SLOVENSKI STANDARD
SIST EN 62387:2016

01-april-2016

Nadomešča:
SIST EN 62387-1:2012

Instrumenti za zaščito pred sevanjem - Pasivni integrirni dozimetrijski sistemi za okoljsko in osebno nadzorovanje - 1. del: Splošne značilnosti in tehnične zahteve

Radiation protection instrumentation - Passive integrating dosimetry systems for personal and environmental monitoring of photon and beta radiation

Instrumentation pour la radioprotection - Systèmes dosimétriques intégrés passifs pour la surveillance de l'individu et de l'environnement des rayonnements photoniques et bêta

Ta slovenski standard je istoveten z: **EN 62387:2016**

ICS:

13.280	Varstvo pred sevanjem	Radiation protection

SIST EN 62387:2016 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62387

February 2016

ICS 13.280

Supersedes EN 62387-1:2012

English Version

Radiation protection instrumentation - Passive integrating dosimetry systems for individual, workplace and environmental monitoring of photon and beta radiation (IEC 62387:2012 , modified)

Instrumentation pour la radioprotection - Systèmes dosimétriques intégrés passifs pour la surveillance de l'individu et de l'environnement des rayonnements photoniques et bêta
(IEC 62387:2012 , modifiée)

Strahlenschutz-Messgeräte - Passive integrierende Dosimetriesysteme zur Personen-, Arbeitsplatz- und Umgebungsüberwachung auf Photonen- und Betastrahlung
(IEC 62387:2012 , modifiziert)

This European Standard was approved by CENELEC on 2016-01-04. 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.

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, 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

Ref. No. EN 62387:2016 E

Contents

1 Modification to the title 4
2 Modification to the Scope 4
3 Modification to Clause 2 4
4 Modification to Clause 3 5
5 Modification to Clause 6 5
6 Modification to 7.6 6
7 Modification to 11.5.1.2 6
8 Modification to 11.5.2.2 6
9 Modification to 11.6.1.2 6
10 Modification to 11.6.2.1 6
11 Modification to 11.6.2.2 7
12 Modification to 11.6.2.3 7
13 Modification to 11.7.1.2 8
14 Modification to 11.8 8
15 Modification to 11.8.1 8
16 Modification to 11.8.2 9
17 Modification to 11.8.3 9
18 Modification to 13.1.2 9
19 Modification to 13.2.1 9
20 Modification to 13.2.4 9
21 Modification to 13.3.1 9
22 Modification to 13.3.4 10
23 Modification to 13.4: 10
24 Modification to 13.4.2 10
25 Modification to 13.4.3 10
26 Modification to 13.4.4 11
27 Modification to 13.6.1 11
28 Modification to 13.6.4 11
29 Modification to 13.7.2 11
30 Modification to 13.7.3 11
31 Modification to 13.7.4 11
32 Modification to 13.8.3 12
33 Modification to 13.8.4 12
34 Modification to 13.9.4 12
35 Modification to 14.2 12
36 Modification to 14.3 12
37 Modification to 15.2.2 13
38 Modification to tables 14
39 Modification to Annex C 23
40 Modification to Annex E 24
41 Modification to Annex H 24
42 Modification to Bibliography 24

European foreword

This document (EN 62387:2016) consists of the text of IEC 62387:2012 prepared by IEC/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 this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-01-04
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2019-01-04

This document supersedes EN 62387-1:2012.

Clauses, subclauses, notes, tables, figures and annexes which are additional to those in IEC 62387:2012 are prefixed “Z”.

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 62387:2012 was approved by CENELEC as a European Standard with agreed common modifications.

COMMON MODIFICATIONS

1 Modification to the title

The title of the standard has been modified to read:

Radiation protection instrumentation – Passive integrating dosimetry systems for individual, workplace and environmental monitoring of photon and beta radiation

2 Modification to the Scope

Delete NOTE 1.

3 Modification to Clause 2

Replace by

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.

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

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

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

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

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

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

EN 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11)*

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

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

ISO 4037-3:1999, *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)*

4 Modification to Clause 3

Add the following terms and definitions:

3.Z1
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 $H'(0.07)$ or $H^*(10)$.

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

3.Z2
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 $H'(0.07)$ or $H^*(10)$.

3.Z3
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 $H'(0.07)$ or $H^*(10)$.

3.Z4
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.

Note 2 to entry: Individual monitoring is performed in terms of $H_p(0.07)$, $H_p(3)$ or $H_p(10)$.

[SOURCE: IAEA glossary, modified – “dose (rate)” has been added and Note 2 to entry has been added]

5 Modification to Clause 6

In the following sentence, replace "Table 9 to 11" by "Table 13 to Table 15":

Details for some of the entries in Tables 8 to 12 (at the end of the document) are given in the further Tables 13 to 15 (at the end of the document).

6 Modification to 7.6

Add the following note:

NOTE Z1 Further details regarding the model function and the determination of uncertainty in measurement are given in IEC/TR 62461.

7 Modification to 11.5.1.2

Add the following NOTE afte NOTE 1:

NOTE Z1 For personal dose quantities: Also take into account section 8.4 f) and line 11 of Table 8.

Modify the following paragraph as follows:

For $H^*(10)$ dosemeters and α = 90°, the dosemeter shall be rotated about its reference direction during the irradiation. If no rotation is possible, eight subsequent irradiations with different polar angles in steps of 45° can be done irradiating the same dosemeter. As α is 90°, the reference direction is orientated perpendicular to the radiation beam. The rotation may be omitted if the dosemeter has a holder defining the orientation with respect to the expected direction of radiation incidence.

8 Modification to 11.5.2.2

Replace the last sentence by:

For this radiation quality, the mean indicated value $\overline{G}$ and the standard deviation s shall be determined.

9 Modification to 11.6.1.2

Add the following NOTE after NOTE 1:

NOTE Z1 Also take into account section 8.4 f) and line 11 of Table 9.

10 Modification to 11.6.2.1

Replace the subclause by:

Requirement A: The variation of the relative response due to a change of the radiation energy and angle of incidence within the rated ranges for beta radiation shall not exceed the values given in line 10 of Table 9.

Requirement B: As the dosemeter is intended to measure $H_p(3)$, the indicated value due to beta radiation with energies up the energy equivalent of ^{85}Kr shall be less than $0{,}1 \cdot H_p(0{,}07)$ (see line 10 of Table 9).

11 Modification to 11.6.2.2

Replace the subclause by:

For requirement A:

The following reference radiation qualities specified in ISO 6980 shall be used:

^{90}Sr/^{90}Y (mean energy ≈ 0,8 MeV); ^{106}Ru/^{106}Rh (mean energy ≈ 1,2 MeV).

As long as no conversion coefficients for the conversion from personal absorbed dose in 0,07 mm depth, $D_p(0,07)$, to the personal dose equivalent, $H_p(3)$, are available in ISO 6980-3, the values given in Annex G shall be used.

The tests shall be performed for those radiation qualities whose mean energy falls in the rated range of energy. Angles of incidence shall be: $\alpha = 0°$, $\alpha = \pm 45°$, $\alpha = \pm 60°$ and $\alpha = \pm 75°$ if included in the rated range of angle of incidence in two perpendicular planes containing the reference direction through the reference point of the dosemeter.

For every radiation quality, the mean indicated value $\overline{G}_{i,A}$ and the standard deviation $s_{i,A}$ shall be determined.

NOTE 1 Details of the reference radiation and the calibration procedure are given in ISO 6980.

NOTE 2 i refers to a group of dosemeters irradiated equally, for example Sr-90, 60° (from above). That means, the different directions (horizontal from the right and left; vertical from above and the bottom) for one angle of incidence are not averaged.

NOTE 3 For an $H_p(3)$ dosemeter, at each of the two lowest radiation energies, at least five groups of dosemeters are irradiated: one at 0° and four at 60°.

For requrirement B:

For this test, the dosemeter shall be placed on a phantom as required (see 5.1.5). Expose n (≥ 4) dosemeters at 0° angle of incidence to beta reference radiation specified in ISO 6980:

– ^{85}Kr (mean energy ≈ 0,24 MeV).

The dose equivalent shall be at least $H_p(0,07)$ = 10 mSv = C.

NOTE Z1 Details of the reference radiation and the calibration procedure are given in ISO 6980.

For this radiation quality, the mean indicated value $\overline{G}_B$ and the standard deviation s_B shall be determined.

12 Modification to 11.6.2.3

Replace the subclause by:

For requirement A:

If, for every radiation quality, the inequality $r_{\text{min}} - U_{C,\text{com}} \leq \left(\frac{\overline{G}_{i,\text{A}}}{\overline{G}_{\text{r,0,A}}} \pm U_{\text{com}} \right) \cdot \frac{C_{\text{r,0,A}}}{C_{i,\text{A}}} \leq r_{\text{max}} + U_{C,\text{com}}$ is valid, then requirement A of 11.6.2.1 is considered to be met. The values for r_{min} and r_{max} are given in line 10 of Table 9.

U_{com} is calculated according to Equation (A.5), Example 2. $U_{C,\text{com}}$ is the combined relative expanded uncertainty of $\frac{C_{\text{r,0}}}{C_i}$: $U_{C,\text{com}} = \sqrt{U^2_{C,\text{rel; r,0}} + U^2_{C,\text{rel; }i}}$ with the relative expanded uncertainties $U_{C,\text{rel; r,0}}$ and $U_{C,\text{rel; }i}$ of the conventional true values $C_{\text{r,0}}$ and C_i for the different radiation qualities, respectively. In case $U_{C,\text{rel; r,0}}$ and $U_{C,\text{rel; }i}$ are correlated, this shall be taken into account. For $U_{C,\text{rel}}$, see 5.2.2.

For requirement B:

If $\overline{G}_{\text{B}} + U_{\text{m}} \leq 0{,}1 \cdot C$ is valid, then requirement B of 11.6.2.1 is considered to be met.

U_{m} is calculated according to Equation (A.3).

13 Modification to 11.7.1.2

Add the following NOTE after NOTE 1:

NOTE Z1 For personal dose quantities: Also take into account section 8.4 f) and line 11 of Table 10.

Modify the following paragraph as follows:

For $H'(0{,}07)$ dosemeters and α = 90°, the dosemeter shall be rotated about its reference direction during the irradiation. If no rotation is possible, eight subsequent irradiations with different polar angles in steps of 45° can be done irradiating the same dosemeter. As α is 90°, the reference direction is orientated perpendicular to the radiation beam. The rotation may be omitted if the dosemeter has a holder defining the orientation with respect to the expected direction of radiation incidence.

14 Modification to 11.8

Modify the title to read **"Over indication due to radiation incident from the side of an $H_{\text{p}}(10)$, $H_{\text{p}}(3)$ or $H_{\text{p}}(0{,}07)$ dosemeter"**

15 Modification to 11.8.1

Replace the subclause by:

If the dosemeter is irradiated free in air from the side (α_{max} to 180°–α_{max}), the indicated value shall not exceed 3 times the indicated value resulting from an irradiation free in air with the same radiation quality from the front (0°). This shall apply to all radiation energies within the rated range of energy.

NOTE 1 This requirement prevents the acceptance of a detector with a high atomic number material without sufficient shielding which may cause a large over response from the side.

NOTE 2 If α_{max} = 60°, this means an irradiation from 60° to 120°.

NOTE Z1 No lower limit is required as the conventional true value is zero for beta radiation and for low energy photon radiation.

16 Modification to 11.8.2

Modify the following paragraph as follows:

Further groups: Irradiations shall be performed at the angle of incidences β corresponding to the "weak points". The azimuthal angle of incidence shall be varied during the irradiation between α_{max} and 180°–α_{max} in steps of 15° including 90°.
Separate groups shall be irradiated separately for every polar angle β (i.e. for every "weak point").

Modify the NOTE as follows:

NOTE In case of α_{max} = 60°, the irradiation of each badge is performed in five equivalent fractions at 75°, 90°, and 105°.

17 Modification to 11.8.3

Replace the subclause by:

If, for every polar angle examined in accordance with 11.8.2, the inequality $\frac{\overline{G}_{\alpha_{max}\,\text{to}\,180°-\alpha_{max}}}{\overline{G}_{0°}} + U_{com} \leq 3$ is valid, then the requirement of 11.8.1 is considered to be met.

U_{com} is calculated according to Equation (A.5), Example 2.

18 Modification to 13.1.2

Add the following sentence at the beginning of the subclause:

As the tests described in this clause are performed using rather low doses such as $7 \cdot H_{low}$ the consideration of the natural background radiation is of special importance, see 5.2.4.

19 Modification to 13.2.1

Replace the subclause by:

The influence quantity dealt with in 13.2 is assumed to be of type F or of type S.

20 Modification to 13.2.4

Modify the last sentence of the subclause as follows:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

21 Modification to 13.3.1

Replace the subclause by:

The influence quantity dealt with in 13.3 is assumed to be of type F or of type S.

22 Modification to 13.3.4

Modify the last sentence of the subclause as follows:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

23 Modification to 13.4:

Modify the title of 13.4 to read "**Dose build-up, fading and self-irradiation (dosemeter)**"

24 Modification to 13.4.2

Replace the subclause by:

The relative response and the deviation due to dose build up, fading and self-irradiation shall not exceed the values given in line 3 of Table 13.

25 Modification to 13.4.3

Replace the subclause by:

For this test, three groups of dosemeters shall be used.

Groups 1 to 3 consisting of n (≥ 6) dosemeters shall be exposed to a reference source, see 13.1.2. The irradiations shall be performed at different times so that all readings take place at the same time (in order to exclude possible effects due to reader instabilities during the test).

Further information regarding the method of test are given in 13.1.2.

Treatment of the three groups after the irradiation:

Group 1 shall be read out 24 hours (or as soon as possible) after the irradiation.

Group 2, reference group, shall be read out one week after the irradiation.

Group 3 shall be read out after the maximum rated measurement time t_{max} after the irradiation.

For every group, the mean indicated value $\overline{G_i}$ and the standard deviation s_i shall be determined.

26 Modification to 13.4.4

Replace the subclause by:

If for groups 1 to 3 the inequality $r_{\text{min}} \leq \left(\frac{\overline{G_i}}{\overline{G_2}} \pm U_{\text{com}} \right) \leq r_{\text{max}}$ (for type F influence quantities) or the inequality $\left| \overline{G_i} - \overline{G_2} \pm U_{\text{com}} \right| \leq D_{\text{max}}$ (for type S influence quantities) is valid, then the requirements of 13.4.2 are considered to be met. The values for r_{min}, r_{max}, and D_{max} are given in line 3 of Table 13.

U_{com} and U_{m} are calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively, and Equation (A.3), respectively.

27 Modification to 13.6.1

Replace the subclause by:

The influence quantity dealt with in 13.6 (time) is assumed to be of type F or of type S.

28 Modification to 13.6.4

Replace the last sentence of the subclause by:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

29 Modification to 13.7.2

Replace the last sentence of the subclause by:

In case it can be made sure by physical reasons that temperature does not have a significant effect on the indicated value then this test can be omitted.

30 Modification to 13.7.3

Replace the second sentence of the subclause by:

For this test, two groups of n (≥ 6) dosemeters shall be exposed to a reference source, see 13.1.2.

31 Modification to 13.7.4

Replace the last sentence of the subclause by:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

32 Modification to 13.8.3

Replace the first sentence of the subclause by:

For this test, two groups of n (≥ 6) dosemeters shall be exposed to a reference source, see 13.1.2.

33 Modification to 13.8.4

Replace the last sentence of the subclause by:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

34 Modification to 13.9.4

Replace the last sentence of the subclause by:

U_{com} is calculated according to Equation (A.5), Example 1 or Example 2, for differences or ratios, respectively.

35 Modification to 14.2

Replace the subclause by:

The absolute value of the deviation due to electromagnetic disturbances shall not exceed $0{,}7 \cdot H_{low}$ for every single influence quantity, see Table 14. Exception: The absolute value of the deviation may be larger than $0{,}7 \cdot H_{low}$ for one indicated value, if the dosimetry system delivers an error message assigning that this value is faulty. In addition, the dosimetry system shall not lose more than one indicated value, see 10.5.

For all influence quantities, the mandatory ranges are taken from IEC 61000-6-2.

The tests in lines 4, 5, and 7 of Table 14 need not to be done for readers for which the manufacturer declares that either the respective influence quantity does not affect the indicated value by more than $0{,}7 \cdot H_{low}$ during readout of dosemeters or the effect is recognized and accompanied by an error message (at most one, see above) or the effect is corrected for (for example by means of software). This declaration shall contain the necessary evidence. This evidence can be a physical reason why the device is not affected by the electromagnetic disturbance or why the electromagnetic disturbance is not present. This evidence has to be stated for each electromagnetic disturbance separately. One example is, that no mobile phones are allowed in the room of the reader.

36 Modification to 14.3

Replace the subclause by:

As the tests described in this clause are performed using rather low doses such as $7 \cdot H_{low}$ the consideration of the natural background radiation is of special importance, see 5.2.4.

For the test according to lines 1 to 6 of Table 14 seven groups of n (≥ 10) dosemeters and for the test according to line 7 of Table 14 one group of n (≥ 13) dosemeters shall be exposed to

a reference source with a dose equivalent of $7 \cdot H_{low}$. For those influence quantities for which a declaration of the manufacturer is available, see 14.2, no dosemeters need to be irradiated.

Group 1, reference group: no electromagnetic influences shall be present. To assure this, appropriate filters, shieldings and so on shall be applied.

Groups 2, 6 and 8: in case the dosemeters contain any electric parts that may be sensitive to electromagnetic disturbances (for example a DIS dosemeter), the dosemeters shall be exposed to the influence quantities according to lines 1, 5 and 7 of Table 14 prior to their readout. The radio frequency radiation shall be applied with the frequencies stated in footnote d to Table 14.

Group 1 shall be read out without any electromagnetic influences.

Groups 2 to 8 shall be read out while the different electromagnetic influences are applied to the reader in accordance with the standards of the IEC 61000-4 series as given in Table 14. Each electromagnetic influence shall be applied for the duration of the readout of one dosemeter. If possible, the output of the reader (for example glow curve) shall be observed. Without error message, no abnormal characteristics (for example spikes in a glow curve that cause non-negligible doses) shall occur.

For every group, the mean indicated value $\overline{G_i}$ and the standard deviation s_i shall be determined. In case any indicated values were marked by the dosimetry system as faulty, these values shall be excluded from the determination of $\overline{G_i}$ and s_i.

37 Modification to 15.2.2

Add the following sentence at the beginning of the clause:

As the tests described in this clause are performed using rather low doses such as $7 \cdot H_{low}$ the consideration of the natural background radiation is of special importance, see 5.2.4.