



DPC: 25/30511360 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Title: Draft BS EN 61005 Ed.4.0 BS EN 61005 Radiation protection instrumentation - Portable neutron ambient dose equivalent (rate) meters.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



45B/1084/CD

COMMITTEE DRAFT (CD)

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IEC SC 45B : RADIATION PROTECTION INSTRUMENTATION

SECRETARIAT:

France

SECRETARY:

Mr Miroslav Voytchev

OF INTEREST TO THE FOLLOWING COMMITTEES:

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

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TITLE:

Radiation protection instrumentation - Portable neutron ambient dose equivalent (rate) meters

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This link leads you to the Online Standards Development (OSD) platform for National Mirror Committee's (NMC) comments. The project draft may be found further down this document.

Resource materials

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- OSD NC roles overview: [here](#)
- How to add and submit comments to the IEC: [here](#)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Radiation protection instrumentation - Portable neutron ambient dose equivalent (rate) meters –

FOREWORD

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International Standard 61005 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This third edition cancels and replaces the second edition of IEC 61005 issued in 2003 and constitutes a technical revision.

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

- a) upper neutron energy of the instruments covered by the standard is increased to 20 MeV;
- b) requirement for the variation of the relative response due to neutron energy is modified;
- c) a clause for additivity of the indicated value (neutron dose/dose rate) is introduced;
- d) a clause and requirement for Monte Carlo calculation of the instrument response are introduced;
- e) a clause and requirement for the software for generation of the measured values are introduced;

- f) environmental testing methods and requirements are referred to IEC 62706;
- g) influence quantities of type S and F are introduced.

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

FDIS	Report on voting
45B/792/FDIS	45B/797/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.

Radiation protection instrumentation - Portable neutron ambient dose equivalent (rate) meters –

1 Scope

This International Standard is applicable to portable assemblies designed to measure the ambient dose equivalent (rate) due to neutron radiation in the energy range from thermal up to 20 MeV. Such instruments have

- a) a detection assembly based on the moderation of neutrons by hydrogen containing moderator with subsequent detection by thermal neutron detector or proportional gas detector with a mixture of gases under pressure , ;
- b) a measuring assembly with a display for the measured entity, which may be incorporated into a single assembly with the detector or connected to it by means of a flexible cable.

If the instrument also provides indication of the neutron dose, it should meet the neutron dose requirements stated in this standard.

No tests are specified in this standard for performance requirements of assemblies in pulsed radiation fields. It is to be understood that an assembly designed to meet this standard may not be suitable for use in pulsed radiation fields.

The object of this standard is to specify requirements for the performance characteristics of neutron ambient dose equivalent (rate) meters, and to prescribe the methods of testing in order to determine compliance with this standard. This standard specifies the general characteristics, general test procedures, radiation characteristics, electrical, mechanical, safety and environmental characteristics, and the minimum documentation (see 13.2). Requirements and test procedures are also specified for the alarm performance of the neutron ambient dose equivalent (rate) meters, equipped with alarm capability.

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

IEC 62706, *Radiation protection instrumentation – Environmental, electromagnetic and mechanical requirements*

ISO 8529-1, *Neutron reference radiations fields — Part 1: Characteristics and methods of production*

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

ISO 8529-3, *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 8529-1:, *Reference neutron radiations – Part 1: Characteristics and methods of production*

3 Terms and definitions, abbreviations and symbols, quantities and units

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in IEC 60050-395 apply.

NOTE For sentence clarity and text conciseness in this standard the term “neutron ambient dose equivalent (rate) meter” is abbreviated as “neutron dose (rate) meter”. Whenever the term “neutron dose (rate) meter” appears in this standard it is understood that “neutron ambient dose equivalent (rate) meter” is meant.

3.1.1

alarm

audible, visual, or other signal activated when the instrument reading exceeds a preset value, falls outside of a preset range, when the instrument is unable to function properly (component failure), or when the instrument detects the presence of the source of radiation according to a preset condition

3.1.2

ambient dose equivalent

$H^*(10)$

dose equivalent at a point in a radiation field that would be produced by the corresponding aligned and expanded field, in the ICRU sphere at a depth of 10 mm on the radius opposing the direction of the aligned field ([1], ICRU Report 57:1998: [2])

Note 1 to entry: An instrument that has an isotropic response and is calibrated in terms of $H^*(10)$ will measure $H^*(10)$ in a radiation field that is uniform over the dimensions of the instrument.

3.1.3

ambient dose equivalent rate

$\dot{H}^*(10)$

ratio of $dH^*(10)$ by dt , where $^*(10)$ is the increment of ambient dose equivalent in the time interval dt

$$\dot{H}^*(10) = \frac{dH^*(10)}{dt} \quad (1)$$

3.1.4

calibration distance

distance between the reference point of the detection assembly and the centre of the calibration source

3.1.5

coefficient of variation

v

ratio of the experimental standard deviation s to the arithmetic mean $\bar{H}$ of a set of n indications H_j . It is given by the following formula:

$$V = \frac{s}{\bar{H}} = \frac{1}{\bar{H}} \cdot \sqrt{\frac{1}{n-1} \cdot \sum_{j=1}^n (H_j - \bar{H})^2} \quad (2)$$

3.1.6

conventional quantity value

H_t

quantity value attributed by agreement to a quantity for a given purpose

Note 1 to entry: In this standard the quantity is the dose equivalent (rate).

Note 2 to entry: The term “conventional true quantity value” is sometimes used for this concept.

Note 3 to entry: Sometimes a conventional quantity value is an estimate of a true quantity value.

Note 4 to entry: A conventional quantity value is generally accepted as being associated with a suitably small measurement uncertainty, which might be zero.

[SOURCE: VIM:2008, 2.12]

3.1.7 deviation

D

difference between the indicated values for the same value of the measurand of a dose equivalent (rate) meter, when made under reference conditions and when subject to an influence quantity

$$D = H_i - H_r \quad (3)$$

Where

H_i is the indicated value under the effect of an influence quantity, and

H_r is the indicated value under reference conditions.

Note 1 to entry: The deviation can be positive or negative resulting in an increase or a decrease of the indicated value, respectively.

Note 2 to entry: The deviation is of special importance for influence quantities of Type S.

3.1.8 effective range of measurement

range of values of ambient dose equivalent (rate) over which the performance of the ambient dose equivalent (rate) meter meets the requirements of this standard

3.1.9 indicated value

H_i

value given by the (digital) indication of the dose (rate) meter in units of dose equivalent or dose equivalent rate

3.1.10 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 micrometer used to measure length.

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.

[SOURCE: IEC 60050-394:2007, 394-40-27]

3.1.11 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.

3.1.12 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 influence quantity, e.g., electromagnetic disturbance.

3.1.13

lower limit of effective range of measurement

H_0 or $(\dot{H}_0)$

the lowest dose (rate) value included in the effective range of measurement

3.1.14

minimal rated range of use

the smallest range being specified for an influence quantity or instrument parameter over which the dose equivalent (rate) meter shall operate within the specified limits of variation in order to comply with this standard

Note 1 to entry: The minimal rated ranges of the influence quantities dealt with in this standard are given in the second column of [Table 2](#), [Table 4](#), [Table 5](#) and [Table 6](#).

3.1.15

neutron dose equivalent response

R_H

ratio, under specified conditions, given by the relation

$$R_H = \frac{R_\phi}{h_\phi} \quad (4)$$

Where

R_ϕ is the neutron fluence response (see definition [neutron fluence response](#)) and

h_ϕ is the neutron fluence-to-dose conversion coefficient (see definition [neutron fluence-to-ambient dose equivalent conversion coefficient](#)).

3.1.16

neutron fluence

Φ

quotient of dN by da , where dN is the number of neutrons incident on a sphere of cross-sectional area da :

$$\Phi = \frac{dN}{da} \quad (5)$$

Note 1 to entry: The unit of neutron fluence is m^{-2} .

3.1.17

neutron fluence rate (flux density)

$\dot{\Phi}$

quotient of $d\Phi$ by dt , where $d\Phi$ is the increment of neutron fluence in the time interval dt :

$$\dot{\Phi} = \frac{d\Phi}{dt} \quad (6)$$

Note 1 to entry: The unit of neutron fluence rate is $\text{m}^{-2} \cdot \text{s}^{-1}$.

3.1.18 neutron fluence response

R_ϕ

ratio, under specified conditions, given by the relation

$$R_\phi = \frac{M}{\phi} \quad (7)$$

Where

M is the reading by the instrument under test (dosemeter) for the neutron fluence and

ϕ is the conventional quantity value of the neutron fluence to which the instrument has been exposed.

Note 1 to entry: The unit of neutron fluence response is m^2 .

3.1.19 neutron fluence-to-ambient dose equivalent conversion coefficient

h_ϕ

quotient of the neutron ambient dose equivalent, $H^*(10)$, and the neutron fluence, ϕ , at a point in the radiation field, undisturbed by the irradiated object

$$h_\phi = \frac{H^*(10)}{\phi} \quad (8)$$

Note 1 to entry: The conversion coefficients for mono-energetic neutrons are provided in ICRP-74 and ICRU 57 and for broad spectra in ISO 8529-3

3.1.20 nominal range of use

range of values of an influence quantity or instrument parameter within which the dose equivalent (rate) meter will operate within the limits of variation. Its limits are the maximum and minimum rated values

3.1.21 non-linearity

variation of the value of the (relative) response with the dose (rate) being measured

3.1.22 point of test of a dose (rate) equivalent meter

point at which the conventional quantity value is determined and at which the reference point of the dose equivalent (rate) meter is placed for calibration and test purposes

3.1.23 quantity value of ambient dose equivalent (rate)

best estimate of the true ambient dose equivalent (rate) used for calibration of the assembly. This value and its uncertainty are determined from a primary or a secondary standard, or by a reference instrument which has been calibrated against a secondary or a primary standard.

Note 1 to entry: Primary or secondary standards for neutron radiation are usually standardized in terms of fluence (rate). For converting the fluence (rate) to the conventional true value of the ambient dose equivalent (rate), the appropriate fluence to ambient dose equivalent conversion coefficients shall be used.

3.1.24 rated range (of use of a dose equivalent (rate) meter)

range of values of an influence quantity or instrument parameter over which the dose equivalent (rate) meter will operate within the specified limits of variation. Its limits are the maximum and minimum rated values