SLOVENSKI STANDARD

SIST EN 60846:2005

julij 2005

Oprema za zaščito pred sevanjem – Merilniki ekvivalentne doze v prostoru in/ali usmerjene ekvivalentne doze in/ali monitorji sevanja beta, rentgenskega sevanja in sevanja gama

Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation

ICS 13.280; 17.240

Referenčna številka
SIST EN 60846:2005(en)

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 60846

November 2004

ICS 13.280

English version

Radiation protection instrumentation – Ambient and/or directional dose equivalent (rate) meters and/or monitors for beta, X and gamma radiation
(IEC 60846:2002, modified)

Instrumentation pour la radioprotection - Instruments pour la mesure et/ou la surveillance de l'équivalent de dose (ou du débit d'équivalent de dose) ambiant et/ou directionnel pour les rayonnements bêta, X et gamma
(CEI 60846:2002, modifiée)

Strahlenschutz-Messgeräte – Umgebungs- und Richtungs-Äquivalentdosis(leistungs)-Messgeräte und -Monitore für Beta, Röntgen- und Gammastrahlung
(IEC 60846:2002, modifiziert)

This European Standard was approved by CENELEC on 2004-10-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

The text of the International Standard IEC 60846:2002, prepared by SC 45B, Radiation protection instrumentation, of IEC TC 45, Nuclear instrumentation, together with the common modifications prepared by the CENELEC BTTF 111-3, Instrumentation for ionizing radiation measurement and protection, was submitted to the formal vote and was approved by CENELEC on 2004-10-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2005-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2007-10-01

Clauses, subclauses, tables and figures which are additional to those in IEC 60846 are prefixed “Z”.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60846:2002 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

3 Terminology

Add:

3.2.Z1
maximum dose equivalent rate (for dosemeters)
the dose rate, specified by the manufacturer, above which the dose reading is no longer within the requirements of this standard

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

4.3.10 **Delete:** “, (see also note 7 in 3.2)”.

4.3.11 **Replace** reference to 3.2 by reference to 3.4.5 and 3.4.7.

5 Radiation characteristics – Directional dose equivalent (rate) meters

5.1.4.1 Last sentence: **replace** “alarm rate” by “alarm rates”.

5.2.1 **Add** a second paragraph reading:

An additional test shall be performed with a beta emitter in the range E_{max} between 100 keV and 500 keV.

5.2.2 **Replace** first paragraph by:

For the beta radiations of ^{85}Kr or ^{204}Tl, ^{90}Sr/^{90}Y and ^{147}Pm, the response is measured for 0° angle and for angles of incidence of $\alpha = \pm 45°$ in two perpendicular planes containing the reference direction through the reference point of the directional dose equivalent (rate) meter.

Delete third paragraph.

5.4 **Replace** the text of subclause **5.4**, **Overload characteristics** by:

5.4 Overload characteristics

5.4.1 Doserate meters

5.4.1.1 Requirements

The dose equivalent ratemeter shall read off-scale on the high side or shall indicate overload when exposed to doses rates greater than the maximum of its measuring range. This requirement shall apply to all ranges.

5.4.1.2 Method of test

The dose equivalent ratemeter shall be submitted to the following dose equivalent rates for a period of 5 min:

– 100 times the range maximum for range maxima up to and including 0,1 $Sv.h^{-1}$;

– 10 times the range maximum, or 10 $Sv.h^{-1}$ whichever is the greater, for range maxima in excess of 0,1 $Sv.h^{-1}$.

The indication of dose equivalent rate shall read off-scale on the high side or indicate overload throughout this period and the dose equivalent ratemeter shall function within specification within 5 min [3] (footnote 3 as given in the IEC publication) after completion of this test. This test is applicable to each range.

5.4.2 Dosemeters

5.4.2.1 Requirements

1) The dose equivalent meter shall read off-scale on the high side or shall indicate overload when exposed to doses greater than the maximum of its measuring range. This requirement shall apply to all ranges.

2) When subjected to doserates in excess of the maximum doserate limit specified by the manufacturer there shall be indication that the equipment is not able to provide correct dose indication.

5.4.2.2 Method of test

1) Subject the dosemeter to doserates to give dose reading in excess of 100 times the maximum dose that can be indicated. The indication shall be off-scale on the high side or overload shall be indicated and shall remain so until the dose indication is reset or the equipment is switched off. The equipment shall not be reset or switched off for at least 30 min after the equipment has been subjected to the test dose. The doserate to achieve the required dose shall be less than the maximum doserate capability as specified by the manufacturer.

2) Subject the dosemeter to a doserate 10 % in excess of that specified as the doserate limit specified by the manufacturer for a period of 100 s. Ensure that either the dose indication is within the limits of this standard or indication is given that the reading of dose is in error. If the latter is not indicated subject the doserate to increased doserates of 10 % for 100 s until the error indication is displayed. Prior this the dose indication shall increase as appropriate.

5.6.2 **Replace** “seller” by “manufacturer”.

5.7.1 **Add** a second paragraph:

If the requirements for dose rate are met, testing for dose may be omitted for instruments measuring both dose and dose rate.

5.8.1 **Add** a new title 5.8.1:

5.8.1 Doserate meters

Renumber previous 5.8.1 as 5.8.1.1 and previous 5.8.2 as 5.8.1.2.

Add the following new headline:

5.8.2 Dosemeters

5.8.2.1 Requirements

When subjected to a doserate, the dosemeter shall, within 10 s, indicate at least 90 % but not more than 110 % of the increase under steady-state conditions.

5.8.2.2 Test method

Subject the dosemeter to a doserate of 360 $\mu Sv.h^{-1}$ for 10 s and note the dose reading at the end of this 10 s period.

Subject the dosemeter for 10 s to the doserate limit of the instrument as specified by the manufacturer. At the end of the 10 s period note the dose reading.

The instrument meets the requirements if both values are within ± 10 % of the reading under steady-state conditions.

6 Radiation characteristics – ambient dose equivalent (rate) meters

6.2.1 In the second paragraph **replace**: “is either … or …” by “shall be … or …".

Replace the third paragraph by:

If the ambient dosemeter is to be used in the vicinity of nuclear power installations, the response up to 10 MeV shall to be stated by the manufacturer. The response at high energies in the reference direction shall be determined and should not differ by more than ± 40 % from its response to ^{137}Cs gamma radiation.

Insert a fourth paragraph:

The manufacturer shall state the response at 90° angle of incidence.

6.2.2 **Replace** the subclause by the following:

6.2.2 Test method

The tests shall be performed using the narrow spectrum series of ISO 4037-1.

The energy dependence of response at angle of incidence α = 0° normalized to the ^{137}Cs gamma energy is measured for the energies of the narrow series starting with high energies down to the first energy that gives a normalized response of less than 0,6. This test shall be repeated for angles of incidence of α = ± 30° and α = ± 45° in two perpendicular planes containing the reference direction and through the reference point of the dose equivalent (rate) meter. The response being normalised to ^{137}Cs α = 0°. If for any of these angles of incidence, the minimum response is greater than 0,6, lower energies shall be measured until the response is less than this value.

The energy corresponding to the limiting values of 60 % and 140 % of the reference response shall be determined form the response curves plotted for each angle of incidence were a straight line shall be drawn between the two values plotted giving the response just below and above the limit values. The limiting energies are determine where these lines cross the 0,6 or 1,4 response.

The response of the dose (rate) meter to ^{137}Cs shall also be determined for the angles given above and shall be within the limits given.

Where the dose (rate) meter is required to measure energies above 1,5 MeV a suitable method of test shall be agreed between the purchaser and manufacturer.

In principle, it is desirable that this test be performed at the same dose equivalent (rate) for each radiation quality. In practice this may not be possible in which case the indicated dose equivalent (rate) for each radiation quality shall be corrected for the intrinsic error of the indicated dose equivalent (rate).

Keep the note as given in the IEC publication.

7 Electrical characteristics of directional and ambient dose equivalent (rate) meters

7.1.1 **Insert** an additional paragraph below the current reading:

For dose equivalent (rate) meters without a set-zero control, the same requirements and test method apply except the step of setting to zero.

7.2.1 **Insert** in the third paragraph, behind "± 5 %":

"(± 5 % in the case of -25 °C to +50 °C)".

Insert in the fifth paragraph behind "± 20 %":

"(± 20 % in the case of -25 °C to +50 °C)".

7.4.4 In the penultimate paragraph **replace** reference to 7.1 by reference to 9.1.

9 Environmental characteristics, performance requirements and tests

9.6.4 **Add** a new headline:

9.6.4.1 General radiated electromagnetic fields

just below the headline of 9.6.4 (current text of 9.6.4 becomes 9.6.4.1).

Add new subclause:

9.6.4.Z1 Radiated electromagnetic fields of mobile phones

Requirements

The additional indication due to electromagnetic fields must not exceed 0,7 H_0 after 6 min of exposure to the electromagnetic field (see Table 6).

Method of test

Compliance with this performance requirement shall be checked by observing and recording the indications of the display with the dosemeter set to the most sensitive range.

The electromagnetic field strength shall be 20 $V.m^{-1}$ in the frequency range of 800 MHz to 960 MHz and 1,4 GHz to 2,4 GHz in steps of 1 % (see EN 61000-4-3).

To reduce the amount of measurements needed to show compliance with the above requirement two methods are suggested:

– the first method is to perform tests at radiation frequencies (820; 900) MHz; (1,4; 1,5; 1,6; 1,8; 2,0; 2,2 and 2,4) GHz with a field strength of 40 $V.m^{-1}$ in one orientation only. At each frequency the test shall be performed for 6 min or the result corrected for a 6 min measuring time. If any additional indication greater than one-third of the limits given in Table 6 is observed at one of these given radiation frequencies, additional tests in the range of ± 5 % around this frequency in steps of 1 % and with a field strength of 20 $V.m^{-1}$ shall be carried out with the dosemeter oriented as described in EN 61000-4-3;

– the second method is to perform an automated sweep with a field strength of 40 $V.m^{-1}$ at a rate not greater than 1,5 x 10^{-3} orders of magnitude per second or not greater than 1 % of the fundamental per second in one orientation only. If, during the scan, operational susceptibilities are observed, the frequencies of susceptibility should be noted. The instrument should then be retested in the range of ± 5 % around this frequency with a field strength of 20 $V.m^{-1}$ in all orientations as described in EN 61000-4-3.

9.6.9 **Replace** “6,0 %” by “60 %”.

10 Summary of characteristics

10 **Replace** reference to “Tables 2, 3, 4, 5, 6, 7, 8 and 9” by “Tables 2, 3, 4, 5, 6 and 7”.

11 Documentation

Add new subclause:

11.Z1 Type test report

At the request of the purchaser, the manufacturer shall make available the report on the type tests performed to the requirements of this standard.

Table 4 **Replace** the first row by the following:

X and gamma radiation energy and angle of incidence	80 keV to 1,5 MeV or 30 keV to 150 keV and 0° to 45° from reference direction	± 40 %[1)]	6.2

Table 5 **Correct** references to subclauses in the last column as follows:

Replace 7.2 by 5.8, **replace** the first 7.4 by 7.1, **replace** 7.5 by 7.2 (twice).

Table 6 **Replace** 9.6.4 by 9.6.4.1 in the second row

and **insert** new row just below:

Radiated electromagnetic fields of mobile phones	800 MHz to 960 MHz and 1,4 GHz to 2,0 GHz 0 V/m to 20 V/m (r.m.s., unmodulated) 80 % AM (1 kHz)	EN 61000-4-3	10 % of time	0,7 H_0	A	9.6.4.Z1

Tables 8 and 9 **Delete** the tables.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

NOTE Where an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60038 (mod) + A1 + A2	1983 1994 1997	IEC standard voltages [1)]	HD 472 S1 + corr. February	1989 2002
IEC 60050-151	2001	International Electrotechnical Vocabulary (IEV) Part 151: Electrical and magnetic devices	-	-
IEC 60050-393	1996	Chapter 393: Nuclear instrumentation: Physical phenomena and basic concepts	-	-
IEC 60050-394	1995	Chapter 394: Nuclear instrumentation: Instruments	-	-
IEC 60068-2-27	1987	Basic environmental testing procedures Part 2: Tests - Test Ea and guidance: Shock	EN 60068-2-27	1993
IEC 60086	series	Primary batteries	EN 60086	series
IEC 61000-4-2	1995	Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	1995
IEC 61000-4-3 (mod)	1995	Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	1996 [2)]
IEC 61000-4-4 A1 A2	1995 2000 2001	Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4 A1 A2	1995 2001 2001
IEC 61000-4-5	1995	Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	1995

1) The title of HD 472 S1 is: Nominal voltages for low voltage public electricity supply systems.

2) EN 61000-4-3 is superseded by EN 61000-4-3:2002, which is based on IEC 61000-4-3:2002 unmodified.

Publication	Year	Title	EN/HD	Year
IEC 61000-4-6	1996	Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	1996
IEC 61000-4-8	1993	Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8	1993
IEC 61000-4-11	1994	Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	1994 [3)]
IEC 61000-6-2 (mod)	1999	Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2	2001
IEC 61187 (mod)	1993	Electrical and electronic measuring equipment - Documentation	EN 61187 + corr. March	1994 1995
ISO 4037-1	1996	X and gamma reference radiation for calibrating dosemeters and doserate meters and for determining their response as a function of photon energy Part 1: Radiation characteristics and production methods	-	-
ISO 4037-2	1997	Part 2: Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV	-	-
ISO 4037-3	1999	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	1996	Reference beta radiations for calibrating dosemeters and dose-rate meters and for determining their response as a function of beta-radiation energy	-	-

3) EN 61000-4-11 is superseded by EN 61000-4-11:2004, which is based on IEC 61000-4-11:2004.

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