

ISO 4037-1:2019 (E)

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 1: Radiation characteristics and production methods

Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	Continuous reference filtered X radiation
4.1	General
4.1.1	Realisation of reference radiation fields
4.1.2	Basis of conversion coefficients
4.1.3	Radiation quality
4.1.4	Choice of reference radiation
4.2	Conditions and methods for producing reference X radiation
4.2.1	Characteristics of the high voltage generator
4.2.2	Tube potential and protective resistor
4.2.3	Filtration
4.2.3.1	Filtration for X radiation qualities with 1 mm Be nominal inherent filtration
4.2.3.2	Determination of the total inherent filtration for X radiation qualities with 1 mm Be nominal inherent filtration
4.2.3.3	Filtration for X radiation qualities with 4 mm Al nominal inherent filtration
4.2.3.4	Determination of the inherent filtration for X radiation qualities with 4 mm Al nominal inherent filtration by HVL measurement
4.2.3.5	Determination of the inherent filtration for X radiation qualities with 4 mm Al nominal inherent filtration by spectrometry
4.2.3.6	Specification of the additional filtration
4.2.4	Limitations concerning matched fields
4.2.5	X radiation shutter
4.2.6	Beam aperture
4.3	Field uniformity and scattered radiation
4.3.1	Field diameter
4.3.2	Field uniformity
4.3.3	Scattered radiation
4.3.3.1	General
4.3.3.2	Test 1
4.3.3.3	Test 2
4.4	Summary of the requirements for reference X radiation fields
4.5	Validation of reference X radiation
4.5.1	General
4.5.2	Criteria for validation by HVL determination
4.5.3	Apparatus for HVL measurement
4.5.4	HVL measurement procedure
4.5.5	Criteria for validation by dosimetry
4.5.6	Criteria for validation by spectrometry
5	Gamma radiation emitted by radionuclides
5.1	General
5.2	Radionuclides used for the production of gamma radiation

- 5.3 Specification of radiation sources
 - 5.3.1 Sources
 - 5.3.2 Encapsulation
- 5.4 Irradiation facility and influence of scattered radiation
 - 5.4.1 General requirements
 - 5.4.2 Collimated geometry installation
 - 5.4.3 Variation of air kerma rate by means of lead attenuators
 - 5.5 Checking installation conformity
- 6 Photon radiation with energies between 4 MeV and 9 MeV
 - 6.1 General
 - 6.2 Production of reference radiation
 - 6.2.1 General
 - 6.2.2 Photon reference radiation from de-excitation of ^{16}O in the $^{19}\text{F}(p, \alpha\gamma)^{16}\text{O}$ reaction
 - 6.2.3 Photon reference radiation from de-excitation of ^{12}C
 - 6.3 Beam diameter and uniformity of radiation field
 - 6.4 Contamination of photon reference radiation
 - 6.4.1 General
 - 6.4.2 Contamination of reference radiation common to all methods of production of reference radiation
 - 6.4.3 Additional contamination of accelerator produced reference radiation from de-excitation of ^{16}O
- Annex A (informative) Fluorescence X radiation with not enough information for matched or characterized fields
 - A.1 Principle
 - A.2 General
 - A.3 Fluorescence X-ray installation
 - A.3.1 General
 - A.3.2 X-ray unit
 - A.3.3 Fluorescence device (see Figure A.2)
 - A.3.3.1 Radiators
 - A.3.3.2 Filters
 - A.3.3.3 Primary diaphragm
 - A.3.3.4 Secondary diaphragm
 - A.3.3.5 Trap
 - A.3.3.6 X-ray shielding
 - A.4 Operating conditions
 - A.4.1 Geometry
 - A.4.2 Characteristics of reference radiation
 - A.5 Measurement of scattered radiation
 - A.6 Guidance on the use of the reference radiation
- Annex B (informative) Gamma radiation emitted by ^{241}Am radionuclide with not enough information for matched or characterized fields
 - B.1 General
 - B.2 Gamma radiation emitted by radionuclides
 - B.2.1 General
 - B.2.2 Radionuclide used for the production of gamma radiation
 - B.3 Specification of radiation sources
 - B.3.1 Sources
 - B.3.2 Encapsulation
 - B.4 Irradiation facility and influence of scattered radiation
 - B.4.1 General requirements
 - B.4.2 Collimated geometry installation
 - B.4.3 Checking installation conformity
- Annex C (informative) Continuous filtered X radiation based on the quality index
 - C.1 Introduction
 - C.2 Quality index