

STN	Prístroje na ochranu pred žiarením Detektor umiestnený v batohu (BRD) na detekciu žiarenia nelegálne prevážaných rádioaktívnych látok	STN EN IEC 62694 35 6607
------------	--	--

Radiation protection instrumentation - Backpack-type radiation detector (BRD) for the detection of illicit trafficking of radioactive material

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 03/24

Obsahuje: EN IEC 62694:2024, IEC 62694:2022

Oznámením tejto normy sa od 22.01.2027 ruší
STN EN 62694 (35 6607) z augusta 2017

138452

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2024
Slovenská technická norma a technická normalizačná informácia je chránená zákonom č. 60/2018 Z. z. o technickej normalizácii v znení neskorších predpisov.

EUROPEAN STANDARD

EN IEC 62694

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2024

ICS 13.280

Supersedes EN 62694:2016

English Version

**Radiation protection instrumentation - Backpack-type radiation detector (BRD) for the detection of illicit trafficking of radioactive material
(IEC 62694:2022)**

Instrumentation pour la radioprotection - Détecteur de rayonnement de type sac à dos (BRD) pour la détection du trafic illicite des matières radioactives
(IEC 62694:2022)

Strahlenschutz-Messgeräte - Rucksack-Strahlungsdetektor für den Nachweis von unerlaubt transportiertem radioaktivem Material
(IEC 62694:2022)

This European Standard was approved by CENELEC on 2024-01-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 62694:2024 (E)**European foreword**

This document (EN IEC 62694:2024) consists of the text of IEC 62694:2022 prepared by IEC/SC 45B "Radiation protection instrumentation" of IEC/TC 45 "Nuclear instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-01-22
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2027-01-22

This document supersedes EN 62694:2016 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62694:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60846-1	NOTE	Approved as EN 60846-1
IEC 61526	NOTE	Approved as EN 61526
IEC 62244	NOTE	Approved as EN IEC 62244
IEC 62327	NOTE	Approved as EN IEC 62327
IEC 62401	NOTE	Approved as EN IEC 62401
IEC 62484	NOTE	Approved as EN IEC 62484
IEC 62533	NOTE	Approved as EN 62533
IEC 62534	NOTE	Approved as EN 62534
IEC 62618	NOTE	Approved as EN 62618
IEC 63121	NOTE	Approved as EN IEC 63121

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-395	2014	International Electrotechnical Vocabulary - Part 395: Nuclear instrumentation: Physical phenomena, basic concepts, instruments, systems, equipment and detectors	-	-
+ A1	2016		-	-
+ A2	2020		-	-
IEC 60068-2-11	-	Environmental testing - Part 2-11: Tests - Test Ka: Salt mist	EN IEC 60068-2-11	2021
IEC 60079-11	-	Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety "I"	-	-
IEC 62706	-	Radiation protection instrumentation - Environmental, electromagnetic and mechanical performance requirements	-	-
IEC 62755	-	Radiation protection instrumentation - Data format for radiation instruments used in the detection of illicit trafficking of radioactive materials	-	-
UL 913	-	Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations	-	-



IEC 62694

Edition 2.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Radiation protection instrumentation – Backpack-type radiation detector (BRD)
for the detection of illicit trafficking of radioactive material**

**Instrumentation pour la radioprotection – Détecteur de rayonnement de type sac
à dos (BRD) pour la détection du trafic illicite des matières radioactives**

**THIS PUBLICATION IS COPYRIGHT PROTECTED****Copyright © 2022 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
info@iec.ch
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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

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

IEC Customer Service Centre - 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: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 62694

Edition 2.0 2022-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Radiation protection instrumentation – Backpack-type radiation detector (BRD)
for the detection of illicit trafficking of radioactive material**

**Instrumentation pour la radioprotection – Détecteur de rayonnement de type
sac à dos (BRD) pour la détection du trafic illicite des matières radioactives**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.280

ISBN 978-2-8322-6053-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

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	10
3.3 Quantities and units	10
4 General test procedure	11
4.1 General.....	11
4.2 Standard test conditions	11
4.3 Uncertainties.....	11
4.4 Statistical fluctuations	11
4.5 Background radiation during testing	12
4.6 Radiation sources	12
4.7 Special nuclear material (SNM) and depleted uranium (DU) sources.....	12
4.8 BRD set up	12
4.9 Speed of moving sources including scaling of speed and distance	14
4.10 Functionality tests.....	14
4.10.1 General	14
4.10.2 Pre-test measurements.....	15
4.10.3 Intermediate-test measurements.....	15
4.10.4 Post-test measurements	16
4.10.5 Acceptance criteria	16
5 General requirements	17
5.1 Design requirements	17
5.2 Markings	17
5.3 Switches	17
5.4 Effective range of dose rate measurement – photons	17
5.5 Explosive atmospheres	17
5.6 Power supply	17
5.6.1 Requirements	17
5.6.2 Method of test.....	17
5.7 Data format.....	18
5.7.1 Requirements	18
5.7.2 Method of test.....	18
5.8 Data transfer.....	18
5.9 User interface – Indications	19
5.10 Alarms	19
5.10.1 Alarm indication.....	19
5.10.2 Personal protection alarm	19
5.10.3 Audible indication for searching	19
5.10.4 Audible alarms.....	19
6 Radiation detection requirements	19
6.1 False alarm test	19
6.1.1 Requirements	19

6.1.2	Method of test.....	19
6.2	Alarm response to gamma radiation	20
6.2.1	Requirements	20
6.2.2	Method of test.....	20
6.3	Alarm response to neutron radiation, if provided	20
6.3.1	Requirements	20
6.3.2	Method of test.....	20
6.4	Personal radiation protection alarm and response time	21
6.4.1	Requirements	21
6.4.2	Method of test.....	21
6.5	Gamma-ray ambient dose equivalent rate indication	21
6.5.1	Requirements	21
6.5.2	Method of test.....	21
6.6	Over range test.....	21
6.6.1	Requirements	21
6.6.2	Method of test.....	21
6.7	Neutron indication in the presence of photons, if applicable	22
6.7.1	Requirements	22
6.7.2	Method of test.....	22
6.8	Detection of gradually increasing radiation levels.....	22
6.8.1	Requirements	22
6.8.2	Method of test.....	22
6.9	Radionuclide identification, when provided.....	23
6.9.1	Single radionuclide identification	23
6.9.2	Simultaneous identification	24
6.9.3	False identification.....	25
6.9.4	Over range characteristics for identification	25
6.10	Addressing natural background variations.....	25
6.10.1	Requirements	25
6.10.2	Method of test.....	25
7	Climatic requirements	26
7.1	General.....	26
7.2	Ambient temperature.....	26
7.2.1	Requirements	26
7.2.2	Method of test.....	26
7.3	Temperature shock	26
7.3.1	Requirements	26
7.3.2	Method of test.....	27
7.4	Relative humidity	27
7.4.1	Requirements	27
7.4.2	Method of test.....	27
7.5	Low/high temperature startup.....	27
7.5.1	Requirements	27
7.5.2	Method of test.....	28
7.6	Dust and moisture protection	28
7.6.1	Requirements	28
7.6.2	Method of test – Dust	28
7.6.3	Method of test – Moisture	28
8	Mechanical requirements.....	28

8.1	General.....	28
8.2	Vibration	29
8.2.1	Requirements	29
8.2.2	Method of test.....	29
8.3	Microphonics/Impact.....	29
8.3.1	Requirements	29
8.3.2	Method of test.....	29
8.4	Mechanical shock	29
8.4.1	Requirements	29
8.4.2	Method of test.....	29
8.5	Drop	30
8.5.1	Requirements	30
8.5.2	Method of test.....	30
9	Electromagnetic requirements	30
9.1	General.....	30
9.2	Electrostatic discharge (ESD)	30
9.2.1	Requirements	30
9.2.2	Method of test.....	30
9.3	Radio frequency (RF).....	30
9.3.1	Requirements	30
9.3.2	Method of test.....	30
9.4	Radiated RF emissions	31
9.4.1	Requirements	31
9.4.2	Method of test.....	31
9.5	Conducted disturbances.....	31
9.5.1	Requirements	31
9.5.2	Method of test.....	31
9.6	Magnetic fields.....	31
9.6.1	Requirements	31
9.6.2	Method of test.....	31
10	Documentation	32
10.1	Operation and maintenance manual	32
10.2	Test certificate	32
10.3	Declaration of conformity	32
	Annex A (informative) Summary of fluence rate calculations	33
	Bibliography.....	35
	Figure 1 – Diagram of the BRD testing angles and source movement directions	13
	Figure 2 – Diagram of the BRD reference point.....	14
	Table 1 – Standard test conditions	11
	Table 2 – Test results analysis.....	17
	Table 3 – List of radionuclides for identification tests	23
	Table 4 – Identification acceptance criteria	24

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIATION PROTECTION INSTRUMENTATION – BACKPACK-TYPE
RADIATION DETECTOR (BRD) FOR THE DETECTION OF ILLICIT
TRAFFICKING OF RADIOACTIVE MATERIAL****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) 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.

IEC 62694 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 2014. This edition constitutes a technical revision.

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

- a) making the standard consistent with the new standards for detection of illicit trafficking of radioactive material;
- b) creating unformed functionality test for all environmental, electromagnetic and mechanical tests and a requirement for the coefficient of variation of each nominal mean reading;
- c) revised radiological requirements including the simplification of radionuclide identification acceptance criteria;
- d) reference to IEC 62706 for the environmental, electromagnetic and mechanical test conditions.

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

Draft	Report on voting
45B/1012/FDIS	45B/1018/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,
- replaced by a revised edition, or
- amended.

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

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 particularly in view of its terrorist potential.

In response to the technical policy of agencies such as 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, international seaports, airports, and major events.

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, vehicle mounted mobile systems, and backpack-based radiation detection and identification systems. A list of those standards is given below.

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 (SPRDs) for the detection of illicit trafficking of radioactive material
	62694	Radiation protection instrumentation – Backpack-type radiation detector (BRD) for the 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 – Spectrometric radiation portal monitors (SRPMs) 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 – BACKPACK-TYPE RADIATION DETECTOR (BRD) FOR THE DETECTION OF ILLICIT TRAFFICKING OF RADIOACTIVE MATERIAL

1 Scope

This document applies to backpack-type radiation detectors (BRDs) that are primarily used for the detection of illicit trafficking of radioactive material. BRDs are portable instruments designed to be worn during use. BRDs detect gamma radiation and may include neutron detection and the ability to identify gamma-ray emitting radionuclides.

This document establishes the operational and testing requirements associated with radiation measurements and the expected electrical, mechanical, and environmental conditions while in use.

This document does not apply to ambient or personal dose equivalent rate meters which are covered in IEC 60846-1 or IEC 61526, respectively.

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*

IEC60050-395:2014/AMD1:2016

IEC 60050-395:2014/AMD2:2020

IEC 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

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

IEC 62755, *Radiation protection instrumentation – Data format for radiation instruments used in the detection of illicit trafficking of radioactive materials*

UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN