

INTERNATIONAL STANDARD

CONSOLIDATED VERSION

**Radiation protection instrumentation - Measurement of personal dose
equivalents for X, gamma, neutron and beta radiations - Active personal
dosemeters**

CONTENTS

FOREWORD	6
INTRODUCTION	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	12
4 Units and symbols	19
4.1 Units	19
4.2 Symbols	19
5 Mechanical characteristics	21
5.1 Case	21
5.2 Switches	22
6 General characteristics	22
6.1 Storage of dose information	22
6.2 Indication	22
6.3 Dosimeter markings	22
6.4 Retention of radioactive contamination	22
6.5 Ranges for dose and dose rate	22
6.6 Rated range of an influence quantity	22
6.7 Effect of radiation not intended to be measured and use of more than one dosimeter	23
6.8 Intrinsic and environmental background of the instrument	23
6.9 Dose or dose rate alarms	23
6.9.1 General	23
6.9.2 Dose alarms	23
6.9.3 Dose rate alarms	24
6.9.4 Alarm output	24
6.10 Indication of malfunction	24
6.11 Assignment of the dose value to the dosimeter	24
6.12 Algorithm to evaluate the indicated value	24
7 General test procedures	25
7.1 Nature of tests	25
7.2 Reference conditions and standard test conditions	25
7.3 Tests for influence quantities of type F	26
7.4 Tests for influence quantities of type S	26
7.5 Phantom for testing	26
7.6 Position of detector assembly for the purpose of testing	26
7.7 Position of dosimeter during use	27
7.8 Minimum rated range of influence quantity	27
7.9 Low dose rates	27
7.10 Statistical fluctuations	27
7.11 Production of reference radiation	27
8 Additivity of indicated value	27
8.1 Requirements	27
8.2 Method of test	28
8.2.1 General	28
8.2.2 Preparation of the test	28

8.2.3	Practical test	29
8.3	Interpretation of the results	29
9	Radiation performance requirements and tests	29
9.1	General.....	29
9.2	Consideration of the uncertainty of the conventional quantity value.....	30
9.3	Constancy of the dose response, dose rate dependence and statistical fluctuations	30
9.3.1	General	30
9.3.2	Requirements	30
9.3.3	Method of test using sources	35
9.3.4	Interpretation of the results of the test using sources	36
9.3.5	Method of test for photon dosimeters using natural radiation	37
9.3.6	Interpretation of the results of the test using natural radiation.....	37
9.4	Variation of the response due to photon radiation energy and angle of incidence	38
9.4.1	Measurement quantity $H_p(0,07)$ or $\dot{H}_p(0,07)$	38
9.4.2	Measurement quantity $H_p(3)$ or $\dot{H}_p(3)$	38
9.4.3	Measurement quantity $H_p(10)$ or $\dot{H}_p(10)$	39
9.5	Variation of the response due to neutron radiation energy and angle of incidence	40
9.5.1	General	40
9.5.2	Measurement quantity $H_p(10)$ or $\dot{H}_p(10)$	40
9.6	Variation of the response due to beta radiation energy and angle of incidence	41
9.6.1	General	41
9.6.2	Measurement quantity $H_p(0,07)$ or $\dot{H}_p(0,07)$	41
9.6.3	Measurement quantity $H_p(3)$ or $\dot{H}_p(3)$	42
9.6.4	Measurement quantity $H_p(10)$ or $\dot{H}_p(10)$	43
9.7	Over indication due to radiation incident from the side of an $H_p(10)$, $H_p(3)$ or $H_p(0,07)$ dosimeter	43
9.7.1	Requirements	43
9.7.2	Method of test	43
9.7.3	Interpretation of the results.....	44
9.8	Retention of dose reading	44
9.8.1	General	44
9.8.2	Requirements	44
9.8.3	Method of test and interpretation of the results	44
9.9	Overload characteristics	44
9.9.1	General	44
9.9.2	Requirements	45
9.9.3	Method of test and interpretation of the results	45
9.10	Alarm	46
9.10.1	General	46
9.10.2	Response time for dose rate indication and alarm.....	46
9.10.3	Accuracy of dose alarm	47
9.10.4	Accuracy of dose rate alarm	47
9.11	Model function	48

10	Electrical and environmental performance requirements and tests	48
10.1	General.....	48
10.2	Power supplies	48
10.2.1	General requirements	48
10.2.2	Specific primary batteries requirements	49
10.2.3	Specific secondary batteries requirements.....	49
10.2.4	Method of test and interpretation of the results (primary and secondary batteries)	49
10.3	Ambient temperature	50
10.3.1	Requirements	50
10.3.2	Method of test and interpretation of the results	51
10.4	Relative humidity	52
10.4.1	Requirements	52
10.4.2	Method of test and interpretation of the results	52
10.5	Atmospheric pressure	52
10.6	Sealing	52
10.7	Storage.....	52
10.8	Light exposure	52
10.8.1	General	52
10.8.2	Requirements	53
10.8.3	Interpretation of the results.....	53
10.9	Dose build-up, fading and self-irradiation (hybrid dosimeters)	53
11	Electromagnetic performance requirements and tests.....	54
11.1	General.....	54
11.2	Electrostatic discharge.....	55
11.2.1	Requirements	55
11.2.2	Method of test and interpretation of the results	55
11.3	Radiated electromagnetic fields	56
11.3.1	Requirements	56
11.3.2	Method of test and interpretation of the results	56
11.4	Conducted disturbances induced by fast transients or bursts	56
11.4.1	Requirements	56
11.4.2	Method of test and interpretation of the results	56
11.5	Conducted disturbances induced by surges	57
11.5.1	Requirements	57
11.5.2	Method of test and interpretation of the results	57
11.6	Conducted disturbances induced by radio-frequencies	57
11.6.1	Requirements	57
11.6.2	Method of test and interpretation of the results	57
11.7	50 Hz/60 Hz magnetic field	57
11.7.1	Requirements	57
11.7.2	Method of test and interpretation of the results	57
11.8	Voltage dips and short interruptions.....	57
11.8.1	Requirements	57
11.8.2	Method of test and interpretation of the results	58
12	Mechanical performance, requirements and tests	58
12.1	General.....	58
12.2	Drop test.....	58

12.2.1	Requirements	58
12.2.2	Method of test and interpretation of the results	58
12.3	Vibration test	59
12.3.1	Requirements	59
12.3.2	Method of test and interpretation of the results	59
12.4	Microphonics test.....	59
12.4.1	Requirements	59
12.4.2	Method of test and interpretation of the results	59
13	Software	60
13.1	General.....	60
13.2	Design and structure of the software.....	61
13.2.1	Requirements	61
13.2.2	Method of test	61
13.3	Identification of the software	61
13.3.1	Requirements	61
13.3.2	Method of test	61
13.4	Authenticity of the software and the presentation of results.....	62
13.4.1	Requirements	62
13.4.2	Method of test	62
13.5	Alarm and stop of system operation under abnormal operating conditions.....	62
13.5.1	Requirements	62
13.5.2	Method of test	62
13.6	Control of instrument parameters	63
13.6.1	Requirements	63
13.6.2	Method of test	63
13.7	Storage of measurement data	63
13.7.1	Requirements	63
13.7.2	Method of test	63
13.8	Transmission of data.....	64
13.8.1	Requirements	64
13.8.2	Method of test	64
13.9	Hardware interfaces and software interfaces.....	64
13.9.1	Requirements	64
13.9.2	Method of test	65
13.10	Documentation for the software test.....	65
13.10.1	Requirements	65
13.10.2	Method of test	66
14	Uncertainty	66
15	Documentation	66
15.1	Type test report	66
15.2	Certificate	66
16	Operation and maintenance manual	67
Annex A (normative)	Statistical fluctuations	68
Annex B (normative)	Coverage intervals	68
Annex C (informative)	Causal connection between readout signals, indicated value and measured value	73
Annex D (informative)	Procedure to determine the variation of the relative response due to radiation energy and angle of radiation incidence.....	74

Annex E (informative) Computational method of test for mixed irradiations	76
Bibliography.....	78
Figure B.1 – Test for coverage interval	70
Figure C.1 – Data evaluation in dosimetry systems	73
Figure E.1 – Flow chart of a computer program to perform tests according to 8.2	77
Table 1 – Symbols and abbreviated terms	19
Table 2 – Reference conditions and standard test conditions	25
Table 3 – Radiation characteristics of $H_p(0,07)$ dosimeters for X, gamma and beta radiation	31
Table 4 – Radiation characteristics of $H_p(3)$ dosimeters for X, gamma and beta radiation	32
Table 5 – Radiation characteristics of $H_p(10)$ dosimeters for X and gamma radiation	33
Table 6 – Radiation characteristics of $H_p(10)$ dosimeters for neutron radiation	34
Table 7 – Values of c_1 and c_2 for w different dose values and n indications for each dose value	37
Table 8 – Electrical and environmental characteristics of dosimeters	53
Table 9 – Electromagnetic disturbance characteristics of dosimeters	55
Table 10 – Mechanical disturbances characteristics of dosimeters.....	58
Table A.1 – Number of instrument readings required to detect true differences (95 % level of confidence) between two sets of instrument readings on the same instrument.....	69
Table B.1 – Student's t -value for a double sided 95 % coverage interval.....	71
Table E.1 – Example of dosimeter response table and range limits.....	76

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Radiation protection instrumentation -
Measurement of personal dose equivalents for
X, gamma, neutron and beta radiations -
Active personal dosimeters**

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61526 edition 4.1 contains the fourth edition (2024-03) [documents 45B/1047/FDIS and 45B/1049/RVD] and its amendment 1 (2026-06) [documents 45B/1113/FDIS and 45B/1121/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

IEC 61526 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2010. This edition constitutes a technical revision.

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

- a) Modification of the title;
- b) Inclusion of the measurement quantity for the dose in the lens of the eye, $H_p(3)$;
- c) Inclusion of measurement quantity for dose in the skin and extremities, $H_p(0,07)$;
- d) Inclusion of dosimeters between active and passive: "hybrid dosimeters";
- e) Inclusion of software requirements;
- f) Harmonization of requirements for linearity to IEC 62387;
- g) Revised neutron energy response requirements.

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

Draft	Report on voting
45B/1047/FDIS	45B/1049/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 and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document applies to active, (direct reading or hybrid) personal dosimeters and monitors used for measuring personal dose equivalents $H_p(10)$, $H_p(3)$, and $H_p(0,07)$, for X, gamma, neutron, and beta radiations.

For personal dose equivalent $H_p(10)$ and for X and gamma radiation, two minimum rated ranges for the photon energy are given. The first from 20 keV to 150 keV is for workplaces where low energy X-rays are used, e.g., in diagnostic medicine, the second from 80 keV to 1,25 MeV is for workplaces where high energy X-rays and/or gamma sources are used, e.g., in industry. For neutron radiation the minimum rated range of neutron energy is from 0,025 eV (thermal neutrons) to 10 MeV. The rated ranges can be extended to all energies covered by the respective standards for reference radiation fields.

For personal dose equivalent $H_p(3)$ and for X and gamma radiation, a minimum rated range for photon energy from 30 keV to 250 keV is given. For personal dose equivalent $H_p(0,07)$ a range of 30 keV to 1250 keV or, for workplaces where low energy X-rays are used, 20 keV to 150 keV, is given. For beta radiation for both quantities, the minimal rated range is from 0,24 MeV to 0,8 MeV (mean beta particle energy). The rated ranges can be extended to all energies covered by the respective standards for reference radiation fields.

In some applications, for example, at a nuclear reactor installation where 6 MeV photon radiation is present, measurement of personal dose equivalent (rate) $H_p(10)$ for photon energies up to 10 MeV should be required. In some other applications, measurement of $H_p(10)$ down to 10 keV should be required.

For personal dosimeters, requirements for measuring the dose quantities $H_p(10)$, $H_p(3)$, and $H_p(0,07)$, and for monitoring of the respective dose rate quantities are given. The measurement of these dose rate quantities is an option for personal dosimeters.

Establishments in some countries may be permitted to use this type of personal dosimeter as the dosimeter to provide the dose of record by an approved dosimetry service.

1 Scope

This document applies to personal dosimeters with the following characteristics:

- a) They are worn on the trunk, close to the eye, or on the extremities.
- b) They measure the personal dose equivalents $H_p(10)$, $H_p(3)$, and $H_p(0,07)$, from external X and gamma, neutron (not for $H_p(3)$), and beta radiations, and may measure the respective personal dose equivalent rates for the same radiations (for alarming purposes).
- c) They have a digital indication. This indication may or may not be attached.
- d) They have alarm functions for the personal dose equivalents or personal dose equivalent rates except for hybrid dosimeters. For hybrid dosimeters an alarm function for the personal dose equivalents shall be implemented in the associated readout system.

NOTE 1 When reference is made in this document to "dose", this is meant to indicate personal dose equivalent, unless otherwise stated.

NOTE 2 When reference is made in this document to "dosimeter", this is meant to include all personal dosimeters, unless otherwise stated.

NOTE 3 This document does not cover neutron dosimeters for the $H_p(3)$ measurements up to now.

This document specifies requirements for the dosimeter and, if supplied, for its associated readout system.

Usually, a dosimeter is not able to measure all quantities given above. Thus, the dosimeter is only tested with regard to those quantities and types of radiation it is intended to be used for. Other types of radiation are considered as influence quantities which also may have requirements.

This document specifies, for the dosimeters described above, general characteristics, general test procedures, radiation characteristics as well as electrical, mechanical, safety and environmental characteristics. The only requirements specified for associated readout systems are those which affect its accuracy of readout of the personal dose equivalent and alarm settings, and those which concern the influence of the reader on the dosimeter.

This document does not cover special requirements for accident or emergency dosimetry, although the dosimeters may be used for this purpose.

This document does not apply to dosimeters used for measurement of pulsed radiation, such as radiation emanating from many medical diagnostic X-ray facilities, linear accelerators or similar equipment.

NOTE 4 Requirements and testing procedure for dosimeters used in pulsed field of ionizing radiation can be found in IEC TS 63050 or IEC TS 62743.

This document does not apply for dosimeters to measure ambient or directional dose equivalent.

NOTE 5 Requirements for ambient or directional dose equivalent meters can be found e.g. in: IEC 60846-1; IEC 62387, IEC 61017 or IEC 60532.

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 60050-395:2014/AMD1:2016

IEC 60050-395:2014/AMD2:2020

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

IEC 60086-1:2021, *Primary batteries – Part 1: General*

IEC 60086-2:2021, *Primary batteries – Part 2: Physical and electrical specifications*

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

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60904-3, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

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

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

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

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

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

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61187:1993, *Electrical and electronic measuring equipment – Documentation*

IEC 62387:2020, *Radiation protection instrumentation – Dosimetry systems with integrating passive detectors for individual, workplace and environmental monitoring of photon and beta radiation*

IEC TR 62461:2015, *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 98-3:2008/Suppl.1:2008, *Propagation of distributions using a Monte Carlo method and Corr.1 (2009)*

ISO 4037-1:2019, *Radiological protection – X and gamma reference radiation for calibrating dosimeters and dose rate meters and for determining their response as a function of photon energy – Part 1: Radiation characteristics and production methods*

ISO 4037-2:2019, *Radiological protection – X and gamma reference radiation for calibrating dosimeters and dose rate 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 4037-3:2019, *Radiological protection – X and gamma reference radiation for calibrating dosimeters and dose rate 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 4037-4:2019, *Radiological protection – X and gamma reference radiation for calibrating dosimeters and dose rate 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 6980-1:2023, *Nuclear energy – Reference beta-particle radiation – Part 1: Methods of production*

ISO 6980-2:2023, *Nuclear energy – Reference beta-particle radiation – Part 2: Calibration fundamentals related to basic quantities characterizing the radiation field*

ISO 6980-3:2023, *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*

ISO 8529-1:2021, *Reference neutron radiations – Part 1: Characteristics and methods of production*

ISO 8529-2:2000, *Reference neutron radiations – Part 2: Calibration fundamentals of radiation protection devices related to the basic quantities characterizing the radiation field*

ISO 8529-3:2023, *Neutron reference radiation fields – Part 3: Calibration of area and personal dosimeters and determination of their response as a function of neutron energy and angle of incidence*

ISO 12789-1, *Reference radiation fields – Simulated workplace neutron fields – Part 1: Characteristics and methods of production*

ISO 12789-2, *Reference radiation fields – Simulated workplace neutron fields – Part 2: Calibration fundamentals related to the basic quantities*

ISO 21909-1:2021, *Passive neutron dosimetry systems – Part 1: Performance and test requirements for personal dosimetry*

ISO 80000-10:2019, *Quantities and units – Part 10: Atomic and nuclear physics*

ICRU Report 51:1993, *Quantities and units in radiation protection dosimetry*

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IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*

IEC 60050-151:2001/AMD1:2013

IEC 60050-151:2001/AMD2:2014

IEC 60050-151:2001/AMD3:2019

IEC 60050-151:2001/AMD4:2020

IEC 60050-151:2001/AMD5:2021

IEC 60050-300:2001, *International Electrotechnical Vocabulary (IEV) – Part 300: Electrical and electronic measurements and measuring instruments – Part 311: General terms relating to measurements – Part 312: General terms relating to electrical measurements – Part 313: Types of electrical measuring instruments – Part 314: Specific terms according to the type of instrument*

IEC 60050-300:2001/AMD1:2015

IEC 60050-300:2001/AMD2:2016

IEC 60050-300:2001/AMD3:2017

IEC 60050-300:2001/AMD4:2020

IEC 60532, *Radiation protection instrumentation – Installed dose rate meters, warning assemblies and monitors – X and gamma radiation of energy between 50 keV and 7 MeV*

IEC 60846-1, *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 61017, *Radiation protection instrumentation – Transportable, mobile or installed equipment to measure photon radiation for environmental monitoring*

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

IEC TS 62743:2012, *Radiation protection instrumentation – Electronic counting dosimeters for pulsed fields of ionizing radiation*

IEC TS 63050, *Radiation protection instrumentation – Dosimeters for pulsed fields of ionizing radiation*

ISO/IEC Guide 99:2007, *International vocabulary of metrology – Basic and general concepts and associated terms (VIM)*

ISO 29661:2012, *Reference radiation fields for radiation protection – Definitions and fundamental concepts*

Brunzendorf, J. and Behrens, R., "How to type test the coefficient of variation of an indication", *Radiation Protection Dosimetry*, Vol. 123, pp. 21-31, 2007

WELMEC European cooperation in legal metrology, WELMEC 7.2: Software Guide (Measuring Instruments Directive 2014/32/EU), available for download at www.welmec.org