



Standard Guide for Selecting Dosimetry Systems for Application in Pulsed X-Ray Sources¹

This standard is issued under the fixed designation E 1894; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide provides assistance in selecting and using dosimetry systems in flash x-ray experiments. Both dose and dose-rate techniques are described.

1.2 Operating characteristics of flash x-ray sources are given, with emphasis on the spectrum of the photon output.

1.3 Assistance is provided to relate the measured dose to the response of a device under test (DUT). The device is assumed to be a semiconductor electronic part or system.

2. Contents

2.1 Section 1: Scope of guide.

2.2 Section 2: Outline.

2.3 Section 3: Related ASTM and ICRU documents.

2.4 Section 4: Definition of terms.

2.5 Section 5: Significance and use of this document for the selection of dosimetry systems for use in pulsed x-ray sources.

2.6 Section 6: Description of large flash x-ray sources and their characteristics.

2.7 Section 7: Measurement principles with an emphasis on obtaining absorbed dose measurements for different spectral conditions in the dosimeter, the DUT, and the relationship between them.

2.8 Section 8: The primary information in this guide. The experimenter will find details on each dosimetry system. Listed are details such as: 1) how the dosimeters work, i.e., physical principles, 2) typical applications or instrumentation configurations, 3) advantages, 4) limitations, 5) sensitivity 6) procedures for calibration and proper use and finally reproducibility and accuracy.

2.9 Section 9: Suggested documentation requirements.

2.10 Section 10: Description of how the experimenter determines uncertainty in the dosimetry measurements.

2.11 Section 11: References.

3. Referenced Documents

3.1 *ASTM Standards:*

E 170 Terminology Relating to Radiation Measurements and Dosimetry²

E 665 Practice for Determining Absorbed Dose Versus Depth in Materials Exposed to the X-ray Output of Flash X-ray Machines²

E 666 Practice for Calculating Absorbed Dose from Gamma or X Radiation²

E 668 Practice for the Application of Thermoluminescence–Dosimetry (TLD) Systems for Determining Absorbed Dose in Radiation–Hardness Testing of Electronic Devices²

E 1249 Practice for Minimizing Dosimetry Errors in Radiation Hardness Testing of Silicon Electronic Devices Using Co–60 Sources²

E 1261 Guide for Selection and Calibration of Dosimetry Systems for Radiation Processing²

E 1275 Practice for Use of a Radiochromic Film Dosimetry System²

E 1310 Practice for Use of a Radiochromic Optical Waveguide Dosimetry System²

3.2 *International Commission on Radiation Units (ICRU) and Measurements Reports:*³

ICRU Report 14–Radiation Dosimetry: X rays and Gamma Rays with Maximum Photon Energies Between 0.6 and 50 MeV

ICRU Report 17–Radiation Dosimetry: X rays Generated at Potentials of 5 to 150 kV

ICRU Report 33–Radiation Quantities and Units

ICRU Report 34–The Dosimetry of Pulsed Radiation

4. Terminology

4.1 *Absorbed Dose*—quotient of $d\bar{e}/dm$, where $d\bar{e}$ is the mean energy imparted by ionizing radiation to matter of mass dm :

$$D = \frac{d\bar{e}}{dm} \quad (1)$$

The special name for the unit for absorbed dose is the gray (Gy).

$$1 \text{ Gy} = 1\text{J/kg.} \quad (2)$$

¹ This practice is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee 94E 10.07 on Radiation Dosimetry for Radiation Effects on Materials and Devices. Current edition approved June 10, 1997. Published July 1998.

² *Annual Book of ASTM Standards*, Vol 12.02.

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