

**Tervishoiutoodete steriliseerimine. Kiirgus. Osa 2:  
Steriliseerimiskoosi määramine**

**Sterilization of health care products - Radiation - Part 2:  
Establishing the sterilization dose (ISO 11137-2:2013)**

## EESTI STANDARDI EESSÕNA

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English Version

**Sterilization of health care products - Radiation - Part 2:  
Establishing the sterilization dose (ISO 11137-2:2013)**

Stérilisation des produits de santé - Irradiation - Partie 2:  
Établissement de la dose stérilisante (ISO 11137-2:2013)

Sterilisation von Produkten für die Gesundheitsfürsorge -  
Strahlen - Teil 2: Festlegung der Sterilisationsdosis (ISO  
11137-2:2013)

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## Foreword

This document (EN ISO 11137-2:2013) has been prepared by Technical Committee ISO/TC 198 "Sterilization of health care products" in collaboration with Technical Committee CEN/TC 204 "Sterilization of medical devices" the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by December 2013, and conflicting national standards shall be withdrawn at the latest by December 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 11137-2:2012.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

For relationship with EU Directives, see informative Annex ZA, B and C, which are integral parts of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

### Endorsement notice

The text of ISO 11137-2:2013 has been approved by CEN as EN ISO 11137-2:2013 without any modification.

## Annex ZA (informative)

### Relationship between this European Standard and the Essential Requirements of EU Directive 90/385/EEC on active implantable medical devices

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 90/385/EEC on active implantable medical devices.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and Directive 90/385/EEC**

| Clauses of this European Standard | Essential Requirements (ERs) of EU Directive 90/385/EEC | Qualifying remarks/Notes   |
|-----------------------------------|---|--|
| 4, 5, 6, 7, 8, 9, 10              | 7   | This relevant ER is only partly addressed in this International Standard and only in conjunction with ISO 11137-1. Packaging for maintenance of sterility during transportation and storage are not covered. |

**WARNING** — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

## Annex ZB (informative)

### Relationship between this European Standard and the Essential Requirements of EU Directive 93/42/EEC on medical devices

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 93/42/EEC on medical devices.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZB.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZB.1 — Correspondence between this European Standard and EU Directive 93/42/EEC**

| Clauses of this European Standard | Essential Requirements (ERs) of EU Directive 93/42/EEC | Qualifying remarks/Notes   |
|-----------------------------------|--|--|
| 4, 5, 6, 7, 8, 9, 10              | 8.3  | This relevant ER is only partly addressed in this International Standard and only in conjunction with ISO 11137-1. Packaging for maintenance of sterility during transportation and storage are not covered. |
| 4, 5, 6, 7, 8, 9, 10              | 8.4  | This relevant ER is addressed in this International Standard only in conjunction with ISO 11137-1.   |

**WARNING** — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

## Annex ZC (informative)

### Relationship between this European Standard and the Essential Requirements of EU Directive 98/79/EC on *in vitro* diagnostic medical devices

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 98/79/EC on *in vitro* diagnostic medical devices.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZC.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZC.1 — Correspondence between this European Standard and Directive 98/79/EC**

| Clauses of this European Standard | Essential Requirements (ERs) of EU Directive 98/79/EC | Qualifying remarks/Notes   |
|-----------------------------------|---|--|
| 4, 5, 6, 7, 8, 9, 10              | B.2.3   | This relevant ER is only partly addressed in this International Standard and only in conjunction with ISO 11137-1. Packaging for maintenance of sterility during transportation and storage are not covered. |
| 4, 5, 6, 7, 8, 9, 10              | B.2.4   | This relevant ER is only addressed in this International Standard in conjunction with ISO 11137-1.   |

**WARNING** — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

# Contents

|   | Page      |
|---|-----------|
| Foreword.....   | v         |
| Introduction.....   | vi        |
| <b>1 Scope.....</b>   | <b>1</b>  |
| <b>2 Normative references.....</b>  | <b>1</b>  |
| <b>3 Terms, definitions, and abbreviated terms.....</b>   | <b>1</b>  |
| 3.1 Terms and definitions.....  | 1         |
| 3.2 Abbreviated terms.....  | 3         |
| <b>4 Definition and maintenance of product families for dose setting, dose substantiation, and sterilization dose auditing.....</b>         | <b>4</b>  |
| 4.1 General.....  | 4         |
| 4.2 Defining product families.....  | 4         |
| 4.3 Designation of product to represent a product family for performance of a verification dose experiment or sterilization dose audit..... | 5         |
| 4.4 Maintaining product families.....   | 6         |
| 4.5 Effect of failure of establishment of sterilization dose or of a sterilization dose audit on a product family.....                      | 7         |
| <b>5 Selection and testing of product for establishing the sterilization dose.....</b>  | <b>7</b>  |
| 5.1 Nature of product.....  | 7         |
| 5.2 Sample item portion (SIP).....  | 8         |
| 5.3 Manner of sampling.....   | 9         |
| 5.4 Microbiological testing.....  | 9         |
| 5.5 Irradiation.....  | 9         |
| <b>6 Methods of dose establishment.....</b>   | <b>9</b>  |
| <b>7 Method 1: dose setting using bioburden information.....</b>  | <b>10</b> |
| 7.1 Rationale.....  | 10        |
| 7.2 Procedure for Method 1 for product with an average bioburden greater than or equal to 1,0 for multiple production batches.....          | 11        |
| 7.3 Procedure for Method 1 for product with an average bioburden greater than or equal to 1,0 for a single production batch.....            | 17        |
| 7.4 Procedure for Method 1 for product with an average bioburden in the range 0,1 to 0,9 for multiple or single production batches.....     | 19        |
| <b>8 Method 2: Dose setting using fraction positive information from incremental dosing to determine an extrapolation factor.....</b>       | <b>20</b> |
| 8.1 Rationale.....  | 20        |
| 8.2 Procedure for Method 2A.....  | 21        |
| 8.3 Procedure for Method 2B.....  | 24        |
| <b>9 Method <math>VD_{max}</math> — Substantiation of 25 kGy or 15 kGy as the sterilization dose.....</b>                                   | <b>28</b> |
| 9.1 Rationale.....  | 28        |
| 9.2 Procedure for Method $VD_{max}^{25}$ for multiple production batches.....   | 29        |
| 9.3 Procedure for Method $VD_{max}^{25}$ for a single production batch.....   | 34        |
| 9.4 Procedure for Method $VD_{max}^{15}$ for multiple production batches.....   | 37        |
| 9.5 Procedure for Method $VD_{max}^{15}$ for a single production batch.....   | 40        |
| <b>10 Sterilization dose audit.....</b>   | <b>43</b> |
| 10.1 Purpose and frequency.....   | 43        |
| 10.2 Procedure for auditing a sterilization dose established using Method 1, Method 2A, or Method 2B.....                                   | 43        |
| 10.3 Procedure for auditing a sterilization dose substantiated using Method $VD_{max}^{25}$ or Method $VD_{max}^{15}$ .....                 | 46        |
| 10.4 Failure of a sterilization dose audit.....   | 52        |
| <b>11 Worked examples.....</b>  | <b>52</b> |



|                           |  |           |
|---------------------------|--|-----------|
| 11.1                      | Worked examples for Method 1 .....   | 52        |
| 11.2                      | Worked examples for Method 2 .....   | 54        |
| 11.3                      | Worked examples for Method $VD_{max}$ .....  | 62        |
| 11.4                      | Worked example of a sterilization dose audit for a dose established using Method 1, the findings from which necessitated augmentation of the sterilization dose .....  | 64        |
| 11.5                      | Worked example of a sterilization dose audit for a dose established using Method 2A, the findings from which necessitated augmentation of the sterilization dose ..... | 64        |
| 11.6                      | Worked example of a sterilization dose audit for a sterilization dose substantiated using Method $VD_{max}^{25}$ .....   | 65        |
| <b>Bibliography</b> ..... |  | <b>67</b> |

## Introduction

This part of ISO 11137 describes methods that can be used to establish the sterilization dose in accordance with one of the two approaches specified in 8.2 of ISO 11137-1:2006. The methods used in these approaches are:

- dose setting to obtain a product-specific dose;
- dose substantiation to verify a preselected dose of 25 kGy or 15 kGy.

The basis of the dose setting methods described in this part of ISO 11137 (Methods 1 and 2) owe much to the ideas first propounded by Tallentire<sup>[19][20][21]</sup>. Subsequently, standardized protocols were developed<sup>[10][11]</sup>, which formed the basis of the dose setting methods detailed in the AAMI Recommended Practice for Sterilization by Gamma Radiation<sup>[6][8]</sup>.

Methods 1 and 2 and the associated sterilization dose audit procedures use data derived from the inactivation of the microbial population in its natural state on product. The methods are based on a probability model for the inactivation of microbial populations. The probability model, as applied to bioburden made up of a mixture of various microbial species, assumes that each such species has its own unique  $D_{10}$  value. In the model, the probability that an item will possess a surviving microorganism after exposure to a given dose of radiation is defined in terms of the initial number of microorganisms on the item prior to irradiation and the  $D_{10}$  values of the microorganisms. The methods involve performance of tests of sterility on product items that have received doses of radiation lower than the sterilization dose. The outcome of these tests is used to predict the dose needed to achieve a predetermined sterility assurance level (SAL).

Methods 1 and 2 can also be used to substantiate 25 kGy if, on performing a dose setting exercise, the derived sterilization dose for an SAL of  $10^{-6}$  is less than or equal to 25 kGy. The basis of the method devised specifically for substantiation of 25 kGy, Method  $VD_{max}$ , was put forward by Kowalski and Tallentire<sup>[16]</sup>. Subsequent evaluations involving computational techniques demonstrated that the underlying principles were soundly based<sup>[15]</sup> and field trials confirmed that Method  $VD_{max}$  is effective in substantiating 25 kGy for a wide variety of medical devices manufactured and assembled in different ways<sup>[18]</sup>.

A standardized procedure for the use of  $VD_{max}$  for substantiation of a sterilization dose of 25 kGy has been published in the AAMI Technical Information Report *Sterilization of health care products — Radiation sterilization — Substantiation of 25 kGy as a sterilization dose — Method  $VD_{max}$* <sup>[7]</sup>, a text on which the method described herein is largely based. Method  $VD_{max}$  is founded on dose setting Method 1 and, as such, it possesses the high level of conservativeness characteristic of Method 1. In a similar manner to the dose setting methods, it involves performance of tests of sterility on product items that have received a dose of radiation lower than the sterilization dose. The outcomes of these tests are used to substantiate that 25 kGy achieves an SAL of  $10^{-6}$ .

To link the use of  $VD_{max}$  for the substantiation of a particular preselected sterilization dose, the numerical value of the latter, expressed in kilograys, is included as a superscript to the  $VD_{max}$  symbol. Thus, for substantiation of a sterilization dose of 25 kGy, the method is designated Method  $VD_{max}^{25}$ .

Method  $VD_{max}^{15}$  is based on the same principles as Method  $VD_{max}^{25}$ . The test procedure is similar to that of Method  $VD_{max}^{25}$ , but Method  $VD_{max}^{15}$  is limited to product with an average bioburden less than or equal to 1,5. The outcomes of the associated tests of sterility are used to substantiate that 15 kGy achieves a sterility assurance level of  $10^{-6}$ .

This part of ISO 11137 also describes methods that can be used to carry out sterilization dose audits in accordance with ISO 11137-1:2006, Clause 12. Following establishment of the sterilization dose, sterilization dose audits are performed routinely to confirm that the sterilization dose continues to achieve the desired SAL.

# Sterilization of health care products — Radiation —

## Part 2: Establishing the sterilization dose

### 1 Scope

This part of ISO 11137 specifies methods for determining the minimum dose needed to achieve a specified requirement for sterility and methods to substantiate the use of 25 kGy or 15 kGy as the sterilization dose to achieve a sterility assurance level, SAL, of  $10^{-6}$ . This part of ISO 11137 also specifies methods of sterilization dose audit used to demonstrate the continued effectiveness of the sterilization dose.

This part of ISO 11137 defines product families for sterilization dose establishment and sterilization dose audit.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11137-1:2006, *Sterilization of health care products — Radiation — Part 1: Requirements for the development, validation and routine control of a sterilization process for medical devices*

ISO 11737-1, *Sterilization of medical devices — Microbiological methods — Part 1: Determination of a population of microorganisms on products*

ISO 11737-2, *Sterilization of medical devices — Microbiological methods — Part 2: Tests of sterility performed in the definition, validation and maintenance of a sterilization process*

### 3 Terms, definitions, and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 11137-1 and the following apply.

#### 3.1 Terms and definitions

##### 3.1.1

##### **batch**

defined quantity of product, intended or purported to be uniform in character and quality, which has been produced during a defined cycle of manufacture

[ISO/TS 11139:2006, definition 2.1]

##### 3.1.2

##### **bioburden**

population of viable microorganisms on or in product and/or sterile barrier system

[ISO/TS 11139:2006, definition 2.2]