Understanding Bowie-Dick Testing: Purpose and Usage in Daily Sterilization Practice

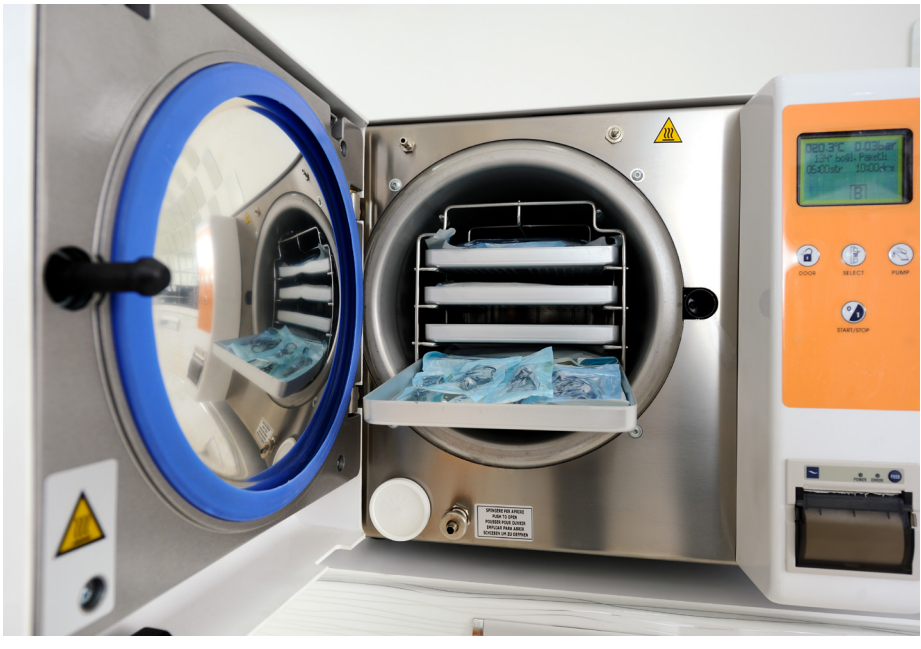
BY KAYLA OSTRANDER

Today, the Bowie-Dick (BD) test is widely used and recognized as a valuable means of monitoring the performance of vacuum-assisted steam sterilizers. However, several aspects have changed since the original work was done in Britain in the early 1960s.[1] Bowie et al. introduced a simple test to detect inadequate air removal in pre-vacuum steam sterilizers, because this air could lead to sterilization failure. They created a stack of porous towels with an indicator sheet placed at the center. When processed in an empty chamber, the indicator experienced a color change; an uneven color change indicated residual air or poor steam penetration. Their work demonstrated that sterilizers could pass routine checks yet fail to remove air effectively, highlighting the need for daily testing. This became the foundation for the BD test, which is now used globally as the standard for monitoring pre-vacuum sterilizer performance.

Current industry standards for sterile processing recommend a BD test be performed daily, before the first processed load, and for all pre-vacuum steam sterilizers. BD test results are maintained as part of the batch record and quality control system. The BD test has evolved in appearance since it was first introduced, and technology has enabled a new electronic BD test that eliminates the need for human interpretation of the printed indicator sheet; instead, it provides an automatic digital record keeping capability. Oversight of BD testing in the United States is provided by the American National Standards Institute(ANSI) and Association for the Advancement of Medical Instrumentation (AAMI) through ANSI/AAMI ST79, a comprehensive standard that serves as a guide to steam sterilization and sterility

Learning Objectives

1. **Explain the purpose and importance of the Bowie-Dick test in sterilization processes.**
2. **Demonstrate the proper procedures for using the Bowie-Dick test effectively.**
3. **Describe the necessary steps to take when a Bowie-Dick test result indicates a failure.**



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assurance in health care facilities.[2,3] This document establishes requirements for daily BD testing in pre-vacuum steam sterilizers, including test pack specifications, cycle parameters, and interpretation of results.

Objective 1: Explain the purpose and importance of BD testing in sterilization processes.

Steam sterilizers use moist heat under pressure to kill microorganisms, including spores. A saturated steam sterilization cycle has at least three phases: condition, exposure, and exhaust. During the conditioning phase, air is removed from the sterilization chamber and saturated steam enters the chamber and begins heating the load. In the exposure phase, the chamber reaches the set temperature and pressure, and the load is held at these conditions for the required time to achieve sterilization. The steam is removed during the exhaust phase, so the pressure returns to ambient. The conditioning phase removes air from the sterilizer chamber. This allows the steam to make contact with all the surfaces in the load. Inadequate vacuum, air leak, or poor steam quality can create air pockets that compromise sterility by preventing steam penetration into the load.

The BD test is an essential Type 2 indicator used to verify the effectiveness of air removal in steam sterilization processes, particularly in pre-vacuum sterilizers.[3] Type 2 indicators, which serve to assess specific performance characteristics of sterilization cycles, are vital for ensuring that sterilizers operate correctly and efficiently. By integrating the BD test into daily sterilization practice, technicians can reliably monitor sterilizer performance, ultimately enhancing patient safety and compliance with industry standards.

Most of today's sterilizers operate differently from those used by Bowie and Dick, which drew a single deep vacuum before beginning the sterilization cycle. Pre-vacuum sterilizers today typically have a series of steam injections and vacuum excursions before beginning the sterilization phase. In addition, the vacuum depth is not as great as in the older high vacuum sterilizers.

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Monitoring with a BD test pack should be done daily, prior to running the first full load of the day. If a sterilizer has an inadequate vacuum, an air leak, or poor steam quality, air pockets may form inside the sterilizer and compromise sterility by preventing steam penetration into some of the packs in the load. The indicator sheet inside the BD test pack will not develop properly if air remains trapped inside the sterilizer chamber, providing a sensitive and rapid means of detecting air leaks, inadequate air removal, inadequate steam penetration, and non-condensable gases, which can be air or gases from boiler additives.[2] If a BD test indicates a problem, the sterilizer should be taken out of service until the malfunction is identified and corrected. If the sterilizer is used continuously, the test may be performed at any time but should be performed at the same time every day.[4] The BD test pack should be placed horizontally, label side up, on the bottom shelf of the sterilizer rack, over the drain in an otherwise empty chamber. It is not acceptable to

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Quiz Answers:
1. C, 2. B, 3. D, 4. D, 5. A, 6. B, 7. B, 8. B, 9. A, 10. A

run the BD test in the same cycle as the biological indicator test pack.

Objective 2: Demonstrate the proper procedures for using the BD test effectively.

Before conducting the BD test, it is crucial for the technician to verify the sterilizer's readiness to ensure accurate results. This begins with confirming that the sterilizer is empty and clean, as any residual materials could interfere with the test. Additionally, the technician should ensure that the sterilizer has completed any necessary warm-up cycles. These initial checks establish proper baseline conditions, which are essential for the reliability of the test results. A well-prepared sterilizer sets the stage for effective testing, allowing for an accurate assessment of the sterilization process's capability to eliminate air pockets and achieve proper steam penetration.

Next, technicians must inspect the integrity and expiration of the test pack or electronic device used in the BD test. It is important to check that the chemical indicator pack is sealed, undamaged, and still within its expiration date. This step helps prevent false results that could arise from compromised materials. In the case of electronic BD devices, technicians should confirm that the device is charged, calibrated, and functioning correctly. By thoroughly examining these components before the test, technicians can ensure that the test accurately reflects the sterilizer's performance and that any potential issues are identified early on.

Once the test pack has been prepared, it is essential to follow standard operating procedures for placement and documentation. The test pack should be positioned horizontally over the sterilizer drain, which is typically the coldest and least penetrated area, to effectively challenge the sterilizer's ability to remove air and allow steam penetration. When running the BD test, the sterilizer should be programmed to run a pre-vacuum cycle at 270-273°F for 3 ½ - 4 minutes with ≤ 1 minute dry time.[4]

After the test, the technician evaluates the indicator result, checking for a uniform color change across the test sheet. Any inconsistencies, such as uneven colors or white spots, indicate a FAIL. Following this evaluation, the technician must document the result according to facility policy, recording necessary details such as test pack type, lot number, and placement location in the sterilizer log or tracking system. For electronic BD systems, while results may be automatically recorded, the technician should still ensure that the results are stored and traceable. If a test result indicates a failure, the technician must respond appropriately, initiating corrective actions to address any identified issues. If a major repair of the sterilizer is required, qualification testing should be conducted before the sterilizer is put back into routine use. During sterilizer qualification testing, the BD test should be run in three consecutive cycles after running three consecutive biological indicator process challenge device cycles.

Objective 3. Describe the necessary steps to take when a BD test result indicates a failure.

If a sterilization test results in a FAIL, the technician needs to take quick and careful steps to make sure everything is safe. First, the technician must quarantine the sterilizer, meaning it cannot be used for processing any instruments until the problem is fixed. This step is very important to avoid any risk of contamination. Next, the technician should immediately inform a supervisor or maintenance team about the failure. After checking for issues like air leaks, making sure the door seal is tight, or reloading the chamber properly, the technician must repeat the sterilization test. This process helps ensure that the sterilization is done correctly and highlights the importance of careful checks. It is recommended for the sterilizer to be properly heated before running the BD test to ensure accurate results and avoid false failures.

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Electronic BD test systems are a big improvement in sterilization monitoring technology. These systems help technicians quickly see the results on a digital display or printout that clearly shows if the test is a PASS or FAIL. This technology removes the need for interpreting color changes, which could be confusing. With electronic BD systems, sensors and auto-readers provide fast and accurate results, reducing the chance of human error. This makes the process quicker and easier, allowing for better documentation. Overall, these electronic systems help keep instruments safe and ensure they are properly sterilized before being used.

Conclusion

BD tests help keep medical instruments safe by ensuring your sterilizers are working efficiently and are properly sterilized before being used. Ensuring the readiness of the sterilizer and the integrity of the test pack or electronic device is fundamental for conducting a reliable BD test, as these initial steps lay the groundwork

for accurate assessments of the sterilization process. Proper placement of the test pack within the sterilizer is critical to effectively challenge the system's ability to eliminate air and achieve adequate steam penetration, which directly impacts the reliability of the test results. Thorough documentation and appropriate responses to test outcomes, especially in the case of failed results, are essential components of a robust sterilization protocol, promoting accountability and continuous improvement in infection control practices.

REFERENCES:

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Understanding Bowie-Dick Testing: Purpose and Usage in Daily Sterilization Practice- Practice Quiz

1. **How often should the Bowie-Dick test be run?**
   A. Weekly
   B. Monthly
   C. Daily before the first processed load
   D. During routine maintenance

2. **The Bowie-Dick test is designed to evaluate the effectiveness of the air removal system of which kind of steam sterilizer?**
   A. Gravity-displacement
   B. Prevacuum
   C. Both a and b

3. **The Bowie-Dick test is designed to detect residual air in the sterilizer chamber due to:**
   A. Inadequate air removal
   B. Air leaks
   C. Non-condensable gases in the steam
   D. All of the above

4. **The appropriate placement of a Bowie-Dick test in the sterilizer is:**
   A. On the floor over the drain
   B. On a basket over the drain
   C. Horizontally, label side up, on the bottom shelf of the sterilizer rack, over the
   D. drain in the first full load of the day
   E. Horizontally, label side up, on the bottom shelf of the sterilizer rack, over the drain in an otherwise empty chamber

5. **It is recommended for the sterilizer to be properly heated before running the Bowie-Dick test to ensure accurate results and avoid false failures.**
   A. True
   B. False

6. **To save time, it is acceptable to run the Bowie-Dick test pack in the same cycle as the biological indicator test pack.**
   A. True
   B. False

7. **When running the Bowie-Dick test, the sterilizer should be programmed to run which of the following cycles?**
   A. 270-273ºF prevacuum for 4 minutes or longer with 20 minute dry time
   B. 270-273ºF prevacuum for 3 ½ - 4 minutes with ≤ 1 minute dry time
   C. 270-273ºF gravity-displacement for 3 ½ - 4 minutes with 1 minute dry time

8. **If the Bowie-Dick test result shows a FAIL (x), what should you do?**
   A. Use the sterilizer and schedule routine maintenance
   B. Take the sterilizer out of use and notify your supervisor
   C. Ignore the result

9. **If a major repair of the sterilizer is required, qualification testing should be conducted before the sterilizer is put back into routine use.**
   A. True
   B. False

10. **During sterilizer qualification testing, the Bowie-Dick test is:**
    A. Run in three consecutive cycles after running three consecutive biological indicator process challenge device cycles
    B. Run in three consecutive cycles before running three consecutive biological
    C. indicator process challenge device cycles
    D. Run once
    E. Not needed

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