Bowie-Dick and other air removal testing

By Deborah Thame, BPharm.

"The purpose of air removal and steam penetration tests is to prove that the steriliser continues to be capable of removing all of the air from both the chamber and all parts of the load including from within porous or hollow items so that steam can effectively penetrate all parts of the load...

The design and quality of small steam sterilisers has changed considerably in the last decade as the global infection control issues surrounding the spread of diseases such as HIV, hepatitis and Creutzfeldt-Jakob Disease (CJD) impact locally on office-based health care. Inclusion of a vacuum function in new sterilisers has become almost standard and in the last decade the further development of B-class sterilisers has enabled office-based practice to sterilise and re-use many instruments that were impossible to sterilise in older small steam sterilisers. Bowie Dick testing of these B-class sterilisers, however, continues to be an area of some confusion.

Since the killing effectiveness of steam sterilisation results from the transfer of the latent heat of condensation that occurs when the steam comes into direct contact with a micro-organism, it is imperative the steam directly contacts all surfaces of the item being sterilised. Physical debris such as blood, body fluids or body tissues will act to insulate the surface of the item from direct contact with the steam as will any air trapped within the steriliser chamber or instrument. Complete air removal is particularly difficult with porous loads such as linen and with hollow items such as cannulated instruments, dental handpieces or re-usable aspirator tips. However, without complete air removal, the item will not be sterile.

The purpose of air removal and steam penetration tests (so named in AS/NZS 4815:2006) is to prove that the steriliser continues to be capable of removing all of the air from both the chamber and all parts of the load including from within porous or hollow items so that steam can effectively penetrate all parts of the load. The tests are designed to simulate air removal from a full load and must therefore be processed in an empty chamber.

Air removal and steam penetration tests are available in two types based on the type of load to be sterilised. The manufacturer of the test will indicate which type of test it is either on the packaging or on the accompanying documentation.

The first type of tests are commonly known as Bowie-Dick type tests, named after the doctors who originally developed the 'chemical indicator wrapped in towels' version of this test. These tests are specific for porous loads such as fabric. You would use this type of test to confirm air removal and steam penetration if your loads include medical drapes or other linen. Various formats of this test are available from different manufacturers, most based on the principle of removing air through the equivalent of thick fabric

Examples of steam penetration and air removal tests.

layers, allowing steam to penetrate to the centre of the load. Most of these tests are single use. A re-usable helix style Process Challenge Device (PCD) test device for porous loads is also available.

The second type of tests are helix type PCD tests. These tests are more rigorous than the porous test as they are designed to demonstrate that the steriliser can effectively remove the air from a Hollow A device as defined in AS/NZS 4815:2006. These tests normally incorporate a long, fine calibrated tube of specific internal diameter and specific length to provide the equivalent of a Hollow A device. Most of these tests are a re-usable device with single use indicator that is fitted into one end of the device.

Note: Two other types of PCD similar in appearance to the Hollow A tests are available and care should be taken to ensure they are not mistakenly used for this testing. One type, usually matched to particular brands of sterilisers, are calibrated to show that the steriliser continues to meet the performance specifications set down by the steriliser manufacturer. These may not necessarily be designed to show air removal and steam penetration equivalent to Hollow A. The other PCD's are batch control devices designed to be processed in each cycle with a normal load. These are for load monitoring purposes only and are not designed for the testing described here.

Both the porous and Hollow A air removal and steam penetration tests include a Class 2 indicator strip within the test that requires exposure to steam to achieve a colour change. These tests are to demonstrate effective air removal and steam penetration only, not to prove that the strip has been subjected to an adequate sterilising time to ensure sterilisation.

It is important to note that while the new Australian Standard has adopted the cycle type definitions and load type definitions of the European Standard, it does not provide the clarification seen in the European Standard regarding which type of air removal and steam penetration tests should be used, only stating that this test should be carried out daily on all B-class sterilisers. It would seem logical to follow the European guidelines that if your load types include porous items such as linen drapes, then you should be testing your steriliser with a test that confirms the air removal and steam penetration of porous loads. Similarly, if your load types include Hollow A items such as cannulated medical devices, dental handpieces or re-usable aspirator tips, then you should be testing your steriliser with a test that confirms the air removal and steam penetration of Hollow A loads.

Daily testing of your steriliser using the appropriate test will provide you with the assurance that the vacuum system on your steriliser is functioning correctly to allow proper sterilisation of your loads throughout the day.

About the author

Deborah Thame is the co-founder and Managing Director of STS Health. STS Health is a wholly owned Australian company specialising in the distribution and maintenance of small steam sterilisation equipment. If you are interested in other testing and monitoring procedures please contact STS Health for a copy of their Practical Guide to testing and monitoring small steam sterilisers - email info@stshealth.com.au, call (08) 9244-4628 or visit www.stshealth.com.au.