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Responsible committee: NCE/2 Radiation protection and measurement

Interested committees:

Title: BS EN IEC 62533 Radiation protection instrumentation - Highly sensitive hand-held instruments for photon detection of radioactive material

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER:

IEC 62533 ED2

DATE OF CIRCULATION:

2023-06-30

CLOSING DATE FOR COMMENTS:

2023-09-22

SUPERSEDES DOCUMENTS:

45B/1040/RR

IEC SC 45B : RADIATION PROTECTION INSTRUMENTATION

SECRETARIAT:

France

SECRETARY:

Mr Miroslav Voytchev

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC☐ ENVIRONMENT☐ QUALITY ASSURANCE☐ SAFETY

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TITLE:

Radiation protection instrumentation – Highly sensitive hand-held instruments for photon detection of radioactive material

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIATION PROTECTION INSTRUMENTATION –
HIGHLY SENSITIVE HAND-HELD INSTRUMENTS
FOR PHOTON DETECTION OF RADIOACTIVE MATERIAL**

FOREWORD

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International Standard IEC 62533 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

The text of this standard is based on the following documents:

FDIS	Report on voting
45B/640/FDIS	45B/654/RVD

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

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

It is important to detect illicit and inadvertent movement of radioactive materials in the form of radiation sources and contaminated metallurgical scrap. Radioactive sources out of regulatory control, so-called “orphan sources”, have frequently caused serious radiation exposures and widespread contamination. Although illicit trafficking of nuclear and other radioactive materials is not a new problem, concern about a nuclear “black market” has increased particularly in view of its terrorist potential.

In response to the technical policy of the International Atomic Energy Agency (IAEA), the World Customs Organization (WCO), and the International Criminal Police Organization (Interpol) related to the detection and identification of special nuclear materials and security trends, nuclear instrumentation companies have developed and manufactured radiation instrumentation to assist in the detection of illicit movement of radioactive and special nuclear materials. This type of instrumentation is widely used for security purposes at nuclear facilities, border control checkpoints, and international seaports and airports.

To ensure that measurement results made at different locations are consistent, it is imperative that radiation instrumentation be designed to specifications based upon agreed performance requirements. IEC standards have been developed to establish performance requirements for personal radiation detectors, radiation portal monitors, highly sensitive gamma and neutron detection systems, spectrometric personal radiation detectors, and backpack-based radiation detection and identification systems. Table 1 contains a list of those standards.

Table 1 – Overview of IEC Radiation Protection Instrumentation Standards

Type of instrumentation	IEC number	Title of the standard
Body-worn	62401	Radiation protection instrumentation – Alarming Personal Radiation Devices (PRD) for detection of illicit trafficking of radioactive material
	62618	Radiation protection instrumentation – Spectroscopy-Based Alarming Personal Radiation Detector (SPRD) for detection of illicit trafficking of radioactive material
	62694	Radiation protection instrumentation – Backpack-type radiation detector (BRD) for detection of illicit trafficking of radioactive material
Portable or hand-held	62327	Radiation protection instrumentation – Hand-held instruments for the detection and identification of radionuclides and for the estimation of ambient dose equivalent rate from photon radiation
	62533	Radiation protection instrumentation – Highly sensitive hand-held instruments for photon detection of radioactive material
	62534	Radiation protection instrumentation – Highly sensitive hand-held instruments for neutron detection of radioactive material
Portal	62244	Radiation protection instrumentation – Installed radiation portal monitors (RPMs) for the detection of illicit trafficking of radioactive and nuclear materials
	62484	Radiation protection instrumentation – Spectroscopy-based portal monitors used for the detection and identification of illicit trafficking of radioactive material
Data format	62755	Radiation protection instrumentation – Data format for radiation instruments used in the detection of illicit trafficking of radioactive materials
Mobile system	63121	Radiation protection instrumentation – Vehicle-mounted mobile systems for the detection of illicit trafficking of radioactive materials

RADIATION PROTECTION INSTRUMENTATION – HIGHLY SENSITIVE HAND-HELD INSTRUMENTS FOR PHOTON DETECTION OF RADIOACTIVE MATERIAL

1 Scope and object

This document applies to hand-held instruments used for the detection and localization of radioactive photon emitting materials. These instruments are highly sensitive meaning that they are designed to detect slight variations in the range of usual photon background caused mainly by illicit trafficking or inadvertent movement of radioactive material. Compared to pocket devices (see IEC 62401), this highly sensitive instrument allows the scanning of larger volume items such as vehicles or containers. They may also be used in fixed or temporarily fixed unattended mode to monitor check points or critical areas.

These instruments also provide an indication of the ambient dose equivalent rate from photon radiation. However, this standard does not apply to the performance of radiation protection instrumentation which is covered in IEC 60846-1 and IEC 61526.

These instruments may provide additional functions as described below without including all features of specialized portable identification devices as defined by IEC 62327:

- rejecting natural background variation encountered when used in movement;
- sorting alarms of interest from naturally occurring radioactive material (NORM) or medical radionuclides originated alarms;
- provide source categorization data (including limited photon spectra) to a remote location.

The object of this standard is to establish performance requirements including physical characteristics, general test conditions, radiation characteristics, electrical safety, and environmental conditions. This standard provides examples of acceptable test methods to determine if an instrument meets the requirements of this standard. The results of tests performed provide information to users on the capability of radiation detection instruments for reliably detecting photon sources.

Obtaining operating performance that meets or exceeds the specifications as stated in this standard depends upon properly establishing appropriate operating parameters, maintaining calibration, implementing a suitable response testing and maintenance program, providing proper training for operating personnel and developing operating procedures that address the instrument limitations and capabilities.

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 60050-395, International Electrotechnical Vocabulary (IEV) – Part 395: Nuclear instrumentation – Physical phenomena, basic concepts, instruments, systems, equipment and detectors

IEC 62706, Radiation protection instrumentation – Recommended climatic, electromagnetic and mechanical performance requirements on methods of tests

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

69 ISO 4037-1, *X and gamma reference radiation for calibrating dosimeters and dose rate meters*
70 *and for determining their response as a function of photon energy – Part 1: Radiation*
71 *characteristics and production methods*

72 ISO 4037-2, *X and gamma reference radiation for calibrating dosimeters and dose rate meters*
73 *and for determining their response as a function of photon energy – Part 2: Dosimetry for*
74 *radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV*

75 ISO 4037-3, *X and gamma reference radiation for calibrating dosimeters and dose rate meters*
76 *and for determining their response as a function of photon energy – Part 3: Calibration of area*
77 *and personal dosimeters and the measurement of their response as a function of energy and*
78 *angle of incidence*

79 **3 Terms and definitions, abbreviated terms and symbols, quantities and units**

80 **3.1 Terms and definitions**

81 For the purposes of this document, the following terms and definitions given in IEC 60050-395,
82 as well as the following apply.

83 ISO and IEC maintain terminology databases for use in standardization at the following
84 addresses:

85 IEC Electropedia: available at <http://www.electropedia.org/>

86 ISO Online browsing platform: available at <http://www.iso.org/obp>

87 **3.1.1**

88 **A-weighted sound level**

89 the frequency weighting of an acoustic spectrum according to a standardized frequency
90 response curve based on the frequency response of the human ear

91 **3.1.2**

92 **alarm**

93 an audible, visual, or other signal activated when the instrument reading exceeds a preset
94 value, falls outside of a preset range, when the instrument is unable to function properly
95 (component failure), or when the instrument detects the presence of the source of radiation
96 according to a preset condition

97 [SOURCE: IEV 395-17-33]

98 **3.1.3**

99 **ambient dose equivalent, $H^*(d)$**

100 dose equivalent that would be produced by the corresponding aligned and expanded field in the
101 ICRU sphere at a depth of d on the radius opposing the direction of the aligned field

102 Note 1 to entry: Parameter defined at a point in a radiation field. Used as a directly measurable proxy (i.e.,
103 substitute) for effective dose for use in monitoring of external exposure.

104 Note 2 to entry: The recommended value of d for strongly penetrating radiation is 10 mm.

105 [SOURCE: IEV 395-12-46]

106 **3.1.4**

107 **ambient dose equivalent rate, $\dot{H}^*(10)$**

108 the quotient of the ambient dose equivalent at the recommended depth for environmental
109 monitoring of 10 mm $dH^*(10)$ by dt , where $dH^*(10)$ is the increment of ambient dose equivalent
110 in the time interval dt

111
$$\dot{H}^*(10) = \frac{dH^*(10)}{dt}$$