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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



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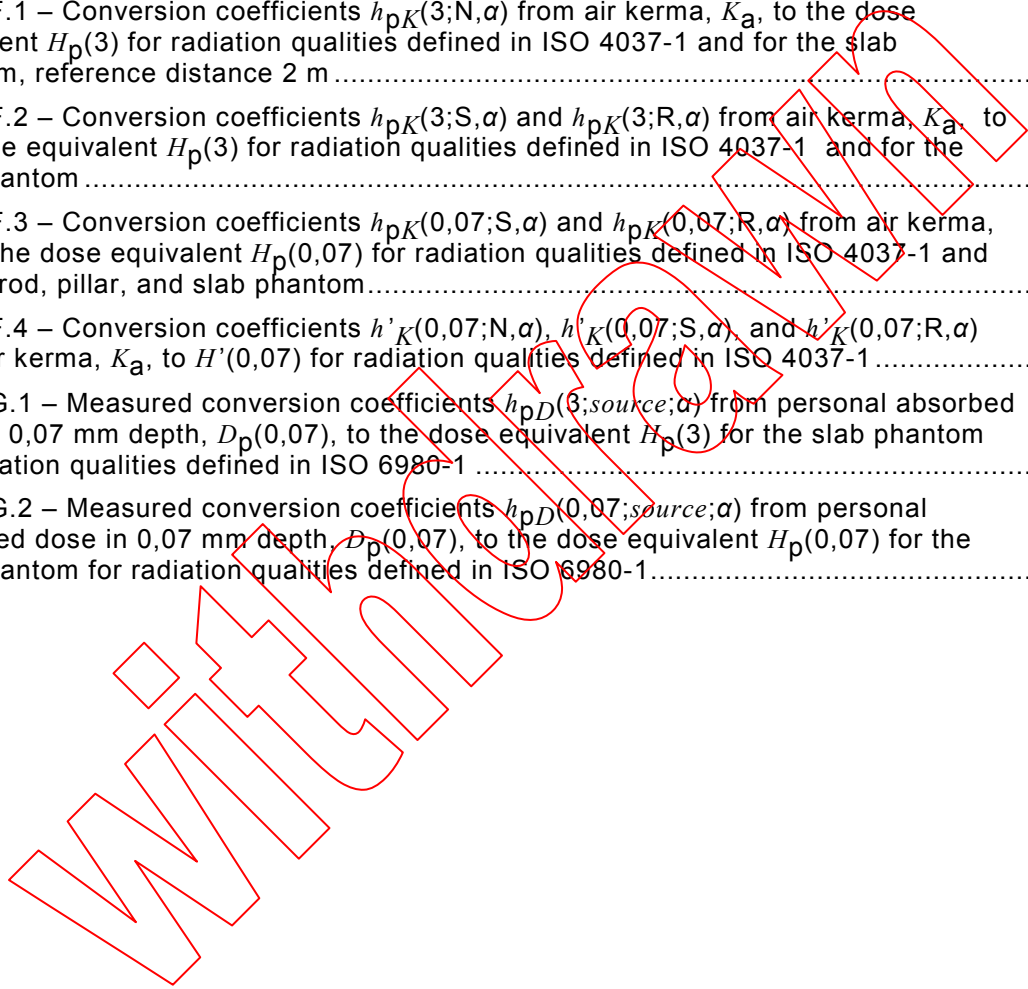
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RADIATION PROTECTION INSTRUMENTATION –
PASSIVE INTEGRATING DOSIMETRY SYSTEMS FOR PERSONAL
AND ENVIRONMENTAL MONITORING OF PHOTON AND BETA RADIATION**

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International Standard IEC 62387 has been prepared by subcommittee 45B: Radiation protection instrumentation, of IEC technical committee 45: Nuclear instrumentation.

This standard cancels and replaces IEC 62387-1 published in 2007. This edition constitutes a technical revision.

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

- Extension of the photon energy range for dosimeters to measure $H_p(0,07)$ from the old range of 8 keV to 250 keV to the new range of 8 keV to 10 MeV.
- Addition of performance requirements for dosimeters to measure $H_p(3)$ for both photon and beta radiation. Such dosimeters can be used to monitor the eye lens dose.
- Addition of performance requirements for dosimeters to measure $H'(0,07)$ for both photon and beta radiation.
- Correction and clarification of several subsections to obtain a better applicability.

- Alignment of IEC performance requirements on dosimetry systems for measuring personal dose equivalents with the recommendations on accuracy stated in ICRP Publication 75, *General Principles for the Radiation Protection of Workers*. Further information is given in the new informative Annex E.

With these changes it also covers the scope of ISO 12794:2000, *Nuclear energy – Radiation protection – Individual thermoluminescence dosimeters for extremities and eyes*.

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

FDIS	Report on voting
45B/743/FDIS	45B/752/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

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INTRODUCTION

A dosimetry system may consist of the following elements:

- a) a passive device, referred to here as a *detector*, which, after the exposure to radiation, stores a signal for use in measuring one or more quantities of the incident radiation field;
- b) a “dosemeter”, that incorporates some means of identification and contains one or more detectors and may contain electronic components;
- c) a “reader” which is used to readout the stored information (signal) from the detector, in order to determine the radiation dose;
- d) a “computer” with appropriate “software” to control the reader, store the signals transmitted from the reader, calculate, display and store the evaluated dose in the form of an electronic file or paper copy;
- e) “additional equipment” and documented procedures (instruction manual) for performing associated processes such as deleting stored dose information, cleaning dosimeters, or those needed to ensure the effectiveness of the whole system.

Withdrawal

RADIATION PROTECTION INSTRUMENTATION – PASSIVE INTEGRATING DOSIMETRY SYSTEMS FOR PERSONAL AND ENVIRONMENTAL MONITORING OF PHOTON AND BETA RADIATION

1 Scope

This standard applies to all kinds of passive dosimetry systems that are used for measuring

- the personal dose equivalent $H_p(10)$ (for whole body dosimetry),
- the personal dose equivalent $H_p(3)$ (for eye lens dosimetry),
- the personal dose equivalent $H_p(0,07)$ (for both whole body and extremity dosimetry),
- the ambient dose equivalent $H^*(10)$ (for environmental dosimetry), or
- the directional dose equivalent $H'(0,07)$ (for environmental dosimetry).

NOTE 1 The term “environmental dosimetry” means ambient, area, and environmental monitoring in this standard.

This standard applies to dosimetry systems that measure external photon and/or beta radiation in the dose range between 0,01 mSv and 10 Sv and in the energy ranges given in Table 1. All the energy values are mean energies with respect to the prevailing dose quantity. The dosimetry systems usually use electronic devices for the data evaluation and thus are often computer controlled.

Table 1 – Mandatory and maximum energy ranges covered by this standard

Measuring quantity	Mandatory energy range for photon radiation	Maximum energy range for testing photon radiation	Mandatory energy range for beta-particle radiation ^a	Maximum energy range for testing beta-particle radiation ^a
$H_p(10)$, $H^*(10)$	80 keV to 1,25 MeV	12 keV to 10 MeV	–	–
$H_p(3)$	30 keV to 250 keV	8 keV to 10 MeV	0,8 MeV almost equivalent to an E_{max} of 2,27 MeV	0,7 MeV ^b to 1,2 MeV almost equivalent to E_{max} from 2,27 MeV to 3,54 MeV
$H_p(0,07)$, $H'(0,07)$	30 keV to 250 keV	8 keV to 10 MeV	0,8 MeV almost equivalent to an E_{max} of 2,27 MeV	0,06 MeV ^c to 1,2 MeV almost equivalent to E_{max} from 0,225 MeV to 3,54 MeV

^a The following beta radiation source are suggested for the different mean energies: For 0,06 MeV: ¹⁴⁷Pm; for 0,8 MeV: ⁹⁰Sr/⁹⁰Y; for 1,2 MeV: ¹⁰⁶Ru/¹⁰⁶Rh.

^b For beta-particle radiation, an energy of 0,7 MeV is required to reach the radiation sensitive layers of the eye lens in a depth of about 3 mm (approximately 3 mm of ICRU tissue).

^c For beta-particle radiation, an energy of 0,07 MeV is required to penetrate the dead layer of skin of 0,07 mm (approximately 0,07 mm of ICRU tissue).

NOTE 2 In this standard, “dose” means dose equivalent, unless otherwise stated.

NOTE 3 For $H_p(10)$ and $H^*(10)$ no beta radiation is considered. Reasons: 1) $H_p(10)$ and $H^*(10)$ are a conservative estimate for the effective dose which is not a suitable quantity for beta radiation. 2) No conversion coefficients are available in ICRU 56, ICRU 57 or ISO 6980-3.

NOTE 4 The maximum energy ranges are the energy limits within which type tests according to this standard are possible.

The test methods concerning the design (Clause 8), the instruction manual (Clause 9), the software (Clause 10), environmental influences (Clause 13), electromagnetic influences (Clause 14), mechanical influences (Clause 15), and the documentation (Clause 16) are