

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Radiation protection instrumentation – X-ray computed tomography (CT) inspection systems of bottled/canned liquids

Instrumentation pour la radioprotection – Systèmes d'inspection par tomographie aux rayons x par ordinateur (CT) des liquides en bouteille ou en canette



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CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references	5
3 Terms and definitions	6
4 Requirements	8
4.1 Structure and appearance.....	8
4.2 Functionality	8
4.3 Performance	8
4.4 Radiation safety.....	17
4.5 Electrical safety	18
4.6 Mechanical safety	19
4.7 Power voltage suitability	20
4.8 Environmental requirements	20
4.9 Electromagnetic compatibility.....	21
5 Marking and documentation.....	22
5.1 Marking.....	22
5.2 Documentation.....	22
6 Packing and shipment	23
6.1 Packing.....	23
6.2 Shipment	23
6.3 Documentation.....	23
Annex A (informative) Guidance for scoring the contrast-sensitivity and spatial-resolution metrics	24
A.1 Contrast sensitivity evaluation.....	24
A.2 Spatial resolution example	24
Annex B (informative) Example recording form for container-artifacts testing	26
Figure 1 – The image-contrast-sensitivity test article (all units are in mm).....	10
Figure 2 – The spatial-resolution test article (all the units are in mm).....	12
Figure 3 – The container-artifacts test article	13
Figure A.1 – Spatial resolution example	25
Table 1 – Reference condition and standard test condition	9
Table 2 – Container for minimum volume test	9
Table 3 – Densities of test samples and respective NaCl concentrations	11
Table 4 – Position versus dimension of line pairs	12
Table 5 – The recording form for container-artifacts test object's parameters.....	13
Table 6 – Standard deviation and relative measured deviation	15
Table 7 – Requirements on accuracy	16
Table 8 – Containers for test.....	17
Table 9 – Reference table of noise correction	17
Table 10 – Tolerance limit of touch current	19
Table 11 – Requirements on temperature and relative humidity	20
Table 12 – Mechanical test projects and relevant requirement	21
Table A.1 – Image contrast sensitivity of different density samples	24
Table B.1 – Recording form for container-artifacts testing.....	26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIATION PROTECTION INSTRUMENTATION –
 X-RAY COMPUTED TOMOGRAPHY (CT) INSPECTION
 SYSTEMS OF BOTTLED/CANNED LIQUIDS**

FOREWORD

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International Standard IEC 62963 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
45B/958/FDIS	45B/962/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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RADIATION PROTECTION INSTRUMENTATION – X-RAY COMPUTED TOMOGRAPHY (CT) INSPECTION SYSTEMS OF BOTTLED/CANNED LIQUIDS

1 Scope

This document describes the technical requirements, test methods, inspection requirements, markings and labelling, and requirements on the accompanying documents, packaging, shipping and storage for X-ray security inspection systems that inspect bottled or canned liquids (hereinafter referred to as "the system") based on X-ray computed tomography (CT). Here, the system is limited to those that feature tomographic scanning, not standard X-ray projection. This document is applicable to liquids, aerosols and gelatinous objects in transparent or visually opaque containers.

This technical performance document includes minimum or baseline performance requirements; regulators may require additional performance testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-6-1:2016, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-3:2006, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

ISO 780:2015, *Packaging – Distribution packaging – Graphical symbols for handling and storage of packages*

ISO 13849 (all parts), *Safety of machinery – Safety-related parts of control systems*

ASTM A624/624M:2013, *Standard Specification for Tin Mill Products, Electrolytic Tin Plate, Single Reduced*

ASTM B221:2014, *Standard Specification for Aluminium and Aluminium-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes*

EN 546-1:2006, *Aluminium and aluminium alloys – Foil – Part 1: Technical conditions for inspection and delivery*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

ambient dose equivalent

$H^*(10)$

dose equivalent at a point in a radiation field that would be produced by the corresponding expanded and aligned field in the ICRU sphere at a depth of 10 mm on the radius opposing the direction of the aligned field

Note 1 to entry: The SI unit of ambient dose equivalent is the sievert (Sv) or its decimal multiples or submultiples (e.g. mSv).

Note 2 to entry: The ambient dose equivalent (rate), used for the monitoring of strongly penetrating radiation, is not an appropriate quantity for any beta radiation even that which is nominally penetrating (ICRU Report 47, 1992).

Note 3 to entry: When the term dose equivalent alone is used in this document, the quantities ambient dose equivalent and directional dose equivalent are implied.

3.2

ambient dose equivalent rate

ratio of $dH^*(10)$ by dt , where $dH^*(10)$ is the increment of ambient dose equivalent in the time interval dt :

$$\dot{H}^*(10) = \frac{dH^*(10)}{dt}$$

Note 1 to entry: The SI unit of ambient dose equivalent rate is the sievert per second ($\text{Sv}\cdot\text{s}^{-1}$). Units of ambient dose equivalent rate are any quotient of the sievert or its decimal multiples or submultiples by a suitable unit of time (e.g., $\text{mSv}\cdot\text{h}^{-1}$).

3.3

CT value

value reported by CT systems on a per voxel basis that is a function of the material's density and atomic number

Note 1 to entry: It is expressed in Hounsfield units (HU) in which the value of air at standard pressure and temperature (STP) is defined as zero HU, while the value of distilled water at STP is defined as 1 000 HU.

3.4

density resolution

measure of the extent to which a tomograph or radiograph can be used to detect physical differences in the test object