

College/Unit:	Department of Mechanical and Biomedical Engineering
Procedure Title:	Standard Operating Procedure #TE0004 Autoclave Safe Handling

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Revision History

Revisions to this procedure are to be documented in Table 1, Revision History.

Table 1: Revision History

Document Section	Details of Amendments	Date	Author (Initials)

1 Introduction

This Standard Operating Procedure (SOP) provides guidelines for the safe use of an autoclave. Autoclaving utilizes steam pressure to achieve higher temperatures than can be obtained at atmospheric pressure to destroy microorganisms and decontaminate biohazardous waste and microbiological equipment. The effectiveness of decontamination by steam autoclaving is dependent on the temperature to which the material is subjected as well as the length of time it is exposed. Proper operation, loading and monitoring of autoclaves are critical to ensure decontamination is achieved. Particular attention should be given to packaging, including the size of containers and their distribution in the autoclave so that the innermost regions of bags and containers reach and maintain the temperature required for sterilization. Arranging items in a manner that allows for free circulation and penetration of steam will help achieve effective decontamination of waste.

This SOP provides information for the following:

- General use of the autoclave,
- Personal Protective Equipment (PPE) requirements,

At the discretion of the Departmental Assistant, a researcher may be asked to repeat training on this SOP, if the researcher has failed to adhere to some of the policies outlined. All users will be required to repeat training on this SOP every three years from the date of the original training.

Persons who do not follow this and other required Mechanical and Biological Engineering SOPs will lose lab privileges (this may mean the inability to conclude research that is required for your degree)

2 Definitions

SOP:	Standard Operating Procedure
SDS:	Safety Data Sheet
WHMIS:	Workplace Hazardous Materials Information System 2015
PPE:	Personal Protective Equipment

3 Potential Hazards

- Hot materials and hot autoclave chamber walls and door.
- Residual steam coming out from autoclave and materials on completion of cycle.
- Superheated materials, boiling liquids and spillage in autoclave.
- Containers damaged during autoclaving
- Rapid unplanned decompression (e.g. failure of seal)

4 Personal Protective Equipment (PPE) Required

- Heat-insulating gloves that provide complete coverage of hands and forearms.
- Long pants.
- Lab coat.
- Eye protection.
- Closed-toe footwear.

5 Procedure

5.1 Material Preparation

- Ensure that the material is safe for autoclaving:
 - Samples containing solvents or substances that emit toxic fumes should not be autoclaved. Check SDS for details.
 - Do not autoclave bleach.
- Glassware must be inspected for cracks prior to autoclaving.
 - Any cracked glassware should not be autoclaved.
- Prepare and package material appropriately:
 - Confirm that any plastic materials used, including bags, containers, and trays, are compatible with autoclaving. Some bags can impede steam penetration while others may melt during the cycle.
 - Loose, dry materials must be placed in autoclaving compatible bags, containers, or trays.
 - Avoid overloading containers and bags (they should never be more than 3/4 full).
 - Autoclave bags should be closed loosely to allow adequate steam penetration.
 - Loosen the caps of liquid containers to prevent bottles from shattering during pressurization. This should be done immediately prior to loading in order to minimize the risk of exposure or contamination if the container is tipped. Vented caps may be a suitable alternative.
 - Autoclave tape is recommended for each separate container in each load
- Place items in secondary containers to secure and contain spills:
 - Items should be placed in a stainless steel pan or other autoclavable container for their stability and ease of handling.

- Place containers of liquid or other materials that may boil over or leak into a secondary pan in the autoclave:
 - The pan must be large enough to contain the total spill of the contents.
 - The pan must sit flat in the autoclave, i.e. no leaning or tilting of the pan.
 - Bags must not be tightly sealed as steam cannot penetrate.

5.2 Operating Procedure for the BioClave STE-18A-16L Autoclave

- **Inspect unit**

- Open the door of the autoclave, and inspect the interior. There may be dust or debris inside, so remove the tray and rack and wipe the unit out. Also examine the door seal and contact surface, and ensure there is no damage to the seal nor debris on the seal and contact surface. Make sure both drains are closed. Reinsert the tray rack

- **Turn on the unit**

- Turn on the power switch on the lower right side of the unit, beneath the display panel. The lights will come on, and the interior of the unit will begin to warm.
- If the unit is low on water, an alarm will sound, and a blue light will come on telling you to add water. It is a good idea check the water level in the water reservoir even if the alarm doesn't come when the machine is turned on, as well as when refilling the reservoir in case the float sensor is stuck.
 - Use only distilled or other forms of low solute purified water when filling the autoclave.

- **Select the settings**

- The temperature can be set to either 121°C or 134°C. The difference is that 121°C will only rise to 16 PSI, and will run for a longer period of time, whereas at 134°C the pressure will rise to 30 PSI and have a shorter cycle.
- The other settings will depend on what you wish to autoclave:
 - *UNWRAPPED* is for instruments that are placed on the tray, and otherwise not enclosed
 - *WRAPPED* is for instruments that are enclosed in a package or container
 - *LIQUID* is for liquid solutions (do not autoclave flammable liquids)
- Any wrapped or liquid materials must not be sealed tightly, as this will prevent the steam and pressure from entering the container and properly sterilizing the instruments/samples, and can also potentially cause an explosion.
- NOTE: the *DRY ONLY* cycle is to operate an extra drying cycle after completing the normal autoclave and drying cycle; this is not the same as dry sterilizing (use the oven for dry sterilizing).

- **Load the autoclave**

- Place your instruments/samples on the tray and insert the tray into the lowest position of the autoclave. Instruments/samples should not come in direct contact with the interior wall of the unit; if possible, they should not come into direct contact with the tray.

- **Start the autoclave**

- Close the door, ensuring that the tray and your instruments/samples do not come into contact with the door, and turn the handle to lock the door. Press the start button.

- **Shut down the autoclave**

- When you are finished, the autoclave has to be shut down. Turn the power switch off. Remove the tray and rack, and wipe the interior of the autoclave, the door seal, and the seal contact with a soft cloth saturated in distilled water (caution: the interior will still be warm, so wear appropriate PPE).
- To drain the autoclave, attach the drain hose to the USED WATER drain, and drain the water into a beaker at least 1 L in volume (if there is too much water, such as after having run multiple cycles or large batches, you may need to close the drain, empty the beaker, then return the beaker and open the valve to complete the draining.
 - If you have run multiple cycles or large batches, you may hear a bubbling/gurgling sound coming from the back of the autoclave while the unit is running; this is a sign that the used water reservoir may be full and should be drained immediately.
- When finished, close the door, but do not lock the door, as this compresses the seal and causes unnecessary wear/strain on the seal.

- **Logbook**

- Please remember to fill out the log book for tracking autoclave use.

For all other questions and information, please see the BioClave operations manual or the Canadian Biosafety Handbook.

6 Emergency Response Procedure (ERP)

- All personnel must be familiar with the Emergency Response Plan located at the entrance of the laboratory, as well as the location of the fire extinguisher and first aid kit. All personnel must be familiar with the Lockdown Procedure for their laboratory and/or office space.
- All personnel are responsible for alerting a Departmental Assistant to any unsafe equipment or situation that they notice in the laboratories.

- All chemical spills, injuries and near misses must be reported to the Departmental Assistant as soon as possible (**within 24 hours**). The appropriate paperwork must be completed. See the following for more information on filling out an incident report: <http://safetyresources.usask.ca/incident-staff.php>
- Any time that a first aid kit is used (even for Band-Aids) a record of the incident and what items were used from the first aid kit must be made in the log book inside the kit. This helps the Departmental Assistant keep track of what is used and restock items as necessary.

7 Bibliography

Canadian Biosafety Handbook, Second Edition, May 26, 2016

<http://canadianbiosafetystandards.collaboration.gc.ca/cbh-gcb/index-eng>

Biomega BioClave Operations Manual V 1.0

8 Persons authorized to perform this SOP:

By signing this form I acknowledge that I have read and understand this SOP, as well as the applicable SDS's and that I will conduct myself in accordance with this SOP and the general laboratory rules. I also acknowledge that I have received training by a qualified trainer, who has initialed this SOP acknowledging that training has been conducted.

List of Qualified Trainer(s)

1. Adam McInnes
- 2.
- 3.

NOTE: ALL SIGNATURES MUST BE PRESENT ON THE SOP LOCATED IN THE YELLOW BINDER IN ROOM 1A26. Digital copies of SOP's are made available for reference and convenience only. Printed SOP's are valid for 24 hours only, after that time their accuracy must be verified with the **OFFICIAL HARDCOPY VERSION**.

Name (Print)	Date	Dep't	Signature	Trainer's Initial

