SLOVENSKI STANDARD
SIST EN 61526:2007

01-oktober-2007

Oprema za varstvo pred sevanjem - Merjenje osebne ekvivalentne doze Hp(10) in Hp(0,07) za rentgensko, gama, nevtronsko in beta sevanje - Merilniki in monitorji za neposredno odļ itavanje osebne ekvivalentne doze (IEC 61526:2005)

Radiation protection instrumentation - Measurement of personal dose equivalents Hp(10) and Hp(0,07) for X, gamma, neutron and beta radiations - Direct reading personal dose equivalent meters and monitors

Strahlenschutz-Messgeräte - Messung der Tiefen- und der Oberflächen- Personendosis Hp(10) und Hp(0,07) für Röntgen-, Gamma-, Neutronen- und Betastrahlung - Direkt ablesbare Personendosimeter und -monitore

Instrumentation pour la radioprotection - Mesure des équivalents de dose individuels Hp (10) et Hp(0,07) pour les rayonnements X, gamma, neutron et beta - Appareils de mesure a lecture directe et moniteurs de l'équivalent de dose individuel

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ICS:

13.280	Varstvo pred sevanjem	Radiation protection
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English version

Radiation protection instrumentation - Measurement of personal dose equivalents $H_p(10)$ and $H_p(0,07)$ for X, gamma, neutron and beta radiations - Direct reading personal dose equivalent meters and monitors
(IEC 61526:2005, modified)

Instrumentation pour la radioprotection - Mesure des équivalents de dose individuels $H_p(10)$ et $H_p(0,07)$ pour les rayonnements X, gamma, neutron et bêta - Appareils de mesure à lecture directe et moniteurs de l'équivalent de dose individuel
(CEI 61526:2005, modifiée)

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(IEC 61526:2005, modifiziert)

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CENELEC
European Committee for Electrotechnical Standardization
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Foreword

The text of the International Standard IEC 61526:2005, 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, Nuclear instrumentation and radiation protection instrumentation, was submitted to the formal vote and was approved by CENELEC as EN 61526 on 2006-10-01.

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)	2007-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2009-10-01

Annexes ZA and ZB have been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 61526:2005 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

Introduction

Modify the second paragraph in order to read:

"... 1,5 MeV is considered in the standard and for neutron radiation, from at least thermal neutrons to 15 MeV."

In the fourth paragraph **replace** "10 MeV is" with "10 MeV should be" and **replace** "10 keV is" with "10 keV should be" .

In the fifth paragraph **delete** "for which no requirements are given".

1 Scope and object

In sub-paragraph b) **replace** "if the radiation can be considered to be continuous" with "and may measure the personal dose equivalent rates $\dot{H}_p(10)$ and $\dot{H}_p(0{,}07)$".

In the paragraph below sub-paragraph d), **replace** "quantities and radiation" with "dose quantities (including the respective dose rates) and radiation".

Add at the end of the penultimate paragraph: "In addition, usage categories are given in Annex ZA with respect to different measuring capabilities."

Replace the last sentence of the last paragraph with: "The standard does not apply to dosemeters used for measurement of pulsed radiation where the dose rate in the pulse exceeds the specification such as that emanating from linear accelerators or similar equipment."

2 Normative references

Add:

IEC/TR 62461:2006, *Radiation protection instrumentation – Determination of uncertainty in measurement*

3 Terms and definitions

3.30 reference point of an assembly

Replace "at a point" with "at the point of test".

3.31 reference response

Replace the whole definition with:

reference response
$\boldsymbol{R_0}$
response of the assembly under reference conditions to unit reference dose (rate) and is expressed as:

$$R_0 = \frac{H_{i,r,0}}{H_{t,r,0}}$$

where $H_{t,r,0}$ is a reference (conventionally true) value of the quantity to be measured for a specified reference radiation under specified reference conditions and $H_{i,r,o}$ is the respective indicated value.

NOTE 1 The background value may be automatically taken in account by an algorithm included in the measurement system.

NOTE 2 The reference response is the reciprocal of the reference calibration factor.

3.33 relative response

Add a note below the equation, reading:

NOTE The reference response R_0 is always measured at 0° radiation incidence at the reference energy, see 3.31.

6 General characteristics

6.1 Personal dose equivalent meter classification

Add a note, reading:

NOTE Personal dosemeters are designed for specific applications (see Table ZA.1) so the manufacturers are required to specify the types of radiation, the measuring range, the energy ranges and the ranges of all other influence quantities their dosimeters are designed for (see 14.2). The purchasers may make reference to Table ZA.1 to determine which categories apply to their requirements.

6.6 Effective range of measurement

In the first paragraph, **replace** “four orders of magnitude” with “the range from 100 µSv to 1 Sv for the measuring quantity $H_p(10)$ and from 1 mSv to 10 Sv for the measuring quantity $H_p(0{,}07)$”.

6.7 Rated range of an influence quantity

Replace the first sentence of 6.7 with:

The rated range of any influence quantity has to be stated by the manufacturer in the documentation, it shall cover at least the minimum rated range given in the third column of Tables 3 to 8. Suggestions for extensions are given in Table ZA.1.

6.9 Zero effect and indication due to natural environmental radiation

Replace the headline with “Indication due to zero effect and natural environmental radiation”.

Replace the text of 6.9 with:

For a personal dose meter for $H_p(10)$ from X and gamma radiations the indication due to zero effect and natural environmental radiation shall be given by the manufacturer for an integrating period equivalent to the maximum possible measuring time t_{max}, for test see 9.4.

NOTE This value is required if measured values of dose equivalents accumulated during several days, for example one month, and measured using different dosemeters should be compared.

6.10 Resettable dose or dose rate alarms

Delete “Resettable” in the headline.

6.10.4 Alarm output

In sub-paragraph b), **add** “(impulse level for intermittent alarm)” between “The A-weighted sound level” and “shall exceed 80 dBA”.

7 General test procedures

7.3 Tests for influence quantities of type F

Add a second paragraph, reading:

It is accepted that some small part of the effects of the influence quantities classified as Type F could be regarded as the effects produced by Type S influence quantities. If these effects are small they shall be ignored in relation to the use of this standard. If during testing larger effects of Type S are observed then the respective test shall be performed at a dose value of 10 H_0 and these findings shall be reported in the type test report.

7.4 Tests for influence quantities of type S

Add a second paragraph above the note, reading:

It is accepted that some small part of the effects of the influence quantities classified as Type S could be regarded as the effects produced by Type F influence quantities. If these effects are small they should be ignored in relation to the use of this standard. If during testing larger effects of Type F or significant negative effects are observed then the respective test shall be performed at a dose value of 10 H_0 and these findings shall be reported in the type test report.

8 Additivity of indicated value

8.1 Requirements

Add a note below the current text, reading:

NOTE If the algorithm used to evaluate the indicated value is either a linear combination of the signals or a linear optimization of them, then this requirement is fulfilled and no tests are required.

8.2 Method of test

Replace the text below the equation with:

$\Delta h_{i,mix}$ shall be determined for any value of H_K and H_L and any combination of radiation fields S_K and S_L. The use of computer simulation programs is permitted and recommended for this test. A prerequisite of their use is the knowledge of measured response values of each signal to all the irradiation conditions K and L and of the evaluation procedure to determine the indicated value from these signals. The simulation of the entire dosemeter to determine the response values of each signal to all the irradiation conditions is not permitted.

NOTE 1 The non-linearity of the signals is treated in 9.3. Therefore, the signals shall be corrected for non-linearity for this test. When different dosemeters are used to determine $H_{i,K}$, $H_{i,L}$ and $H_{i,K+L}$, in addition the effect of the different dosemeters on the signals shall be corrected.

NOTE 2 The aim of the use of simulation programs is to minimize the number of irradiations. With the use of simulation programs it is possible to determine $\Delta h_{i,mis}$ for any combination of radiation fields S_K and S_L without performing additional mixed irradiations but using the evaluation algorithm of the dosemeter.

8.3 Interpretation of the results

Delete note 1.

9 Radiation performance requirements and tests

9.1 General

Add the following notes below the text:

NOTE 1 The requirements for the influence quantity *radiation energy and angle of radiation incidence* are given with respect to the reference response R_0 under reference conditions (reference radiation and 0° radiation incidence, reference dose and/or dose rate and all the other reference conditions as given in Table 2). The possible reference radiations can be found for photon radiation in Table 1 of ISO 4037-1, for beta radiation in Table 1 of ISO 6980 and for neutron radiation in Table 1 of ISO 8529-1. The most used reference radiations are given in Table 1, but especially for neutron dosemeters it can be necessary to choose other radiations as reference radiation to comply with the requirements for this influence quantity, even an energy value can be chosen as reference condition for which no physical radiation is available. In that case this (virtual) reference radiation is realized by an available reference radiation and the deviation of the response to the (virtual) reference radiation.

NOTE 2 For the reasons for the non symmetric limits for the relative response due to radiation energy and angle of radiation incidence see IEC/TR 62461.

9.3 Linearity of the response

Replace the headline with “Linearity of the dose response”.

9.3.1 General

Replace the first paragraph with:

If the methods of detection are different for photon, beta or neutron radiation or for specific energy ranges of these radiations, this requirement shall be tested separately for all types of radiation.

Delete the last sentence of the second paragraph.

9.3.3 Method of test

Replace in the first paragraph of sub-paragraph a) “appropriate reference sources” with “reference sources of appropriate activity”.

9.4 Variation of the response due to dose rate dependence of dose measurements

9.4.1 General

Replace the first paragraph with:

If the methods of detection are different for photon, beta or neutron radiation or for specific energy ranges of these radiations, then this requirement shall be tested separately for all types of radiation.

9.4.2 Requirements

Replace the second sentence of the first paragraph with “The minimum rated range of use for dose rate dependence is 0,5 µSv h^{-1} to 1 Sv h^{-1} for $H_p(10)$ from X and gamma radiations and 5 µSv h^{-1} to 1 Sv h^{-1} for $H_p(0,07)$ from beta, X and gamma radiations and $H_p(10)$ from neutron radiations (see Tables 3 to 5).”

Replace the first sentence of the second paragraph with “In addition, for dosemeters to measure $H_p(10)$ from X and gamma radiations, the variation of the relative response due to low dose rates down to natural environmental radiation shall be tested.”

Replace in the second sentence of the second paragraph “The manufacturer shall at least state” with “For that purpose the manufacturer shall state”.

9.4.4 Method of test using natural radiation

Replace the headline with “Method of test for photon dosemeters using natural radiation”.

Replace the text of 9.4.4 with:

Place the dosemeter on the appropriate phantom for at least one week (t_{env}) in a normal laboratory environment and assume as a first estimate a background dose rate $\dot{H}_{true,nat}$ of 2 µSv d^{-1}, if no other information is available. Determine the instrument’s accumulated dose $H_{i,nat}$ for time t_{env} (see also 6.9). Calculate the expected dose value from the known dose rate due to natural environmental radiation $H_{true,nat}$ = 2 µSv d^{-1} × t_{env}. If with the obtained values for $H_{i,nat}$ and $H_{true,nat}$ the requirement of 9.4.5 b) is met, then no further test is necessary.

Otherwise the following refined test is necessary. Place the dosemeter on the appropriate phantom for at least one week (t_{env}) in an environment where the background dose rate $\dot{H}_{true,nat}$ is known and “constant”. This shall be at a standard field stations where the dose rates have been measured with reference instruments which are traceable to national standards. Determine the instrument’s accumulated dose $H_{i,nat}$ for time t_{env} (see also 6.9). Calculate the expected dose value from the known dose rate due to natural environmental radiation: $H_{true,nat} = \dot{H}_{true,nat} \times t_{env}$.

9.4.5 Interpretation of the results

Replace the text of 9.4.5 with:

a) The variation of the relative response due to dose rate dependence determined in 9.4.3 shall not exceed ± 0,2.

b) For photon dosemeters to measure $H_p(10)$ from X and gamma radiations the difference between $H_{i,nat}$ and $H_{true,nat}$ obtained in 9.4.4 and extrapolated for the stated maximum measuring time t_{max}, shall not exceed

$$H_0: \frac{\left| H_{i,nat} - H_{true,nat} \right|}{t_{env}} \times t_{max} \le H_0 .$$

NOTE This inequation can also be used to fix (new) values for H_0 and t_{env}.

In case these requirements are met, the requirements of 9.4.2 can be considered to be met.

9.5 Variation of the response due to photon radiation energy and angle of incidence

9.5.1 Measuring quantity $H_p(0,07)$ or $\dot{H}_p(0,07)$

9.5.1.1 Requirements

Add a further paragraph in between the first and second paragraphs, reading:

If the methods of detection are different for specific dose (rate) ranges, this requirement shall be tested separately for all these ranges.

9.5.1.2 Method of test

Add at the end of the first paragraph: ”, otherwise low air kerma rate series or K-fluorescence reference radiations of ISO shall be used”.

9.5.2 Measuring quantity $H_p(10)$ or $\dot{H}_p(10)$

9.5.2.1 Requirements

Add a note below the last paragraph, reading

NOTE The two minimum rated ranges reflect the two main workplace conditions. The minimum rated range of use from 80 keV to 1,5 MeV is for workplaces where gamma sources are used, e.g. in industry, and the minimum rated range of use from 20 keV to 150 keV is for workplaces where X-rays are used, e.g. in medical diagnostic. Both ranges can be extended until in the extreme case the rated range of use covers all energies from 10 keV to 10 MeV.

9.6 Variation of the response due to neutron radiation energy and angle of incidence

9.6.1 Measuring quantity $H_p(10)$ or $\dot{H}_p(10)$

9.6.1.1 Requirements

Replace the text of 9.6.1.1 with:

The relative response due to radiation energy and angle of radiation incidence for neutron radiation shall be within 0,65 to 4,0 for the energy range between the minimum energy of the rated range and 100 keV, shall be from 0,65 to 2,22 for the energy range between 100 keV and 10 MeV and shall be from 0,65 to 4,0 for the energy range between 10 MeV and the maximum energy of the rated range (see Table 5). The minimum rated range of use covers energies between 0,025 eV and 5 MeV and angles of radiation incidence between 0° and 60° (see Table 5).

If the methods of detection are different for specific dose (rate) ranges, this requirement shall be tested separately for all these ranges.

All indicated dose values shall be corrected for non-linear response and, if necessary, for the effect of the influence quantity dose rate on dose measurements.

9.6.1.2 Method of test

In the second paragraph, **add** “nearly” in between “personal dose equivalent greater than 50 % and one” and “mono energetic neutron field between 10 keV and 100 keV” and **add** “appropriate” between “If the rated range is extended above 15 MeV, additional” and “energies shall be used”.

Replace sub-paragraph c) with:

c) If the response for up to two mono energetic neutron fields in the energy range from 100 keV to 10 MeV is out of the limits given in 9.6.1.1, then simulated work place fields or broad sources shall be used instead. The mean energy (dose equivalent weighted) of the mono energetic and the replacement neutron fields shall be within a factor of 1/1,5 to 1,5.

9.6.1.3 Interpretation of the results

Replace the first sentence of 9.6.1.3 with:

All the relative response values due to neutron radiation energy and angle of incidence shall be within the interval from 0,65 to 4,0 for the energy range between the minimum energy of the rated range and 100 keV, shall be within the interval from 0,65 to 2,22 for the energy range between 100 keV and 10 MeV and shall be within the interval from 0,65 to 4,0 for the energy range between 10 MeV and the maximum energy of the rated range.

9.7 Variation of the response due to beta radiation energy and angle of incidence

9.7.1 Measuring quantity $H_p(0{,}07)$ or $\dot{H}_p(0{,}07)$

9.7.1.1 Requirements

Add a new paragraph below the first paragraph, reading

If the methods of detection are different for specific dose (rate) ranges, this requirement shall be tested separately for all these ranges.

9.9 Overload characteristics

9.9.1 General

Add "or for specific energy ranges of these radiations," between "photon, beta and neutron radiation" and "then this requirement shall be tested separately".

9.9.3 Method of test and interpretation of results

9.9.3.3 Dose equivalent rate meters

Delete "appropriate" in the second paragraph.

9.10 Alarm

9.10.2 Response time for dose equivalent rate indication and alarm

9.10.2.1 Requirements

Replace the text of 9.10.2.1 with:

When the dosemeter is subjected to a step increase or decrease in dose equivalent rate of one order of magnitude within the effective range of the dosemeter, the readout shall indicate the new dose equivalent rate with an error of less than 20 % of the upper dose equivalent rate value within 10 s and the alarm, if set to one half of the upper dose equivalent rate value, shall respond within 2 s. These requirements shall apply for changes from background dose equivalent rates to upper case dose equivalent rate values which are greater than 1 mSv h^{-1} for $\dot{H}_p(10)$ from X and gamma radiation and 10 mSv h^{-1} for $\dot{H}_p(0{,}07)$ from X, gamma and beta radiation and 10 mSv h^{-1} for $\dot{H}_p(10)$ from neutron radiation. Alternatively, any delay of more than 2 s in the alarm responding or 10 s in the indication shall not result in the receipt of a dose in excess of 10 µSv for $\dot{H}_p(10)$ from X and gamma radiation and 100 µSv for $\dot{H}_p(0{,}07)$ from X, gamma and beta radiation and 500 µSv for $\dot{H}_p(10)$ from neutron radiation.

9.10.2.2 Method of test and interpretation of the results

Replace the text of 9.10.2.2 with:

For this test the dosemeter shall be placed in the irradiation facility in non-irradiating conditions and allowed to stabilize. The irradiation facility shall then rapidly be set to irradiating conditions and readings recorded continuously until the dosemeter stabilizes at the new upper dose equivalent rate. The change to 80 % of the high reading $\dot{H}_{high}$ shall take less than 10 s and the alarm, if set to one half of the dose equivalent rate reading, 0,5 $\dot{H}_{high}$, shall respond within 2 s. Next the irradiation facility shall rapidly be set to non-irradiating conditions. The dosemeter reading shall be below 20 % of the reading $\dot{H}_{high}$ within 10 s and the alarm, if set to one half of the dose equivalent rate reading, 0,5 $\dot{H}_{high}$, shall stop within 2 s. The dose accrued during the delay in the alarm responding shall be measured. When, in any case where the delay is greater than 2 s, the dose is less than 10 µSv for $\dot{H}_p(10)$ from X and gamma radiation and 100 µSv for $\dot{H}_p(0{,}07)$ from X, gamma and beta radiation and 500 µSv for $\dot{H}_p(10)$ from neutron radiation, the requirements of 9.10.2.1 can be considered to be met. This test shall be performed for one $\dot{H}_{high}$ value for each order of magnitude of the effective range of the dosemeter.

10 Electrical and environmental performance requirements and tests

10.1 General

Replace the text of 10.1 with:

All influence quantities dealt with in this clause are regarded as of type F, although some of them can be partly also of type S, see 7.3.

10.2 Power supplies – Battery operation

10.2.1 General requirements

Add in the note "last" between "This" and "requirement".

10.6 Sealing

Delete the last sentence.

11 Electromagnetic performance requirements and tests

11.1 General

Renumber the current note to "NOTE 1".

Add a second note below, reading:

NOTE 2 For special applications the electromagnetic performance requirements can be reduced, if the workplace environment assures proper operation. For example, in an reactor, where mobile phones are prohibited, the requirements of 11.4 may be excluded. In such cases, special agreements between customer and supplier are necessary together with a warning in the documentation.

13 Uncertainty

Add at the end of the first sentence of the first paragraph ", see IEC/TR 62461".

Start the second sentence of the first paragraph "The uncertainty depends on …".

Add at the end of the second paragraph "and IEC/TR 62461."

14 Documentation

14.2 Certificate

Add a further dash below "maximum possible measuring time t_{max} (see 9.4.2)":

– indication due to zero effect and natural environmental radiation and the method to determine it (see 6.9 and 9.4.2);

Add a further dash below the whole listing:

– the usage category according to Annex ZA may be indicated.

Table 1 - Symbols (and abbreviated terms)

Replace the entries in the right column of the last three rows with “–“.

Table 3 - Radiation characteristics of $H_p(0,07)$ dosemeters for X, gamma and beta radiation

Replace line 1 with:

1	Variation of the relative response due to the non-linearity of the response itself	1 mSv to 10 Sv for personal dose equivalent	±15 % a) dose equivalent meter	9.3

Replace line 8 with:

8	Dose rate	5 µSv h^{-1} to 1 Sv h^{-1} d)	±20 % a)	9.4

Replace line 10 with:

10	Response time for dose equivalent rate indication and alarm functions	$\dot{H}_p(0,07) \geq 10$ mSv h^{-1}	±20 % for the indication and any delay of more than 2 s in the alarm responding shall not result in the receipt of a dose in excess of 100 µSv	9.10.2

Delete line 12 and footnote e).

Table 4 - Radiation characteristics of $H_p(10)$ dosemeters for X and gamma radiation

Replace line 1 with:

1	Variation of the response due to the non-linearity of the response itself	100 µSv to 1 Sv for personal dose equivalent	±15 % a) dose equivalent meter	9.3

Replace line 9 with:

9	Response time for dose equivalent rate indication and alarm functions	$\dot{H}_p(10) \geq 1$ mSv h^{-1}	±20 % for the indication and any delay of more than 2 s in the alarm responding shall not result in the receipt of a dose in excess of 10 µSv	9.10.2

Replace line 11 with:

11	Response due to zero effect and natural background radiation	—	Deviation of the indication during t_{max} from the natural background less than H_0	9.4.2

Table 5 - Radiation characteristics of $H_p(10)$ dosemeters for neutron radiation

Replace lines 1 to 4 with:

1	Variation of the response due to the non-linearity of the response itself	100 µSv to 1 Sv for personal dose equivalent	±15 % a) dose equivalent meter	9.3
2	Statistical fluctuation, v: dose equivalent	H < 100 µSv 100 µSv ≤ H < 5 100 µSv H ≥ 5 100 µSv	25 % (25,4 – H/(250 µSv)) % 5 %	9.3.5
3	Statistical fluctuation, v: dose equivalent rate for alarm functions	$\dot{H}$ < 1 mSv h^{-1} 1 mSv h^{-1} ≤ $\dot{H}$ < 6 mSv h^{-1} $\dot{H}$ ≥ 6 mSv h^{-1}	20 % (21 – $\dot{H}$ /(1 mSv h^{-1})) % 15 %	9.3.5
4	Radiation energy and angle of incidence	0,025 eV to 100 keV plus 100 keV to 10 MeV plus 10 MeV to 15 MeV and 0° to 60° from reference direction under consideration	–35 % to +300 % b) c) –35 % to +122 % b) c) –35 % to +300 % b)	9.6.1

Replace line 6 with:

6	Dose rate	5 µSv h^{-1} to 1 Sv h^{-1} d)	±20 % a)	9.4

Replace line 8 with:

8	Response time for dose equivalent rate indication and alarm functions	$\dot{H}_p(10)$ ≥ 10 mSv h^{-1}	±20 % for the indication and any delay of more than 2 s in the alarm responding shall not result in the receipt of a dose in excess of 500 µSv	9.10.2

Delete line 10 and footnote e).

Annex B (informative) Procedure to determine the variation of the relative response due to radiation energy and angle of radiation incidence

Replace "response" with "relative response" all over Annex B.

Replace the first paragraph with:

The easiest way to determine the rated range of radiation energy is to measure the (absolute) response values for all energies and angles of incidence for all radiation qualities within the anticipated rated range. Special care shall be taken at large polar angles of incidence, because the response might also depend on the azimuth angle. Then the relative response values are determined by dividing all these (absolute) response values by the value of the (absolute) response for the reference energy and 0° radiation incidence. If all relative response values are within the allowed limits (for example 0,71 – U_{rel} and 1,67 + U_{rel} for photon radiation) then the anticipated rated range can be stated as rated range of the dosemeter. This rated range may not be the maximum possible rated range, because even lower or higher energies may fulfil the requirements and thus larger rated ranges may be possible. In addition, especially for neutron dosemeters, a change of the reference energy may lead to a larger rated range. A better and more direct way to determine the maximum rated range, especially for photon radiation, is given in the following.

Add "for photon radiation" behind "0,71 – U_{rel} to 1,67 + U_{rel}" (six times).

Add additional Annexes ZA and ZB:

Annex ZA
(informative)

Usage categories of personal dosemeters

The usage categories given in Table ZA.1 can be used to categorize personal dosemeters for approval purposes.

Table ZA.1 – Usage categories of personal dosemeters

Category	Symbol	Minimum required range of use	Optional extensions		
			for energy range	for dose range	for dose rate range
$H_p(10)$ Gamma radiation	**G**	80 keV to 1,5 MeV a) 100 µSv to 10 Sv b) 0,5 µSv h^{-1} to 1 Sv h^{-1} c)	**m** (mid): lower limit 60 keV **l** (low): lower limit 20 keV **h** (high): includes 6 MeV	**f**: lower limit 10 µSv	**a** (accident): upper limit 10 Sv/h **e** (environmental): lower limit 0,05 µSv h^{-1}
$H_p(10)$ X radiation	**X**	20 keV to 150 keV a) 100 µSv to 10 Sv b) 0,5 µSv h^{-1} to 1 Sv h^{-1} c)	**l** (low): lower limit 10 keV **h** (high): includes 300 keV	**f**: lower limit 10 µSv	**a** (accident): upper limit 10 Sv h^{-1} **e** (environmental): lower limit 0,05 µSv h^{-1}
$H_p(10)$ Neutron radiation	**N**	0,025 eV to 15 MeV a) 100 µSv to 1 Sv b) 5 µSv h^{-1} to 1 Sv h^{-1} c)		**f**: lower limit 10 µSv	**a** (accident): upper limit 10 Sv h^{-1} **e** (environmental): lower limit 0,5 µSv h^{-1}
$H_p(0,07)$ X, gamma radiation	**S** skin	30 keV to 250 keV a) 1 mSv to 10 Sv b) 5 µSv h^{-1} to 1 Sv h^{-1} c)	**l**: lower limit 20 keV **n**: lower limit 15 keV	**g**: lower limit 100 µSv	**a** (accident): upper limit 10 Sv h^{-1} **e** (environmental): lower limit 0,5 µSv h^{-1}
$H_p(0,07)$ Beta radiation	**B**	200 keV to 800 keV (E_{mean}) a) 1 mSv to 10 Sv b) 5 µSv h^{-1} to 1 Sv h^{-1} c)	**l**: lower limit 60 keV (E_{mean})	**g**: lower limit 100 µSv	**a** (accident): upper limit 10 Sv h^{-1} **e** (environmental): lower limit 0,5 µSv h^{-1}

a) Minimal rated energy range

b) Minimal effective range of measurement

c) Minimal rated range of use for influence quantity dose rate

Example: A personal gamma neutron dosemeter for a nuclear plant may be classified as **Gmh-N**.