZE indicator**
It turns on when the sterilization course is selected.
- ⑯ **MEMORY indicator**
It turns on when a preferred sterilization course stored in memory is selected. The indicator of the sterilization course selected for the preferred course lights up at the same time.
- ⑰ **STOP indicator**
It turns on when the stop key is pressed.

<Control Panel Keys>



- A. Exhaust speed level setting keys**
Press these up/down arrow keys to change the level of the exhaust speed. In the liquid sterilization course, the exhaust rate can only be changed during the temperature and pressure falling process.
- B. COOLING FAN key**
Press this key to change the cooling fan setting. In the liquid sterilization course, the setting can be changed during the temperature and pressure falling process.
- C. EXT. SENSOR key**
It is activated when the external sensor for articles to be sterilized is connected.
- D. TIMER key**
Press this key to select the timer setting and display or set the waiting time.
- E. FUNCTION key**
Press this key to display or set the useful function or the optional function.
- F. Temperature setting keys**
Press these up/down arrow keys to increase or decrease the set temperature for the sterilization cycle.
- G. Time setting keys**
Press these up/down arrow keys to increase or decrease the set time for the sterilization cycle.
- H. STERILIZE LIQUID key**
Press this key to select the liquid sterilization course while the FLS-1000 is in standby mode.
- I. STERILIZE key**
Press this key to select the sterilization course while the FLS-1000 is in standby mode.
- J. MEMORY key**
Press and hold down this key in standby mode to save the course setting currently displayed in memory. Press this key in standby mode to select a preferred course setting stored in memory.
- K. CHECK key**
Press this key in standby mode to display the current temperature. Press this key during an operation to display the set operating parameters.
- L. START key**
Press this key to start an operation.
- M. STOP key**
Press this key to stop an operation.

<Work Monitor>



- ① **Timer indicator**
It turns on when the timer setting is set. Please refer to "6-4. Timer Function".
- ② **Temperature rising process indicator**
It turns on to indicate that the temperature rising process is currently being performed.
- ③ **Temperature and pressure rising process indicator**
It turns on to indicate that the process of temperature and pressure rise is currently being performed.
- ④ **Sterilization process indicator**
It turns on to indicate that the sterilization process is currently being performed.
- ⑤ **Temperature and pressure falling process indicator**
It turns on to indicate that the process of temperature and pressure falling is currently being performed.
- ⑥ **Temperature falling process indicator**
It turns on to indicate that the temperature falling process is currently being performed.
- ⑦ **READY indicator**
It turns on to indicate that the FLS-1000 is ready for operation.
- ⑧ **POWER FAILURE indicator**
It turns on to indicate that a power failure occurs during an operation. Please refer to "6-5. Power Failure Alert Function".
- ⑨ **COMPLETED indicator**
It turns on to indicate that the sterilization cycle is completed normally. It begins to flash to indicate that the operation is completed normally and the lid can be opened. It stays on when the operation is completed normally and the chamber temperature drops below 60°C.

3. INSTALLATION

3-1. Moving and Installing the FLS-1000

⚠ WARNING



Do not install the FLS-1000 in a place where chemicals that are likely to generate flammable or corrosive gases or fumes are stored.

- Failure to do so may cause fire. Electric components can corrode and cause short circuit or electric shock.



Avoid installing the FLS-1000 in a place where there is a lot of dust or moisture.

- Failure to do so may cause short circuit of electric components or fire.



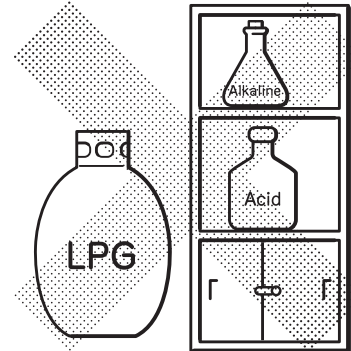
Avoid installing the FLS-1000 in or near a sink or tap where there is a risk of it being splashed with water.

- Failure to do so may cause short circuit or electric shock.



Install the FLS-1000 on a sturdy and level surface such as concrete floors that can support its weight.

- Failure to do so may cause FLS-1000 to fall over, thereby resulting in personal injury or physical damage.



<Installation Location>

- To install the FLS-1000 select a location in a room that is well ventilated and free of direct sunlight.
- Place the FLS-1000 onto a solid flat surface such as a concrete floor.
 - ※ Weight of the FLS-1000 : 108kg
- Avoid installing the FLS-1000 in a slippery place or a place which may be exposed to vibration.
- Considering the steam coming from steam exhaust vent and surrounding area, install FLS-1000 providing a clearance of at least 25cm at the rear and on each side of the unit.
- When operating the FLS-1000, the following environmental requirements should be met:

Ambient temperature range : 10 to 35°C

Atmospheric pressure range : 750 to 1060hPa

Relative humidity : less or equal to 75%

Altitude : below 2,000m

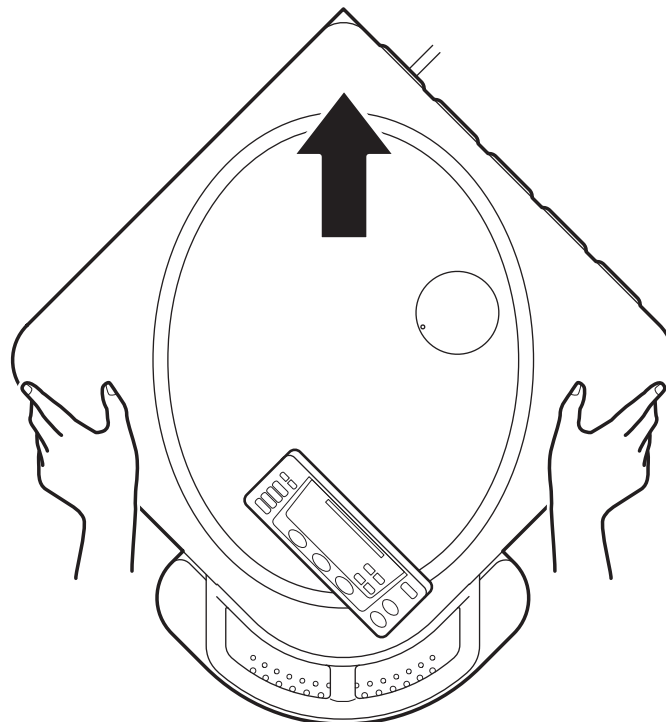
Maximum gradient : 2 degrees

Overvoltage category : Class II

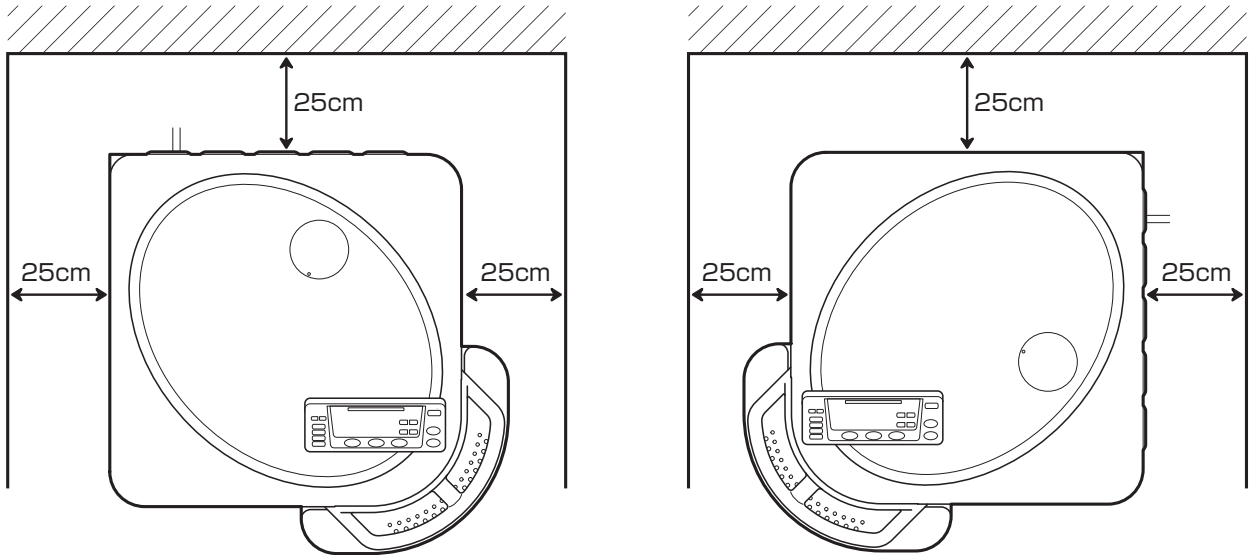
Pollution degree : 2

<To move and install the FLS-1000>

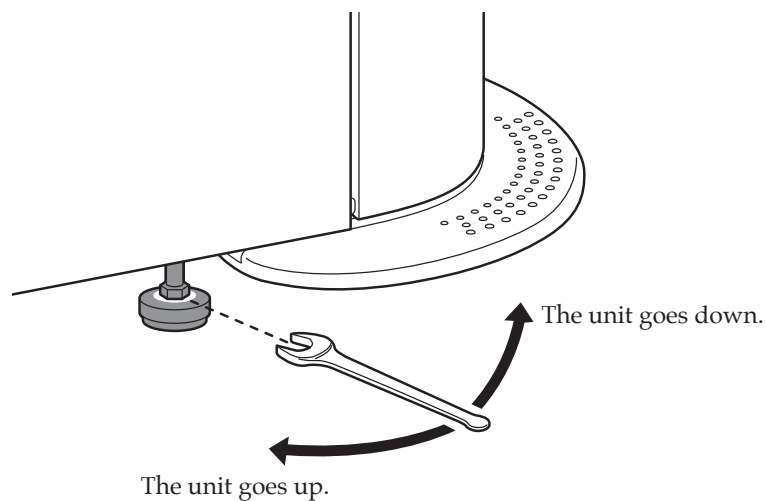
- ① To move the FLS-1000 hold the top of the unit on both sides of the chamber lid handle with both hands and carefully push it.
 - ※ Four casters are mounted in the four corners of the bottom of the FLS-1000. A caster in the corner where the chamber lid handle is attached on top is a fixed one, and casters on each of the other three corners are swivel ones.
 - ※ Never attempt to lift the FLS-1000 while it is being moved. This model is not designed to be lifted up.



- ② Place the FLS-1000 so that the chamber lid handle is located either on the front right side or the front left side of the unit. Choose either side and install the unit. Install the FLS-1000 providing a clearance of at least 25cm at the rear and on each side of the unit. Maintain sufficient space for access in front and above the unit.



- ③ Turn the level adjustment bolt located on either side of the lid-lock releasing pedal clockwise by hand until the rotation becomes difficult. Turn it an additional 90° (1/4 turn) with a spanner (19mm width) to fix it on the floor. Inspect for any possible shake or wobble by pushing the unit from all four corners.



- ④ The control panel can be moved either in the right or left direction so that it faces the front, allowing users easy access to the control panel. Hold the control panel with both hands and move it slowly.
- ⑤ Fix the clear plastic accessory case for storing the Operator's Manual to the outer panel of the unit with the mounting screws provided with the case. Screw holes are provided in two adjacent panels on the chamber lid handle side.
- ※ After reading the Operator's Manual, store it in the clear plastic accessory case for future reference.

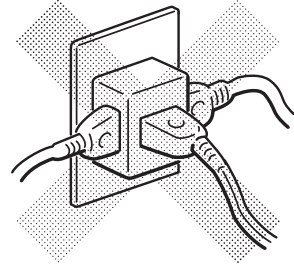
3-2. Connecting to the Power Source and Grounding

⚠ WARNING



Connect the FLS-1000 to a power outlet of the voltage specified as correct for FLS-1000. Do not connect it to a shared outlet.

- Failure to do so may cause accidental fire, short circuit or malfunction.



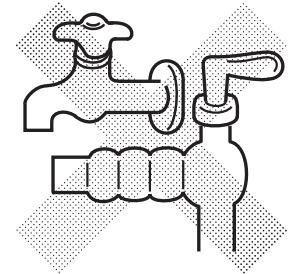
Do not use extension cords or power strips.

- Failure to do so may cause accidental fire, short circuit or malfunction.



Make sure that the FLS-1000 is properly grounded.

- Failure to do so may cause explosion, electric shock or malfunction.



Never ground the FLS-1000 through a water main or a gas pipe.

- Failure to do so may cause explosion, electric shock or malfunction.

To protect against electric shock adequate grounding of FLS-1000 must be provided. When it cannot be provided, arrange for a qualified electrician to carry out the necessary grounding work.

The FLS-1000 employs a plug with a two-pole grounding electrode. Plug the FLS-1000 into a two-pole socket outlet of the voltage specified as correct for FLS-1000.

※ For the power requirements of the FLS-1000 please refer to “11-1. Specifications of the FLS-1000”.

Plug the FLS-1000 directly into a power outlet of the specified voltage. Do not connect it to a shared outlet.

Leave sufficient space around the power outlet so that the plug can be easily unplugged.

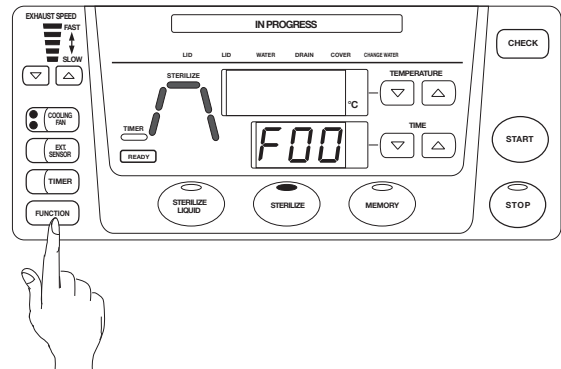
※ When hearing thunder, unplug the power plug from the outlet to prevent lightning damage.

3-3. Setting the Altitude Level

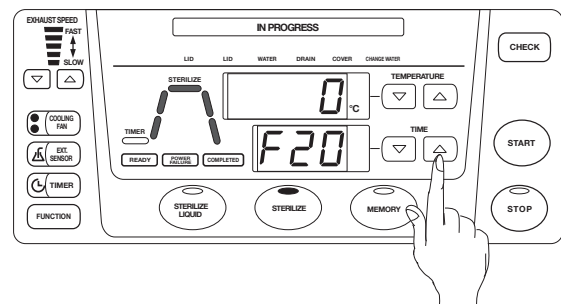
The FLS-1000 operates by generating steam under pressure and temperature. Therefore, its sterilization process can be greatly affected by the atmospheric pressure at the location where the FLS-1000 is installed. In order to ensure proper operation of the FLS-1000 please reset the altitude level if it is moved to another location.

<To set the altitude level>

- ① Press the FUNCTION key while the READY indicator is on. The time display flashes "F00".



- ② Press the time setting up and down arrow keys to show "F20" in the time display. The temperature display shows the altitude level code.



- ③ Press the START key. The temperature display starts to flash.
- ④ Press the temperature setting up and down arrow keys to display the altitude level code that corresponds to the location where the FLS-1000 is installed.

Table. Altitude level code and the corresponding altitude level and maximum setting sterilization and lid interlock releasing temperatures.

Altitude level code	Altitude level	Maximum setting sterilization temp.	Maximum lid interlock releasing temp.
0	Below 800m	123°C	100°C
1	Above 800m ~ below 1500m	122°C	97°C
2	Above 1500m ~ below 2000m	121°C	95°C

- ⑤ Press and hold down the START key. The buzzer will sound in approximately 4 seconds to indicate that the setting is finalized and the display will return to the normal.

4. OPERATIONAL FLOW

1. Turning on the power switch..... P.24
2. Checking the pressure gauge..... P.27
3. Checking the water level of the exhaust tank..... P.28
4. Checking the sterilizing water in the chamber..... P.30
5. Placing articles to be sterilized..... P.31
6. Setting operating parameters..... P.33
7. Starting operation..... P.35
8. Ending operation..... P.37
9. Removing articles to be sterilized..... P.38
10. Draining the sterilizing water from the chamber..... P.39
11. Turning off the power switch..... P.24

※ For repetitive operation, restart the operation with “2. Checking the pressure gauge” after performing “9. Removing articles to be sterilized” on the above operation flow.

5. OPERATION

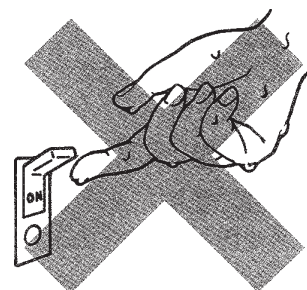
5-1. Turning On/Off the Power Switch

⚠ WARNING



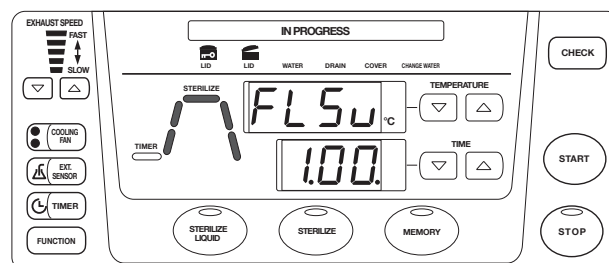
Do not touch the power switch with a wet hand.

- Failure to do so may cause electric shock.



<To turn on the power>

- ① Check that the power supply is correctly connected and the protective grounding is properly provided.
- ② To turn on the power, press the main power switch to the [I] "ON" position.
The control program version appears in the time display on the control panel.






- ③ Operating parameters of the previous operation will be displayed in approximately 10 seconds.

<To turn off the power>


- ① Press the power switch to the [O] "OFF" position.
※ Check that the IN PROGRESS indicator on the control panel turns off or the COMPLETED indicator in the work monitor display flashes.

5-2. Opening and Closing the Chamber Lid

WARNING

-  **Never attempt to open the lid until the chamber pressure returns to 0MPa.**
 - If the lid is opened while pressure remains in the chamber, articles to be sterilized or steam may gush out, thereby resulting in death or serious injury.
-  **Be extremely careful of steam coming out of the chamber when opening the chamber lid.**
 - Steam coming out of the chamber is very hot and can cause burns or injury.
-  **Avoid leaving any foreign materials between the chamber lid gasket and the chamber.**
 - Failure to do so may cause steam leak, thereby resulting in burns.

CAUTION

-  **Do not place hands on the top plate.**
 - Otherwise, fingers or hands may get caught in the chamber lid, resulting in injury.

<To open the chamber lid>

- ① Check that the pressure gauge reads “0MPa”.
- ② Check that the power switch is at “ON” position.
- ③ Check that the IN PROGRESS indicator on the control panel turns off or the COMPLETED indicator in the work monitor display flashes.
- ④ Step on the lid-lock releasing pedal.
- ⑤ Pull up the lid gently by holding the chamber lid handle.



<To close the chamber lid>

- ① Pull the lid down by holding the chamber lid handle.
- ② Place hands on the chamber lid handle and push it down until the lid open indicator turns off.
 - ※ When the power switch is turned on with the lid being closed, the lid open indicator turns on. Open and then close the lid to activate the lid open/close detection system.
 - ※ The chamber lid may not be closed easily when the chamber temperature is still high immediately or shortly after the operation. In such a case, allow the chamber to cool and then close the lid. Do not apply excessive force to the lid handle. Deformation or damage may be caused.

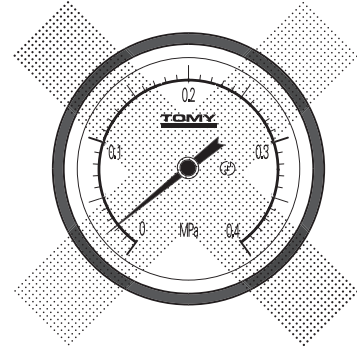
5-3. Checking the Pressure Gauge

⚠ WARNING



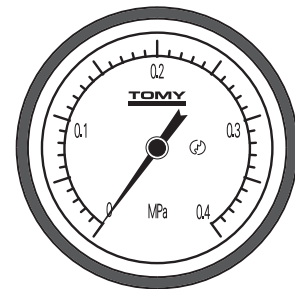
When the pressure gauge is not working properly, stop operation.

- Otherwise, abnormality inside the chamber, if any, cannot be found, thereby causing serious accident. If pressure gauge malfunction is suspected, please contact your dealer or our local representative.



<To check the pressure gauge>

- ① Open the chamber lid.
- ② Check that the pressure gauge reads "0MPa".



5-4. Checking the Water Level in the Exhaust Tank

⚠WARNING



Do not bend the exhaust hose.

- If exhaust venting is not carried out smoothly, the chamber pressure may become abnormally high, thereby causing damage to parts. Broken parts may scatter and cause burns, injury or serious accident.

⚠CAUTION



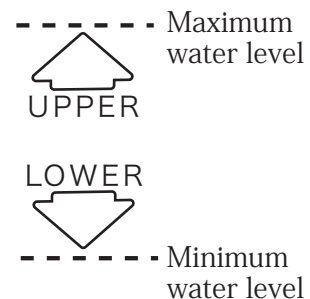
Allow sterilizing water to cool down sufficiently before draining water from the chamber.

- Water in the chamber or the exhaust tank may be very hot after the operation, causing burns.

The FLS-1000 discharges hot steam during the operation. To prevent accidents, such as burn injuries, the steam exhausted from the chamber is captured in the trap bottle after passing through the water in the exhaust tank. Check that the water level in the exhaust tank is between the maximum water level and the minimum water level.

<To check the water level in the exhaust tank>

- ① Visually check the water level in the exhaust tank by looking through a slit on the drain access cover. Pour water into the exhaust tank if the water level is lower than the minimum level. Drain the exhaust tank if the water level exceeds the maximum level.
※ For details on the illumination function, please refer to "6-11. Exhaust Tank Illumination Function".

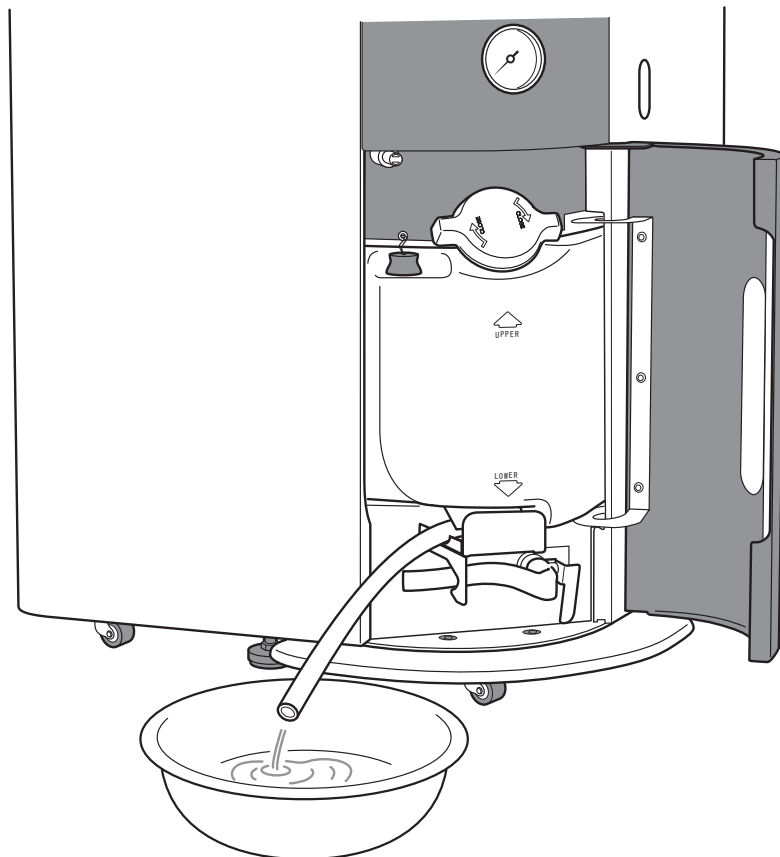


<To pour water into the exhaust tank>

- ① Check that the water inside the exhaust tank is cooled down.
- ② Open the drain access cover.
- ③ Remove the exhaust tank cap.
- ④ Pour water in the exhaust tank through the feed-water inlet until the water level exceeds the minimum water level.
- ⑤ Install the exhaust tank cap.
- ⑥ Close the drain access cover. Check the drain access cover open indicator turns off.

<To drain water from the exhaust tank>

- ① Check that the water inside the exhaust tank is cooled down.
- ② Open the drain access cover.
- ③ Remove the cap on the end of the drain hose.
- ④ Place the drain container on the floor and insert the free end of the drain hose into the container. The water will drain when the end of the hose is lower than the water level in the exhaust tank.
- ⑤ When the water level drops to an appropriate level, lift up the end of the hose.
- ⑥ Install the cap onto the end of the hose.
- ⑦ Insert the drain hose into the space on the left side of the exhaust tank.
- ⑧ Close the drain access cover. Check the drain access cover open indicator turns off.



5-5. Checking the Sterilizing Water in Chamber

The FLS-1000 generates steam by heating up the sterilizing water in the chamber, which has a heating element in its bottom. Check the quality and level of the sterilizing water inside the chamber to perform adequate sterilization.

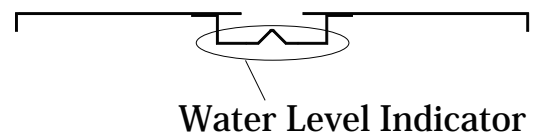
Use tap water as sterilizing water. When purified water or cold water is used, the water level sensor may not correctly detect the level of the sterilizing water in the chamber.

If tap water has inferior quality, purified water may be added to fill the chamber. In such a case, fill the chamber with purified water first until the water level indicator is covered in water and then, fill it with tap water until the low sterilizing water level indicator turns off.

Quality of tap water may vary widely, depending on location. Therefore, it is recommended that approximately 300mL of tap water per 3L of purified water be used as a guide.

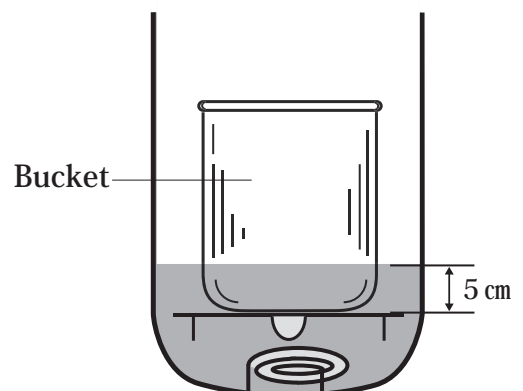
<To check the quality and amount of sterilizing water>

- ① Open the chamber lid and check that the sterilizing water in the chamber is not contaminated. Drain water from the chamber if the sterilizing water is contaminated.
 - ※ For drainage of water, please refer to “5-11. Draining the Sterilizing Water from the Chamber”.
- ② Check that the water level in the chamber is sufficient enough to cover the water level indicator. Add water to the chamber, if necessary, until the indicator is completely covered with water.
 - ※ The water level in the chamber should be maintained only barely higher than the surface of the water level indicator to prevent articles to be sterilized from getting wet.
 - ※ To sterilize the large amount of liquid in a bucket, fill the chamber with water until the bottom of the bucket is covered to approximately 5 cm.
- ③ Check the low sterilizing water level indicator turns off.



<Approximate indication of the amount of water in the chamber>

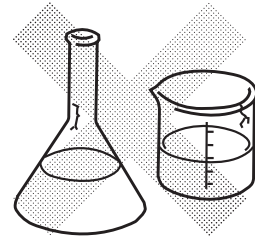
- Up to 5cm above the bottom of the bucket···approx. 6.7L
- Up to the chamber bottom plate ············ approx. 6.0L
- Up to the water level indicator ············ approx. 4.4L



5-6. Placing Articles to be Sterilized

⚠WARNING

- ⊘ **Do not use the FLS-1000 to sterilize flammable or explosive articles.**
 - Failure to do so may cause fire or explosion.
- ⊘ **Do not use the FLS-1000 to sterilize corrosive articles.**
 - Otherwise, the stainless steel chamber may corrode and explode or burst while pressure rises, thereby causing death, injury or serious accident.
- ⊘ **Do not use the FLS-1000 to sterilize sealed articles.**
 - Sealed articles may explode or burst when they are removed from the chamber, thereby causing burns, injury or serious accident. The chamber pressure may become abnormally high, thereby causing damage to parts. Broken parts may scatter and cause burns, injury or serious accident.
- ⊘ **Do not sterilize any cracked or damaged glassware.**
 - Damaged glassware may explode or burst when it is removed from the chamber, thereby causing burns, injury or serious accident.
- ⊘ **Make sure that holes inside the chamber are not blocked by articles to be sterilized.**
 - If the vent hole is blocked by such items as sterilization bags, the chamber pressure cannot be controlled, thereby causing serious accident such as explosion of the chamber. Make sure that articles to be sterilized are placed in a container, such as a basket provided with the FLS-1000, to prevent the vent hole and its surrounding area from being blocked.



<To place articles to be sterilized in the chamber>

- ① Place articles to be sterilized in the stainless steel basket provided or in an optional stainless steel bucket.
 - ※ Stainless steel buckets and baskets are available as optional containers.
 - ※ Make sure that the articles to be sterilized will not touch the chamber lid gasket or the temperature sensor when they are placed in the chamber. Otherwise, it may cause damage.
- ② Place articles to be sterilized carefully in the chamber.
 - ※ When loading the container with articles to be sterilized, make sure that the articles to be sterilized never exceeds the load line or the upper surface of the container. Otherwise, the articles to be sterilized may be damaged or broken when the chamber lid is closed.
- ③ Close the chamber lid.
- ④ Check the lid open indicator turns off.

<To perform effective sterilization>

- When the form of the article to be sterilized prevents air from escaping, the efficiency of sterilization may be reduced by the residual air. It is, therefore, recommended that the following actions should be taken before performing sterilization:
 - When using a sterilizing bag, fill it with approximately 100mL of water and leave it open as widely as possible.
 - When using a container, fill it with a small amount of water (approximately 10 to 50mL).
 - Make sure that the load does not exceed 50% of the chamber capacity.
- If the container with poor penetration is sterilized, it may be deformed or the efficiency of sterilization may be decreased. It is, therefore, recommended that the following actions should be taken before performing sterilization:
 - Remove or loosen the lid of container before sterilization.
 - Replace the cap with a highly breathable or porous one.
- When plastic articles are sterilized, they may be deformed. It is, therefore, recommended that sterilization should be performed referring to the table given below.



Table. Sterilization adaptability in the plastic articles to be sterilized

Adaptability	Polyethylene	Polypropylene co polymer	Polypropylene	Polycarbonate	Tefron FEP
Autoclave	Not allowed	Allowed (121°C)	Allowed (121°C)	Caution needed	Allowed (121°C)
Water absorption ratio (%)	0.02 or less	0.02 or less	0.03 or less	Approx. 0.3	0.01 or less
Transparency	Opaque	Translucence	Translucence	Transparence	Translucence

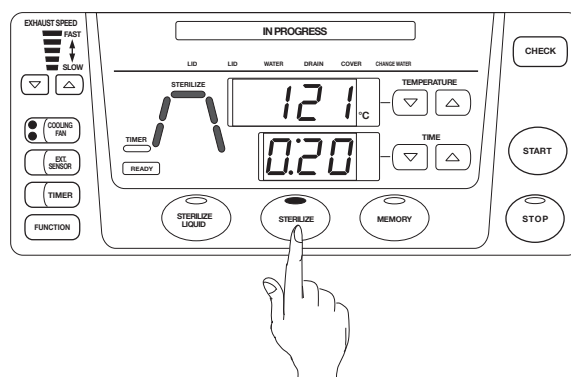
※ The above table should be referred as a guide. Please note that the characteristics of the material may change with operating parameters, including pressure, temperature and time.

5-7. Setting Operating Parameters

<To set the sterilization operating parameters>

- ① Press the STERILIZE key.

The STERILIZE indicator lights up to indicate that the sterilization course is selected, while all process indicators on the work monitor light up green.



- ② Press the temperature setting up and down arrow keys to set the temperature for the sterilization process.

- ③ Press the time setting up and down arrow keys to set the time for the sterilization process.

- ④ Press the exhaust speed level setting up and down arrow keys to set the exhaust level for the temperature and pressure falling process.

- ⑤ Press the cooling fan setting key to select the number of fans which operate during the temperature and pressure falling and temperature falling processes.

Table. Altitude level code and the corresponding altitude level, temperature and time setting ranges in sterilization process

Altitude level code	Altitude level	Sterilization process	
		Temp. setting range	Time setting range
0	Below 800m	105 ~ 123°C	0 : 01 ~ 9 : 59 (switchable: ~ 99 hours)
1	Above 800m ~ below 1500m	105 ~ 122°C	
2	Above 1500m ~ below 2000m	105 ~ 121°C	

※ To change the time display format, refer to “6-7. Setting the Time Display Format”.

※ The upper limit of the temperature setting range varies depending on the altitude level selected at the time of installation of the autoclave.

<To perform effective sterilization>

- The FLS-1000 controls the temperature using the temperature detected by the temperature sensor in the chamber as an index. When more reliable sterilization is required, set the appropriate conditions for sterilization using an external temperature sensor for articles to be sterilized or a sterilization index body.
- When sterilizing a large amount of liquid, it will take a longer time to raise the temperature for articles to be sterilized. Therefore, it is recommended that the operating time should be extended referring to the following figure:

Extended sterilization time for liquid sterilization (reference example: sterilization for 20 minutes at 121°C)

0.5L of water in a container(for 20 minutes) + 12 minutes
1L of water in a container(for 20 minutes) + 17 minutes
2L of water in a container(for 20 minutes) + 28 minutes
5L of water in a container(for 20 minutes) + 38 minutes
10L of water in a container(for 20 minutes) + 67 minutes

5-8. Starting Operation

WARNING



Stop operation immediately when the pressure gauge pointer is over the red line.

- Otherwise, parts can be damaged and broken parts may scatter, resulting in burns, injury or serious accident. In this case, stop operation immediately and contact your dealer or our local representative.

CAUTION



Keep away from the FLS-1000 while it is in operation.

- Failure to do so may cause burns. Please keep at least 50 cm away from all four corners of the autoclave while it is in operation.



Do not attempt to touch the outer panel of the FLS-1000 during or immediately after the operation.

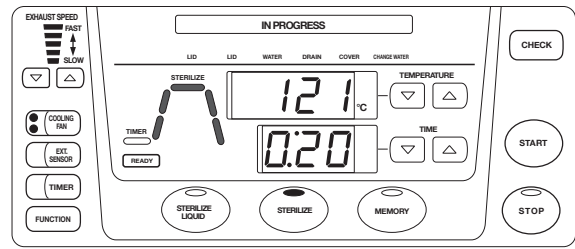
- Failure to do so may cause burns.



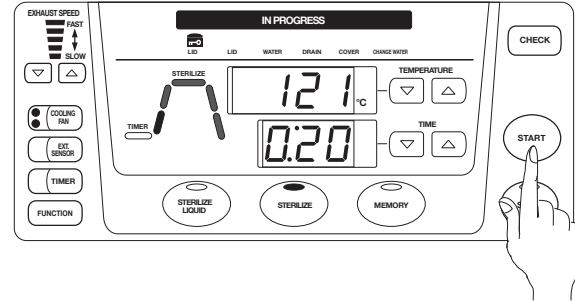
Be careful of steam coming out of the steam exhaust vent and its surrounding area during the operation.

- Hot steam may cause burns.

① Check that the READY indicator is on. If it is off, follow the instructions stated in the table on the next page to turn the READY indicator on.



② Press the START key.
The autoclave will start an operation in a few seconds after performing the checking of the safety system.



For details on the indicator and buzzer, please refer to “Operation of the indicator and buzzer in each process of the sterilization cycle” stated in the table on the next page.

- ※ To temporarily suspend operation, press the stop key during the operation.
- ※ If an error occurs during the operation, the indicator of the current operating process on the work monitor continues to flash red.
- ※ If a power failure occurs during the operation, the POWER FAIL indicator lights up.

Table. Cause and remedy when the READY indicator does not turn on

Cause	Remedy
Lid open indicator is on.	Check the opening/closing of the lid and then close the lid completely again.
Low sterilizing water level indicator is on.	Fill the chamber with water.
Drain indicator is on.	Drain the exhaust tank.
Drain access cover open indicator is on.	Close the drain access cover.
Sterilizing water change indicator is on.	Drain and pour water into the chamber.

※ While the lid open, low sterilizing water level, drain, drain access cover open or sterilizing water change indicator is on, the READY indicator does not turn on.

Table. Operation of the indicator and buzzer in each process of the sterilization cycle

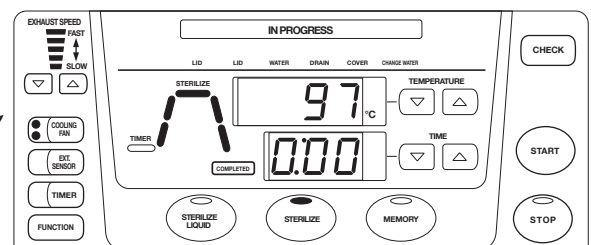
Process status	"IN PROGRESS" indicator	Operation completed "COMPLETED" indicator	Lid interlocked indicator	Buzzer
Preparation completed	Off	Off	Off	
Operation started	↓	↓	↓	One beep
Temperature rising process	Yellow on	Off	On	One beep
Temperature and pressure rising process	Red on	Off	On	
Sterilization process	Red on	Off	On	
Temperature and pressure falling process	Red on	Off	On	3 beeps
Temperature falling process	Yellow on	Off	On	
Lid interlock release temperature reached (Operation completed)	Yellow on	Flashes (normal) Off (abnormal)	Off	6 beeps
60°C reached	Off	On (normal) Off (abnormal)	Off	10 beeps

- ※ If a system error or a power failure occurs during the operation, the autoclave does not flash or light the COMPLETED indicator by deciding it as being an abnormal state. It does not flash or light the COMPLETED indicator when the operation is temporarily suspended by pressing the stop key during the operation.
- ※ If the autoclave detects an error in the system, a power failure, or temporarily suspension of the operation, it will show an error code in the temperature display, or turn on the POWER FAILURE indicator or the stop indicator.

5-9. Ending Operation





When the chamber temperature reaches the lid interlock release temperature, the sterilization cycle is completed and the lid can be opened. Do not attempt to open the lid unless the chamber temperature drops to 60°C. Otherwise, explosive boiling of water may occur immediately or shortly after the operation, causing burns.

- ① When the operation ends, the IN PROGRESS indicator turns off. If the sterilization process is performed successfully according to the set program, the COMPLETED indicator will flash or turn on after the operation is completed. For operation of the indicator and buzzer in each process of the sterilization cycle, refer to the table shown previously.




5-10. Removing Articles to be Sterilized

⚠WARNING

-  **Never attempt to open the lid until the chamber pressure returns to 0MPa.**
 - If the lid is opened while pressure remains in the chamber, articles to be sterilized or steam may gush out, thereby resulting in death or serious injury.
-  **Be extremely careful of steam coming out of the chamber when opening the chamber lid.**
 - Steam coming out of the chamber is very hot and can cause burns or injury.
-  **Use special caution when handling the hot liquid that may suddenly boil over.**
 - The sterilized liquid inside the chamber is cooled down slowly than the chamber and may boil over suddenly on any shocks. This bumping may cause burns or unexpected accident.
-  **Do not leave any contamination inside the chamber or in the sterilizing water.**
 - Failure to do so may cause corrosion or damage on the chamber. It may also cause malfunction of the water level sensor, which may hamper the empty heating prevention function, resulting in fire.

⚠CAUTION

-  **Be careful of the chamber or its surrounding area after the operation because it is very hot.**
 - Failure to do so may cause burns.

- ① Check that the gauge for pressure in the chamber reads “0MPa”.
- ② Check that the lid interlocked indicator is off.
- ③ Open the chamber lid.
- ④ Remove articles to be sterilized from the chamber.
 - ※ When removing articles to be sterilized, make sure that they do not touch the chamber lid gasket or the temperature sensor. It may cause damage.
- ⑤ Clean if the chamber interior or sterilization water is contaminated.
 - ※ Refer to “8. ROUTINE MAINTENANCE”.

5-11. Draining the Sterilizing Water from the Chamber

⚠WARNING



Do not attempt to open the drain cock unless the pressure gauge reads 0MPa.

- If the drain cock is opened when pressure still remains in the chamber, hot water may spurt out, causing death, injury or serious accident.

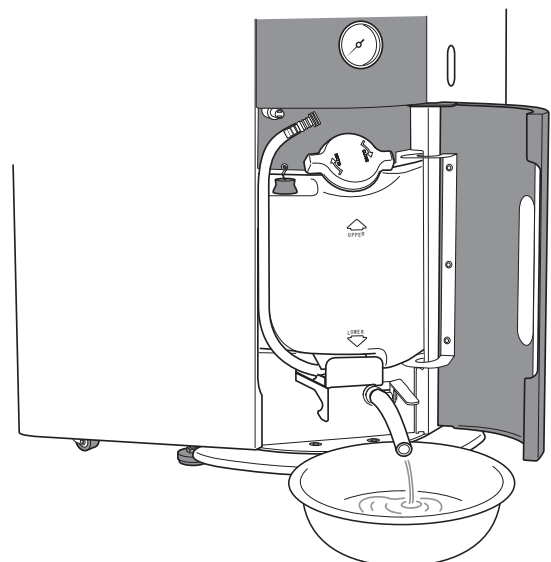
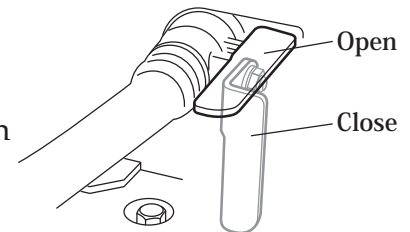
⚠CAUTION



Allow sterilizing water to cool down sufficiently before draining water from the chamber.

- Water in the chamber or the exhaust tank may be very hot after the operation, causing burns.

- ① Open the chamber lid.
- ② Open the drain access cover.
- ③ Pull out the drain hose.
- ④ Place the drain container underneath the drain hose.
- ⑤ Open the drain cock by rotating it slowly and drain the sterilizing water from the drain port. If the water drains very slow or does not drain, the port may be clogged. Clean the drain port with tools such as a wire to remove the clog.
- ⑥ After completely draining water from the chamber, close the drain cock.
- ⑦ Place the drain hose back to its original position.
- ⑧ Close the drain access cover.
- ⑨ Close the chamber lid.



6. USEFUL FUNCTIONS

6-1. Liquid Sterilization Function

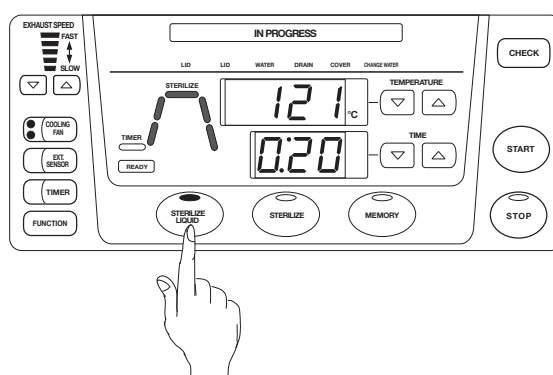
The FLS-1000 provides the liquid sterilization function which allows liquids to be sterilized. To avoid explosive boiling in the liquid sterilization course the setting of the exhaust speed and cooling fan can only be changed during the temperature and pressure falling process or temperature falling process.

<To set operating parameters for the liquid sterilization course>

Follow the procedures given below to set operating parameters.

- ① Press the STERILIZE LIQUID key.
The STERILIZE LIQUID indicator turns on to indicate that the liquid sterilization course is selected while all process indicators on the work monitor light up green.
- ② Press the temperature setting up and down arrow keys to set the temperature for the sterilization process.
- ③ Press the time setting up and down arrow keys to set the sterilization time for the sterilization process.

- ※ Parameters for the exhaust speed and cooling fan cannot be preset.
- ※ These parameters can only be set during the temperature and pressure falling process or temperature falling process.

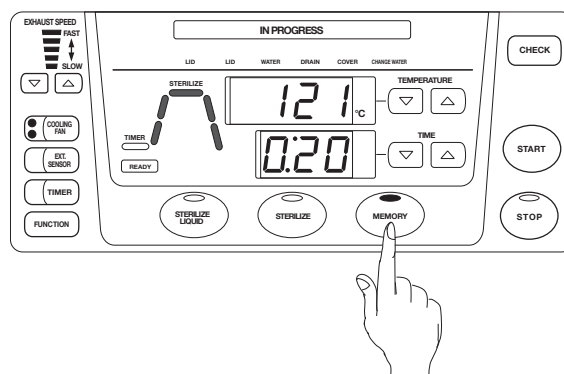


6-2. Memory Function

By using the memory function frequently used settings of operating parameters can be stored in memory and easily called up.

<To store preferred operating parameters>

- ① Set and display preferred operating parameters.
- ② Press and hold down the MEMORY key for approximately 2 seconds, the buzzer will sound to indicate that the preferred setting has been stored in memory.
 - ※ All parameters currently displayed are stored in memory.



<To call up preferred operating parameters>

- ① Press the MEMORY key.
 - The memory indicator turns on and the preferred setting of operating parameters is displayed.

6-3. Check Function

The check function allows operators to view the set temperature and time while the display shows the actual value of temperature. The display view can be toggled between set and actual values by using this function.

<To check set values for the temperature and time>

- ① Press and hold down the CHECK key while the IN PROGRESS indicator is on. Set values for the temperature and time are displayed while the key is pressed.

<To check actual value of the temperature>

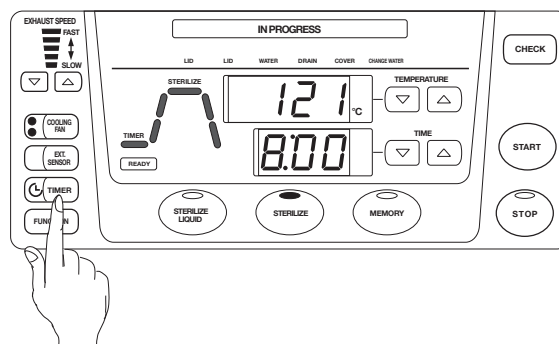
- ① Press and hold down the CHECK key while the IN PROGRESS indicator is off. Actual value of the temperature is displayed while the key is pressed.

6-4. Timer Function

The timer function allows the operator to set the waiting time for the operation to start. To set the timer follow the procedures given below after setting the desired operating parameters.

- ① Press the TIMER key.

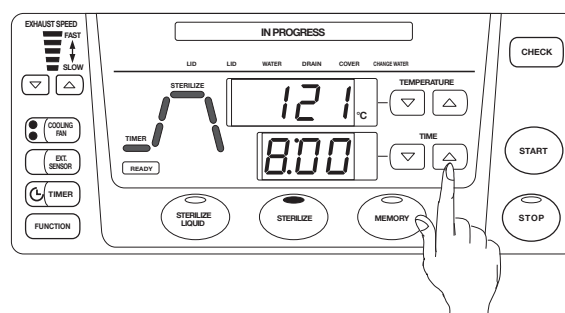
The timer indicator turns on and the time display shows the currently set value of the waiting time.



- ② Press the time setting up and down arrow keys to set a value of the waiting time while the timer indicator is on.

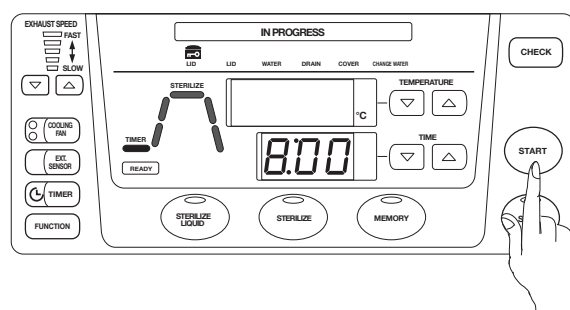
※ Timer setting range

0 : 01 ~ 9 : 59 , 10 ~ 99 hours



- ③ Press the START key while the timer indicator is on. The autoclave will enter into the timer mode in a few seconds after performing the checking of the safety system. The time display shows the waiting time until the autoclave starts an operation.

※ The operation can be interrupted by pressing the STOP key.

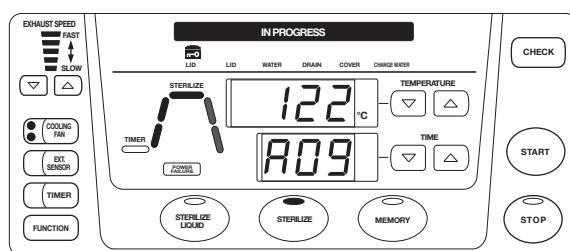


6-5. Power Failure Alert Function

If a power failure occurs or the autoclave is turned off at the power switch during operation, the POWER FAILURE indicator will turn on when the power is restored. If a power failure occurs before the sterilization process has completed, the time display will show the error code "A09" to indicate that the chamber is not heated when the power returns. Operation can be restarted while the error code "A09" is displayed. If a power failure occurs after the sterilization process has completed, the autoclave will operate the temperature and pressure falling process or the temperature falling process when the power returns.

<When the error code "A09" appears in the display>

- ① Check that the error code "A09" appears in the time display.
- ② Check the operation process of the sterilization cycle when a power failure occurred.
The process in operation when a power failure occurred flashes red on the work monitor.



- ③ Press the START key to restart operation.
Press the STOP key to stop operation.
 - ※ The cycle process to be resumed is determined based on the information recorded before interruption, and the data on temperature and pressure at the time of resumption of operation.
 - ※ The POWER FAILURE indicator turns off when the lid is opened next time.
 - ※ When the operation is restarted by this function, the COMPLETED indicator will not turn on after the operation is completed.

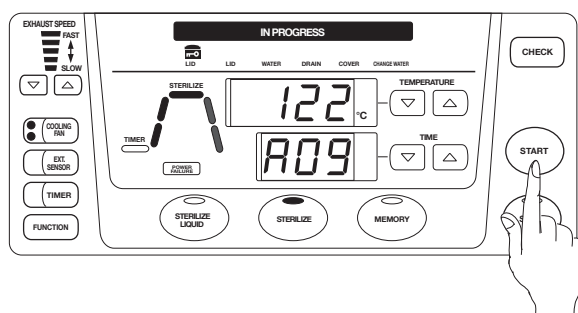


Table. Basis for determination of the sterilization cycle process to be resumed

Operation process at the time of interruption	Temperature and pressure at the time of resumption of operation	Process to be resumed
Sterilization	Temperature over the set sterilization temperature	Sterilization ※ 1
	Positive pressure and temperature lower than the set sterilization temperature	Temperature and pressure rise
	Negative pressure	Temperature rise
Temperature and pressure rise	Positive pressure	Temperature and pressure rise
	Negative pressure	Temperature rise
Temperature rise	-	Temperature rise
Temperature and pressure fall	Positive pressure	Temperature and pressure fall
	Negative pressure	Temperature fall
Temperature fall	-	Temperature fall

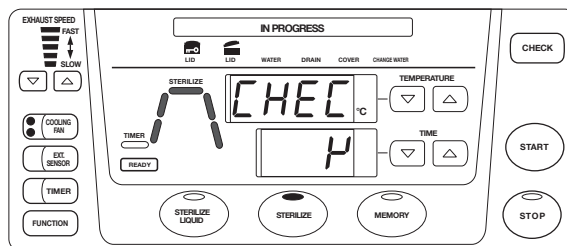
※ 1 After resumption the set sterilization time will be achieved regardless of the time already elapsed in the sterilization process when a power failure occurred.

6-6. Annual Inspection Reminder Function

Perform a voluntary inspection annually to ensure safe operation of the autoclave. The annual inspection reminder function will notify the operator of the timing for the annual inspection when it approaches.

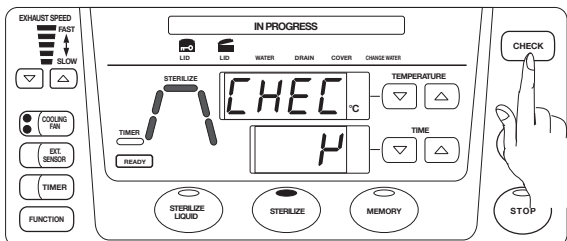
<When the reminder appears in the display>

① The reminder appears in the display as a due date approaches. When the autoclave is turned on, both the temperature and time displays will show "CHECK". It reminds the user 30 days before the due date, and on and after the day of the due date. Check the inspection record for the last inspection date and prepare for the inspection.



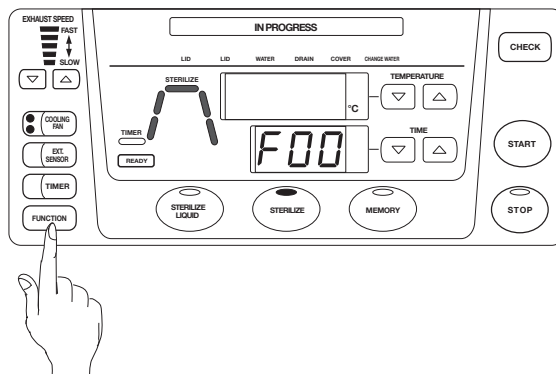
② The annual inspection reminder can be removed by pressing the CHECK key once.

③ When the annual inspection is performed, the date should be recorded.

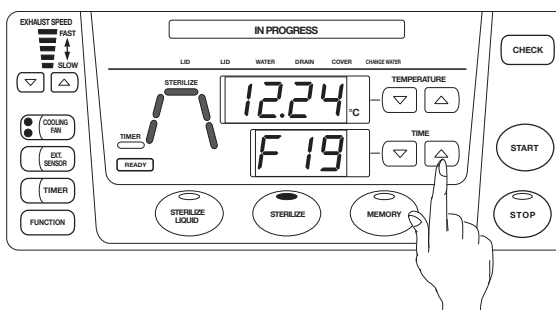


<To enter the date of inspection>

① Press the FUNCTION key while the IN PROGRESS indicator is off. The time display flashes "F00".



② Press the time setting up and down arrow keys to show "F19" in the time display. The temperature display shows the month/day of the current date. Check that the date displayed is correct.

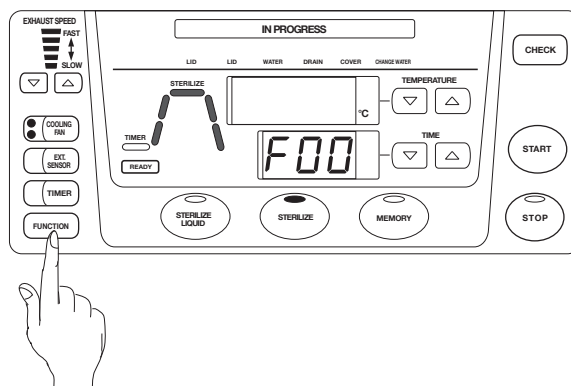


③ Press and hold down the START key. The buzzer will sound in approximately 4 seconds to indicate that the setting is finalized and the display will return to normal display.

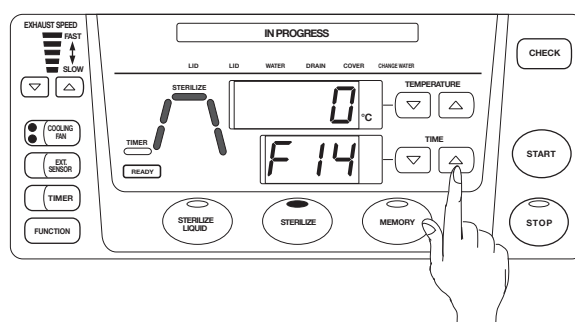
6-7. Setting the Time Unit for Display

This function allows the operator to change the time unit for display. The time unit for display for sterilization and timer can be set individually.

- ① Press the FUNCTION key while the IN PROGRESS indicator is off. The time display flashes "F00".



- ② Press the time setting up and down arrow keys to show the number (F14 or F15). The temperature display shows the code of time unit for display.
 ※ F14- Sterilization time
 F15- Timer



- ③ Press the START key. The temperature display starts to flash.
 ④ Press the temperature setting up and down arrow keys to show the desired code of the time unit for display.

Code	Time unit for display	Display range	Setting range
0	Hour: minute	0 : 00 ~ 9 : 59	0 : 01 ~ 9 : 59
1	Hour	0 ~ 99 hours	1 ~ 99 hours
2	Minute	0 ~ 999 minutes	1 ~ 999 minutes
3	Hour : minute / hour	0 : 01 ~ 9 : 59 , 10 ~ 99 hours	0 : 01 ~ 9 : 59 , 10 ~ 99 hours

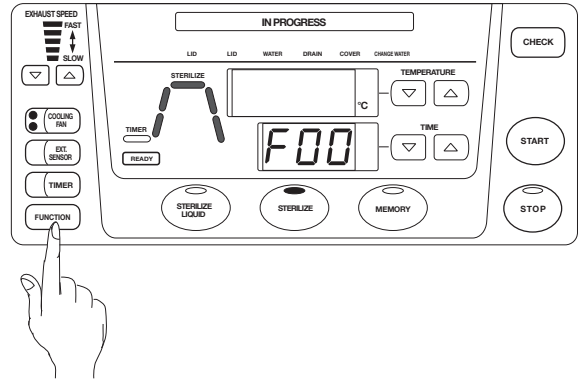
※ The factory default values for F14 and F15 are 0 and 3, respectively.

- ⑤ Press and hold down the START key.
 The buzzer will sound in approximately 4 seconds to indicate that the setting is finalized and the display will return to normal display.

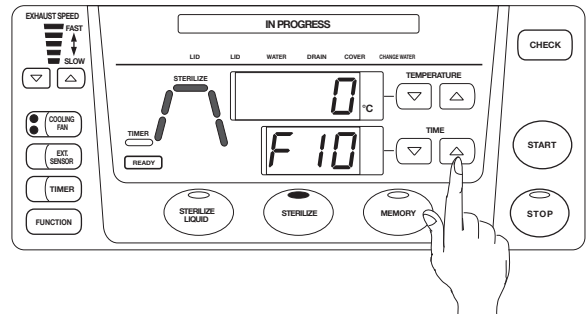
6-8. Selecting the Exhaust Setting for the Liquid Sterilization Course

In addition to the normal speed level setting, variable speed setting, which allows the fine adjustment of the exhaust valve opening, can be selected for the exhaust speed in the liquid sterilization course.

- ① Press the FUNCTION key while the IN PROCESS indicator is off. The time display flashes "F00".



- ② Press the time setting speed up and down arrow keys to show "F10" in the time display. The temperature display shows the code of exhaust setting.



- ③ Press the START key. The temperature display starts to flash.
- ④ Press the temperature setting up and down arrow keys to show the desired code of exhaust setting.

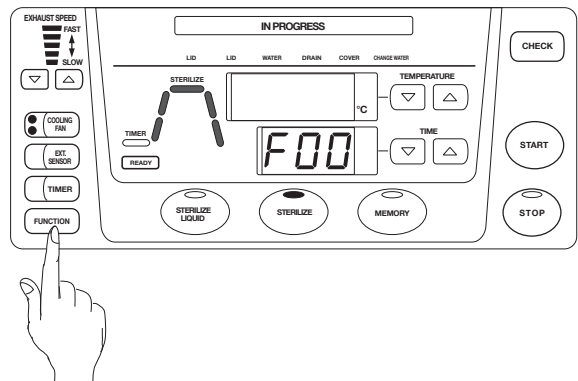
Code	Exhaust setting	Description
0	Speed level setting	Six levels
1	Variable setting	Variable

- ⑤ Press and hold down the START key. The buzzer will sound in approximately 4 seconds to indicate that the setting is finalized and the display will return to normal display.

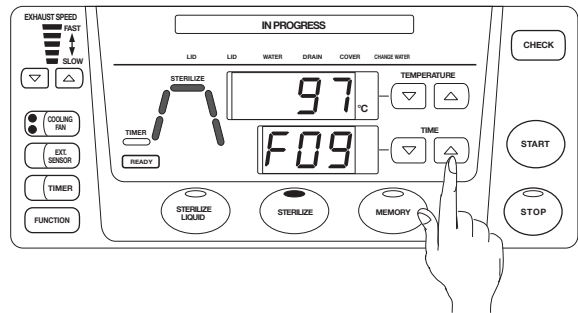
6-9. Setting the Temperature to Release the Lid Interlock

The FLS-1000 is equipped with the lid interlock which activates and prevents the lid from opening when the lid is forced open while the chamber temperature is still high. The lid interlock release temperature can be changed depending on the operation. It can be separately set for the sterilization course and liquid sterilization course.

- ① Press the FUNCTION key while the IN PROGRESS indicator is off. The time display flashes "F00".



- ② Press the time setting up and down arrow keys to show the course number to be changed. The temperature display shows the currently set value of the lid interlock release temperature.
 - ※ Select F09 and F11 for liquid sterilization course and sterilization course, respectively.



- ③ Press the START key. The temperature display starts to flash.
- ④ Press the temperature setting up and down arrow keys to show the desired value for the temperature of the lid interlock release.
- ⑤ Press and hold down the START key.

The buzzer will sound in approximately 4 seconds to indicate that the setting is finalized and the display will return to normal display.

 - ※ The factory default values for both F09 and F11 are set at 97°C.
 - ※ The upper limit and specified value may vary depending on the altitude level. (Refer to "3-3. Setting the Altitude Level".)
 - ※ The lid interlock release temperature can also be monitored by the external temperature sensor for articles to be sterilized. (Refer to "7-1. Temperature Sensor for Articles to be Sterilized".)

6-10. Sterilizing Water Change Alert Function

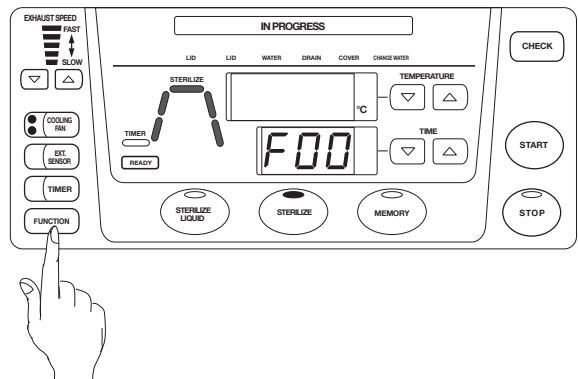
When the set number of sterilization cycles is reached, the sterilizing water change indicator lights up to notify the operator of the timing for water change to prevent the chamber from getting rust by contaminated water inside. When the sterilizing water change indicator is turned on, follow the instructions below for pouring water into the chamber. If the start key is pressed without changing water while the sterilizing water change indicator is on, "A01" appears in the time display and the autoclave enters into the standby mode. The number of cycles which activates the water change alert function can be changed depending on the level of contamination in water.

<When the sterilizing water change indicator is on>

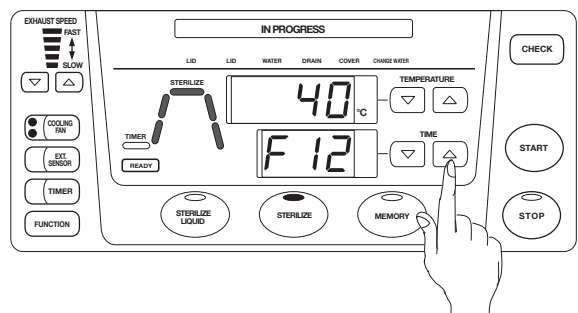
- ① Drain water from the chamber and pour water into the chamber.
※ Refer to "5-11. Draining the Sterilizing Water from the Chamber".
- ② Press and hold down the CHECK key.
The buzzer will sound in approximately two seconds and the number of the operated cycles after change will be reset.
※ To continue operation without pouring water into the chamber, press the CHECK key. Five cycles can be performed.

<To set the change alert>

- ① Press the FUNCTION key while the IN PROGRESS indicator is off. The time display flashes "F00".



- ② Press the time setting up and down arrow keys to show "F12" in the time display. The temperature display shows the number of cycles which activates the alert function when it is reached.



- ③ Press the START key. The temperature display starts to flash.
- ④ Press the temperature setting up and down arrow keys to show the desired number of cycles.
※ The factory default value is 40.
※ The setting range is between 5 and 80 cycles. When "--" is selected, the alert function will not activate.
- ⑤ Press and hold down the START key to finalize the setting.
The buzzer will sound in approximately 4 seconds and the display will return to normal display.

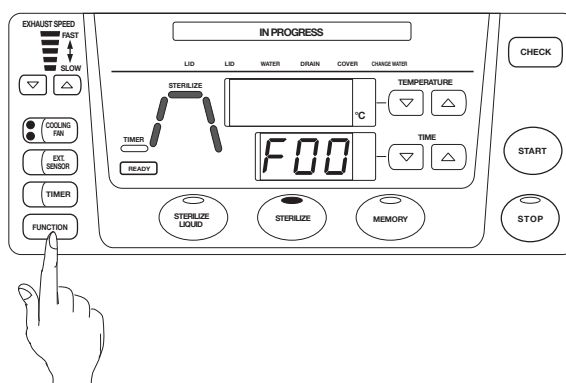
6-11. Exhaust Tank Illumination Function

Illumination of the exhaust tank displays levels of water inside and raises an alert when the water reaches full level, thereby allowing easy monitoring of the water level in the exhaust tank. The exhaust tank turns on blue when the autoclave operates a cycle with water levels in the exhaust tank between adequate levels. It turns on red when the lid is opened after a full water level has been detected in the exhaust tank. Drain the exhaust tank when it turns on red. The illumination function for the exhaust tank can be turned on or off.

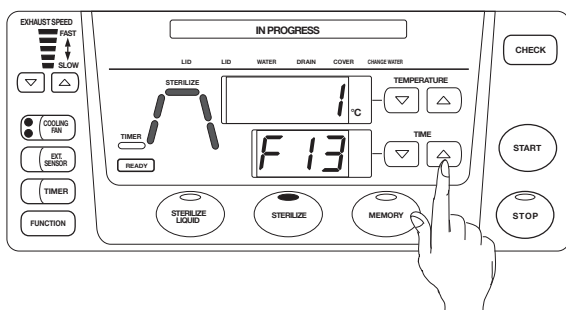
※ For draining the tank refer to “5-4. Checking the Water Level in the Exhaust Tank”.

<To turn on or off the illumination function>

- ① Press the FUNCTION key while the IN PROGRESS indicator is off. The time display flashes “F00”.



- ② Press the time setting up and down arrow keys to show “F13” in the time display. The temperature display shows the code of the illumination function.



- ③ Press the START key. The temperature display starts to flash.
- ④ Press the temperature setting up and down arrow keys to select the desired code of the illumination function.

Code	Illumination function
0	Off
1	On

※ The factory default value is 1.

- ⑤ Press and hold down the START key to finalize the setting. The buzzer will sound in approximately 4 seconds and the display will return to normal display.

MEMO

7. OPTIONAL FUNCTIONS

The following optional accessories and functions are available for the FLS-1000.

■ The external temperature sensor for articles to be sterilized

Sterilization process is monitored using the temperature sensor for articles to be sterilized by installing it directly into the article in the chamber so that the autoclave begins the sterilization time countdown only when the temperature for articles to be sterilized has reached a set sterilization temperature and, therefore, provides adequate heating.

※ The temperature is controlled to within 0°C to + 2°C of the set temperature.

※ The lid interlock release and the cycle complete temperatures can also be measured and monitored by the external temperature sensor for articles to be sterilized.

■ Data output function

The data output function allows producing up to 3 outputs of process data in analog form, including chamber temperature, temperature of articles to be sterilized, chamber pressure. The data can be stored to an optional recorder when it is connected.

■ Printer

Data of the chamber temperature, chamber pressure and article temperature can be printed out on the optional printer.

■ Brackets for anti-tip straps

Metal brackets for anti-tip straps are provided to secure the autoclave with a commercially available overturn prevention strap or wire.

For the operation of the optional accessories and functions, please refer to the supplement to the Operator's Manual; "FLS-1000 Autoclave Optional Functions".

8. ROUTINE MAINTENANCE

⚠WARNING



Be sure to unplug the FLS-1000 before performing maintenance procedures.

- Failure to do so may cause electric shock.

⚠CAUTION



Allow chamber to cool down sufficiently before performing maintenance work.

- Otherwise, high temperature inside the chamber may cause burns.

8-1. Cleaning and Disinfecting the Main Body

If the main body exterior or the chamber interior of the FLS-1000 becomes stained or dirty, clean or disinfect it according to the following procedures:

<To clean the main body>

- ① Wipe the unit with a soft cloth moistened with a mild detergent.
- ② Wipe away any detergent residue using a cloth dipped in clear water and squeezed almost dry.

<To disinfect the main body>

- ① Disinfect the main body with ethanol.

8-2. Weekly Maintenance

⚠WARNING

- ❗ **Do not operate the FLS-1000 if any corrosion, damage, deformation or loose connections are found on its chamber, chamber lid, hinges, hinge shafts, retaining rings, lid hooks, or lid hook catches.**
 - Otherwise, explosion may occur while the pressure rises, resulting in death, injury or serious accident. If any abnormality is found, please contact your dealer or our local representative.
- ❗ **Do not operate the FLS-1000 if any crack, deformation or damage is found on its chamber lid gasket.**
 - Otherwise, steam leak may occur, resulting in burns. If any abnormality is found, please contact your dealer or our local representative.
- ❗ **Do not operate the FLS-1000 if the chamber lid handle is deformed or damaged.**
 - Failure to do so may cause burns or injury. If any abnormality is found, please contact your dealer or our local representative.
- ❗ **Unplug and inspect the power plug regularly.**
 - Failure to do so may cause fire or burnout.

To ensure safe operation of the FLS-1000, perform cleaning and inspection weekly according to the following procedures:

<To clean each part>

1. Chamber interior and water level sensor

- ① Remove the chamber bottom plate carefully.
- ② Wipe the chamber interior and the water level sensor using a mild detergent and a cloth or other suitable materials and wash away any detergent residue using running water and drain the water.
 - ※ Be careful not to distort sensors in the chamber while cleaning.

2. Chamber lid gasket

- ① Wipe the surface of the chamber lid gasket using a soft clean cloth dipped in clear water and squeezed almost dry without applying force.
 - ※ Be careful not to damage the chamber lid gasket while cleaning.
- ② Wipe the chamber opening using a soft clean cloth or other suitable materials.

3. Outer covering

- ① Wipe the outer covering of the unit with a soft cloth moistened with a mild detergent.
- ② Wipe away any detergent residue using a cloth dipped in clear water and squeezed almost dry.

<To inspect each part>

1. Leakage breaker

- ① Turn on the power supply switch on the main body.
- ② Push the gray test button provided inside the power switch with a thin rod.
If the autoclave automatically switches off the power, the leakage breaker functions normally.
If it does not switch off, contact your dealer or our local representative.

2. Chamber

- ① Check chamber lid gasket for cracks or other damage.
- ② Check chamber interior for corrosion, cracks or other damage.
- ③ Check chamber lid for corrosion, cracks or other damage.
- ④ Check hinges, hinge shafts, retaining rings, lid hooks and lid catches for corrosion, cracks or other damage.
- ⑤ Check safety valve for any signs of corrosion, cracks or other damage. The safety valve can be visually inspected through the inspection port by removing its cover with a screwdriver.
After inspection reinstall the cover.

3. Power plug

- ① Unplug the autoclave.
- ② Wipe off any dust or dirt on the surface of the power plug using a dry cloth.
 - ※ If the power plug generates abnormal heat or has any burn marks on it, stop using the autoclave and call for your dealer or our local representative.
 - ※ If the power plug is too loose in the outlet, stop using the autoclave and call for your dealer or our local representative.

4. Chamber lid handle

- ① Check chamber lid handle for deformation or other damage.

9. TROUBLESHOOTING

If any system malfunction in the FLS-1000 is suspected, when it is operated properly according to this Operator's Manual, check the cause referring to the table below given in "9-1. Symptoms and Solutions" and take the corresponding remedy. If the symptom of the malfunction is not identified or the remedies described do not solve the problem, unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.

9-1. Symptoms and Solutions

Symptom	Possible cause	Remedy
No display appears on the control panel when the power switch is turned on.	FLS-1000 is not properly plugged.	Check the power cord for proper connection.
	Fuse or breaker at the power supply side is blown or tripped.	Connect the power cord to the power supply with the output capacity required by the FLS-1000.
READY indicator does not turn on.	Lid open indicator is on.	Check opening and closing of the lid and then close the lid.
	Low sterilizing water level indicator is on.	Fill the chamber with water.
	Drain indicator is on.	Drain the exhaust tank.
	Drain access cover open indicator is on.	Close the drain access cover.
	Sterilizing water change indicator is on.	Change water in the chamber.
Temperature rises slowly.	Extremely large amount of water is in the chamber.	Check and adjust a level of water in the chamber.
	FLS-1000 is loaded with a large amount of articles to be sterilized.	Check and adjust a volume of the load.
Sterilization is not performed sufficiently.	Sterilization time is insufficient.	Extend the sterilization time.
Steam leaks from the chamber lid.	Chamber lid gasket or chamber opening is covered with dust or dirt.	Clean the chamber lid gasket and chamber opening.
	Chamber lid gasket is damaged.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
Steam leaks from the safety valve.	Chamber pressure is too high.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
The FLS-1000 won't start or will stop operation while displaying an error code.	Take each remedy corresponding to the error code displayed, referring to the "Error Code Table" given below.	

9-2. Error Code Table

<System Error Code Table>

Error code	Possible cause	Remedy
E04	Level of sterilizing water becomes insufficient during the operation.	Turn off the power switch and wait until the chamber pressure becomes 0MPa to open the lid. And then pouring water into the chamber.
E05	Temperature inside the chamber is much higher than the set temperature during the sterilization process. ※ It exceeds the set value by 5°C or more.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E06	Pressure inside the chamber rises because the shape of the article to be sterilized serves to prevent air from escaping. ※ The pressure exceeds 175kPa.	Turn off the power switch and wait until the chamber pressure becomes 0MPa to open the lid. And then take some measures to allow air to escape from the load or reduce the volume of the load. (Refer to “5-6. Placing Articles to be Sterilized”.)
E07	Chamber temperature sensor is disconnected or broken.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E08	The temperature inside the chamber is much lower than the set temperature during the sterilization process. ※ It is more than 5°C lower than the set value.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E09	Chamber lid opens during the operation. ※ Lid open is detected by the sensor.	Close the chamber lid securely. If this happens during the operation, unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E10	Interlocking system of the chamber lid is not activated.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E11	Temperature does not rise during temperature rising and temperature and pressure rising processes. ※ Temperature rises less than 2°C within the specified time limit. A temperature equal to or below 60°C in 120 minutes, and above 60°C in 40 minutes.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E12	Pressure sensor is disconnected or broken.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E13	External temperature sensor for articles to be sterilized is disconnected or broken.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E15	Air vent valve is broken.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.

Error code	Possible cause	Remedy
E20	The pressure inside the chamber is high when the power is turned on. ※ It exceeds 5.6kPa.	Wait until the chamber pressure drops to 0MPa and then turn on the power.
E22	The chamber pressure rises because the shape of the article to be sterilized serves to prevent air from escaping. ※ The pressure exceeds the value predicted by the chamber temperature by equal to or greater than 25kPa during full opening of the valve.	Turn off the power switch and wait until the chamber pressure becomes 0MPa to open the lid. And then take some measures to allow air to escape from the load or reduce the volume of the load. (Refer to “5-6. Placing Articles to be Sterilized”.)
E23	The pressure drops because the exhaust channel is blocked. ※ The pressure drops below the value predicted by the chamber temperature by equal to or less than 30kPa.	Turn off the power switch and wait until the chamber pressure becomes 0MPa to open the lid. Take out and place the load again so that the hole in the chamber is not blocked. Open the sterilization bag if it is closed.
E25	Control system malfunction ※ Memory abnormality	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E26	Control system malfunction ※ Memory’s lifetime has expired.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E27	Control system malfunction ※ External temperature sensor for articles to be sterilized is not adjusted.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.
E28	Control system malfunction ※ Chamber temperature sensor is not adjusted.	Unplug the power plug of the FLS-1000 from the outlet and contact your dealer or our local representative.

<Operation Error Code Table>

Error code	Possible cause	Remedy
A01	The start key is pressed before draining and pouring water into the chamber. ※ The default value is 40 cycles.	Refer to “6-10. Sterilizing water change Alert Function”.
A02	The start key is pressed when the water level in the chamber is low. ※ Low sterilizing water level is detected.	Fill the chamber with water.
A03	The start key is pressed when the lid open/close system failed to detect the lid status. ※ 1	Open then close the lid.
A04	The start key is pressed when the lid remains open.	Close the lid.
A05	The start key is pressed when the drain access cover remains open. The drain access cover is opened during the operation.	Close the drain access cover.
A06	The start key is pressed when the exhaust tank is full.	Drain the exhaust tank.
A07	The start key is pressed when the temperature inside the chamber is below 0°C.	Wait until the chamber temperature rises to the operating temperature.
A09	Power-off is detected after a sterilization process has started or before it has completed.	Refer to “6-5. Power Failure Alert Function”.
A10	The memory approaches the end of its lifetime. (E26) ※ An alarm notification appears when 80% , 90% , 95% , 98% , 99% , and 99.5% of the lifetime is reached.	Press the check key once to clear the error, and enable the system.
A20	The start key is pressed while printing.	Press the check key once.
A21	Printer trouble. ※ Printer error includes: cover open, paper out, printer head abnormal temperature, and disconnection.	Refer to “7. Optional Functions”.
A30	The calendar battery has reached the end of its lifetime.	Press the check key once to clear the error, and enable the system. Contact your dealer or our local representative.
CHECK	Timing of the annual voluntary inspection approaches. ※ Reminder activates 30 days before the due date, and on and after the day of the due date.	Press the check key once to clear the error, and enable the system. Refer to “6-6. Annual Inspection Reminder Function”.

※ 1 The FLS-1000 checks the operation of the lid open/close detection system to ensure its safe operation, therefore, open and close the lid at least once before each operation or timer operation.

9-3. Contact Information

⚠WARNING



When returning FLS-1000 or any parts of FLS-1000 for replacement or repair, FLS-1000 or the parts must be appropriately decontaminated before shipping it in any of the following cases:

- 1 : In cases where FLS-1000 or any parts of FLS-1000 has been exposed to infectious and hazardous or radioactive substances.
- 2 : In cases where FLS-1000 or any parts of FLS-1000 has any residue of blood or other chemicals and has been identified as hazardous.

If any system malfunction or abnormality in FLS-1000 is suspected, contact your dealer or the following TOMY offices.

For Assistance or Service Contact ;

TOMY KOGYO CO., LTD.

TOMY SEIKO CO., LTD.

TOMY DIGITAL BIOLOGY CO., LTD.

3-14-17 Tagara, Nerima-ku, Tokyo 179-0073, Japan

e-mail : info@digital-biology.co.jp

URL : <http://www.digital-biology.co.jp>

phone : +81-3-5971-8160 fax : +81-3-3970-6036

10. DISPOSAL AND TRANSFER

WARNING



When disposing or transferring FLS-1000 or its parts, FLS-1000 or the parts must be appropriately decontaminated before shipping it in any of the following cases:

- 1 : In cases where FLS-1000 or any parts of FLS-1000 has been exposed to infectious and hazardous or radioactive substances.
- 2 : In cases where FLS-1000 or any parts of FLS-1000 has any residue of blood or other chemicals and has been identified as hazardous.

To ensure smooth operations for product assurance, we implement and maintain adequate record keeping systems. Please contact your dealer or our local representative when you dispose or transfer the product.

11. SPECIFICATIONS

11-1. Specifications of the FLS-1000

	220V model	230V model	240V model
Equipment category: (medical/laboratory)	Laboratory equipment		
Model name	Autoclave FLS-1000		
Operating temperature range Sterilize	105°C to 123°C (It varies depending on altitude level.)		
Maximum operating pressure	0.193MPa		
Temperature Display form	Digital		
Display range	-15°C to 175°C		
Pressure gauge Display form	Analog		
Display range	0MPa to 0.4MPa (red zone:0.193MPa)		
Heat source (electric heater)	3.0kW	3.0kW	3.3kW
Safety devices	<ul style="list-style-type: none"> ●Safety valve ●No water heating prevention ●Leakage breaker ●Lid interlock ●Over-temperature prevention ●Over-pressure prevention ●Temperature sensor malfunction detection ●Pressure sensor malfunction detection ●Exhaust valve malfunction detection ●Low sterilizing water level detection ●Chamber lid open/close detection ●Drain access cover open detection ●Exhaust tank full level detection 		
Leakage breaker Rated breaking current	15A		
Rated sensitivity current	10mA		
Protection against electric shock	Class I		
Time Display form	Digital		
Display range Sterilize	0:00 ~ 9:59/0 ~ 99hours/0 ~ 999minutes/0:00 ~ 9:59, 10 ~ 99hours (switchable)		
Setting range Sterilize	0:00 ~ 9:59/0 ~ 99hours/0 ~ 999minutes/0:00 ~ 9:59, 10 ~ 99hours (switchable)		
Chamber dimensions	Inside diameter × inside dimension : φ 450×678mm		
Chamber capacity	100L(0.100m ³)		
Effective diameter × effective depth	φ 440×501mm		
Effective internal capacity	76L(0.076m ³)		
Chamber material	SUS304 (stainless steel)		
Main body dimensions(mm)	600W×600D×940H, top plate height: 785 680W×680D×1022H (including the pedal and control panel)		
Net weight	108kg		

Rated current	14A	13A	14A
Power requirements	Single-phaseAC220V 50/60Hz 15A	Single-phaseAC230V 50/60Hz 15A	Single-phaseAC240V 50/60Hz 15A
Power consumption (heat output)	3.0kW (2,580kcal/h)	3.0kW (2,580kcal/h)	3.3kW (2,838kcal/h)
Environmental requirements	Ambient temperature: Atmospheric pressure: Relative humidity: Altitude: For indoor use only Overvoltage category: Pollution degree: Maximum gradient:	from 10 to 35°C from 750 to 1060hPa 75% or less not exceeding 2000m II 2 2°	
Accessories	Digital warranty information Inspection sheet Specifications of small sized pressure vessel Operator's manual (English) Operator's manual (English) OPTIONAL FUNCTIONS Chamber bottom plate Stainless steel basket(ϕ 415×233mm)		1 copy 1 copy 1 copy 1 copy 1 copy 1 piece 2 pieces

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