

SLOVENSKI STANDARD

SIST EN 61005:2017

01-april-2017

Nadomešča:
SIST EN 61005:2005

Oprema za zaščito pred sevanjem - Merilniki ekvivalentne doze v prostoru za nevtronsko sevanje (IEC 61005:2014)

Radiation protection instrumentation - Neutron ambient dose equivalent (rate) meters (IEC 61005:2014)

Strahlenschutz-Messgeräte - Umgebungsäquivalentdosis (Leistungs)-Messgeräte für Neutronenstrahlung (IEC 61005:2014)

Instrumentation pour la radioprotection - Appareils de mesure de l'équivalent de dose ambiant neutron (ou de son débit d'équivalent de dose) (IEC 61005:2014)

Ta slovenski standard je istoveten z: EN 61005:2017

ICS:

13.280	Varstvo pred sevanjem	Radiation protection
17.240	Merjenje sevanja	Radiation measurements

SIST EN 61005:2017

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61005:2017

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61005

January 2017

ICS 13.280

Supersedes EN 61005:2004

English Version

Radiation protection instrumentation - Neutron ambient dose
equivalent (rate) meters
(IEC 61005:2014 , modified)

Instrumentation pour la radioprotection - Appareils de
mesure de l'équivalent de dose ambiant neutron (ou de son
débit d'équivalent de dose)
(IEC 61005:2014 , modifiée)

Strahlenschutz-Messgeräte -
Umgebungsäquivalentdosis(leistungs)-Messgeräte für
Neutronenstrahlung
(IEC 61005:2014 , modifiziert)

This European Standard was approved by CENELEC on 2016-11-14. 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.

SIST EN 61005:2017

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, Serbia, 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

EN 61005:2017**European foreword**

This document (EN 61005:2017) consists of the text of IEC 61005:2014 prepared by 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 the document has to be implemented at national level (dop) 2017-11-14
by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-11-14

This document supersedes EN 61005:2004.

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 61005:2014 was approved by CENELEC as a European Standard with agreed common modifications.

(standards.iteh.ai)

[SIST EN 61005:2017](https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017)

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>

COMMON MODIFICATIONS

1 Scope

In the note, **replace** “realistic field” with “workplace field” twice.

3 Terms and definitions, abbreviations and symbols, quantities and units**3.1 Terms and definitions****3.1.17****minimal rated range of use**

Replace “minimal” with “minimum” (in the term and in the note).

6 Radiation detection requirements**6.4 Variation of the response due to neutron energy****6.4.2 Requirements**

In the first paragraph, **delete** “at least” twice.

And, **add** a dot above the H in the second term $r_{H^*}(10)$.

6.4.3 Test method

In the second paragraph, **add** at the end of item b) “(one of them 144 keV)”.

And in item c), **replace** “one broad source (e.g. ^{252}Cf or $^{241}\text{Am-Be}$)” with “two broad sources (D_2O -moderated ^{252}Cf and e.g. ^{252}Cf or $^{241}\text{Am-Be}$)”.

Replace the fourth paragraph starting with “The test distance should be at least 3 times ...” with “The test distance should be at least 3 times the sum of the largest linear dimension of the source and the detector. In case of neutron fields according to ISO 8529, the scatter contribution to the indicated value shall be determined in compliance with ISO 8529-2 and the indicated value shall be corrected for scattered neutrons.”

In the note, **replace** “realistic work place” with “workplace”.

6.6 Variation of the response due to angle of incidence**6.6.3 Test method**

Replace the fourth and fifth sentence starting with “The scatter contribution to the indicated value ...” with “In case of neutron fields according to ISO 8529, the scatter contribution to the indicated value shall be determined in compliance with ISO 8529-2 and the indicated value shall be corrected for scattered neutrons.”

6.13 Response to other external ionizing radiations

Replace the paragraph by “If the detector’s cover does not shield alpha and beta radiation, the response due to alpha and beta radiation should be measured – and the results should be documented.”

EN 61005:2017

7 Additivity of indicated value

7.2 Test method

Replace the equation with
$$\Delta H_{\text{imix}} = \frac{H_{iK} + H_{iL} - H_{i(K+L)}}{H_{i(K+L)}}$$

9 Electrical characteristics

9.3 Power supplies – battery operation

9.3.3 Test method

9.3.3.3 Test using power supply

9.3.3.3.3 Interpretation of the results

Replace “0,91” with “0,9”.

Table 1 – Reference conditions and standard test conditions

In the first line (Reference neutron radiation), **replace** “L(p,n)” with “Li(p,n)” twice.

Table 2 – Radiation characteristics of ambient neutron dose (rate) equivalent meters

In the fourth line (Overload), **replace** “until unit is reset or switched off” with “until unit is reset or is switched off”.

SIST EN 61005:2017

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>

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	Series	International Electrotechnical Vocabulary	-	-
IEC 60086-1	2011	Primary batteries - Part 1: General	EN 60086-1	2011 ¹⁾
IEC 60086-2	2011	Primary batteries - Part 2: Physical and electrical specifications	EN 60086-2	2011 ²⁾
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 61187	-	Electrical and electronic measuring equipment - Documentation	EN 61187	-
IEC 62706	-	Radiation protection instrumentation - Environmental, electromagnetic and mechanical performance requirements	-	-
ISO 8529-1	2001	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	1998	Reference neutron radiations - Part 3: Calibration of area and personal dosimeters and determination of response as a function of energy and angle of incidence	-	-

¹⁾ Superseded by EN 60086-1:2015 (IEC 60086-1:2015): DOW=2018-09-01.

²⁾ Superseded by EN 60086-2:2016 (IEC 60086-2:2015): DOW=2018-12-03.

EN 61005:2017

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 11929	2010	Determination of the characteristic limits (decision threshold, detection limit and limits of the confidence interval) for measurements of ionizing radiation - Fundamentals and application	-	-
ISO 12789-1	2008	Reference radiation fields - Simulated workplace neutron fields - Part 1: Characteristics and methods of production	-	-
ISO 12789-2	2008	Reference radiation fields - Simulated workplace neutron fields - Part 2: Calibration fundamentals related to the basic quantities	-	-

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61005:2017

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>



IEC 61005

Edition 3.0 2014-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Radiation protection instrumentation – Neutron ambient dose equivalent
(rate) meters**

(standards.iteh.ai)

**Instrumentation pour la radioprotection – Appareils de mesure de l'équivalent
de dose ambiant neutron (ou de son débit d'équivalent de dose)**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XA

ICS 13.280

ISBN 978-2-8322-1676-7

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

CONTENTS

FOREWORD	6
1 Scope	8
2 Normative references	8
3 Terms and definitions, abbreviations and symbols, quantities and units	9
3.1 Terms and definitions	9
3.2 Test nomenclature	15
3.3 Abbreviations and symbols	15
3.4 Quantities and units	16
4 General test procedure	16
4.1 Test requirements	16
4.2 Tests performed with variation of influence quantities	16
4.2.1 General	16
4.2.2 Tests for influence quantities of type F	16
4.2.3 Tests for influence quantities of type S	17
4.3 Consideration of non-linearity	17
4.4 Consideration of several detectors or signals in a dose (rate) meter	17
4.5 Statistical fluctuations	17
4.6 Radiation sources	17
4.7 Work place neutron fields	18
5 General requirements	18
5.1 Summary of requirements	18
5.2 General characteristics	18
5.2.1 Effective range of measurement	18
5.2.2 Minimum range of measurement	19
5.2.3 Rated range of an influence quantity	19
5.2.4 Minimum rated range of influence quantity	19
5.2.5 Indication of the assembly	19
5.3 Mechanical characteristics	19
5.3.1 IP classification	19
5.3.2 Assembly labels and markings	19
5.3.3 Ease of decontamination	20
5.4 Interface requirements	20
5.5 Algorithm to evaluate the indicated value	20
6 Radiation detection requirements	20
6.1 General	20
6.2 Consideration of the uncertainty of the conventional quantity value	20
6.3 Constancy of the dose rate response, dose dependence and statistical fluctuations	20
6.3.1 General	20
6.3.2 Requirements	21
6.3.3 Test method using sources	21
6.3.4 Interpretation of the results of the test using sources	21
6.3.5 Test procedure with variation of the calibration distance	21
6.3.6 Equivalent electrical test method	22
6.3.7 Interpretation of the equivalent electrical test results	22
6.4 Variation of the response due to neutron energy	22

6.4.1	General	22
6.4.2	Requirements	23
6.4.3	Test method	23
6.4.4	Interpretation of the results	24
6.5	Monte Carlo calculation of the instrument response	24
6.5.1	General	24
6.5.2	Requirements	24
6.5.3	Test method	24
6.5.4	Interpretation of the results	24
6.6	Variation of the response due to angle of incidence	25
6.6.1	General	25
6.6.2	Requirements	25
6.6.3	Test method	25
6.6.4	Interpretation of the results	25
6.7	Overload characteristics	25
6.7.1	Dose equivalent meters	25
6.7.2	Dose rate equivalent meters	26
6.8	Response time	26
6.8.1	Requirements	26
6.8.2	Test method	27
6.8.3	Interpretation of the results	27
6.9	Relationship between response time and statistical fluctuations	27
6.10	Dose equivalent rate alarm	28
6.10.1	Requirements	28
6.10.2	Test method	28
6.10.3	Interpretation of the results	28
6.11	Dose equivalent alarm	28
6.11.1	Requirements	28
6.11.2	Test method	28
6.11.3	Interpretation of the results	28
6.12	Response to photon radiation	29
6.12.1	Requirements	29
6.12.2	Test method	29
6.12.3	Interpretation of the results	29
6.13	Response to other external ionizing radiations	29
7	Additivity of indicated value	30
7.1	Requirements	30
7.2	Test method	30
7.3	Interpretation of the results	30
8	Software	31
8.1	General	31
8.2	Requirements	31
8.2.1	General requirements	31
8.2.2	Design and structure of the software	31
8.2.3	Protection of the software and data	31
8.2.4	Documentation	32
8.3	Test method	32
8.3.1	General	32
8.3.2	Testing the documentation	32

9	Electrical characteristics	33
9.1	Stability of zero indication with time	33
9.1.1	Requirements	33
9.1.2	Test method	33
9.1.3	Interpretation of the results	33
9.2	Warm-up time	33
9.2.1	Requirements	33
9.2.2	Test method	33
9.2.3	Interpretation of the results	33
9.3	Power supplies – battery operation	33
9.3.1	General	33
9.3.2	Requirements	34
9.3.3	Test method	34
9.4	Power supplies – Mains operations	35
9.4.1	Requirements	35
9.4.2	Test method	35
9.4.3	Interpretation of the results	36
10	Environmental requirements	36
10.1	General	36
10.2	Ambient temperature	36
10.3	Temperature shock	36
10.4	Relative humidity	37
10.5	Atmospheric pressure	37
10.6	Protection against moisture and dust (IP classification)	37
10.7	Storage and transport	37
11	Mechanical requirements	37
11.1	General	37
11.2	Drop test	38
11.3	Vibration test	38
11.4	Microphonics impact	38
11.5	Mechanical shock	38
12	Electromagnetic requirements	39
12.1	General	39
12.2	Emission of electromagnetic radiation	39
12.3	Electrostatic discharge	39
12.4	Radio frequency disturbance	39
12.5	Magnetic fields	39
12.6	Alternating current powered equipment requirements	40
13	Documentation	40
13.1	Operation and maintenance manual	40
13.2	Identification certificate	40
13.3	Type test report	41
Annex A (informative)	Neutron fluence-to-ambient dose equivalent conversion coefficients	47
Bibliography	50

Figure A.1 – Neutron fluence-to-ambient dose equivalent conversion coefficients for mono-energetic neutrons [5]

Table 1 – Reference conditions and standard test conditions	41
Table 2 – Radiation characteristics of ambient neutron dose (rate) equivalent meters	42
Table 3 – Values of c_1 and c_2 for w different dose rate values and n indications for each dose rate value [8]	43
Table 4 – Electrical and environmental characteristics of ambient dose equivalent (rate) meters	44
Table 5 – Maximum values of deviation due to mechanical requirements	44
Table 6 – Maximum values of deviation due to electromagnetic disturbances	45
Table 7 – Emission frequency range	45
Table 8 – Symbols and abbreviations used in this standard	46
Table A.1 – Neutron fluence-to-ambient dose equivalent conversion coefficients for mono-energetic neutrons ([5],[6])	47
Table A.2 – Neutron fluence-to-ambient dose equivalent conversion coefficients for the neutron reference radiation sources ([5] and ISO 8529-3)	49

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61005:2017

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RADIATION PROTECTION INSTRUMENTATION – NEUTRON AMBIENT DOSE EQUIVALENT (RATE) METERS

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61005:2017

<https://standards.iteh.ai/catalog/standards/sist/3a6f2d50-00d2-4f61-b5c4-51285b3ccfbc/sist-en-61005-2017>