

This is a preview - click here to buy the full publication



IEC 62463

Edition 2.0 2024-04

# PRE-RELEASE VERSION (FDIS)



---

**Radiation protection instrumentation – X-ray systems for the security screening of persons**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 13.280

**Warning! Make sure that you obtained this publication from an authorized distributor.**



This is a preview - click here to buy the full publication

# 45B/1058/FDIS

FINAL DRAFT INTERNATIONAL STANDARD (FDIS)

PROJECT NUMBER:

**IEC 62463 ED2**

DATE OF CIRCULATION:

**2024-03-29**

CLOSING DATE FOR VOTING:

**2024-05-10**

SUPERSEDES DOCUMENTS:

**45B/1035/CDV, 45B/1050/RVC**

IEC SC 45B : RADIATION PROTECTION INSTRUMENTATION

SECRETARIAT:

France

SECRETARY:

Mr Miroslav Voytchev

OF INTEREST TO THE FOLLOWING COMMITTEES:

HORIZONTAL STANDARD:

FUNCTIONS CONCERNED:

EMC

ENVIRONMENT

QUALITY ASSURANCE

SAFETY

SUBMITTED FOR CENELEC PARALLEL VOTING

NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is a draft distributed for approval. It may not be referred to as an International Standard until published as such.

In addition to their evaluation as being acceptable for industrial, technological, commercial and user purposes, Final Draft International Standards may on occasion have to be considered in the light of their potential to become standards to which reference may be made in national regulations.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to consider for future work to include relevant "In Some Countries" clauses. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (See [AC/22/2007](#) or new [GUIDANCE DOC](#)).

TITLE:

**Radiation protection instrumentation – X-ray systems for the security screening of persons**

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

Copyright © 2024 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Units.....	11
5 General test procedures .....	11
5.1 Nature of tests .....	11
5.2 Reference conditions and standard test conditions.....	11
5.3 Tests performed under standard test conditions.....	12
5.4 Tests performed with variation of influence quantities .....	12
6 Safety considerations .....	13
6.1 General.....	13
6.2 Shielding.....	13
6.2.1 Requirements .....	13
6.2.2 Method of test.....	13
6.3 System controls and normal operation indications.....	13
6.3.1 Requirements .....	13
6.3.2 Method of test.....	14
6.4 Safety indicators and interlocks .....	14
6.4.1 Safety standards.....	14
6.4.2 Requirements .....	14
6.4.3 Method of test.....	14
7 Conditions and methods for producing the X-ray screening spectra .....	15
7.1 General.....	15
7.2 Tube potential characteristics of the X-ray unit.....	15
7.2.1 Requirements .....	15
7.2.2 Method of test.....	15
8 Effective dose at the position of the person being screened.....	15
8.1 Classification of systems.....	15
8.2 Requirements .....	15
8.2.1 General .....	15
8.2.2 General-use systems .....	16
8.2.3 Limited-use systems .....	16
8.3 Method of test.....	16
9 Electrical characteristics .....	16
9.1 Requirements .....	16
9.2 Method of test.....	16
10 Environmental conditions.....	16
10.1 Ambient temperature.....	16
10.1.1 Requirements .....	16
10.1.2 Method of test.....	17
10.2 Relative humidity .....	17
10.2.1 Requirements .....	17
10.2.2 Method of test.....	17

11	Electromagnetic compatibility .....	17
11.1	Requirements .....	17
11.2	Method of test .....	17
12	Mechanical characteristics .....	18
12.1	Requirements .....	18
12.2	Method of test .....	18
13	Documentation .....	18
13.1	Standard operating procedure .....	18
13.2	Other documentation .....	18
Annex A (normative) Estimation of the effective dose per screening at the reference position .....		19
A.1	General .....	19
A.2	Determination of the reference position .....	19
A.3	Measurement of the air kerma at the reference position .....	20
A.4	Estimation of the half-value layer of aluminum of the beam .....	20
A.5	Estimation of the effective dose .....	20
Annex B (informative) Guidance on detector choice for measuring air kerma .....		23
B.1	Background .....	23
B.2	Guidance .....	24
Annex C (informative) Requirements of International Basic Safety Standards (BSS) for Protection Against Ionizing Radiation and For the Safety of Radiation Sources. International Atomic Energy Agency (IAEA) Safety Series No. 115, 1996 .....		25
Bibliography .....		26
Figure A.1 – Illustrative examples .....		19
Figure A.2 – Conversion coefficients from air kerma to effective dose from Table A.1 plotted as a function of $HVL_{Al}$ .....		22
Table 1 – Reference conditions and standard test conditions .....		11
Table 2 – Tests performed under standard test conditions .....		12
Table 3 – Tests performed with variations of influence quantities .....		12
Table A.1 – Conversion coefficients from air kerma to operational quantities for estimating effective dose .....		21

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# RADIATION PROTECTION INSTRUMENTATION – X-RAY SYSTEMS FOR THE SECURITY SCREENING OF PERSONS

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC 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, IEC 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 <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62463 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) title modified;
- b) the operational quantities recommended in ICRU Report 95 (2020) were introduced to estimate effective dose;
- c) the scope has been updated from X-ray systems for screening persons to X-ray systems that deliberately expose persons to X-rays for security purposes, which clarifies the ambiguity of whether occupied vehicle scanners are within scope;

- d) the scheme for classifying systems was changed from one based on whether the system is backscatter, transmission or a combination to a classification system based on the dose level and administrative controls;
- e) numerous electrical, environmental, electromagnetic, and mechanical safety requirements were updated.

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

Draft	Report on voting
45B/XX/FDIS	45B/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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

- reconfirmed,
- withdrawn, or
- revised.

**IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

This document concerns the radiation safety of security screening systems where persons are intentionally exposed to X-rays. The document is applicable to a wide range of system designs, X-ray spectra, and irradiation geometries, and while current screening systems can be divided into X-ray backscatter, X-ray transmission, and combination systems, the methods in the document are general enough to be applicable to other systems too. The document sets dose limits in terms of effective dose and uses the operational quantities described in ICRU Report 95 to estimate the effective dose per screening. The document also specifies other requirements related to the electrical, environmental, electromagnetic, and mechanical safety of the systems.

## **RADIATION PROTECTION INSTRUMENTATION – X-RAY SYSTEMS FOR THE SECURITY SCREENING OF PERSONS**

### **1 Scope**

This document is applicable to security screening systems designed to expose persons to X-rays. In particular, the document applies to systems where the body is exposed to the primary beam of X-rays. It is common to divide currently used systems into three types: backscatter systems, transmission systems and combination backscatter/transmission systems. Some examples of systems that fall within the scope of this document are backscatter X-ray scanners; transmission X-ray scanners; occupied vehicle scanners.

The purpose of this document is to provide standardized requirements and test methods to ensure the safe operation of X-ray personnel screening systems, from a radiation protection point of view. In particular, the document specifies requirements related to the radiation protection of the persons being screened, persons who are in the vicinity of the equipment and the operators. Standard methods are provided to estimate the effective dose to the persons being screened. There are several simplifying assumptions inherent in such procedures that limit their accuracy. Nevertheless, there is value in having simple standard methods for dose estimation, e.g. for regulatory use. When highly accurate dose estimates are needed, different methods should be used that account for the particular characteristics of the X-ray system and persons being screened.

The document does not address image quality or detection performance.

### **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 60721-3-3:2019, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations*

IEC 61187:1993, *Electrical and electronic equipment – Documentation*

IEC 61326-1:2020, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety related systems*

IEC 62061:2021, *Safety of machinery – Functional safety of safety-related control systems*

ISO 4037-1:2019, *Radiological protection – X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy – Part 1: Radiation characteristics and production methods*

ISO 13849-1:2023, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*



[This is a preview - click here to buy the full publication](#)

ICRU Report 95:2020, *Operational Quantities for External Radiation Exposure*