Designation: F2547 – 06

StandardTest Method for Determining the Attenuation Properties in a Primary X-ray Beam of Materials Used to Protect Against Radiation Generated During the Use of X-ray Equipment[1]

This standard is issued under the fixed designation F2547; 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 test method establishes procedures for measuring the attenuation of X-rays by protective materials at accelerating potentials from 60 to 130 kVp.

1.2 This test method provides attenuation values of primary beam X-radiation.

1.3 This test method applies to both leaded and non-leaded radiation protective clothing materials.

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:*[2]

F1494 Terminology Relating to Protective Clothing

3. Terminology

3.1 *Definitions:*

3.1.1 *attenuation, n*—For radiological protective material, the reduction in the intensity of the X-ray beam resulting from the interactions between the X-ray beam and the protective material that occur when the X-ray beam passes through the protective material.

3.1.1.1 *Discussion*—In this test method, the attenuation is calculated as 1 minus the ratio of the measured exposure with a protective material in the beam to the measured exposure without the protective material in the beam at a specific accelerating potential. Multiplying the resulting value by 100 gives percent attenuation.

$$\text{Attenuation (percent)} = \left(1 - \frac{\text{exposure with sample}}{\text{exposure without sample}}\right) \times 100 \quad (1)$$

3.1.2 *lead equivalency, n*—For radiological protective material, the thickness in millimetres of lead (commonly designated mmPb) of greater than 99.9 percent purity that provides the same attenuation as a given protective material.

3.1.2.1 *Discussion*—This test method provides the attenuation of the material and not the lead equivalency. Determining lead equivalency would require testing lead of known thickness and purity, and comparing the attenuation of the protective material with the attenuation of the lead. Although lead equivalency has been the standard for reporting protective material capability, the drafters of this test method believe it is not feasible to obtain adequate standard lead samples for reporting lead equivalency values.

3.1.3 *secondary radiation, n*—radiation outside the primary X-ray beam.

3.1.4 *scatter radiation, n*—a form of secondary radiation resulting from the interaction of the primary X-ray beam and the target (for example, protective material being tested or a patient undergoing a medical procedure).

3.1.5 *half-value layer (HVL), n*—the thickness of aluminum, in millimetres (commonly designated mmAl), that reduces the intensity of the X-ray beam by one half.

3.1.5.1 *Discussion*—The HVL is dependent on the energy of the X-ray beam and, therefore, is different for X-rays produced at different accelerating potentials.

3.1.6 *kilovolts, peak (kVp), n*—the maximum electrical potential across an X-ray tube during an exposure, expressed in kilovolts.

3.1.7 *exposure, n*—for radiological purposes, the amount of ionization in air at standard conditions caused by interaction with X-rays, expressed in units of Roentgen (R) or milliroentgen (mR).

3.1.8 *wave form ripple, n*—for radiological purposes, the peak-to-peak variation in the output voltage of the X-ray generator.

[1] This test method is under the jurisdiction of ASTM Committee F23 on Protective Clothing and is the direct responsibility of Subcommittee F23.70 on Radiological Hazards.

Current edition approved June 1, 2006. Published June 2006. DOI: 10.1520/F2547-06.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.