

Guide for selection and calibration of dosimetry systems for radiation processing —

ICS 17.240

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National foreword

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO title page, pages ii to iv, pages 1 to 18 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Engineering Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 October 1999

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INTERNATIONAL STANDARD

**ISO
15556**

First edition
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Guide for selection and calibration of dosimetry systems for radiation processing

*Guide de choix et d'étalonnage des appareils de mesure dosimétrique pour
le traitement par irradiation*



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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 15556 was prepared by the American Society for Testing and Materials (ASTM) Subcommittee E10.01 (as E 1261-94) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 85, *Nuclear energy*, in parallel with its approval by the ISO member bodies.

A new ISO/TC 85 Working Group WG 3, *High-level dosimetry for radiation processing*, was formed to review the voting comments from the ISO “Fast-track procedure” and to maintain these standards. The USA holds the convenership of this working group.

International Standard ISO 15556 is one of 20 standards developed and published by ASTM. The 20 fast-tracked standards and their associated ASTM designations are listed below:

ISO Designation	ASTM Designation	Title
15554	E 1204-93	<i>Practice for dosimetry in gamma irradiation facilities for food processing</i>
15555	E 1205-93	<i>Practice for use of a ceric-cerous sulfate dosimetry system</i>
15556	E 1261-94	<i>Guide for selection and calibration of dosimetry systems for radiation processing</i>
15557	E 1275-93	<i>Practice for use of a radiochromic film dosimetry system</i>
15558	E 1276-96	<i>Practice for use of a polymethylmethacrylate dosimetry system</i>
15559	E 1310-94	<i>Practice for use of a radiochromic optical waveguide dosimetry system</i>
15560	E 1400-95a	<i>Practice for characterization and performance of a high-dose radiation dosimetry calibration laboratory</i>
15561	E 1401-96	<i>Practice for use of a dichromate dosimetry system</i>
15562	E 1431-91	<i>Practice for dosimetry in electron and bremsstrahlung irradiation facilities for food processing</i>
15563	E 1538-93	<i>Practice for use of the ethanol-chlorobenzene dosimetry system</i>
15564	E 1539-93	<i>Guide for use of radiation-sensitive indicators</i>

ISO Designation	ASTM Designation	Title
15565	E 1540-93	<i>Practice for use of a radiochromic liquid dosimetry system</i>
15566	E 1607-94	<i>Practice for use of the alanine-EPR dosimetry system</i>
15567	E 1608-94	<i>Practice for dosimetry in an X-ray (bremsstrahlung) facility for radiation processing</i>
15568	E 1631-96	<i>Practice for use of calorimetric dosimetry systems for electron beam dose measurements and dosimeter calibrations</i>
15569	E 1649-94	<i>Practice for dosimetry in an electron-beam facility for radiation processing at energies between 300 keV and 25 MeV</i>
15570	E 1650-94	<i>Practice for use of cellulose acetate dosimetry system</i>
15571	E 1702-95	<i>Practice for dosimetry in a gamma irradiation facility for radiation processing</i>
15572	E 1707-95	<i>Guide for estimating uncertainties in dosimetry for radiation processing</i>
15573	E 1818-96	<i>Practice for dosimetry in an electron-beam facility for radiation processing at energies between 80 keV and 300 keV</i>

1 Scope

1.1 This guide provides the basis for selecting and calibrating dosimetry systems used to measure absorbed dose in gamma-ray or X-ray fields and in electron beams used for radiation processing. It discusses the types of dosimetry systems that may be employed during calibration or on a routine basis as part of quality assurance in commercial radiation processing of products. This guide also discusses interpretation of absorbed dose and briefly outlines the uncertainties associated with the dosimetry measurements. The details of the calibration of the analytical instrumentation are addressed in individual dosimetry system standard practices.

1.2 The absorbed-dose range covered is from about 1 Gy (100 rad) to 1 MGy (100 Mrad). Source energies covered are from 0.1 to 50 MeV photons and electrons.

1.3 Standard practices and guides for specific dosimetry systems and applications are covered in other standards. Dosimetry for radiation processing with neutrons or heavy charged particles is not covered in this guide.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2 Referenced Documents

2.1 ASTM Standards:

E 170, *Terminology Relating to Radiation Measurements and Dosimetry*¹⁾.

E 178, *Practice for Dealing with Outlying Observations*²⁾.

E 666, *Practice for Calculating Absorbed Dose from Gamma or X Radiation*¹⁾.

E 668, *Practice for the Application of Thermoluminescence-Dosimetry (TLD) Systems for Determining Absorbed Dose in Radiation-Hardness Testing of Electronic Devices*¹⁾.

E 1026, *Practice for Using the Fricke Reference Standard Dosimetry System*¹⁾.

E 1204, *Practice for Dosimetry in Gamma Irradiation Facilities for Food Processing*¹⁾.

E 1205, *Practice for Use of a Ceric-Cerous Sulfate Dosimetry System*¹⁾.

E 1275, *Practice for Use of a Radiochromic Film Dosimetry System*¹⁾.

E 1276, *Practice for Use of a Polymethylmethacrylate Dosimetry System*¹⁾.

E 1310, *Practice for Use of a Radiochromic Optical Waveguide Dosimetry System*¹⁾.

E 1400, *Practice for Characterization and Performance of a High-Dose Radiation Dosimetry Calibration Laboratory*¹⁾.

E 1401, *Practice for Use of a Dichromate Dosimetry System*¹⁾.

E 1431, *Practice for Dosimetry in Electron and Bremsstrahlung Irradiation Facilities for Food Processing*¹⁾.

E 1538, *Practice for Use of the Ethanol-Chlorobenzene Dosimetry System*¹⁾.

E 1540, *Practice for Use of a Radiochromic Liquid Dosimetry System*¹⁾.

E 1607, *Practice for Use of the Alanine-EPR Dosimetry System*¹⁾.

E 1631, *Practice for Use of Calorimetric Dosimetry Systems for Electron Beam Dose Measurements and Dosimeter Calibrations*¹⁾.

2.2 International Commission on Radiation Units and Measurements Reports:

ICRU Report 14, *Radiation Dosimetry: X-rays and Gamma rays with Maximum Photon Energies Between 0.6 and 50 MeV*³⁾.

ICRU Report 17, *Radiation Dosimetry: X-rays Generated at Potentials of 5 to 150 kV*³⁾.

ICRU Report 33, *Radiation Quantities and Units*³⁾.

ICRU Report 34, *The Dosimetry of Pulsed Radiation*³⁾.

ICRU Report 35, *Radiation Dosimetry: Electron Beams with Energies between 1 and 50 MeV*³⁾.

ICRU Report 37, *Stopping Powers for Electrons and Positrons*³⁾.

3 Terminology

3.1 Descriptions of Terms Specific to This Standard

3.1.1

accredited dosimetry calibration laboratory
a laboratory that meets specific performance criteria and has been tested and approved by a recognized accrediting organization

¹⁾ Annual Book of ASTM Standards, Vol 12.02.

²⁾ Annual Book of ASTM Standards, Vol 14.02.

³⁾ Available from International Commission on Radiation Units and Measurements, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814.