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# **Sterilization of health care products — Low temperature vaporized hydrogen peroxide — Requirements for the development, validation and routine control of a sterilization process for medical devices**

*Stérilisation des produits de santé — Vapeur de peroxyde d'hydrogène  
à basse température — Exigences pour la mise au point, la validation  
et le contrôle de routine d'un procédé de stérilisation pour dispositifs  
médicaux*



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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 198, *Sterilization of health care products*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document specifies the requirements for the development, validation and routine control of sterilization processes using a vaporized composition of water and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) as the sterilizing agent. Vaporized hydrogen peroxide (VH2O2) sterilizers process typically below 60 °C and are primarily used for the sterilization of thermolabile or moisture-sensitive medical devices in health care facilities but can also be used for sterilization of other reusable medical devices that have been established as compatible with VH2O2 processes. The sterilizers operate automatically using pre-set cycles. VH2O2 sterilizer processes can also be used by medical device manufacturers during commercial production.

NOTE 1 Work is underway within CEN/TC 102 to develop a standard for requirements for VH2O2 sterilizers (EN 17180<sup>1</sup>). It is intended that applicable test procedures to demonstrate conformity (e.g. type tests and works tests) will be included.

A sterile medical device is one that is free of viable microorganisms. International Standards that specify requirements for validation and routine control of sterilization processes require, when it is necessary to supply a sterile medical device, that adventitious microbiological contamination of a medical device prior to sterilization be minimized. Even so, medical devices produced under standard manufacturing conditions in accordance with the requirements for quality management systems (see, for example, ISO 13485) can, prior to sterilization, have microorganisms on them. Such medical devices are non-sterile. The purpose of sterilization is to inactivate the microbiological contaminants and thereby transform the non-sterile medical devices into sterile ones.

The kinetics of inactivation of microorganisms by physical or chemical agents used to sterilize medical devices generally can best be described by an exponential relationship between the number of microorganisms surviving and the extent of treatment with the sterilizing agent; inevitably this means that there is always a finite probability that a microorganism can survive regardless of the extent of treatment applied. For a given treatment, the probability of survival is determined by the number and resistance of microorganisms and by the environment in which the microorganisms exist during treatment. It follows that the sterility of any one medical device in a population subjected to sterilization processing cannot be guaranteed and the sterility of a processed population is defined in terms of the probability of there being a viable microorganism present on a medical device.

This document describes requirements that, if met, will provide a sterilization process by VH2O2 with appropriate microbicidal activity intended to sterilize medical devices. Furthermore, conformance with the requirements ensures that the sterilization process is both reliable and reproducible so that predictions can be made, with reasonable confidence, that there is a small probability of there being a viable microorganism present on a medical device after sterilization. Specification of this probability is a matter for regulatory authorities and can vary from country to country (see, for example, EN 556-1 and ANSI/AAMI ST67).

Generic requirements of the quality management system for design and development, production, installation and servicing are given in ISO 9001 and particular requirements for quality management systems for medical device production are provided in national and international standards (e.g. ISO 13485). The standards for quality management systems recognise that, for certain processes used in manufacturing, the effectiveness of the process cannot be fully verified by subsequent inspection and testing of the product. Sterilization is an example of such a process. For this reason, sterilization processes are validated for use, the performance of the sterilization process is monitored routinely and the equipment is maintained.

Exposure to a properly validated, accurately controlled sterilization process is not the only factor associated with the provision of reliable assurance that a processed medical device is sterile and, in this regard, suitable for its intended use. Attention should also be given to a number of factors including:

- a) the microbiological status of incoming raw materials or components;

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- b) the validation and routine control of any cleaning and disinfection procedures used on the medical device;
- c) the control of the environment in which the medical device is manufactured, assembled and packaged;
- d) the control of sterilizer and processes;
- e) the control of personnel and their hygiene;
- f) the sterile barrier system(s) including any protective packaging as applicable;
- g) the conditions under which the medical device is transported and stored;
- h) the material and design of the medical devices being processed.

The type of contaminants on a medical device to be sterilized varies, and this influences the effectiveness of a sterilization process. Medical devices used in a health care facility and that are being presented for sterilization in accordance with the manufacturer's instructions (see ISO 17664-1) should be regarded as special cases. There is the potential for such medical devices to possess a wide range of contaminating microorganisms and residual inorganic or organic contaminants in spite of the application of a cleaning process. Hence, the validation and control of the cleaning and disinfection processes used during processing are critical.

The guidance given in [Annexes E, F, G, H, I, J](#) and [K](#) on the application of this document is informative and is not provided as a checklist for auditors. The guidance provides explanations and methods in relation to the application of the document that are regarded as being a suitable means for conforming with the requirements of this document. Methods other than those given in the guidance can be used if they are effective in achieving conformance with the requirements of this document.

The development, validation and routine control of a sterilization process comprise a number of discrete but interrelated activities, e.g. calibration, maintenance, product definition, process definition, installation qualification, operational qualification and performance qualification. While the activities required by this document have been grouped together and are presented in a particular order, this document does not require that the activities be performed in the order that they are presented. The activities required are not necessarily sequential, as the programme of development and validation can be iterative. The responsibility for carrying out the activities required by this document vary from case to case. This document requires that the responsibilities of the various parties be defined (see [4.1](#)) but does not specify to whom the responsibilities are allocated. [E.4](#) provides guidance on allocation of responsibility.

Like other standardized low temperature sterilization processes such as ethylene oxide (ISO 11135) or low temperature steam and formaldehyde (ISO 25424), the VH2O2 sterilization processes are specified by physical and chemical parameters and can be verified using physical, chemical and microbiological means.

Sterilization processes to which this document applies should consider not only technical issues but also the environmental impact. Activities required by this document can contribute to an environmental burden that can be minimised by planning and combining tests. Additional information regarding environmental impact is provided in [Annex G](#).

NOTE 2 Specifications on operating safety are addressed in IEC 61010-1, IEC 61010-2-040 and are not included in this document. IEC 60204-1 can also apply.

NOTE 3 Requirements on occupational safety are not specified in this document (see [1.2.4](#)).

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This document has two distinct applications:

- for manufacturers of VH2O2 sterilizers and users of VH2O2 sterilization processes in the health care facility;
- for manufacturers of VH2O2 sterilizers and users of VH2O2 sterilization processes in the manufacture of healthcare products.