SLOVENSKI STANDARD
SIST EN 550:2000

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Sterilizacija medicinskih pripomoļ kov - Validacija in redni nadzor sterilizacije z etilenoksidom

Sterilization of medical devices - Validation and routine control of ethylene oxide sterilization

Sterilisation von Medizinprodukten - Validierung und Routineüberwachung für die Sterilisation mit Ethylenoxid

Stérilisation de dispositifs médicaux - Validation et contrôle de routine pour la stérilisation a l'oxyde d'éthylene

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Sterilization of medical devices - Validation and routine control of ethylene oxide sterilization

Stérilisation de dispositifs médicaux — Validation et contrôle de routine pour la stérilisation à l'oxyde d'éthylène

Sterilisation von Medizinprodukten - Validierung und Routineüberwachung für die Sterilisation mit Ethylenoxid

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Contents

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 204 "Sterilization of medical devices", the secretariat of which is held by BSI.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

This standard has been considered by CEN/TC 204 as one of a sequence of European standards concerned with three common sterilization processes and their control. These standards are:

EN 550 Sterilization of medical devices - Validation and routine control of ethylene oxide sterilization

EN 552 Sterilization of medical devices - Validation and routine control of sterilization by irradiation

EN 554 Sterilization of medical devices - Validation and routine control of sterilization by moist heat

EN 556 Sterilization of medical devices - Requirements for medical devices to be labelled "STERILE"

In this European Standard the terms defined in clauses 3 are in italic type.

This European Standard shall be given the status of a National Standard, either by publication of an identical text or by endorsement, at the latest by December 1994, and conflicting national standards shall be withdrawn at the latest by December 1994.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Introduction

A *sterile* product item is one which is free of viable micro-organisms. The European Standards for *medical devices* require, when it is necessary to supply a sterile product item, that adventitious microbiological contamination of a *medical device* from all sources is minimized by all practical means. Even so, product items produced under standard manufacturing conditions in accordance with the requirements for quality systems for *medical devices* (see EN 46001 or EN 46002) may, prior to sterilization, have micro-organisms on them, albeit in low numbers. Such product items are non-sterile. The purpose of sterilization processing is to inactivate the microbiological contaminants and thereby transform the non-sterile items into sterile ones.

The inactivation of a pure culture of micro-organisms by physical and/or chemical agents used to sterilize *medical devices* often approximates to an exponential relationship; inevitably this means that there is always a finite probability that a micro-organism may survive regardless of the extent of treatment applied. For a given treatment, the probability of survival is determined by the number and types of micro-organisms and by the environment in which the organisms exist during treatment. It follows that the sterility of any one item in a population of items subjected to sterilization processing cannot be guaranteed and the sterility of the processed population of items has to be defined in terms of the probability of the existence of a non-sterile item in that population. The value taken by this probability is specified elsewhere (see EN 556). However, the principles specified in this standard are applicable irrespective of the stated probability.

Requirements for the quality system for the design/development, production, installation and servicing of *medical devices* are given in EN 46001 and EN 46002 which supplement the EN 29000 series of European Standards.

The EN 29000 series of standards designates certain processes used in manufacture as "special" if the results cannot be fully verified by subsequent inspection and testing of the product. Sterilization is an example of a special process because process efficacy cannot be verified by inspection and testing of the product. For this reason, sterilization processes have to be validated before use, the performance of the process monitored routinely and the equipment maintained.

It is important to be aware that exposure to a properly validated and accurately controlled sterilization process is not the only factor associated with the provision of reliable assurance that the product is *sterile* and, in this respect, suitable for its intended use. Attention has also to be given to a number of factors including the microbiological status (*bioburden*) of incoming raw materials and/or components, their subsequent storage and to the control of the environment in which the product is manufactured, assembled and packaged.

The object of this European Standard is standardization in the field of *validation* and routine monitoring of ethylene oxide sterilization processes and procedures that are carred out by those who sterilize *medical devices*. The *validation* of sterilization procedures presupposes that the sterilization equipment complies with appropriate specifications.

This standard contains requirements for the *validation* and routine monitoring of sterilization by gaseous ethylene oxide; guidance on the application of this standard is offered in informative annex B.

NOTE: The requirements are the obligatory parts of this standard in that these are to be observed if compliance is to be achieved. The guidance given in annex B, is not obligatory and it is not provided as a check list for auditors.

1 Scope

1.1 This European Standard specifies requirements for the development, *validation*, process control and monitoring of the sterilization of medical devices using ethylene oxide.

NOTE: Specifications for sterilizers are being prepared by CEN/TC 102.

1.2 This European Standard does not describe a quality assurance system for the control of all stages of manufacture.

NOTE: Attention is drawn to the standards for quality systems (see EN 46001 or EN 46002) which control all stages of manufacture including the sterilization process. It is not a requirement of this standard to have a complete quality system during manufacture but certain elements of such a system are required and these are normatively referenced at appropriate places in the text.

1.3 This European Standard does not cover operator safety (see note).

NOTE: Ethylene oxide is toxic, flammable and explosive. Attention is drawn to the existence in some countries of national regulations laying down safety requirements for handling ethylene oxide and for premises in which it is used.

1.4 This European Standard does not cover the level of residual ethylene oxide within medical devices.

NOTE: Attention is drawn to the existence in some countries of standards stipulating the level of ethylene oxide residue within *medical devices*.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 556[1)]	Sterilization of medical devices - Requirements for medical devices to be labelled 'STERILE'
EN 866-2[1)]	Biological systems for testing sterilizers Part 2: Systems for use in ethylene oxide sterilizers
EN 1174-1[1)]	Sterilization of medical devices - Estimation of the population of micro-organisms on product Part 1: Requirements
EN 29001 : 1987	Quality systems - Model for quality assurance in design/development, production, installation and servicing
EN 29002 : 1987	Quality systems - Model for quality assurance in production and installation
EN 46001 : 1993	Particular requirements for the application of EN 29001 for medical devices
EN 46002 : 1993	Particular requirements for the application of EN 29002 for medical devices

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1 aeration: Part of the sterilization process during which ethylene oxide and/or its reaction products desorb from the *medical device* until predetermined levels are reached.

NOTE: This may be performed within the sterilizer and/or in a separate chamber or room.

3.2 bioburden: Population of viable micro-organisms on a product and/or a package.

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1) In preparation.

3.3 **biological indicator:** *Inoculated carrier* contained within its primary pack.

3.4 **chamber:** Enclosed area which only accommodates sufficient product to fill the sterilizer.

3.5 **commissioning:** Obtaining and documenting evidence that equipment has been provided and installed in accordance with its specifications and that it functions within predetermined limits when operated in accordance with operational instructions.

3.6 **conditioning:** Treatment of product within the *sterilization cycle*, but prior to sterilant admission, to attain a predetermined temperature and relative humidity throughout the *sterilization load.*

NOTE: This part of the *sterilization cycle* may be carried out either at atmospheric pressure or under vacuum. (See also *preconditioning.*)

3.7 **cycle completion:** That time after completion of the *sterilization cycle* at which the *sterilization load* is ready to be removed from the chamber.

3.8 **D-value; decimal reduction value:** Time (expressed in minutes) or the irradiation dose (expressed in kilograys) required to secure inactivation of 90 % of the test organisms under stated exposure conditions.

3.9 **exposure time:** Time for which the sterilizer chamber is maintained at the specified temperature, sterilant concentration, pressure and humidity.

3.10 **flushing:** Procedure by which further sterilant is removed from the load and *chamber* by either:

a) multiple alternate admissions of filtered air or inert gas and evacuations of the *chamber*; or

b) continuous passage of filtered air or inert gas through the load and *chamber*.

3.11 **inoculated carrier:** Piece of supporting material on which a defined number of specified micro-organisms has been deposited.

3.12 **medical device:** (The definition given in EN 46001 applies.)

3.13 **parametric release:** Declaring product as "sterile" based on physical process data rather than on the basis of sample testing or *biological indicator* results.

3.14 **performance qualification:** Obtaining and documenting evidence that the equipment as *commissioned* will produce acceptable product when operated in accordance with the process specification.

3.15 preconditioning: Treatment of product prior to the *sterilization cycle* to attain a predetermined temperature and relative humidity throughout the *sterilization load*. (See also *conditioning*.)

3.16 preconditioning area: Either a *chamber* or a *room* in which *preconditioning* occurs.

3.17 process challenge device: Object which simulates the worst case conditions as they are given for the sterilizing agent(s) in the goods to be sterilized.

NOTE 1: The device is so constituted that a *biological indicator* can be arranged in the place most difficult for the sterilant to reach. The design of the *process challenge device* depends on the kind of goods to be sterilized and the sterilization procedure. The *biological indicator* should not interfere with the function of the *process challenge device*.

NOTE 2: In some *process challenge devices* an *inoculated carrier* may be used in place of a *biological indicator*.

3.18 product compatibility: Ability of the *sterilization cycle* to achieve the intended results without detrimental effect on the product.

3.19 reference load: Specified load made up to represent the most difficult combination of products to be sterilized.

3.20 revalidation: Set of documented procedures to confirm an established *validation*.

3.21 room: Enclosed area capable of holding more product than can be accommodated in the sterilizer(s) at any one time.

3.22 sterilant injection stage: Stage beginning with the first introduction of sterilant into the *chamber* and ending whenever the set operating pressure has been attained.

3.23 sterilant injection time: Duration of the sterilant injection stage.

3.24 sterilant removal time: Portion of the *sterilization cycle* in which gaseous ethylene oxide is removed from the *chamber* and *sterilization load* but not necessarily desorbed from individual products. (See also *aeration*.)

3.25 sterile: Condition of a *medical device* that is free from viable micro-organisms. (See EN 556.)

3.26 sterilization cycle: Automatic sequence of operating stages performed in a sterilizer for the purpose of sterilization.

NOTE: In the context of ethylene oxide sterilization, treatment in a hermetically sealed *chamber* comprises *conditioning* (if used), exposure to ethylene oxide, removal of ethylene oxide and *flushing* (if used).

3.27 sterilization load: Goods that are to be or have been sterilized simultaneously in the sterilization *chamber*.

NOTE: The *sterilization load* may include more than one manufacturing batch or lot.

3.28 usable sterilizer chamber volume: Space inside the *sterilizer chamber* which is not restricted by fixed or mobile parts (loading units, pallets, etc.) and which is consequently available to accept the *sterilization load*.

NOTE: This is usually expressed in terms of height, width and depth.

3.29 validation: Documented procedure for obtaining, recording and interpreting the data required to show that a process will consistently comply with predetermined specifications.

NOTE: For ethylene oxide sterilization, *validation* is considered as a total programme which consists of *commissioning* and *performance qualification*.

4 General

Medical devices to be sterilized shall be manufactured under conditions that ensure that their *bioburden* is consistently low (see EN 556). Employing a quality system complying with EN 46001 or EN 46002 meets this requirement.

The documented procedures and instructions required by this standard shall be implemented effectively. Documentation and records shall be reviewed and approved by designated personnel (see **4.1**).

4.1 Personnel

Responsibility for the maintainance of equipment (see **4.4.1**), for the *validation* and routine control of ethylene oxide sterilization and for the release of product shall be assigned to qualified personnel as specified in **4.1.2.2** and **4.18** of EN 29001 : 1987 or in **4.1.2.2** and **4.17** of EN 29002 : 1987.

4.2 Process development and product compatibility

4.2.1 Prior to the introduction of a new or altered product, package, loading pattern or sterilization process, the process to be validated shall be defined and documented. A demonstration of equivalence to a previously validated product, package or loading pattern shall be considered to satisfy this requirement. Any demonstration of equivalence shall be documented.

4.2.2 Product and packaging shall be designed to allow removal of air and penetration of steam and ethylene oxide. The location within the product at which sterilization is most difficult to achieve shall be identified.

4.2.3 It shall have been demonstrated that the specified sterilization process does not affect the correct functioning of the product and its packaging.

4.2.4 If resterilization is to be permitted, the effects of such processing shall be evaluated.

4.3 Process

The process shall include *preconditioning* and/or *conditioning*, sterilization, and *aeration*.

4.3.1 Preconditioning and/or conditioning

Preconditioning and/or conditioning treatments shall be performed under controlled conditions for a stipulated period of time in order to achieve the specified temperature and relative humidity within the load.

Humidity during *preconditioning* and/or *conditioning* shall be generated by the introduction of steam into the *preconditioning area* and sterilizer respectively.

4.3.2 Sterilization cycle

The *sterilization cycle* shall include:

- air removal
- *conditioning* (if used)
- sterilant injection
- maintenance of specified conditions for the *exposure time*
- sterilant removal
- flushing (if used)
- air admission to atmospheric pressure.

4.3.3 Aeration

Product shall be retained under specified conditions for a defined period for *aeration*. (See also 5.3.4.)

NOTE: *Aeration* may be performed within the sterilizer and/or in a separate *chamber* or *room*.

4.4 Equipment

4.4.1 The specification for the equipment to be used for ethylene oxide sterilization, including the *preconditioning area*, sterilizer and *aeration* area, shall be documented.

4.4.2 The conditions used for storage of sterilant prior to and during use shall ensure that its quality and composition remains within specification.

4.5 Calibration

An effective system shall be established, documented and maintained for the calibration of all controlling, indicating and recording instruments used for *validation* and routine control of the sterilization process. This system shall comply with the requirements of either 4.12 of EN 29001 : 1987 or 4.11 of EN 29002 : 1987.

4.6 Maintenance

4.6.1 Preventative maintenance shall be planned and performed in accordance with documented procedures. The procedure for each planned maintenance task and the frequency at which it is to be carried out shall be specified and documented.

4.6.2 Equipment (see 4.4.1) shall not be used to process *medical devices* until all maintenance tasks have been satisfactorily completed and recorded.

4.6.3 Records of maintenance shall be retained as specified in 4.16 of EN 29001 : 1987 or in 4.15 of EN 29002 : 1987.

4.6.4 The maintenance scheme, maintenance procedures and maintenance records shall be reviewed periodically by a designated person (see 4.1).

5 Validation

5.1 General

Procedures for *validation* shall be documented and records of each *validation* shall be retained.