IEC 62387

Edition 2.0 2020-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Instrumentation pour la radioprotection – Systèmes dosimétriques avec détecteurs intégrés passifs pour le contrôle radiologique individuel, du lieu de travail et de l'environnement des rayonnements photoniques et bêta

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

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RADIATION PROTECTION INSTRUMENTATION – DOSIMETRY SYSTEMS WITH INTEGRATING PASSIVE DETECTORS FOR INDIVIDUAL, WORKPLACE AND ENVIRONMENTAL MONITORING OF PHOTON AND BETA RADIATION

FOREWORD

International Standard IEC 62387 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 62387 published in 2012. This edition constitutes a technical revision.

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

- Modification of title.
- Addition of performance requirements for dosemeters to measure $H'(3)$ for both photon and beta radiation.
- Adoption of the cylinder instead of the slab phantom for the quantity $H_p(3)$.
- Correction and clarification of several subclauses to obtain a better applicability.

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

FDIS	Report on voting
45B/945/FDIS	45B/954/RVD

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

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

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

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- withdrawn,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

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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

A dosimetry system may consist of the following elements:

a) a passive device, referred to herein as a *detector*, which, after the exposure to radiation, stores a signal for use in measuring one or more quantities of the incident radiation field;

b) a "dosemeter", that incorporates some means of identification and contains one or more detectors and may contain electronic components, e.g. for the readout (e.g., in a direct ion storage (DIS) dosemeter);

c) a "reader" which is used to readout the stored information (signal) from the detector, in order to determine the radiation dose;

d) a "computer" with appropriate "software" to control the reader, store the signals transmitted from the reader, calculate, display and store the evaluated dose in the form of an electronic file or paper copy;

e) "additional equipment" and documented procedures (instruction manual) for performing associated processes such as deleting stored dose information, cleaning dosemeters, or those needed to ensure the effectiveness of the whole system.

RADIATION PROTECTION INSTRUMENTATION – DOSIMETRY SYSTEMS WITH INTEGRATING PASSIVE DETECTORS FOR INDIVIDUAL, WORKPLACE AND ENVIRONMENTAL MONITORING OF PHOTON AND BETA RADIATION

1 Scope

This document applies to all kinds of passive dosimetry systems that are used for measuring:

– the personal dose equivalent $H_p(10)$ (for individual whole body monitoring),

– the personal dose equivalent $H_p(3)$ (for individual eye lens monitoring),

– the personal dose equivalent $H_p(0,07)$ (for both individual whole body skin and local skin for extremity monitoring),

– the ambient dose equivalent $H^*(10)$ (for workplace and environmental monitoring),

– the directional dose equivalent $H'(3)$ (for workplace and environmental monitoring), or

– the directional dose equivalent $H'(0,07)$ (for workplace and environmental monitoring).

This document applies to dosimetry systems that measure external photon and/or beta radiation in the dose range between 0,01 mSv and 10 Sv and in the energy ranges given in Table 1. All the energy values are mean energies with respect to the fluence. The dosimetry systems usually use electronic devices for the data evaluation and thus are often computer controlled.

Table 1 – Mandatory and maximum energy ranges covered by this document

Measuring quantity	Mandatory mean energy range for photon radiation	Maximum mean energy range for testing photon radiation	Mandatory mean energy range for beta-particle radiation[a]	Maximum mean energy range for testing beta-particle radiation[a]
$H_p(10)$, $H^*(10)$	80 keV to 1,25 MeV[b]	12 keV to 7 MeV	–	–
$H_p(3)$, $H'(3)$	30 keV to 250 keV	8 keV to 7 MeV	0,8 MeV[c]	0,7 MeV[c] to 1,2 MeV
$H_p(0,07)$, $H'(0,07)$	30 keV to 250 keV	8 keV to 1,25 MeV[b]	0,24 MeV to 0,8 MeV	0,07 MeV[d] to 1,2 MeV[e]

[a] The following beta radiation sources are suggested for the different mean energies: For 0,06 MeV: ^{147}Pm; for 0,8 MeV: ^{90}Sr/^{90}Y; for 1,2 MeV: ^{106}Ru/^{106}Rh.

[b] 1,25 MeV is the mean energy of photon radiation from ^{60}Co.

[c] For beta-particle radiation, an energy of 0,7 MeV is required to reach the radiation sensitive layers of the eye lens in a depth of about 3 mm (approximately 3 mm of ICRU tissue).

[d] For beta-particle radiation, an energy of 0,07 MeV is required to penetrate the dead layer of skin of 0,07 mm (approximately 0,07 mm of ICRU tissue).

[e] 0,07 MeV, 0,8 MeV and 1,2 MeV beta mean energy are almost equivalent to an E_{max} of 0,225 MeV, 2,27 MeV and 3,54 MeV, respectively.

NOTE 1 In this document, “dose” means dose equivalent, unless otherwise stated.

NOTE 2 For $H_p(10)$ and $H^*(10)$ no beta radiation is considered. Reasons:

a) $H_p(10)$ and $H^*(10)$ are a conservative estimate for the effective dose which is not a suitable quantity for beta radiation.

b) No conversion coefficients are available in ICRU 56, ICRU 57 or ISO 6980-3.

NOTE 3 The maximum energy ranges are the energy limits within which type tests according to this document are possible.

NOTE 4 Direct ion storage (DIS) dosemeters are covered in this document as they are often operated without an online display but a separate reader.

The test methods concerning the design (Clause 8), the instruction manual (Clause 9), the software (Clause 10), environmental influences (Clause 13), electromagnetic influences (Clause 14), mechanical influences (Clause 15), and the documentation (Clause 16) are independent of the type of radiation. Therefore, they can also be applied to other dosimetry systems, e.g. for neutrons, utilizing the corresponding type of radiation for testing.

This document is intended to be applied to dosimetry systems that are capable of evaluating doses in the required quantity and unit (Sv) from readout signals in any quantity and unit. The only correction that may be applied to the evaluated dose (indicated value) is the one resulting from natural background radiation using extra dosemeters.

NOTE 5 The correction due to natural background can be made before or after the dose calculation.

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 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*

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

ISO 4037 (all parts), *Radiological protection – X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy*

ISO 4037-3:2019, *Radiological protection – X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy – Part 3: Calibration of area and personal dosemeters and the measurement of their response as a function of energy and angle of incidence*

ISO 6980 (all parts), *Nuclear energy – Reference beta-particle radiation*

ISO 6980-3, *Nuclear energy – Reference beta-particle radiation – Part 3: Calibration of area and personal dosemeters and the determination of their response as a function of beta radiation energy and angle of incidence*

ISO 8529 (all parts), *Reference neutron radiations*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

Several quantities with specific subscripts are explained in Table 6.

3.1
ambient dose equivalent
$H^*(d)$
dose equivalent at a point in a radiation field, produced by the corresponding expanded and aligned field, in the ICRU sphere at a depth, d, on the radius opposing the direction of the aligned field

Note 1 to entry: The recommended depth, d, for environmental monitoring in terms of $H^*(d)$ is 10 mm, and $H^*(d)$ may be written as $H^*(10)$.

[SOURCE: IEC 60050-395:2014, 395-05-43 – Note 1 to entry is note 3 in the source]

3.2
calibration coefficient
N_0
quotient of the conventional quantity value to be measured and the corrected indication of the dosemeter, $G_{r,0}$, normalized to reference conditions

Note 1 to entry: The calibration coefficient for the reference radiation quality U and the angle of incidence α is equivalent to the calibration factor multiplied by the instrument coefficient. It is given by

$$N_0 = \frac{C_{r,0}}{G_{r,0}} = C_f(\mathrm{U},\alpha) \cdot c_i$$

where

$C_{r,0}$ is the conventional quantity value, see 3.5

$G_{r,0}$ is the corrected indication, see 3.14

$C_f(\mathrm{U},\alpha)$ is the calibration factor for the radiation quality U and the angle of incidence α, see 3.3, and

c_i is the instrument constant, see 3.18.

Concerning the dimension of the calibration factor and the calibration coefficient, see notes to 3.3 and 3.18.

Note 2 to entry: The reciprocal of the calibration coefficient is the response under reference conditions. The value of the calibration factor may vary with the magnitude of the quantity to be measured. In such cases a dosemeter is said to have a non-constant response (or a non-linear indication).

[SOURCE: ISO 29661:2012, 3.1.5, modified – Note 3 to entry has been deleted]

3.3
calibration factor
$\boldsymbol{C_\mathrm{f}(\mathrm{U},\alpha)}$
factor by which the product of the corrected indication, $G_{\mathrm{r},0}$, and the associated instrument constant, c_i, of the dosemeter is multiplied to obtain the conventional quantity value to be measured under reference conditions

Note 1 to entry: The calibration factor is dimensionless.

[SOURCE:ISO 29661:2012, 3.1.7]

3.4
coefficient of variation
v
ratio of the standard deviation s to the arithmetic mean $\overline{G}$ of a set of n indicated values G_j (indicated value)

$$v = \frac{s}{\overline{G}} = \frac{1}{\overline{G}}\sqrt{\frac{1}{n-1}\sum_{j=1}^{n}\left(G_j - \overline{G}\right)^2}$$

3.5
conventional quantity value
C
quantity value attributed by agreement to a quantity for a given purpose

Note 1 to entry: The conventional quantity value C is the best estimate of the quantity to be measured, determined by a primary standard or a secondary or working measurement standard which are traceable to a primary standard.

[SOURCE: ISO/IEC Guide 99:2007, 2.12]

3.6
correction for non-linearity
r_n
quotient of the response R_n under conditions where only the value of the dose equivalent is varied, and the reference response R_0

$$r_\mathrm{n} = \frac{R_\mathrm{n}}{R_0}$$

Note 1 to entry: For a linear dosimetry system, r_n is equal to unity.

3.7
coverage factor
k
numerical factor used as a multiplier of the combined standard uncertainty in order to obtain an expanded uncertainty

Note 1 to entry: A coverage factor k is typically in the range 2 to 3.

Note 2 to entry: In case of a normal distribution, using a coverage factor of 2 results in an expanded uncertainty that defines an interval around the result of a measurement that contains approximately 95 % of the distribution of values that could reasonably be attributed to the measurand. For other distributions, the coverage factor may be larger.

[SOURCE: GUM 2.3.6:1995, modified – The symbol k has been added]

3.8
detector
radiation detector
apparatus or substance used to convert incident ionizing radiation energy into a signal suitable for indication and/or measurement an apparatus or substance which, in the presence of radiation, provides by either direct or indirect means a signal or other indication suitable for use in measuring one or more quantities of the incident radiation

Note 1 to entry: The detector usually requires a separate reader to read out the signal. That means the detector usually is not able to provide a signal without any external reading process.

Note 2 to entry: A passive detector does not need an external power supply to collect and store dose information.

Note 3 to entry: In IEV, the term reads “radiation detector”.

[SOURCE: IEC 60050-881:1983, 881-13-01, modified – The term “detector” has been added as the first preferred term]

3.9
deviation
D
difference between the indicated values for the same value of the measurand of a dosimetry system, when an influence quantity assumes, successively, two different values

$$D = G - G_{\mathrm{r}}$$

where

G the indicated value under the effect, and

G_{r} the indicated value under reference conditions

Note 1 to entry: The original term in IEV 311-07-03 reads “variation (due to an influence quantity)”. In order not to mix up variation (of the indicated value) and variation of the response, in this standard, the term is called “deviation”.

Note 2 to entry: The deviation can be positive or negative resulting in an increase or a decrease of the indicated value, respectively.

[SOURCE: IEC 60050-300-311:2001, 311-07-03, modified – "deviation" has replaced “variation (due to an influence quantity)” and “dosimetry system” has replaced “an indicating measuring instrument, or the values of a material measure” and Notes 1 and 2 to entry have been added]

3.10
directional dose equivalent
$H'(d)$
at a point in a radiation field, dose equivalent that would be produced by the corresponding expanded field, in the ICRU sphere at a depth, d, on the radius in a specified direction

Note 1 to entry: The currently recommended depth, d, for environmental monitoring with respect to local skin and lens of the eye is 0,07 mm and 3 mm, respectively, and $H'(d)$ may be written as $H'(0,07)$and $H'(3)$, respectively.

[SOURCE: ICRU 51:1993, modified – Note 1 to entry has been added]

3.11
dosemeter
radiation meter designed to measure quantities such as an absorbed dose or dose equivalent

Note 1 to entry: In a wider sense, this term is used for meters designed to measure other quantities related to radiation such as exposure, fluence, etc. Such use is deprecated.

Note 2 to entry: This apparatus may require a separate reader to read out the absorbed dose or dose equivalent.

Note 3 to entry: A dosemeter usually consists of a detector and a badge, for example thermoluminescence detector (TLD) badge with filters.

Note 4 to entry: A dosemeter may contain electronic components (e.g. for the readout (e.g. in a direct ion storage (DIS) dosemeter)).

[SOURCE: IEC 60050-395:2014, 395-05-02, modified – Notes 3 and 4 to entry have been added]

3.12
dosimetry system
dosemeter, reader and all associated equipment and procedures used for assessing the indicated value

3.13
expanded uncertainty
U
quantity defining an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand

Note 1 to entry: The expanded uncertainty is obtained by multiplying the combined standard uncertainty by a coverage factor.

Note 2 to entry: A confidence level of 95 % is recommended for the use of this document.

[SOURCE: GUM:1995, 2.3.5]

3.14
indicated value
indication
G
value of the measurand given directly by a measuring instrument on the basis of its calibration curve

Note 1 to entry: In this standard, the indicated value is the one given by the dosimetry systems as the final result of the evaluation algorithm (for example, display of the software, print out) in units of dose equivalent (Sv), see 8.2.

Note 2 to entry: For details, see Annex B.

[SOURCE: IEC 60050-300-311:2001, 311-01-08, modified – The original note has been replaced by new Notes 1, 2 and 3 to entry]

3.15
influence quantity
quantity that is not the measurand but that affects the result of the measurement

Note 1 to entry: For example, temperature of a length measuring instrument.

Note 2 to entry: If the effect on the result of a measurement of an influence quantity depends on another influence quantity, these influence quantities are treated as a single one. In this standard, this is the case for two pairs of influence quantities:

a) radiation energy and angle of incidence,

b) ambient temperature and relative humidity.

[SOURCE: GUM:1995, B.2.10, modified – Examples 1, 2 and 3 have been removed and Notes 1 and 2 to entry have been added]

3.16
influence quantity of type F
influence quantity whose effect on the indicated value is a change in response

Note 1 to entry: An example is radiation energy and angle of radiation incidence.

Note 2 to entry: F stands for factor. The indication due to radiation is multiplied by a factor due to the influence quantity.

3.17
influence quantity of type S
influence quantity whose effect on the indicated value is a deviation independent of the indicated value

Note 1 to entry: An example is the electromagnetic disturbance.

Note 2 to entry: All requirements for influence quantities of type S are given with respect to the value of the deviation D.

Note 3 to entry: S stands for sum. The indication is the sum of the indication due to radiation and due to the disturbance.

3.18
instrument constant
c_i
constant by which the indication of the dosemeter G or – if corrections or a normalization were applied – the corrected indication $G_{\mathrm{r},0}$ is multiplied to convert it to the same unit as the measurand

Note 1 to entry: Adapted from ICRU Report 76.

Note 2 to entry: If the instrument's indication is already expressed in the same unit as the measurand the instrument constant, c_i, is unnecessary. This is the case in this standard.

[SOURCE: ISO 29661:2012, 3.1.17]

3.19
lower limit of the measuring range
H_low
lowest dose value included in the measuring range

Note 1 to entry: H_low is equivalent to H_0 in ISO 14146:2018.

3.20
mandatory range
mandatory range of use
smallest range specified for an influence quantity or instrument parameter over which the dosimetry system must operate to be in compliance with this document

Note 1 to entry: The mandatory ranges of the influence quantities dealt with in this document are given in the second column of Table 8 to Table 16.

3.21
maximum rated measurement time
t_max
longest continuous period of time over which the dose is accumulated and over which all requirements of this document are fulfilled

Note 1 to entry: The maximum rated measurement time depends on the lower limit of the measuring range H_low, the fading, and other influences.

Note 2 to entry: The beginning of this period of time can for example be erasing the dose by heating (for TLDs) or a dose reset by means of software (for DIS).

3.22
measured value
M
value that can be obtained from the indicated value G by applying the model function for the measurement

Note 1 to entry: For "model function", see 3.25.

Note 2 to entry: For details, see Annex B.

3.23
measuring range
range defined by two values of the measurand, or quantity to be supplied, within which the limits of uncertainty of the measuring instrument are specified

Note 1 to entry: In this standard, the measuring range is the range of dose equivalent, in which the requirements of this standard are fulfilled and thus the uncertainty is limited.

[SOURCE: IEC 60050-300-311:2001, 311-03-12, modified – The original note has been replaced by a new Note 1 to entry]

3.24
personal dose equivalent
$H_p(d)$
dose equivalent in soft tissue, at an appropriate depth, d, below a specified point on the body

Note 1 to entry: The recommended depths are 10 mm for penetrating radiation, 3 mm to monitor the eye lens dose, and 0,07 mm to monitor skin dose.

Note 2 to entry: Soft tissue means ICRU 4-element tissue, see ICRU Report 39.

[SOURCE: ICRU 51:1993, modified – Notes 1 and 2 to entry have been added]

3.25
model function
mathematical model of the measurement that transforms the (set of) observation(s) into the result of the measurement

Note 1 to entry: The model function combines the indicated value G with the reference calibration coefficient N_0, the correction for non-linearity r_n, the l deviations D_p (p = 1..l) for the influence quantities of type S, and the m relative response values r_q (q = 1..m) for the influence quantities of type F. An example of a model function is

$$M = \frac{N_0}{r_n \prod_{q=1}^{m} r_q} \left[G - \sum_{p=1}^{l} D_p \right].$$

A model function is necessary to evaluate the uncertainty of the measured value according to the GUM (see GUM:1995, 3.1.6, 3.4.1 and 4.1).

Note 2 to entry: The calculations according to the model function are usually not performed, only in the case that specific influence quantities are well known and an appropriate correction is applied.

Note 3 to entry: For details, see Annex B.

3.26
point of test
point in the radiation field at which the conventional quantity value of the quantity to be measured is known

[SOURCE: ISO 29661:2012, 3.1.23, modified – "to be measured" has been added]

3.27
preparation
normal treatment of dosemeters or detectors before a dose measurement, which the dosemeters or detectors are intended to be subjected to in routine use

Note 1 to entry: For example, a procedure to erase stored dose information, reset the dose information by means of software, cleaning.

3.28
rated range
rated range of use
specified range of values which an influence quantity can assume without causing a deviation or variation of the response exceeding specified limits

Note 1 to entry: In IEC 60050-300-311:2001, 311-07-05, the term reads “nominal range of use”. In this document, “rated range” is used in order to avoid complicated terms like “the range of use of an influence quantity” but to have terms that are easily readable like “the rated range of an influence quantity”.

Note 2 to entry: Influence quantities can be either of type S or of type F.

[SOURCE: IEC 60050-300-311:2001, 311-07-05, modified – “rated range” has replaced “nominal range” and “deviation or variation of the response” has replaced “variation”; Notes 1 and 2 to entry have been added]

3.29
reader
dosemeter reader
instrument used to read one or more detectors in a dosemeter

Note 1 to entry: Signal of a passive dosemeter can be amount of light, amount of charge, transparency of film and so on. Each type of passive dosemeter thus has very a different type of reader.

Note 2 to entry: The readout can also be taken over by self-reading components of the dosemeter, e.g. within DIS dosemeters.

3.30
readout
process of measuring the stored dose information of a detector in a reader

Note 1 to entry: If the dosemeter contains self-reading components, e.g. DIS dosemeters, the resulting signal may be corrected for influences such as temperature, fading, etc.

3.31
reference conditions
set of specified values and/or ranges of values of influence quantities under which the uncertainties admissible for a dosimetry system are the smallest

[SOURCE: IEC 60050-300-311:2001, 311-06-02, modified – After “uncertainties” the words “, or limits of error,” have been deleted and “dosimetry system” has replaced “measuring instrument”]

3.32
reference direction
direction, in the coordinate system of a dosemeter, with respect to which the angle to the direction of radiation incidence is measured in unidirectional fields

[SOURCE: ISO 29661:2012, 3.1.29]

3.33
reference orientation
(dosemeter) orientation for which the direction of the incident radiation coincides with the reference direction of the dosemeter

[SOURCE: ISO 29661:2012, 3.1.31]

3.34
reference point of a dosemeter
physical mark or marks on the outside of the dosemeter (possibly described in the manual) to be used in order to position it with respect to the point of test; if there is no mark or marks on the outside of the dosemeter, the geometric centre of the dosemeter should be taken as the reference point

3.35
reference response
R_0
response for a reference value $C_{r,0}$ of the quantity to be measured under reference conditions

$$R_0 = \frac{G_{r,0}}{C_{r,0}}$$

where $G_{r,0}$ is the corresponding indicated value

Note 1 to entry: The reference response is the reciprocal of the reference calibration coefficient.

Note 2 to entry: The reference values for the dose are given in Table 7.

3.36
relative expanded uncertainty
U_{rel}
expanded uncertainty divided by the measurement result

3.37
relative response
r
quotient of the response R and the reference response R_0

$$r = \frac{R}{R_0}$$

3.38
response of a radiation measuring assembly
R
ratio, under specified conditions, given by the relation:

$$R = \frac{G}{C}$$

where

G is the indicated value of the quantity measured by the equipment or assembly under test (dosimetry system), and

C is the conventional quantity value of this quantity

Note 1 to entry: The value of the response may vary with the dose being measured. In such cases, a dosimetry system is said to be non-linear.

[SOURCE: IEC 60050-395:2014, 395-03-72, modified – The letters representing quantities have been modified, "value" has been replaced by "indicated value of the quantity", "(dosimetry system)" has been added and the original notes have been replaced by a new Note 1 to entry]

3.39
result of a measurement
set of values attributed to a measurand, including a value, the corresponding uncertainty, and the unit of the measurand

Note 1 to entry: The central value of the whole (set of values) can be selected as *measured value* M (see 3.22) and a parameter characterizing the dispersion as *uncertainty* (see 3.43).

Note 2 to entry: The result of a measurement is related to the *indicated value given by the instrument* G (see 3.14) and to the values of correction obtained by calibration and by the use of a *model* (see 3.25).

Note 3 to entry: The estimation of M can be based on one or more indicated values.

[SOURCE: IEC 60050-300-311: 2001, 311-01-01, modified – "including a value, the corresponding uncertainty, and the unit of the measurand" has been added, the original Notes 1, 4, and 5 have been deleted, and Notes 1 and 2 to entry have been aligned to terms used in this document]

3.40
signal
S
quantity obtained in a reader after readout of a detector from which the indicated value of the dose equivalent is evaluated

Note 1 to entry: Examples are the charge measured in a photomultiplier tube due to TL-light; the area of a certain region from a glow curve of a TL detector; a fitting parameter evaluated from a glow curve analysis.

Note 2 to entry: In principle, it is possible to obtain more than one signal from one detector (for example several fitting parameters from a glow curve analysis).

Note 3 to entry: Using more than one detector always means using more than one signal.

Note 4 to entry: The "signal" is similar to the "readout value" in ISO 12794:2000, 3.13.

Note 5 to entry: For details, see Annex B.

3.41
standard deviation
experimental standard deviation
s
for a series of n measurements of the same measurand, the quantity s characterizing the dispersion of the results

$$s = \sqrt{\frac{1}{n-1}\sum_{j=1}^{n}\left(G_j - \overline{G}\right)^2}$$

where

G_j is the result of the j-th measurement, and

$\overline{G}$ is the arithmetic mean of the n results considered

Note 1 to entry: Considering the series of n values as sample of a distribution, $\overline{G}$ is an unbiased estimate of the mean μ, and s^2 is an unbiased estimate of the variance σ^2 of that distribution.

Note 2 to entry: The expression $s/\sqrt{n}$ is an estimate of the standard deviation of the distribution of $\overline{G}$ and is called the "experimental standard deviation of the mean".

Note 3 to entry: "Experimental standard deviation of the mean" is sometimes incorrectly called "standard error of the mean".

[SOURCE: GUM:1995, B.2.17, modified – The preferred term "standard deviation" has been added, as well as the symbol s, and the formula has been modified]

3.42
standard test conditions
conditions represented by the range of values of a set of influence quantities under which a calibration or a determination of response is carried out

Note 1 to entry: Appropriate corrections to reference conditions should be made.

Note 2 to entry: Ideally, calibrations should be carried out under reference conditions. As this is not always achievable (e.g. for ambient air pressure) or convenient (e.g. for ambient temperature) a (small) interval around the reference values is acceptable. Values for the standard test conditions together with the reference conditions are given in Table 7.

Note 3 to entry: During type tests, all values of influence quantities which are not the subject of the test are fixed within the interval of the standard test conditions.

[SOURCE: ISO 29661:2012, 3.1.36, modified – Note 3 to entry has been added]

3.43
standard uncertainty
u
uncertainty of the result of a measurement expressed as a standard deviation

Note 1 to entry: Standard uncertainty is a more general term than standard deviation, for example, standard uncertainty may also contain uncertainty contributions evaluated using non statistical methods.

[SOURCE: GUM 2.3.1, modified – Note 1 to entry has been added, as well as the symbol u]

3.44
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.45
upper limit of the measuring range
H_{up}
highest dose value included in the measuring range

3.46
area monitoring
monitoring in which a workplace or an area in the environment is monitored by taking dose (rate) measurements

Note 1 to entry: Area monitoring is performed in terms of $H'(0,07)$, $H'(3)$ or $H^*(10)$.

Note 2 to entry: Definition orientated at ICRP 103 and ICRP 116.

3.47
workplace monitoring
area monitoring using dose (rate) measurements made in the working environment

Note 1 to entry: Usually contrasted with individual monitoring.

Note 2 to entry: Workplace monitoring is performed in terms of $H'(0,07)$, $H'(3)$ or $H^*(10)$.

3.48
environmental monitoring
area monitoring by the measurement of external dose (rate) in the environment

Note 1 to entry: Environmental monitoring is performed in terms of $H'(0,07)$, $H'(3)$ or $H^*(10)$.

3.49
individual monitoring
monitoring using dose (rate) measurements by equipment worn by individual workers, or measurements of quantities of radioactive material in or on their bodies

Note 1 to entry: Also called personal monitoring. Usually contrasted with workplace monitoring.