

# INTERNATIONAL STANDARD

---

**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**





**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2017 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

#### **About the IEC**

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

#### **About IEC publications**

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

#### **IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)**

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### **IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)**

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### **IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)**

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

#### **Electropedia - [www.electropedia.org](http://www.electropedia.org)**

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### **IEC Glossary - [www.iec.ch/glossary](http://www.iec.ch/glossary)**

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### **IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)**

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD

---

**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**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 13.280

ISBN 978-2-8322-5182-9

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

## CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references .....	8
3 Terms and definitions, abbreviated terms and symbols, quantities and units.....	9
3.1 Terms and definitions.....	9
3.2 Abbreviated terms and symbols .....	11
3.3 Quantities and units .....	12
4 General characteristics and requirements.....	12
4.1 General.....	12
4.2 Radiation detectors.....	12
4.3 Personal protection alarm .....	12
4.3.1 Requirements .....	12
4.3.2 Method of test.....	12
4.4 Stabilization time .....	13
4.4.1 Requirements .....	13
4.4.2 Method of test.....	13
4.5 Power supplies – battery.....	13
4.5.1 Requirements .....	13
4.5.2 Method of test.....	13
4.6 Markings.....	14
4.7 Communication interface.....	14
4.7.1 Requirements .....	14
4.7.2 Method of test.....	14
4.8 Data.....	14
4.8.1 Requirements .....	14
4.8.2 Method of test.....	15
5 General test procedures .....	15
5.1 Nature of test.....	15
5.2 Statistical fluctuations .....	15
5.3 Standard test conditions .....	15
5.4 Functional test.....	16
5.4.1 General.....	16
5.4.2 Pre-test measurements.....	16
5.4.3 Intermediate measurements.....	16
5.4.4 Post-test measurements .....	16
6 Radiation detection requirements .....	17
6.1 Ambient dose equivalent rate.....	17
6.1.1 Requirements .....	17
6.1.2 Method of test.....	17
6.2 Gamma source localization .....	17
6.2.1 Requirements .....	17
6.2.2 Method of test.....	17
6.3 Over-range characteristics for ambient dose equivalent rate .....	18
6.3.1 Requirements .....	18
6.3.2 Method of test.....	18

6.4	Neutron detection .....	18
6.4.1	Requirements .....	18
6.4.2	Method of test.....	19
6.5	Neutron indication in the presence of photons.....	19
6.5.1	Requirements .....	19
6.5.2	Method of test.....	19
6.6	Radionuclide identification .....	20
6.6.1	Radionuclide identification library .....	20
6.6.2	Identification results .....	20
6.6.3	Radionuclide and radioactive material identification.....	21
6.6.4	Identification of mixed radioactive materials.....	22
7	Environmental requirements .....	23
7.1	General.....	23
7.2	Ambient temperature.....	23
7.2.1	Requirements .....	23
7.2.2	Method of test.....	23
7.3	Temperature shock.....	23
7.3.1	Requirements .....	23
7.3.2	Method of test.....	24
7.4	Relative humidity .....	24
7.4.1	Requirements .....	24
7.4.2	Method of test.....	24
7.5	Low/high temperature start-up .....	24
7.5.1	Requirements .....	24
7.5.2	Method of test.....	25
7.6	Moisture and dust protection.....	25
7.6.1	Requirements .....	25
7.6.2	Method of test – dust .....	25
7.6.3	Method of test – moisture .....	25
8	Mechanical requirements.....	26
8.1	General.....	26
8.2	Vibration .....	26
8.2.1	Requirements .....	26
8.2.2	Method of test.....	26
8.3	Mechanical shock .....	26
8.3.1	Requirements .....	26
8.3.2	Method of test.....	26
8.4	Impact (microphonics).....	26
8.4.1	Requirements .....	26
8.4.2	Method of test.....	27
	Electromagnetic requirements .....	27
9.1	General.....	27
9.2	Electrostatic Discharge (ESD).....	27
9.2.1	Requirements .....	27
9.2.2	Method of test.....	27
9.3	Radio Frequency (RF).....	27
9.3.1	Requirements .....	27
9.3.2	Method of test.....	27
9.4	Radiated RF emissions .....	28

9.4.1	Requirements .....	28
9.4.2	Method of test.....	28
9.5	Conducted disturbances.....	28
9.5.1	Requirements .....	28
9.5.2	Method of test.....	29
9.6	Magnetic fields.....	29
9.6.1	Requirements .....	29
9.6.2	Method of test.....	29
10	Documentation .....	29
10.1	Operation and maintenance manual.....	29
10.2	Test certificate .....	30
10.3	Declaration of conformity .....	30
	Bibliography.....	33
	Table 1 – IEC standards concerning instruments for the detection of illicit trafficking of radioactive material .....	7
	Table 2 – Standard test conditions .....	15
	Table 3 – Test result analysis .....	17
	Table 4 – Radionuclide library.....	20
	Table 5 – Guidance regarding identification performance.....	22
	Table 6 – List of likely daughters and possible impurities .....	22
	Table 7 – Emission frequency limits .....	28
	Table 8 – Summary of performance requirements .....	31

Currently in preview, click buy full version.

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

## 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, accept 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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62327 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This second edition cancels and replaces the first edition of IEC 62327, issued in 2006. It constitutes a technical revision.

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

- a) addition of detailed methods of test;
- b) revised identification test acceptance criteria for environmental tests;
- c) changed format to match SC 45B template.

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

FDIS	Report on voting
45B/882/FDIS	45B/887/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

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

A bilingual version of this publication may be issued at a later date.

## INTRODUCTION

Illicit and inadvertent movement of radioactive materials in the form of radiation sources and contaminated metallurgical scrap has become a problem of increasing importance. Radioactive sources out of regulatory control, so-called “orphan sources”, have frequently caused serious radiation exposures and widespread contamination. Although illicit trafficking in nuclear and other radioactive materials is not a new phenomenon, concern about a nuclear “black market” has increased in the last few years 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 are developing and manufacturing 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. However, to ensure that measurement results made at different locations are consistent, it is imperative that radiation instrumentation be designed to rigorous specifications based upon agreed performance requirements stated in this document. IEC standards have also been developed to address 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 below contains a list of those standards.

**Table 1 – IEC standards concerning instruments for the detection of illicit trafficking of radioactive material**

Type of instrumentation	IEC number	Title of the standard
Body-worn	62401	Radiation protection instrumentation – Alarming Personal Radiation Devices (PRDs) for the detection of illicit trafficking of radioactive material
	62618	Radiation protection instrumentation – Spectroscopy-Based Alarming Personal Radiation Devices (SAPRD) 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

# 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

## 1 Scope

This document applies to hand-held instruments used to detect and identify radionuclides and radioactive material, to estimate ambient dose equivalent rate from photon radiation, and optionally, to detect neutron radiation. They are commonly known as radionuclide identification devices or RIDs.

This document specifies general characteristics, general test procedures, radiation characteristics, as well as electrical, mechanical, safety, and environmental characteristics.

This document does not cover laboratory type, high-resolution photon spectrometers, or instruments covered by IEC 60846-1 (Portable workplace and environmental meters and monitors), IEC 60846-2 (photon dose (rate) meters) or IEC 61005 (neutron dose equivalent (rate) meters).

Table 8 provides a summary of requirements and relevant clauses.

## 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 60050-395:2014, *International Electrotechnical Vocabulary (IEV) – Part 395: Nuclear instrumentation: physical phenomena, basic concepts, instruments, systems, equipment and detectors*

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 60068-2-11, *Basic environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-18, *Environmental testing – Part 2-18: Tests – Test R and guidance: Water*

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 60068-2-66, *Environmental testing – Part 2-66: Test methods – Test Cx: Damp heat, steady state (unsaturated pressurized vapour)*