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Radiological protection — X and gamma reference radiation for calibrating dosimeters and doserate meters and for determining their response as a function of photon energy —

Part 2:

Dosimetry for radiation protection over the energy ranges from 8 keV to 1,3 MeV and 4 MeV to 9 MeV

Radioprotection — Rayonnements X et gamma de référence pour l'étalonnage des dosimètres et des débitmètres, et pour la détermination de leur réponse en fonction de l'énergie des photons —

Partie 2: Dosimétrie pour la radioprotection dans les gammes d'énergie de 8 keV à 1,3 MeV et de 4 MeV à 9 MeV



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies and radiological protection*, Subcommittee SC 2, *Radiological protection*.

This second edition cancels and replaces the first edition (ISO 4037-2:1997), which has been technically revised.

A list of all the parts in the ISO 4037 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This corrected version of ISO 4037-2:2019 incorporates the following corrections:

- In 10.5.2.2, the subscripts to the values have been reapplied;
- In Table 5, the headers in columns 4 and 5 have been reinserted.

Introduction

The maintenance release of this document incorporates the improvements to high voltage generators from 1996 to 2017 (e.g., the use of high frequency switching supplies providing nearly constant potential), and the spectral measurements at irradiation facilities equipped with such generators (e.g., the catalogue of X-ray spectra by Ankerhold^[1]). It also incorporates all published information with the aim to adjust the requirements for the technical parameters of the reference fields to the targeted overall uncertainty of about 6 % to 10 % for the phantom related operational quantities of the International Commission on Radiation Units and Measurements (ICRU)^[2]. It does not change the general concept of the existing ISO 4037.

ISO 4037, focusing on photon reference radiation fields, is divided into four parts. ISO 4037-1 gives the methods of production and characterization of reference radiation fields in terms of the quantities spectral photon fluence and air kerma free-in-air. This document describes the dosimetry of the reference radiation qualities in terms of air kerma and in terms of the phantom related operational quantities of the International Commission on Radiation Units and Measurements (ICRU)^[2]. ISO 4037-3 describes the methods for calibrating and determining the response of dosimeters and doserate meters in terms of the phantom related operational quantities of the ICRU^[2]. ISO 4037-4 gives special considerations and additional requirements for calibration of area and personal dosimeters in low energy X reference radiation fields, which are reference fields with generating potential lower or equal to 30 kV.

In this document, two methods are given to determine the phantom related operational quantities. Both methods need a reference field according to ISO 4037-1. The first method requires the dosimetry with respect to air kerma free-in-air and after that the selected operational quantity is derived by the application of a conversion coefficient that relates the air kerma free-in-air to the selected operational quantity. For matched reference fields, this conversion coefficient is taken from ISO 4037-3, for characterized reference fields the conversion coefficient is determined using spectrometry. The second method, applicable for characterized reference fields, requires the direct dosimetry with respect to the selected operational quantity. For all calibrations secondary standard instruments are required, which have a nearly constant energy dependence of the response to the selected quantity.

The general procedures described in ISO 29661 are used as far as possible in this document. Also, the used symbols are in line with ISO 29661.