INTERNATIONAL STANDARD

ISO 11607-1

Second edition
2019-02

AMENDMENT 1
2023-09

Packaging for terminally sterilized medical devices —

Part 1: Requirements for materials, sterile barrier systems and packaging systems

AMENDMENT 1: Application of risk management

Emballages des dispositifs médicaux stérilisés au stade terminal —

Partie 1: Exigences relatives aux matériaux, aux systèmes de barrière stérile et aux systèmes d'emballage

AMENDEMENT 1: Application de la gestion des risques

Reference number
ISO 11607-1:2019/Amd.1:2023(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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.

This document was prepared by Technical Committee ISO/TC 198*, Sterilization of health care products,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 102, *Sterilizers for medical purposes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 11607 series can be found on the ISO website.

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.

Packaging for terminally sterilized medical devices —

Part 1:
Requirements for materials, sterile barrier systems and packaging systems

AMENDMENT 1: Application of risk management

Clause 1, Scope

Delete the following text:

> It is applicable to industry, to health care facilities, and to wherever medical devices are placed in sterile barrier systems and sterilized.

3.7

Replace term and definition entry with the following:

3.7
labelling
label, instructions for use and any other information that is related to identification, technical description, intended purpose and proper use of the medical device, but excluding shipping documents

[SOURCE: ISO 13485:2016, 3.8]

Clause 3

Add the following term entries:

3.32
hazard
potential source of harm

[SOURCE: ISO/IEC Guide 63: 2019, 3.2]

3.33
intended use
intended purpose
use for which a product, process or service is intended according to the specifications, instructions and information provided by the manufacturer

Note 1 to entry: The intended medical indication, patient population, part of the body or type of tissue interacted with, user profile, use environment, and operating principle are typical elements of the intended use.

Note 2 to entry: "intended use" is used in the United States and "intended purpose" is used in the European Union. These terms have essentially the same meaning. Throughout this document, the term "intended use" is used.

[SOURCE: ISO/IEC Guide 63:2019, 3.4, modified — "intended purpose" was added to term, Note 2 to entry was added.]

3.34
process
set of interrelated or interacting activities that use inputs to deliver an intended result

Note 1 to entry: Whether the "intended result" of a process is called output, product or service depends on the context of the reference.

Note 2 to entry: Inputs to a process are generally the outputs of other processes and outputs of a process are generally the inputs to other processes.

Note 3 to entry: Two or more interrelated and interacting processes in series can also be referred to as a process.

[SOURCE: ISO 9000:2015, 3.4.1, modified — Notes to entry 4, 5 and 6 have been deleted]

3.35
reasonably foreseeable misuse
use of a product or system in a way not intended by the manufacturer, but which can result from readily predictable human behaviour

Note 1 to entry: Readily predictable human behaviour includes the behaviour of all types of users, e.g. lay and professional users.

Note 2 to entry: Reasonably foreseeable misuse can be intentional or unintentional.

[SOURCE: ISO/IEC Guide 63:2019, 3.8]

3.36
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 63:2019, 3.10, modified — Note 1 to entry has been deleted]

4.2

Replace the text with the following:

4.2 Risk management

A risk management process conforming with the requirements of Annex F shall be implemented.

NOTE Annex F details requirements for the packaging risk management process, which is a subset of risk management for medical devices. Annex G provides background information on risk management for medical device packaging. Additional requirements for risk management of medical devices including sterile packaging can be specified by some regulatory jurisdictions. ISO 14971 covers application of risk management to medical devices and guidance on the application of ISO 14971 can be found in ISO/TR 24971.

4.4.3, NOTE

Replace with the following:

NOTE Annex B contains a list of test methods. Publication of a method by a standards body does not make it validated by the user of the test method.

6.1.1

Replace the text with the following:

6.1.1 The packaging system shall be designed to minimize the risks, as specified in Annex F, to the user and patient during intended use and/or reasonably foreseeable misuse.

NOTE See also 4.2 as well as Annex G for guidance on packaging risk management.

Bibliography

Add the following entries to the Bibliography:

[170] ISO/TR 24971, *Medical devices — Guidance on the application of ISO 14971*

[171] ISO/IEC Guide 63:2019, *Guide to the development and inclusion of aspects of safety in International Standards for medical devices*

[172] ISO 9000:2015, *Quality management systems — Fundamentals and vocabulary*

Annex F, Annex G

Add the following new Annexes F and G after Annex E.

Annex F
(normative)

Risk management

F.1 Risk management process

An ongoing risk management process applicable to packaging systems shall be established, implemented, documented and maintained. This process shall include:

a) identification of hazards and hazardous situations associated with the packaging system (see F.4,);

b) estimation (see F.5) and evaluation (see F.6) of the associated risks;

c) risk control (see F.7);

d) monitoring of the effectiveness of the risk control measures (see F.8).

F.2 Application of the risk management process

This process shall apply throughout the phases of design and development, validation, production and post-production of the packaging system. The following shall be included:

a) Design and development phase

— Packaging system design (see Clause 6).

NOTE G.2.7.4 provides guidance on general requirements for design and G.2.8.2 provides guidance on usability for aseptic presentation. Sealing and assembly process development is addressed in G.2.7.5 and ISO 11607-2.

b) Validation phase

— Performance and stability testing (see Clause 8 and G.2.8.3);

— Usability evaluation (see Clause 7 and G.2.8.2).

NOTE Process validation is addressed in G.2.8.4 and ISO 11607-2.

c) Production phase

— Packaging system changes (see Clause 9 and G.2.10).

NOTE Process control and monitoring, assembly, use of reusable sterile barrier systems, process changes and revalidation are addressed in ISO 11607-2 and G.2.9.

d) Post-production phase

— If post-production information is available on the performance of the packaging system, it shall be analysed to determine if risks are controlled appropriately or if unidentified hazards or hazardous situations are present. Consequent corrective and preventive actions shall be implemented as needed.

NOTE 1 The corrective and preventive actions can include redesign, additional controls or revalidation.

NOTE 2 This document does not include requirements for collecting post-production information or for reporting adverse events and field safety corrective actions to authorities or other related activities. This is typically established based on the requirements of the quality management system.

F.3 Risk management plan

F.3.1 General

A risk management plan shall be documented in accordance with the risk management process for each packaging system including at least the following:

— the scope of the planned risk management activities;

— criteria for risk acceptability;

— activities for verification of the implementation and effectiveness of risk control measures.

Risk management plans and related records and documentation for packaging systems may be combined with those for the medical device.

F.3.2 Criteria for risk acceptability

Criteria for risk acceptability shall be developed based on the following principles (see also G.2.6):

— align with the device to be packaged and its intended use;

— align with the intended use environment and related aseptic presentation;

— differentiate between essential design requirements for functionality (e.g. integrity) and lesser impact requirements (e.g. dimensional variance);

— consider the hazards defined in Table F.1, taking into account generally acknowledged state-of-the-art acceptance criteria as applicable (e.g. biocompatibility).

NOTE Local regulatory requirements can provide mandatory criteria for risk acceptability, or these criteria can be based on the generally accepted state-of- the-art.

F.3.3 Similar packaging systems

Risk management plans for similar packaging systems may be combined, in which case the rationale for these similarities shall be documented.

F.4 Specific hazards and hazardous situations to be addressed

For each of the hazards below, considering both normal and fault conditions, sequences of events shall be identified, and the resulting hazardous situations shall be evaluated:

— Microbial contamination;

— Chemical contamination;

— Adverse environmental, processing and use conditions;

— Misleading information.

Table F.1 provides examples of hazards and potential relevant factors.

Table F.1 — Hazards and potential relevant factors

Hazard	Potential relevant factors
Microbial contamination	Airborne, surface or material microbial contamination
Chemical contamination	Bio-incompatible or toxic materials or components, process residuals (e.g. EO residuals), incompatibility between device and packaging materials, sterilization process, labelling system
Adverse environmental, processing and use conditions	Exposure to incompatible temperature / pressure / humidity or moisture / UV lighting / shock / vibration (all storage and transport conditions)
	Inadequate or uncontrolled manufacturing process including the work environment
	Inappropriate sterilization method, inappropriate sterilization process cycle or sterilization process failure
	Use-related activities affecting patient safety including foreseeable misuse, such as human error
	Use-related activities affecting user safety, e.g. involved in transport and storage and dispensing (e.g. sharp edges, weight)
	Disposal factors: contamination, sharp edges, gas from incineration
Misleading information	Label design error
	Selection of label material and printing technology leading to incorrect ink transfer and poor legibility
	Mix-ups (e.g. incorrect label, wrong file or information, data)

NOTE For further guidance see G.2.2 on hazards to be addressed, G.2.3 on identification of sequences of events and G.2.4 on related hazardous situations. Table G.1 provides examples of relationship between hazards, foreseeable sequences of events and resulting hazardous situations.

F.5 Risk estimation

For each identified hazardous situation, the associated risk(s) shall be estimated using available information or data.

Hazardous situations shall be assessed based on their probability of occurrence and the potential severity of related harm. For hazardous situations for which the probability of the occurrence of harm cannot be estimated, the possible consequences shall be listed for use in risk evaluation and risk control.

The risk estimate may include detectability if the ability to detect the hazardous situation can be directly assessed.

NOTE See G.2.5 for guidance on risk estimation applied to medical packaging.

F.6 Risk evaluation

Under risk evaluation, estimated risks shall be compared against criteria for risk acceptability defined in the risk management plan to determine if the risk is acceptable or not and to identify risks to be controlled.

NOTE See G.2.6 for guidance on risk evaluation applied to medical packaging.

F.7 Risk control

Risks shall be controlled by implementing appropriate measures such that they are reduced to, or maintained within, levels as defined by the criteria for risk acceptability.

NOTE For further guidance on risk control see G.2.7.

Risk control in packaging system design for terminally sterilized medical devices shall be based on the following principles in the priority order listed:

a) Eliminate or reduce risks to an acceptable level through safe design. A packaging system (inclusive of sterile barrier system and protective packaging), is considered inherently safe by design for assurance of sterility when it meets the requirements below without additional measures.

   — Allow for sterilization (see 6.1.5).

   — Provide physical protection to maintain SBS integrity (see 6.1.3) for expected conditions and hazards during the specified processing, storage, handling, and distribution until that SBS is opened at the point of use (see 6.1.6).

   — Allow for the aseptic opening of the SBS and presentation of its contents (see 6.1.2).

   NOTE 1 The term “safe” in this context indicates the state where the risks from recognized hazardous situations have been reduced to an acceptable level (see ISO Guide 63:2019).

   NOTE 2 ISO 11607-1 provides the state-of-art approach to validate packaging for assurance of sterility, i.e. to reduce the risk of microbial contamination. In addition to the control of microbial contamination hazards for assurance of sterility, further hazards and risks must be considered where the state-of-art approach will be provided by other standards, e.g. ISO 10993-1 for chemical contamination and biocompatibility aspects.

b) Take adequate measures in relation to risks that cannot be eliminated, for example, shipping controls.

   NOTE An example of shipping controls would be the use of a temperature or humidity indicator for either a device or packaging, or both, that can be adversely affected by potential extreme temperature or high humidity exposures in transport.

c) Provide information for safety (warnings/precautions/contra-indications) and, where appropriate, training to users, for example, indication of opening location and sterile barrier system symbols.

F.8 Monitoring effectiveness of risk control measures

The implementation of risk control measures shall be verified.

If both design and manufacturing process outputs meet the acceptance criteria established in validation activities, the effectiveness of risk controls is then verified.

NOTE See G.2.8 for guidance on demonstration the effectiveness of the risk control measures and G.2.9 on process control and monitoring.

Annex G
(informative)

Risk management for medical device packaging — Rationale for requirements

G.1 Objective of risk management for medical devices

The objective of risk management for medical devices is to control risks of hazards leading to patient harm or, where applicable, risks of hazards that lead to harm of users and other persons during either intended use or reasonably foreseeable misuse, or both, of the medical device. The intent is to improve the safety of the medical device, where safety means freedom from unacceptable risk. Manufacturers use a risk management process and a risk management plan to perform risk assessments to determine the need for risk controls, implement controls and verify effectiveness. The risk management plan continues to apply over the life cycle of the device to collect/review production and post-production information and evaluate its relevance to safety for patients and users.

Different jurisdictions can define the need to minimize risk slightly differently (e.g. requiring minimizing the risk as far as possible or as low as reasonably possible, which obviously changes the requirement).

In general, risk controls can be considered acceptable if generally acknowledged state-of-the-art controls, solutions or standards are implemented or, after performing a benefit-risk determination, if the benefits associated with the intended use outweigh the residual risks. A benefit is a positive impact or desirable outcome of the use of a medical device on the health of an individual, or a positive impact on patient management or public health. A final benefit/risk determination will be performed by the clinician when deciding on the clinical procedure to be performed while considering the condition of the patient.

Packaging risk management is part of the overall medical device risk management process and cannot be addressed in isolation. Since the packaging of a sterile device is an integral part of the device, the benefit to the patient must be reviewed on the basis of the intended use of the device. For example, packaging ensures that sterility of invasive devices or those that come in contact with injured skin is maintained, and in this respect assures that these devices are suitable for their intended use by being sterile. There is no benefit to the patient in terms of positive impact on health from the packaging system without the medical device.

NOTE Charts, tables, and illustrations provided in this annex are examples and are not necessarily fully applicable or all inclusive.

G.2 Application of risk management for sterile medical device packaging

G.2.1 General

During the risk management process, a list of known and foreseeable hazards associated with the packaging of the medical device in both normal and fault conditions is compiled. Then, foreseeable sequences of events which can produce hazardous situations and harms are identified. The focus of packaging risk management within the device risk management process is to identify sequences of events for known hazards that can lead to hazardous situations (see Figure G.1). Failure mode analysis is a common tool that can be used to define and address these sequences of events.

Packaging fault conditions involve one or more means of protection against a hazard being defective (e.g. lack of sterile barrier caused by open seal or material breach, inability to present aseptically because of

incorrect device placement), in which case the product should not be used. These risks are addressed through adequate design and validation and are typically further controlled with labelling (e.g. symbol "do not use if damaged", SBS symbol). The control measures should be properly documented.

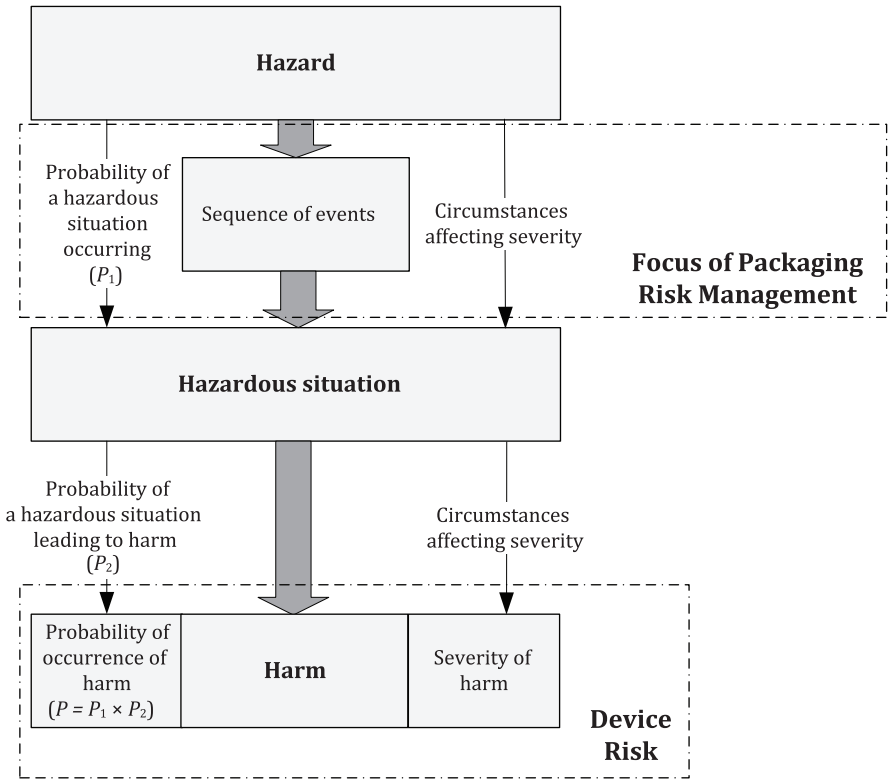


Figure G.1 — Pictorial example of the relationship between hazard, sequence of events, hazardous situation and harm highlighting the focus of packaging risk management (from ISO/IEC Guide 63:2019, amended)

This document and ISO 11607-2 represent the generally acknowledged state of the art for the packaging of terminally sterilized medical devices. This document and ISO 11607-2 have been developed to control risks associated with known hazards for use of packaged terminally sterilized medical devices. The intended use of sterile packaging is to:

— allow for terminal sterilization;

— provide physical protection;

— maintain sterility to the point of use or until the expiry date;

— enable aseptic presentation during opening.

G.2.2 Hazards to be addressed for medical packaging

The key hazards addressed by this document and ISO 11607-2 are:

— microbial contamination;

— chemical contamination;

— adverse environmental, processing and use conditions;

— misleading information.

Packaging system risk management requires:

— identification of sequences of events based on the above hazards that can lead to a hazardous situation (e.g. non-sterile device) that can lead to harm (e.g. infection);

— estimation and evaluation to determine risks to be eliminated or controlled;

— application of safety by design principles to systematically eliminate or control the identified sequences of events;

— demonstration that the probability of the hazardous situation occurring is minimized to an acceptable level through verification and validation activities;

— application of process control and monitoring and management of any changes during the production phase.

G.2.3 Identification of sequences of events

Figure G.2 provides an example in a graphical representation of a possible sequence of events that can lead to contamination of a sterile device.

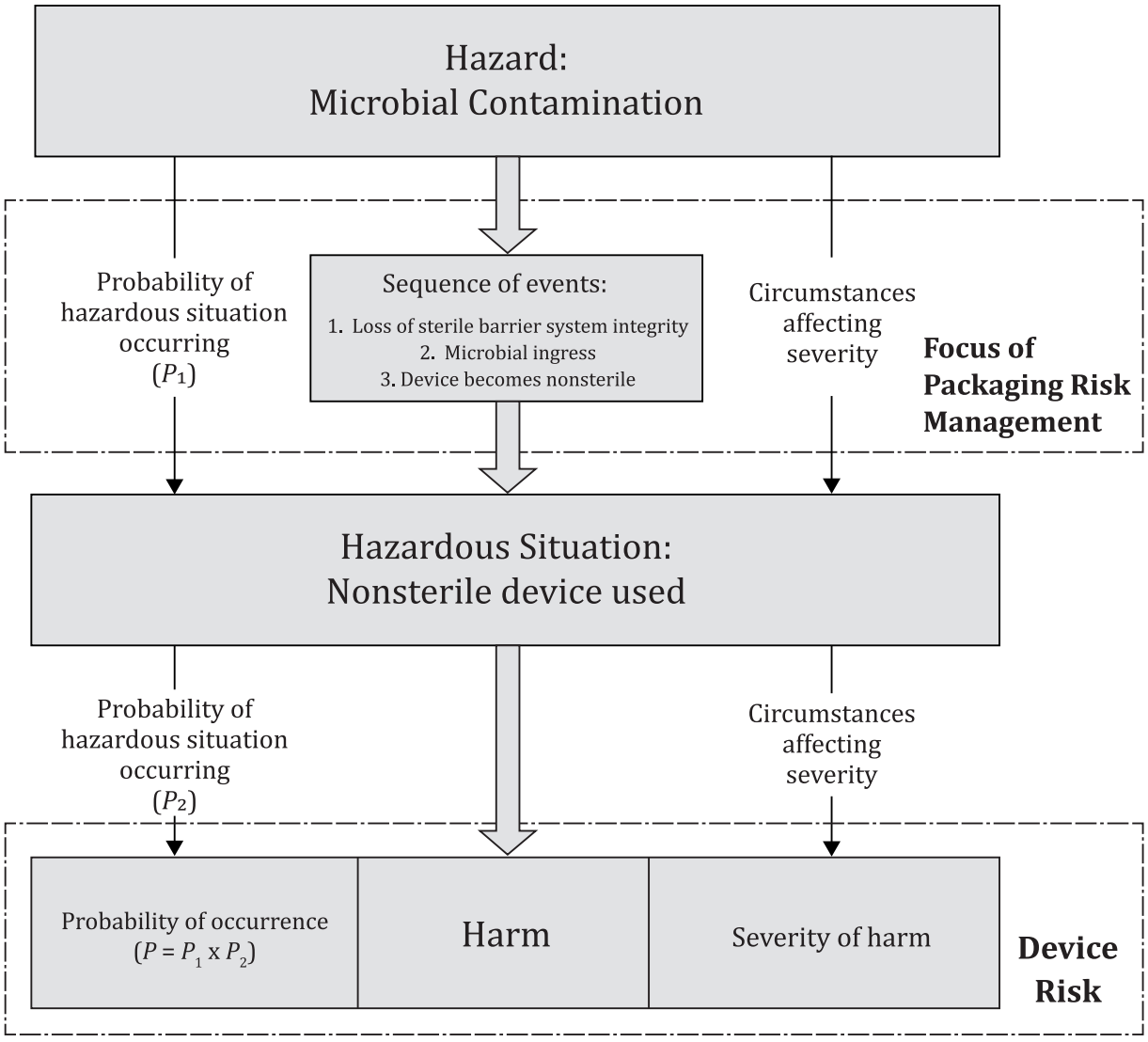


Figure G.2 — Example of sequence of events leading to contamination of a sterile device

The probability of occurrence of harm can be expressed as a combination of separate probabilities (P_1, P_2). Together they represent the probability (P) of occurrence of harm. For risk management applied to packaging for terminally sterilized medical devices, the focus is on P_1.

In situations where either P_1 or P_2 can be estimated and the other probability cannot, a conservative approach can be followed by setting the unknown probability equal to 1. The risk can then be assessed based on the severity and the conservative estimate of the probability of occurrence of harm.

NOTE It is not possible to measure sterility by subsequent inspection and testing of product to determine the performance of sterilization, and in a similar way it is not possible to measure sterility of sterile devices to fully verify the performance of packaging. These processes must be validated taking a quality by design approach through rigorous design controls. Also, it is normally impossible to determine the direct impact of packaging in terms of a meaningful, measurable, patient-relevant clinical infection-free outcome(s) independent from the sterile devices and clinical procedures. This is because many factors can lead to patient infections, e.g. hand hygiene, medical gloves, gowning of healthcare professionals, disinfection of skin areas, the clinical environment.

G.2.4 Hazardous situations

Table G.1 provides examples of relationship between hazards, foreseeable sequences of events and resulting hazardous situations.

Table G.1 — Examples of relationship between hazards, foreseeable sequences of events and hazardous situations

Hazard	Foreseeable sequence of events	Hazardous situation
Microbial contamination	(1) Weak seal created (2) Package seal opens in sterilizer (3) Microbes enter packaging post sterilization (4) Microbes contaminate device (5) User does not detect breach	Contaminated device used
Chemical contamination	(1) Packaging materials contain toxic compound (2) Toxic compound leaches out of material (3) Toxic compound alters device	Bioincompatible device used
Adverse environmental, processing and use conditions	(1) Packaging system protection inadequate (2) Device damaged (3) Damage not detected	Non-functional device used
Misleading information	(1) Package labelling gone, not legible, or mislabelled (2) Wrong/expired device not identified	Wrong/expired device used

G.2.5 Risk estimation

G.2.5.1 Estimating the probability of occurrence and severity of harm

Medical device risk estimation involves analysing hazards, hazardous situations, and estimating the occurrence and severity of patient harm. A risk chart can be established as shown in Figure G.3. It is expected that risk acceptability will be different based on the type of device and the intended use.

Semi-quantitave probability levels	Qualitative severity levels: Negligible	Minor	Major	Critical	Catastrophic
Frequent	2	2	1	1	1
Probable	3	2	2	1	1
Occasional	3	3	2	2	1
Remote	3	3	3	2	2
Improbable	3	3	3	3	2

Key

1 unacceptable risk

2 medium risk, investigate further risk reduction

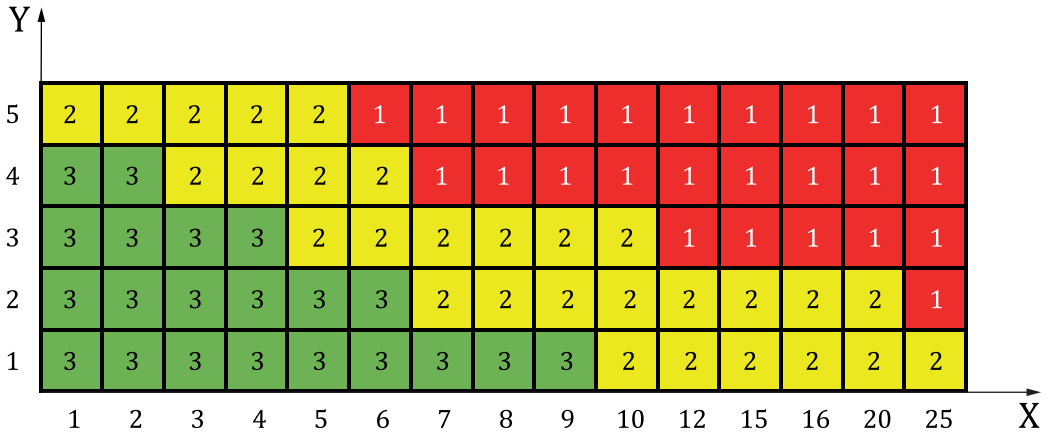
3 insignificant or negligible risk

Figure G.3 — Risk estimation using a criticality matrix

G.2.5.2 Risk estimation applied to hazardous situations

For packaging, the objective is to determine sequences of events that can lead to undesirable hazardous situations potentially leading to harm. Risk is a combination of the probability of occurrence of harm and the severity of that harm. The medical device risk management process establishes the severity of the harm based on the specific characteristics of the device. This severity is utilized for the packaging risk management when assessing the hazardous situations that could lead to harm.

For example, assigning a risk priority number (RPN) will help to identify the critical risks that have to be controlled. The risk priority number is the product of three ratings for severity, occurrence and detection (RPN = S x O x D). An example of an RPN matrix with criticality zones is shown in Figure G.4. In this case, the probability of harm is not estimated directly. Rather, the focus is on the hazardous situation that would impact the characteristics of the medical device (See also G.2.4).



Key

X occurrence x detectability

Y severity levels

1 unacceptable risk

2 medium risk, investigate further risk reduction

3 insignificant or negligible risk

Figure G.4 — Risk estimation using the risk priority number (RPN) method

Examples are provided in Tables G.2, G.3 and G.4.

Table G.2 — Example of five qualitative severity levels

Common terms	Possible description
Catastrophic 5	Direct source of unacceptable risk (For example: Medical device packaging as a direct source of unacceptable risk should be extraordinarily rare. If this is identified, either a design or process change, or both, should be considered.)
Critical 4	Indirect source of unacceptable risk or direct source of medium risk Loss of function/properties of sterile barrier or device (For example: Extremely low seal strength leading to seal integrity breach.)
Major 3	Indirect source of medium risk or direct source of insignificant risk Reduction of performance beyond specification limits Disruption in activities, user dissatisfied (For example: user concern triggered by seal width reduction resulting from seal strength below minimum specification causing seal creep.)
Minor 2	Reduction of performance with potential to be beyond specification limits Detectable by a user, leading to annoyance (For example: user concern triggered by slightly narrow or narrowing seal width.)
Negligible 1	Insignificant reduction of performance within specification limits Only detectable for the most critical user (For example: Seal strength lower than usual.)

Table G.3 — Examples of quantitative severity levels with three levels

Common Terms	Possible description
Significant 3	Loss of function/properties of sterile barrier or device (For example: seal integrity breach.)
Moderate 2	Reduction of performance outside spec limits Disruption in daily activities, user dissatisfied (For example: user concern triggered by slightly narrow or narrowing seal width.)
Negligible 1	Minor reduction of performance within spec limits user annoyed (For example: minor seal width reduction not triggering user concern.)

Table G.4 — Example of semi-quantitative probability levels

Common Terms	Examples of probability range
Frequent 5	$\geq 10^{-3}$
Probable 4	$< 10^{-3}$ and $\geq 10^{-4}$
Occasional 3	$< 10^{-4}$ and $\geq 10^{-5}$
Remote 2	$< 10^{-5}$ and $\geq 10^{-6}$

Table G.4 *(continued)*

Common Terms	Examples of probability range
Improbable 1	$< 10^{-6}$

The detectability rating D represents the likelihood with which a failure mode is expected to be detected before significant failure effects occur. Although the ability of users to detect issues cannot be a component in risk control, it is part of a sequence of events that can lead to a hazardous situation. Unless the ability to detect can be directly assessed when determining a detectability rating, it should be omitted in a specific RPN calculation. For instance, the ability of a healthcare user to assess should not be presumed when taking a conservative approach while the ability of operators of packaging processes can be assessed. Table G.5 provides an example of a rating scheme, with the numbers ranked in reverse order, the higher the detection number, the less likely the detection.

Table G.5 — Example of a typical measurement scale for detectability

Detectability rating (D)	Description: The failure mode…
1	… will always be discovered before consequences come into effect.
2	… is apparent and will normally be discovered before consequences come into effect.
3	… will only be discovered occasionally.
4	… can only be discovered by checks, e.g. by sample inspections.
5	… cannot be detected, e.g. inaccessible.

NOTE See also ISO/TR 24971.

G.2.6 Risk evaluation

The criteria for risk acceptability, as documented in the risk management plan (see F.3), should be applied to evaluate the risks. Table G.6 shows an example of actions to be taken depending on the criticality zones of the risk matrix.

Table G.6 — Risk criticality zones and actions to be taken

Zone	Actions
Zone 3	Reduce risks within this zone to Zone 2 or Zone 1 risk with risk control measures.
Zone 2	Investigate further reduction of Zone 2 risks with risk control measure(s).
Zone 1	Within this zone the level of risk is insignificant or negligible.

G.2.7 Risk control

G.2.7.1 General

The risk management process is part of the design and the process development of the packaging system. If risks are not acceptable, then F.7 of this document applies, which requires risk control options to be developed by applying safe design principles.

G.2.7.2 Application of safe design principles

When designing a packaging system, the first objective should be to eliminate or minimize risks through inherently safe design and manufacture. For example, a packaging system that meets requirements after exposure to worst case transport conditions can be considered to have minimized the risk associated with the transport condition, and no further controls during transport are necessary. If risks cannot be eliminated that way, adequate measures can be implemented, including for example packaging temperature indicators, shock indicators or packaging equipment alarms if necessary.

Finally, warnings, precautions or training associated with significant remaining (residual) risks should be provided to users.

G.2.7.3 Selection of suitable materials

Material selection per the requirements of ISO 11607-1:2019, Clause 5 is intended to ensure materials are appropriate for sterile barrier systems and packaging systems. Application of these requirements controls risks associated with the identified hazards that can be caused by using inappropriate materials in the design of the packaging system.

G.2.7.4 General requirements for design

ISO 11607-1:2019, Clause 6 provides design requirements that support the implementation of appropriate risk controls for the identified hazards, intended to ensure either the sterile barrier system or packaging system, or both, allows for sterilization, maintains sterile barrier integrity, provides physical protection, and allows for aseptic presentation of the device.

G.2.7.5 Process development

Process development is part of ISO 11607-2, which includes detailed requirements for validation of forming, sealing and assembly processes to demonstrate that sterile barrier systems consistently meet predetermined specifications and quality properties. Risk management applied to process development and the related risk controls can be based on a process failure analysis addressing faults induced either by the process, by packaging materials or by contents (e.g. machine misalignment, packaging material creases, device protective covering missing).

G.2.8 Demonstrate the effectiveness of the risk control measures

G.2.8.1 General

The validation phase confirms that the design outputs meet the input requirements and the effectiveness of risk controls. Effectiveness of risk controls is assessed through usability evaluation for aseptic presentation, performance testing, stability testing and process validation.

G.2.8.2 Usability for aseptic presentation

This document provides requirements for the usability evaluation for aseptic presentation of the medical device. Aseptic presentation is a key part of the overall usability of the sterile device and often very device specific which is beyond the scope of this document. This should be part of the risk assessment of the medical device. A benefit-risk determination of aseptic presentation can only be performed considering the benefits of the device and the specific medical procedure which is beyond the scope of this document. For example, the acceptability of residual risk for a class III implantable device will be less than for a simple sterile wound care product.

NOTE For the application of risk management to medical devices see ISO 14971, for the application of usability engineering to medical devices see IEC 62366-1.

Figure G.5 is an example of the risk management for use-related hazards which can be applied for aseptic presentation at the point of use.

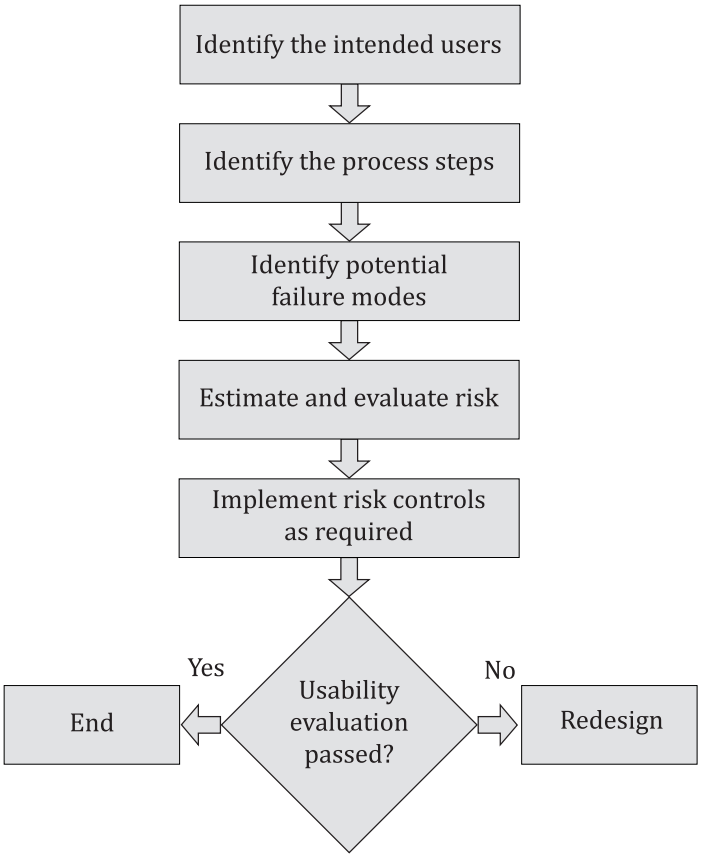


Figure G.5 — Example of risk management for use-related hazards

G.2.8.3 Addressing environmental conditions through performance and stability testing

The capability of the sterile barrier system and packaging system for the intended use is established by applying specific design validation requirements.

Performance testing (see 8.2) and stability testing (see 8.3) demonstrate that the packaging is able to maintain integrity through the hazards of handling, distribution and storage over the intended shelf life of the product. This approach is considered generally acknowledged state of the art and demonstrates that risks have been reduced to an acceptable risk level if the actual distribution challenges are within the boundaries used for performance or stability testing.

G.2.8.4 Process validation

Validation is performed under anticipated operating conditions over at least three production runs. This approach, based on a statistically valid sampling plan, demonstrates the effectiveness of risks controls related to processing risks.

G.2.9 Process control and monitoring

Process control and monitoring will ensure consistency over time and that risks continue to be controlled at an acceptable level. Any deviations from desired process performance should be investigated and the risk analysis reviewed and adapted as required.

G.2.10 Manage changes during the production phase

Risk management should be readdressed before implementation of changes (see Clause 9) to determine if new risks are emerging or if the control of existing risks is affected. This will be the basis to determine revalidation steps to demonstrate the continued effectiveness of risk controls.

G.2.11 Risk management applied to either preformed sterile barrier systems or materials, or both

When applying this document and ISO 11607-2, the approach to risk management will vary depending on the point in time that the device is enclosed into the sterile barrier system.

If the sterile barrier system is used to contain the medical device before the device is placed on the market, the risk management activities will be taken within the scope of the device risk management activities, e.g. design control, change control, packaging process control (see Annex F), and become part of the device files/records. In this case the sterile barrier system is considered a component of the sterile medical device.

Depending on regional regulations, either preformed SBS or materials, or both, sold directly to healthcare facilities for the purposes of sterilization of reusable devices, can be considered an accessory (e.g. European Union) or a classified device (e.g. United States), with distinct regulatory requirements based on their classification.

NOTE See also ISO/TS 16775 for further guidance.

G.3 Documentation

Plans, procedures, records and documentation required for packaging risk management activities can be a series of separate documents, a single document, or they can be integrated with the medical device risk management activities. In any case, packaging risk management should be done taking a holistic approach within the overall risk management of the medical device. Device-specific risk management topics applicable to packaging can include biocompatibility (e.g. by applying ISO 10993-1) or contamination and the risk of cross-contamination which require the use of standards other than ISO 11607-1 or ISO 11607-2.

ICS 11.080.30

Price based on 17 pages