

Autoclave Safety

Autoclaves are a permanent fixture in a laboratory, and it is easy to forget what hazards they can pose. The autoclave's job is to render the contents sterile, or free of any living organisms. If it fails to do so, serious health hazards can result. The hot, pressurized steam that is generated (274° Fahrenheit, 30 pounds per square inch gauge, for large autoclaves and the 249° Fahrenheit, 15 pounds per square inch gauge, for small table top autoclaves) makes them a serious burn hazard. The conditions created inside steam autoclaves are so extreme, safety precautions must be observed. Always wear protective gloves and apron (also a face shield if processing liquids) when removing a processed load. Autoclaves can easily malfunction if they are not carefully maintained.

Before using any autoclave, for the first time, read and thoroughly understand the owner's manual, because many makes and models have unique characteristics. If you cannot locate the manual, contact the manufacturer and have a copy sent to you.

Modes of Operation

THE AUTOCLAVE, DEPENDING ON THE MODEL, USES DIFFERENT PATTERNS OF HIGH HEAT, VACUUM, AND PRESSURE TO STERILIZE ITS LOAD. THE TYPE OF MATERIALS YOU STERILIZE WILL DETERMINE THE TYPE OF STERILIZATION "RUNS" YOU USE. THE GENERAL TYPES OF RUNS ARE "LIQUIDS" FOR ANY TYPE OF WATER-BASED SOLUTIONS, "DRY GOODS WITH VACUUM," AND "DRY GOODS WITHOUT VACUUM."

Autoclaves often have an additional "drying" cycle in which hot air is DRAWN THROUGH THE CHAMBER TO DRY MATERIALS BEFORE REMOVAL. Controls for different brands of autoclave vary, so you should follow manufacturers' instructions about loading, load sizes, and cycle types and settings carefully.

When sterilizing liquids, to prevent personal injury or property damage resulting from bursting bottles and hot fluid, you must observe the following procedures. Use liquid cycle only. No other cycle is safe for processing liquids. Use only types I borosilicate glass bottles - do not use ordinary glass bottles or any container not designed for sterilization. Use only vented closures - do not screw CAPS OR RUBBER STOPPERS WITH CRIMPED SEAL. VAPOR EXPANDING DURING HEATING WILL CAUSE AN EXPLOSION, IF NOT VENTED. NEVER AUTOCLAVE ANY FLAMMABLE OR VOLATILE LIQUIDS BECAUSE THEY COULD EXPLODE.

THE "DRY GOODS WITH VACUUM" RUN MOVES STEAM AND HEAT INTO THE DEEPEST PARTS OF LARGE BAGS OR BUNDLES OF MATERIALS AND PRODUCES THE BEST CONDITIONS FOR KILLING PERSISTENT ORGANISMS. DURING THIS TYPE OF RUN, THE CHAMBER ALTERNATES BETWEEN CYCLES OF VACUUM AND HIGH PRESSURE.

Then the chamber is pressurized with steam for a long period, followed

BY A SHORT VACUUM CYCLE. IT IS IMPORTANT THAT STEAM AND PRESSURE BE ABLE REACH THE ENTIRE LOAD, SO CAREFULLY LOOSEN AUTOCLAVE BAG CLOSURES ONCE THEY ARE IN THE AUTOCLAVE.

THE "DRY GOODS WITHOUT VACUUM" RUN SIMPLY PRESSURIZES THE CHAMBER WITH STEAM FOR THE DURATION OF THE CYCLE, AND THEN RETURNS TO NORMAL. THIS PROCESS IS USED PRIMARILY FOR ITEMS THAT HAVE BEEN CLEANED BUT NEED TO BE STERILIZED. MATERIALS SHOULD BE PACKED SO THAT THE HEAT AND PRESSURE CAN READILY REACH THE WHOLE LOAD.

Ensuring Thorough Sterilization

It is imperative to know that the autoclave has thoroughly sterilized its contents. Most autoclave bags or tapes are imprinted with a dye that changes color when the correct temperature is reached. The problem with this type of check is that the dye is on the surface of the load, and a positive reading does not ensure that the innermost parts of a large load are also sterile. However, an easy way to check this is to wrap something with autoclave tape (a disposable plastic test tube or pipette tip are possibilities), and attach string to it as its being put deep into the load. Tape the other end of the string to the outside of the bag so that you can easily pull the indicator out (do not open up a load of potentially infected material to bury something inside). Recover the indicator after the run and confirm that it too has changed color.

Routine Maintenance

IT IS A GOOD PRACTICE TO USE A BIOLOGICAL INDICATOR (E.G., AMSCO'S PROOF SYSTEM, BBL'S KILIT) MONTHLY TO CONFIRM THAT THE AUTOCLAVE IS WORKING PROPERLY. IF EITHER THE DYE (SEE PROCEDURE ABOVE) OR BIOLOGICAL INDICATOR FAILS, YOU MUST EXAMINE THE AUTOCLAVE TO IDENTIFY AND CORRECT THE PROBLEM AND ALSO RE-AUTOCLAVE THE LOAD TO ENSURE STERILITY. THE AUTOCLAVE GASKET IS REPLACED AND EITHER THE MANUFACTURER OR ENGINEERING PERFORMS MAINTENANCE SEMI-ANNUALLY, DEPENDING ON THE AUTOCLAVE.

In addition, users should perform the daily and weekly maintenance procedures described in the owner's manual. Also make sure the drain strainer is clean before each run.

The sterilization chamber must be cleaned and drained daily using the following procedure: wash wetted portion of the cylinder thoroughly by adding a mild detergent (such as calgonite) to water in cylinder. If a soft cloth or brush used with detergent does not completely remove the surface film, a nylon soap pad should be used. Never use a wire brush, abrasives or steel wool on door and chamber assembly. After washing, a thorough rinse, with clean soft water, is imperative. DRY CYLINDER AND LEAVE DOOR OPEN OVERNIGHT.

Autoclave Safety and Contact Information

Autoclaves generate extreme heat and high pressure. Users should understand and respect the hazards these can create. Autoclave doors and their gaskets must be firmly locked into place before running the autoclave, to prevent a sudden release of high-pressure steam. Most, but not all, autoclaves have safety interlocks that prevent the autoclave from running if the door isn't closed properly. Know if yours has an interlock-you'll need to use extra caution if it doesn't.

Some older autoclaves have little or no heat shielding around the Outside. Attach signs warning of "hot surfaces, keep away" or similar wording on or next to the autoclave to remind people of the hazard. Do not stack or store combustible materials next to an autoclave (cardboard, plastic, volatile or flammable liquids). Use heat-resistant gloves when removing materials after sterilization and avoid touching the inner chamber surfaces.

If you are burned, you can receive treatment at NMG Corporate Health at 312.926.8282 (7 a.m. – 4:30 p.m. Monday-Friday) or the Lurie Children's Emergency Department (after hours). Burns to the face, third-degree burns, or burns over large areas of the body should be treated as emergencies. Call 911 from a phone to get help. You can treat minor burns yourself using standard first aid. Regardless of the degree of severity, report the burn to your supervisor or principal investigator as an occupational injury.

IF YOU HAVE QUESTIONS ABOUT AUTOCLAVE OPERATION OR NEED HELP REACHING A MANUFACTURER, OR NOTICE A DOOR GASKET FAILURE, PLEASE CONTACT ENGINEERING AT X56348.