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

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

FOREWORD

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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 main dose quantity was updated from ambient dose equivalent (H*(10)) to the operational quantities recommended in ICRU Report 95:2020;
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/1058/FDIS	45B/1068/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. The main document types developed by IEC are described in greater detail at 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 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- withdrawn, or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 dosemeters 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*

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