

## How Does Steam Sterilization Work?

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**Objectives:**

Discuss the advantages and disadvantages of steam sterilization

Describe some of the factors that impact the effectiveness of sterilization

Explain what the most frequent reason for sterilization failure is and what must be done to correct it

Steam sterilization is the most commonly used sterilization system in the world. Steam is easy to produce as well as being a cheap commodity. Does that necessarily make it the best? Not in all cases but for the majority of instrumentation used in ORs today, the answer is yes. There are distinct advantages to using steam.

1. It is the preferred way of method destroying microorganisms.
2. It is non-toxic
3. Kills spores
4. Inexpensive
5. Cycles are fast

What about the disadvantages? Just as there are advantages there are also disadvantages. One very large disadvantage is steam can be hazardous to certain pieces of equipment. This is because of the heat generated and by moisture which is what steam is. Another disadvantage involves the purity of the steam. If the steam is not pure, there may be impurities

that get into the very small lumens and block them. You might also find pitting or metal discoloration on instruments that were exposed to steam that wasn't pure. Care must be taken also when loading the carriages so the steam has the ability to get into every nook and cranny of the package holding the item to be sterilized. It doesn't do any good to have the best steam in the world if it can't get to what needs to be sterilized.

Do you know what some of the things are that can affect the sterilization process? Let's look at cleaning first. What do you know about sterilization as it pertains to cleaning? First rule, if the item is not clean, it can not be properly sterilized. Without this first step, nothing else matters, the item will not be sterile. Conditions lethal to the microorganism living on the item must be present. In other words, are all the parameters for sterilization present? For instance, is the temperature appropriate to the type of sterilizer being used? If it's a gravity air displacement sterilizer, the temp should be 250 F or 121C. If it's a prevac sterilizer, the temp should be 272F or 134 C. How about humidity? Approximately 97% humidity and a water vapor in the steam of no more than 3% is considered the standard. What about

pressure? The psi (pounds per square inch) means that within the chamber of the autoclave the system is building up a head of steam which calculates into pressures. If you are using a prevac autoclave, the psi needs to be at 27 pounds in order to force the steam into the packs to sterilize the items inside the pack. This is considered to be saturated steam. In other words, the steam entering the sterilizer is considered to be a moist steam, ergo the need to have 3% liquid water. More than that and what you get are wet packs. Less than that and what you get is superheated steam which causes a sterilizer failure due to lack of heat transfers to the load contents. You must also be on the alert for any air pockets inside the chamber as steam cannot sterilize through air. That's why your sterilizers have a mechanism so that at the beginning of each cycle, all the air is removed from the chamber before sterilization cycles start. Steam sterilizers date back to the early days of formal health-care. Before the advent of the steam sterilizer, instruments were generally , if you were lucky, dropped in a pan of hot water to be cleaned/sterilized. Charles Chamberland invented the first real steam sterilizer in 1880. This steam sterilizer

looked very much like a pressure cooker and in many ways worked the same way. Now most steam sterilizers are built very much the same. There is



the outer shell or external portion of the sterilizer. There is a chamber or the inside of the autoclave. The area around the chamber but inside the outer shell is called the jacket. Steam comes into the jacket and keeps the chamber at a constant temperature so there aren't air pockets developing from chambers that are too cool and you don't have to wait for the jacket to heat up each time which helps the turnaround time. It also cuts down on the amount of condensation that occurs when the hot steam hits the side of the chamber walls when the cycle starts.

Autoclave load failure. Very frustrating and time consuming. The most common cause is lack of contact between steam and the microbes on the surface of the item being sterilized. Causes of steam contact failure can include:

Item is not clean. Again, you can clean an item without sterilizing it but you can't sterilize an item without cleaning it. Because of proteins, if an item is not thoroughly cleaned and all visual bioburden removed, there is the potential for microbes to be under the proteins and not be killed which could lead to a SSI.

Packages are too tightly wrapped. The package must be able to allow the steam to force the air out either by mechanical means or by steam being pulled into the autoclave. If air is trapped inside a package, it forms a cooler bubble within the package and steam can't get to the items which prevents the temperature from getting high enough to adequately sterilize the items in the package.

Loads that are packed too tightly together. Again, if steam can't get into the packages, the items inside can't be sterilized. If items are too close together, it prevents the air from being adequately removed. There are some manufacturers that allow containers to be stacked two or even three high. Please check with the container manufacturer as well as the autoclave manufacturer to see what the preferred practice is and if there is documentation to support stacking. Peel packs should be placed on their sides, paper to plastic to ensure adequate steam penetration and that the layers of plastic don't stick to-

gether and cause a potential tear or contamination of the sterile item. Basins, for instance, need to be placed on their side in such a way that any moisture that collects inside can be drained out during the cycle. If the load contains bottles, the lids must be removed and the bottles placed on their sides. This will allow air to be displaced and steam will be able to get inside the bottle.

Mechanical malfunction is another way to get a failure. For instance, if the drain strainer, found at the front bottom of the chamber, becomes clogged, the air can't be removed as effectively and will cause a time delay as well as the potential for ineffective air removal to occur and cause some items to not be sterilized.

Occasionally you may run into other types of mechanical failures. For instance, defective steam traps, clogged exhaust lines, ineffective filters in the steam lines and a myriad of other things can cause a steam failure. If the hospital's boiler goes down, another steam failure. These things are beyond a CS tech's ability to fix. Call the repair guy.

This has been just a start to show you how complicated the steam process can be. Later we will be looking at other forms of autoclaving and how it impacts your job.

## How Does Steam Work? Summer 2009

1. The following are advantages of using steam to sterilize instrumentation: Slow cycles, non-toxic, inexpensive, kills spores.

True  False

2. Steam can be used on all types of equipment without harm.

True  False

3. All items to be sterilized must be cleaned before the sterilization process.

True  False

4. In a gravity displacement sterilizer, the temperature must reach 250 F before sterilization can occur.

True  False

5. There needs to be 7% water vapor in the steam to get the best steam.

True  False

6. Charles Chamberland invented the first steam sterilizer in 1880.

True  False

7. The jacket is the area around the chamber but inside the outer shell where the steam comes into.

True  False

8. Autoclave load failure can be attributed to packages being too tightly wrapped.

True  False

9. Air trapped inside the packaging makes it easier to sterilize the items inside.

True  False

10. If the drain strainer becomes clogged, the air inside the chamber can't be removed effectively.

True  False

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