STEAM STERILIZATION

LEARNING OBJECTIVES
1. Identify the different types of steam sterilization cycles used in healthcare facilities
2. Describe steam sterilization load configuration to assure sterilization
3. Address proper steam sterilization load release
4. Outline the unloading process to prevent load contamination

STEAM STERILIZATION IS THE MOST COMMON FORM OF sterilization for instrumentation in the healthcare setting; therefore, it is important that Central Service (CS) technicians understand how to operate the steam sterilizer and also know and understand the sterilization parameters in order to be able to safely release a load. Steam sterilization requires specific steam quality, pressure, temperature and time. The ideal steam for sterilization is dry, saturated steam. Pressure serves as a means to obtain the high temperatures necessary to quickly kill microorganisms. Specific temperatures and times are required to attain microbicidal activity.

During the unloading process, packages must be removed to maintain sterility, and Central Service (CS) technicians must be able to identify any sterilization failures. This lesson addresses the processes necessary for successful steam sterilization cycles.

OBJECTIVE 1: IDENTIFY THE DIFFERENT TYPES OF STEAM STERILIZATION CYCLES USED IN HEALTHCARE FACILITIES
There are two basic types of steam sterilization: gravity and dynamic air removal, the latter of which includes prevacuum and steam flush pressure pulse (SFPP).

Gravity Sterilizers
During the gravity displacement cycle, steam enters from the top or sides of the sterilizer chamber. As the steam enters the chamber, it forces the cooler air out the bottom of the chamber through the drain vent. Packaged instrument set standard sterilization times are 30 minutes at 250° F or 15 minutes at 270° F.

Dynamic Air Removal Sterilizers
Dynamic air removal sterilizers are similar to gravity sterilizers, except they have vacuum pumps (or ejectors).

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to remove air before the steam enters the chamber. This results in nearly instantaneous steam penetration. Packaged instrument set standard sterilization times are 4 minutes at 270° F or 275° F for 3 minutes.

**Prevacuum Dynamic Air Removal Sterilizers** - Because a vacuum pump is used to remove air, an air removal test (Bowie-Dick test) is performed to detect air leaks. The Bowie-Dick test is run in an otherwise empty chamber and is placed horizontally in the front bottom section, near the door over the drain. This test should be performed daily and after major repairs.

**Steam Flush Pressure Pulse - SFPP** rapidly remove air by repeatedly alternating a steam flush and a pressure pulse above atmospheric pressure. Air is removed from the load as with the prevacuum sterilizer; however, air leaks do not effect this process because the steam in the chamber is always above atmospheric pressure.

**OBJECTIVE 2: DESCRIBE STEAM STERILIZATION LOAD CONFIGURATION TO ASSURE STERILIZATION**

All items undergoing sterilization must be thoroughly cleaned and prepared in a manner that allows steam to come in contact with all surfaces. The sterilizer should be loaded to ensure complete steam contact, adequate air removal, penetration of steam into each package, and steam evacuation (this allows adequate air elimination and drainage of condensate). Items capable of holding water, such as solid-bottomed pans, basins and trays, should be placed in the same direction, so if water is present, it will drain. Orienting items, such as solid-bottomed pans, in the same direction allows rapid, even distribution of steam throughout the load. It is also important not to stack items. Textile and paper/
OBJECTIVE 3: ADDRESS PROPER STEAM STERILIZATION LOAD RELEASE

The sterilization cycle is monitored with a combination of physical, chemical and biological monitors. Physical monitors are the charts or digital printouts on the sterilizer; these provide a real-time assessment of the sterilization cycle. Physical monitoring is needed to quickly detect malfunctions and allow appropriate corrective actions can be taken as soon as possible. At the end of the cycle, the physical monitors are reviewed to ensure the sterilization parameters have been met. Before the packages are removed from the sterilizer, the CS technician should examine and interpret the physical monitor to verify that all cycle parameters were met. Following this verification step, the employee should initial the physical monitor for identification purposes and maintain it as a permanent record.

External chemical indicators (CIs) demonstrate that the package has been processed through a sterilization cycle. These CIs should be reviewed to ensure the CI strip has completely changed to the appropriate color.

If a process challenge device (PCD), such as a Class 5 PCD or biological monitor PCD, is used, it is either removed and examined for end-point response, or incubated. Every sterilization load that contains implants should be monitored with a biological monitor PCD containing a Class 5 integrating CI. The Class 5 integrating CI should be reviewed to determine whether it met its end point (complete color change of the indicator). Implants should be quarantined until the results of the biological indicator (BI) testing are available.

If “wet packs” are observed, they should not be released. Wet packs are identified when there is visible moisture left in or on a package after sterilization and cooling. The moisture may be in the form of visible dampness, droplets or puddles of water on or within a pack. If there are two or more wet packs present, the load should be considered a wet load and the entire load should be reprocessed.

If the interpretation of any of the monitors suggests inadequate steam processing, the load should not be released. The CS technician should inform the appropriate supervisor and all items should be reprocessed in a manner that ensures excess moisture/condensation will not occur. These loads should be repackaged and the CIs should be replaced with new ones. Sterilized textiles should be removed and replaced with freshly laundered textiles that have not been ironed. Nonwoven tray liners should be discarded and replaces with a new liner. Rigid containers should be clean and dry, or new, unused flat wraps to contain the sets should be used.

OBJECTIVE 4: OUTLINE THE UNLOADING PROCESS TO PREVENT LOAD CONTAMINATION

All items removed from the sterilizer after sterilization processing, including items packaged in rigid sterilization container systems, should remain on the sterilizer cart until adequately cooled. Packages contain a significant amount of moisture after being exposed to steam. That moisture migrates out of the package as a gas or water vapor during both the drying and cooling phases. Packages should not be touched until they are cool because a hand can act as a point of condensation for the warm water vapor emanating from the package, thereby creating a moist area on the outside of the package. This moist area can then act as a wick to draw bacteria from the hands into the package. The cool-down period begins within the sterilizer chamber. Always follow the sterilizer’s and device manufacturer’s cooling guidelines. In some cases, the door may be opened slightly at the end of the cycle, with the items left inside for a period of time to reduce the potential for condensation formation. After the items are removed from the sterilizer, a minimum cooling time of 30 minutes is recommended for small items, while large trays may take two hours or more to adequately cool. In some instances, a longer cooling time (up to four hours) may be required.
Rigid sterilization container systems must be properly cooled to prevent re-condensation of the steam vapor. Materials used for containers are not absorbent; therefore, condensate can appear as small droplets on or within the container system. Condensate on the outside of a container system can flow downward toward the filter of another container and contaminate it. Condensate can also run down the sides to the items below. Condensate within any container system can compromise the sterility of the contents if the moisture comes in contact with outside contaminants. Note: After sterilization, the sterilization containers may be hot and can burn the CS technician. Care should be exercised when these containers are handled.

After cooling, the CS technician unloads the cart. At this time, packages should be inspected to ensure the lot control stickers and indicator tape are still attached to the packages, and that the chemical change has occurred. Wrappers should be visually checked for rips, cuts, tears or moisture. Tamper-evident devices on rigid containers should also be checked to ensure they are intact.

Records should be properly completed, verified and filed according to departmental policy.

CONCLUSION
Achieving effective steam sterilization requires due diligence by CS technicians to ensure that steam has come into full contact with the items being sterilized and that specific parameters are met for the type of steam sterilization in use. CS technicians must ensure that the sterilizer is properly loaded and well-functioning, and that quality monitors are carefully reviewed during and after the sterilization process to ensure that sterilization parameters have been met. When the sterilizer is unloaded, the CS technician must carefully inspect the items to ensure that all indicators have changed properly, that the packages are intact and contain a lot control sticker, and that there is no visible moisture present. Carefully following each of these steps helps ensure successful steam sterilization cycles.

RESOURCES


IAHCSMM acknowledges the assistance of the following two CS professionals who reviewed this quiz:

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1. Steam flush pressure pulse sterilizers remove air from the chamber in the same manner as gravity sterilizers.
   a. True
   b. False

2. A standard sterilization time for dynamic air removal sterilizers is:
   a. 250°F for 30 minutes
   b. 270°F for 15 minutes
   c. 270°F for 4 minutes
   d. All the above

3. A Bowie-Dick test should be run daily in __________ sterilizers.
   a. Steam flush pressure pulse
   b. Prevacuum dynamic air removal
   c. Gravity
   d. All the above

4. Steam flush pressure pulse sterilizers do not need a Bowie-Dick test run because:
   a. They remove air using the gravity method
   b. The chamber always remains above atmospheric pressure
   c. They remove air using a vacuum pump
   d. The gasket in this type of sterilized does not allow air leaks

5. When loading items onto a sterilizer cart, metal items should be placed below the peel-packed items.
   a. True
   b. False

6. Incorrectly loading a steam sterilizer can cause:
   a. Incomplete steam contact on all instruments
   b. A positive Bowie-Dick test
   c. Lower steam pressures
   d. All the above

7. To maintain the distribution of metal mass during sterilization, perforated instrument pans should be:
   a. Placed on edge
   b. Placed flat on the shelf
   c. Stacked loosely on the bottom shelves
   d. All the above

8. Which of the following monitoring processes provides real-time assessment of the sterilization cycle?
   a. Biological indicator
   b. Chemical indicator
   c. Physical indicator
   d. All the above

9. Every load that contains implants should contain a biological indicator.
   a. True
   b. False

10. Wet packs can be identified by:
    a. Visible moisture on the pack
    b. Visible moisture inside the pack
    c. Droplets on the outside of the pack
    d. All the above

11. When a wet pack is discovered, Central Service technicians should:
    a. Replace all linens with freshly laundered linens
    b. Replace all chemical indicators
    c. Use a new flat wrap
    d. All the above

12. At the end of a sterilization cycle, but before the items are removed from the sterilizer, the physical monitor should be read and initialed.
    a. True
    b. False

13. Rigid containers may be removed from the sterilizer cart as soon as the cart is removed from the sterilizer.
    a. True
    b. False

14. If not properly cooled after sterilization, rigid containers may develop condensate and cause a wet pack.
    a. True
    b. False

15. When unloading a sterilizer cart, the following should occur:
    a. Wrappers should be checked for holes and tears
    b. Tamper-evident devices should be checked to ensure they are intact
    c. Central Service technicians should verify that load control labels remain on each packaged sterilized
    d. All the above

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