

Safety instruction for operating autoclaves

Autoclave is a device using steam, temperature and pressure to sterilize instruments/tools, biohazard waste, media and cultures.

Autoclave can pose physical hazards (e.g. heat, steam and pressure) and biological hazards (e.g. improperly autoclaved infectious materials).

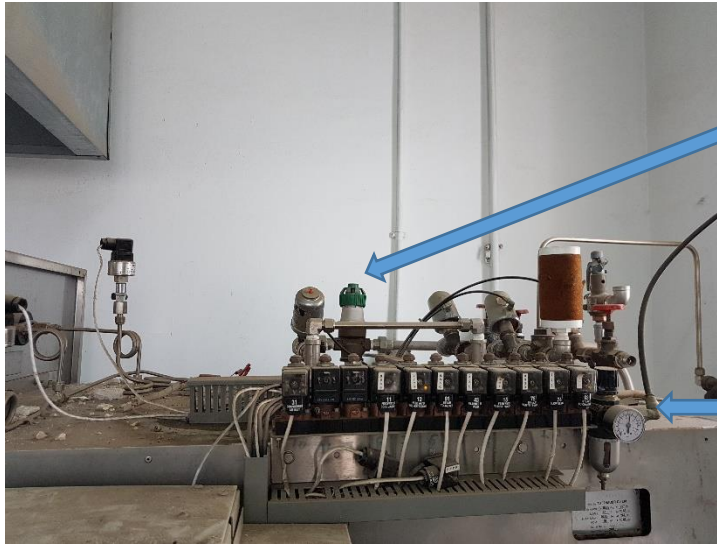
Therefore, all employees / students operating the autoclave should receive training from the instrument manufacturer / supplier and/or the person responsible for the device.

1. In each laboratory / unit running an autoclave, a person should be appointed to verify its proper function, once a week, and to instruct those wishing to work with the device.
2. Make sure that the autoclave is checked once a year (by an authorized examiner) and that the standard mark has been pasted.



3. The autoclave supervisor will receive instructions from the Autoclave manufacture/ vendor and practical training.
4. The instructions should be placed in close proximity to the device, along with the supplier's telephone numbers and a list of people trained to work with the autoclave.
5. In addition, add the company's technicians telephone numbers.
6. The person in charge will perform a functional / efficacy check with the Kit: Bacillus Stearothermophilus Spore test at least once a month (details in the Additions section).

Typical structure of autoclave



Safety valve

Steam supply



Drainage of liquids

Steam supply line:

Local generator:

Steam is supplied to an autoclave from a water reservoir that is part of the autoclave. Follow the manufacturer's instructions regarding the quantity and quality of the water.

Central Generator:

Steam is supplied to an autoclave, through a pipeline, from a remote water reservoir. It is important to avoid contamination of the piping and the reservoir, if the fluid drain at the end of the process, is back to the steam generator.

Safety valve:

Opens in case of over-pressure in the cell. Check for structural integrity before any use of the autoclave. Do not use autoclave if the valve has been bent or blocked.

Drainage:

At the end of the sterilization process, the steam condenses and becomes liquid, which drains through the drainage hole, located at the bottom of the autoclave into a reservoir, in the autoclave with a local generator, or into the sewer system or back to the steam generator in the case of a central generator.

If the drainage filter is blocked, it must be cleaned immediately to allow the fluid to drain from the autoclave cavity.



Do not use autoclave as long as the drainage filter is blocked.

personal protective equipment:

Equipment to protect against scalds and burns include:

- Long-sleeved lab coat
- For regular autoclave operators: Wear a rubber apron over the lab coat when unloading the equipment.
- Gloves.
- Heat-resistant gloves (to be worn only when hot equipment is unloaded).
- Goggles, preferably with a face shield.

- Closed shoes.
- Cover-sleeves (to make sure that the arms are well covered, to avoid heat and steam burns as a result of a splash accident of hot liquid).

Preparing the autoclave:

1. Check the autoclave seal system. Make sure that there are no cracks or bumps or swelling in the sealing system. The seals should be smooth and flexible
2. Make sure that the drainage filter is not clogged or contains residues from a previous operation.
3. If any problem is discovered, contact the person responsible for the autoclave in the department / laboratory.

Preparation of items:

1. Materials that are not allowed/forbidden in autoclave: flammable, reactive, substances that their boiling point is less than 100°C, toxins, items containing corrosives, bleach, cytotoxic substances, organic solvents or radioactive materials.
2. Make sure that the plastic products that are inserted into the autoclave are suitable and resistant to heat and autoclaves (see the Additions section).
3. Check the glassware and make sure they do not have any cracks.
4. For sterilizing liquids: Keep the lids of a bottles loosely closed or covered with any means ,(like aluminum foil), that will allow steam to enter the vessel/bottle in order to prevent the explosion of the vessel as a result of building pressure. Do not fill the bottles with liquid, exceeding 2/3 of their volume, to prevent fluid leakage. Place the liquid bottles in a storage tank and add 2 cm of water to achieve uniform heat dissipation.



5. For biological waste (in biohazard bag): The bag should be loosely closed: at least 5 cm width opening, should be left, to allow the steam to enter and to achieve an efficient sterilization of the waste. In order to prevent the spill that may result from the explosion of the biohazard bag, it is recommended to insert the bag into a suitable bucket / container. Do not fill the biohazard bag more than 2/3 of it's volume, in order to allow effective sterilization.



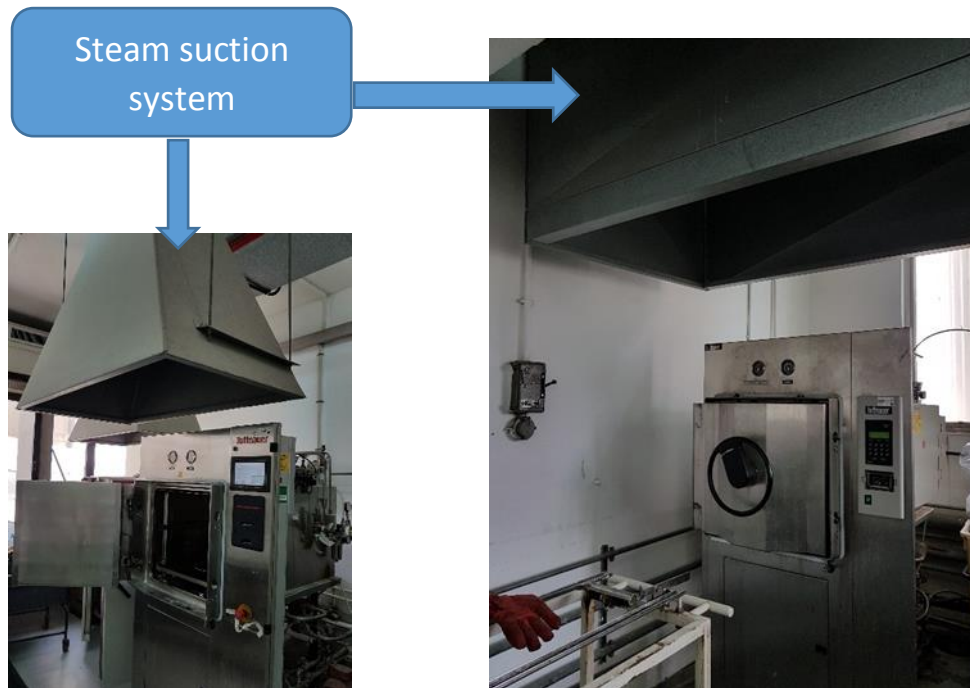
6. For sharp container: make sure that the pressure release opening is open.
7. In order to optimize the sterilization of a dry waste, it is advised to add some water (carefully to prevent the formation of aerosols) into the waste bag or the sharp waste container.
8. For sterilization of bottles: release the bottle caps. It is recommended to cover the bottles with aluminum foil and place the caps next to the bottle.

Inserting items:

1. When the items are inserted, check that no spills are created.
2. Insert the items on a tray / capacity tool, for insident of spill / explosion. Never put items on the bottom of the autoclave.
3. Do not overload the autoclave. Leave space between the items to allow the steam to reach anywhere.
4. In case of dry waste, you can add 100 ml of water into the bag / container, to optimize the sterilization process.

Activation:

1. Turn on the suction system located above / near the autoclave.



2. Make sure the door is firmly closed before turning on the machine.
3. Select a sterilization program, depending on which factor you are sterilizing (eg dry materials-tools, fluids, biological waste, etc.).
4. Check, after 20 minutes, that the autoclave works properly.
5. Do not open the autoclave door during the sterilization process. If necessary, stop the operation and wait until the pressure in the autoclave stabilized/dropped.
6. If there is a malfunction in the operation, inform the person in charge.

Removing items:

1. After completion of the procedure, make sure that the autoclave temperature has decreased and that the pressure in the cell has reached 0.
2. Wear protective gear to protect yourself from heat and steam.
3. Open the door lightly (not full opening), to allow the hot vapors to come out. Do not stand in front of the door, but on the protected side.
4. Allow the item to remain inside the autoclave for 10 minutes before touching them.
5. Carefully remove the items and set them aside to cool. Do not shock the containers / bags / bottles to avoid the eruption of liquids, which are in a state

of boiling or overheating (if moved too quickly). For a vessel with high heat capacity liquids, it is recommended to wait another 15 minutes before moving / removing. **A container containing hot liquid may explode due to shaking, while cooling.**

6. The biological waste, which has been sterilized in autoclave, can be removed into municipal waste containers after the biohazard symbol has been erased (or marked with X).

Methods for testing sterilization efficiency:

1. **Chemical testing:** Using a tape with color-changing stripes. A change in the color of the stripes (in the tape) does not indicate the efficacy of the sterilization procedure, but only that the device has overheated.



2. **Biological testing:** Using a spores containing : Bacillus Stearothermophilus. The commercial kit, serves as a quality control for the efficiency of the sterilization process. The kit contains, heat resistant spores. The spores are killed at 121⁰C after a duration of 13 minutes. The success of their extermination predicts the efficacy of the sterilization process. It is important to place the biological detector at the center of the cargo.

Spore Ampoules Test Results

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- **Weekly Verify:**
- Record negative (no growth) results after 48h incubation.
 - No color change in the purple media indicates proper sterilization.
- Any positive (turbidity and/or color change from purple to yellow) result should be reported immediately to a supervisor.
 - Corrective action is considered
 - Returned the autoclaved back to hazard bin



A change in the color of the ampoule after incubation (55°C) for 24 hours indicates an ineffective sterilization procedure.

Appendix:

Durable to autoclave	Not durable to autoclave
Borosilicate glass (Pyrex)	Standard glass
Polypropylene (PP)	Polystyrene (PS)
Stainless steel tools	Polyethylene (PE)
Bio-Hazard Bags	

Risks in working with Autoclave:

1. Breaking glass vessels or dumping containers containing contaminated biological liquids when they are inserted into the autoclave.
2. Burns as a result of contact with internal (and sometimes external) walls of the autoclave.
3. Accumulation of steam and water due to the obstruction of the drain filter.
4. Release of toxic gases.
5. Explosion of glassware, containers with liquids and waste bags, while operating the autoclave.
6. Steam escape when opening the autoclave door (when the operation is completed).
7. Escape of hot liquids when removing the "load", at the end of the sterilization process.
8. Opening the autoclave door in the middle of the work/process, as a result of damage to the sealing of the device, the release of the safety valve and sometimes the explosion of the autoclave.