



NSAI
Standards

Irish Standard
I.S. EN 60846-1:2014

Radiation protection instrumentation -
Ambient and/or directional dose equivalent
(rate) meters and/or monitors for beta, X and
gamma radiation - Part 1: Portable workplace
and environmental meters and monitors

I.S. EN 60846-1:2014

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:

EN 60846-1:2014

Published:

2014-09-05

*This document was published
under the authority of the NSAI
and comes into effect on:*

2014-09-23

ICS number:

13.280

NOTE: If blank see CEN/CENELEC cover page

NSAI
1 Swift Square,
Northwood, Santry
Dublin 9

T +353 1 807 3800
F +353 1 807 3838
E standards@nsai.ie
W NSAI.ie

Sales:
T +353 1 857 6730
F +353 1 857 6729
W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

EUROPEAN STANDARD

EN 60846-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2014

ICS 13.280

Supersedes EN 60846:2004

English Version

**Radiation protection instrumentation - Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation - Part 1: Portable workplace and environmental meters and monitors
(IEC 60846-1:2009 , modified)**

Instrumentation pour la radioprotection - Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma - Partie 1: Instruments de mesure et de surveillance portables pour les postes de travail et l'environnement
(CEI 60846-1:2009 , modifiée)

Strahlenschutz-Messgeräte - Umgebungs- und/oder Richtungs-Äquivalentdosis(leistungs)-Messgeräte und/oder Monitore für Beta-, Röntgen- und Gammastrahlung - Teil 1: Tragbare Messgeräte und Monitore für den Arbeitsplatz und die Umgebung
(IEC 60846-1:2009 , modifiziert)

This European Standard was approved by CENELEC on 2014-07-28. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN 60846-1:2014) consists of the text of IEC 60846-1:2009 prepared by IEC/SC 45B "Radiation protection instrumentation" of IEC/TC 45 "Nuclear instrumentation", together with the common modifications prepared by CLC/TC 45B "Radiation protection instrumentation".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2015-07-28
at national level by publication of an identical
national standard or by endorsement
- latest date by which the national standards conflicting (dow) 2017-07-28
with this document have to be withdrawn

This document supersedes EN 60846:2004.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 60846-1:2009 are prefixed "Z".

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

Endorsement notice

The text of the International Standard IEC 60846-1:2009 was approved by CENELEC as a European Standard with agreed common modifications.

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

IEC 60325:2002 NOTE Harmonized as EN 60325:2004 (modified).

IEC 61005:2003 NOTE Harmonized as EN 61005:2004 (modified).

COMMON MODIFICATIONS

All over the document

Replace “1,5 MeV” with “1,33 MeV”.

3 Terms and definitions

In the note of 3.19, **replace** “Tables 5 to 8” with “Tables 5 to 9”.

4 Units and list of symbols

In Table 2, **delete** the row starting with t_{\min} .

5 General characteristics of ambient and directional dose equivalent (rate) meters

In 5.7, **replace** “Tables 4 to 8” with “Tables 5 to 9”.

8 Radiation performance requirements and tests

In 8.9.2.2, **replace** the second paragraph by the following:

The initial and final dose equivalent rates shall differ by a factor of 10 or more up to the factor for the change from background dose rate to the maximum dose rate of the rated range. The measurements shall be carried out for both an increase and a decrease in the dose equivalent rate by this factor. The initial or the final dose equivalent rate shall be the background dose rate.

10 Mechanical characteristics of directional and ambient dose equivalent (rate) meters

Add the following new subclause.

10.Z1 Drop test during operation

10.Z1.1 Requirements

Portable dose equivalent (rate) meters shall be able to withstand without damage, a drop from a height of 0,3 m onto a hard steel or concrete surface.

10.Z1.2 Test method

The dose equivalent (rate) meter shall withstand at least one single drop from 0,3 m to each surface of dose equivalent (rate) meter so that the unit is still operable after the drop. The test may be performed either with one or more test units in such a way that one drop onto each surface of the dose equivalent (rate) meter is tested. The instrument passes the test if the instrument response does not deviate after the 6 drop tests from the original response by more than - 17 % to + 25 %. The drop can make the instrument switch off but the user shall be able to switch the unit back on. The physical condition of the instrument shall not be affected by these drops (for example solder joints shall hold, nuts and bolts shall not come loose).

11 Environmental characteristics, performance requirements and tests

In 11.4.2, **replace** the last sentence by “The differences shall be within - 9 % to + 11 %”.

Table 9 – Mechanical performance under test conditions

Add the following at the end of Table 9.

Drop during operation	0,3 m	6 drops from a given height onto steel or concrete surface	10.Z1
-----------------------	-------	--	-------

Annexes

Add the following new annex.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When 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.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-151	2001	International Electrotechnical Vocabulary (IEV) Part 151: Electrical and magnetic devices	-	-
IEC 60050-393	2003	International Electrotechnology Vocabulary Part 393: Nuclear instrumentation - Physical phenomena and basic concepts	-	-
IEC 60050-394	2007	International Electrotechnical Vocabulary Part 394: Nuclear instrumentation - Instruments, systems, equipment and detectors	-	-
IEC 60068-2-31	2008	Environmental testing Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	2008
IEC 60086-1	2006	Primary batteries Part 1: General	EN 60086-1 ¹⁾	2007
IEC 60086-2 + corr. April	2006 2007	Primary batteries Part 2: Physical and electrical specifications	EN 60086-2 ²⁾	2007
IEC 60359	2001	Electrical and electronic measurement equipment - Expression of performance	EN 60359	2002
IEC 60529 + A1	1989 1999	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May + A1	1991 1993 2000
IEC 61000-4-2 + A1 + A2	1995 1998 2000	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2 + A1 + A2 ³⁾	1995 1998 2001
IEC 61000-4-3 + A1	2006 2007	Electromagnetic compatibility (EMC) Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3 + A1	2006 2008
IEC 61000-4-6	2008	Electromagnetic compatibility (EMC) Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6 ⁴⁾	2009
IEC 61000-4-8 + A1	1993 2000	Electromagnetic compatibility (EMC) Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8 + A1 ⁵⁾	1993 2001

1) EN 60086-1 is superseded by EN 60086-1:2011, which is based on IEC 60086-1:2011.

2) EN 60086-2 is superseded by EN 60086-2:2011, which is based on IEC 60086-2:2011.

3) EN 61000-4-2 is superseded by EN 61000-4-2:2009, which is based on IEC 61000-4-2:2008.

4) EN 61000-4-6 is superseded by EN 61000-4-6:2014, which is based on IEC 61000-4-6:2013.

5) EN 61000-4-8 is superseded by EN 61000-4-8:2010, which is based on IEC 61000-4-8:2009.

IEC 61000-6-2	2005	Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2 + corr. September	2005 2005
IEC 61187 (mod)	1993	Electrical and electronic measuring equipment - Documentation	EN 61187 + corr. March	1994 1995
IEC/TR 62461	2006	Radiation protection instrumentation - Determination of uncertainty in measurement	-	-
ISO/IEC Guide 98-3	2008	Uncertainty of measurement Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-
ISO/IEC Guide 99	2007	International vocabulary of metrology - Basic and general concepts and associated terms (VIM)	-	-
ISO 4037-1	1996	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 4037-2	1997	X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy Part 2: Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV	-	-
ISO 4037-3	1999	X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy Part 3: Calibration of area and personal dosimeters and the measurement of their response as a function of energy and angle of incidence	-	-
ISO 4037-4	2004	X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy Part 4: Calibration of area and personal dosimeters in low energy X reference radiation fields	-	-
ISO 6980-1	2006	Nuclear energy - Reference beta-particle radiation Part 1: Methods of production	-	-
ISO 6980-2	2004	Nuclear energy - Reference beta-particle radiation Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field	-	-
ISO 6980-3	2006	Nuclear energy - Reference beta-particle radiation Part 3: Calibration of area and personal dosimeters and the determination of their response as a function of beta radiation energy and angle of incidence	-	-



IEC 60846-1

Edition 1.0 2009-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation –
Part 1: Portable workplace and environmental meters and monitors**

**Instrumentation pour la radioprotection – Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma –
Partie 1: Instruments de mesure et de surveillance portables pour les postes de travail et l'environnement**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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 la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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.

- Catalogue of IEC publications: www.iec.ch/searchpub

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

- IEC Just Published: www.iec.ch/online_news/justpub

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

- Electropedia: www.electropedia.org

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

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00



IEC 60846-1

Edition 1.0 2009-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation –
Part 1: Portable workplace and environmental meters and monitors**

**Instrumentation pour la radioprotection – Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma –
Partie 1: Instruments de mesure et de surveillance portables pour les postes de travail et l'environnement**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XA

ICS 13.280

ISBN 978-2-88910-308-9

CONTENTS

FOREWORD.....	6
1 Scope and object.....	8
2 Normative references	9
3 Terms and definitions	10
4 Units and list of symbols.....	15
4.1 Units	15
4.2 List of symbols	16
5 General characteristics of ambient and directional dose equivalent (rate) meters	18
5.1 Indication	18
5.2 Read-out	18
5.3 Dose equivalent rate range.....	18
5.4 Effective range of measurement	18
5.5 Minimum range of measurement.....	19
5.6 Rated range of an influence quantity	19
5.7 Minimum rated range of influence quantity	19
5.8 Alarm levels	19
5.9 Additional indication	20
5.10 Failure operation of indication	20
5.11 Ease of decontamination	20
5.12 Information given on the instruments	20
5.13 Algorithm to evaluate the indicated value	20
5.14 Classification of the dosimeters	20
6 General test procedures	20
6.1 Instructions for use.....	20
6.2 Nature of tests.....	21
6.3 Reference conditions and standard test conditions	21
6.4 Tests for influence quantities of type F	21
6.5 Tests for influence quantities of type S	21
6.6 Consideration of non-linearity	21
6.7 Consideration of several detectors or signals in a dosimeter	21
6.8 Position of dose equivalent (rate) meter for test purposes	22
6.9 Low dose equivalent rates	22
6.10 Statistical fluctuations	22
6.11 Production of reference radiation.....	22
6.12 Reference photon radiation	22
6.13 Reference beta radiation	23
6.14 Determination of dose equivalent (rate) response.....	23
7 Additivity of indicated value	23
7.1 Requirements	23
7.2 Method of test	23
7.3 Interpretation of the results	24
8 Radiation performance requirements and tests	24
8.1 General	24
8.2 Consideration of the uncertainty of the conventional quantity value	24
8.3 Model function.....	24

8.4	Variation of the response due to photon radiation energy and angle of incidence.....	24
8.4.1	Measuring quantity $H'(0,07)$ or $\dot{H}'(0,07)$	24
8.4.2	Measuring quantity $H^*(10)$ or $\dot{H}^*(10)$	25
8.5	Variation of the response due to beta radiation energy and angle of incidence.....	26
8.5.1	Measuring quantity $H'(0,07)$ or $\dot{H}'(0,07)$	26
8.5.2	Measuring quantity $H^*(10)$ or $\dot{H}^*(10)$	27
8.6	Response to neutron radiation.....	28
8.6.1	Requirements	28
8.6.2	Test method	28
8.7	Linearity and statistical fluctuations	28
8.7.1	General	28
8.7.2	Requirements	28
8.7.3	Method of test	28
8.7.4	Interpretation of the results.....	29
8.8	Overload characteristics	30
8.8.1	Dose equivalent meters	30
8.8.2	Dose equivalent ratemeters	30
8.9	Response time	31
8.9.1	Dose equivalent meters	31
8.9.2	Dose equivalent ratemeters	31
8.10	Interrelation between response time and statistical fluctuations.....	32
8.11	Variation of the response due to dose rate dependence of dose measurements.....	32
8.11.1	General	32
8.11.2	Requirements	32
8.11.3	Method of test using radiation sources	33
8.11.4	Method of test using natural radiation	33
8.11.5	Interpretation of the results.....	33
8.12	Response to pulsed ionizing radiation fields	33
8.12.1	Requirements	33
8.12.2	Test method	33
8.13	Requirements on the accuracy of alarm of dose equivalent (rate) monitors.....	33
8.13.1	Dose equivalent alarm	33
8.13.2	Dose equivalent rate alarm	34
9	Electrical characteristics of directional and ambient dose equivalent (rate) meters	35
9.1	Stability of zero indication with time.....	35
9.1.1	Requirements	35
9.1.2	Test method	35
9.1.3	Interpretation of the results.....	35
9.2	Warm-up time.....	35
9.2.1	Requirements	35
9.2.2	Test method	35
9.2.3	Interpretation of the results.....	35
9.3	Power supplies	36
9.3.1	General	36
9.3.2	Requirements	36
9.3.3	Test method	36

10	Mechanical characteristics of directional and ambient dose equivalent (rate) meters	37
10.1	Shock during operation (microphonics)	37
10.1.1	General	37
10.1.2	Requirements	37
10.1.3	Method of test and interpretation of the results	37
10.2	Drop test during transport	38
10.2.1	Requirements	38
10.2.2	Test method	38
10.2.3	Interpretation of the results	38
10.3	Orientation of dose equivalent (rate) meter (geotropism)	38
10.3.1	General	38
10.3.2	Requirements	38
10.3.3	Test method	38
11	Environmental characteristics, performance requirements and tests	39
11.1	General	39
11.2	Ambient temperature	39
11.2.1	Requirements	39
11.2.2	Test method	39
11.2.3	Interpretation of the results	39
11.3	Relative humidity	39
11.3.1	Requirements	39
11.3.2	Test method	39
11.3.3	Interpretation of the results	40
11.4	Atmospheric pressure	40
11.4.1	Requirements	40
11.4.2	Test method	40
11.5	Sealing against moisture	40
11.6	Storage and transport	40
11.7	Electromagnetic compatibility	40
11.7.1	General	40
11.7.2	Emission of electromagnetic radiation	41
11.7.3	Electrostatic discharge	41
11.7.4	Radiated electromagnetic fields	41
11.7.5	Conducted disturbances induced by radio-frequencies	42
11.7.6	50 Hz/60 Hz magnetic field	42
12	Software	43
12.1	General	43
12.2	Requirements	43
12.2.1	General requirements	43
12.2.2	Design and structure of the software	43
12.2.3	Protection of the software and data	43
12.2.4	Documentation	44
12.3	Method of test	44
12.3.1	General	44
12.3.2	Testing the documentation	45
13	Summary of characteristics	45
14	Documentation	45

14.1 Information on the instrument	45
14.2 Certificate	45
14.3 Operation and maintenance manual	46
14.4 Type test report	46
Annex A (normative) Statistical fluctuations	52
Annex B (informative) Usage categories of ambient/directional dose (rate) meters	54
Annex C (informative) Calibration of ambient dose equivalent (rate) meters for environmental monitoring	55
Bibliography	57
Table 1 – Measuring quantities and energy ranges covered by the standard	8
Table 2 – Symbols (and abbreviated terms)	16
Table 3 – Values of c_1 and c_2 for w different dose (rate) values and n indications for each dose (rate) value	46
Table 4 – Reference conditions and standard test conditions	47
Table 5 – Radiation characteristics of directional dose equivalent (rate) meters	48
Table 6 – Radiation characteristics of ambient dose equivalent (rate) meters	49
Table 7 – Electrical, mechanical and environmental characteristics of directional and ambient dose equivalent (rate) meters	50
Table 8 – Maximum values of deviation due to electromagnetic disturbances	50
Table 9 – Mechanical performance under test conditions	51
Table A.1 – Number of instrument readings required to detect true differences (95 % confidence level) between two sets of instrument readings on the same instrument	53
Table B.1 – Usage categories of ambient or directional dose (rate) meters	54

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 1: Portable workplace and environmental meters and monitors

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 60846-1 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This edition cancels and replaces the second edition of IEC 60846 published in 2002 of which it constitutes a technical revision. It also replaces IEC 61017-1:1991 and IEC 61017-2:1994 as far as portable equipment is concerned.

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

FDIS	Report on voting
45B/603/FDIS	45B/611/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.

A list of all parts of the IEC 60846 series can be found, under the general title *Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

RADIATION PROTECTION INSTRUMENTATION – AMBIENT AND/OR DIRECTIONAL DOSE EQUIVALENT (RATE) METERS AND/OR MONITORS FOR BETA, X AND GAMMA RADIATION –

Part 1: Portable workplace and environmental meters and monitors

1 Scope and object

This part of the IEC 60846 series applies to dose equivalent (rate) meters and/or monitors for the measurement of ambient dose equivalent (rate) and/or directional dose equivalent (rate) from external beta, X and gamma radiation, as recommended in ICRU, Report 47.

NOTE 1 If both quantities, ambient dose equivalent and directional dose equivalent are meant, the term dose equivalent may be used as an abbreviation.

This part of IEC 60846 series applies only to portable meters and monitors which are intended to be used in both the workplace and the environment. It applies to devices that measure the dose equivalent or dose equivalent rate from external beta and/or X and gamma radiation in the dose range between 0,01 μSv and 10 Sv and the dose rate range between 0,01 $\mu\text{Sv h}^{-1}$ and 10 Sv h^{-1} and in the energy ranges given in the following Table. All the energy values are mean energies with respect to the prevailing dose quantity.

Table 1 – Measuring quantities and energy ranges covered by the standard

Measuring quantity	Energy range for Photon radiation	Energy range for Beta-particle radiation
$H^*(10)$	12 keV to 10 MeV	—
$H'(0,07)$	8 keV to 250 keV	0,07 MeV ^a to 1,2 MeV almost equivalent to E_{max} from 225 keV to 3,54 MeV
^a For beta-particle radiation, an energy of 0,07 MeV is required to penetrate the dead layer of skin of 0,07 mm (almost equivalent to 0,07 mm of ICRU tissue) nominal depth.		

NOTE 2 Where a dose rate meter or monitor may be attached to a supplementary probe used to monitor contamination, the relevant standard for that probe is IEC 60325.

If national legislation requires the use of different measuring quantities, for example, air kerma or exposure, the standard may be used with the respective adjustments.

In this document, the expression "dose equivalent (rate)" is used when the provisions apply to both the measurement of dose equivalent and the measurement of dose equivalent rate.

NOTE 3 It does not apply to medical radiology which is within the scope of technical committee 62, where the conditions of radiation exposure may be extremely inhomogeneous, but precisely known.

NOTE 4 It does not apply to instruments intended to be worn by an individual for the purpose of estimating the radiation dose received by that individual.

The object of this standard is to specify the design requirements and the performance characteristics of dose equivalent (rate) meters intended for the determination of ambient dose equivalent (rate) and directional dose equivalent (rate) as defined in ICRU Report 47.

Accordingly, this standard specifies:

- a) general characteristics, the functions and performance characteristics of dose equivalent (rate) meters;

- b) the methods of test to be used to determine compliance with the requirements of this standard.

Some countries may wish to use this type of dose equivalent (rate) meter for measurements in the framework of legal metrology.

2 Normative references

The following referenced documents are indispensable for the application 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 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050-393:2003, *International Electrotechnical Vocabulary (IEV) – Part 393: Nuclear instrumentation – Physical phenomena and basic concepts*

IEC 60050-394:2007, *International Electrotechnical Vocabulary (IEV) – Part 394: Nuclear instrumentation – Instruments, systems, equipment and detectors*

IEC 60068-2-31:2008, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60086-1:2006, *Primary batteries – Part 1: General*

IEC 60086-2:2006, *Primary batteries – Part 2: Physical and electrical specifications*

IEC 60359:2001, *Electrical and electronic measurement equipment – Expression of performance*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
Amendment 1 (1999)¹

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*
Amendment 1 (1998)
Amendment 2 (2000)²

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
Amendment 1 (2007)³

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*
Amendment 1 (2000)⁴

¹ There exists a consolidated edition (2.1) which includes IEC 60529 (1989) and its Amendment 1 (1999).

² There exists a consolidated edition (1.2) which includes IEC 61000-4-2 (1995), its Amendment 1 (1998) and its Amendment 2 (2000).

³ There exists a consolidated edition (3.1) which includes IEC 61000-4-3 (2006) and its Amendment 1 (2007).

⁴ There exists a consolidated edition (1.1) which includes IEC 61000-4-8 (1993) and its Amendment 1 (2000).

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

-
- Looking for additional Standards? Visit Intertek Inform Infostore
 - Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-