Designation: F 526 – 97 (Reapproved 2003)

Standard Test Method for Measuring Dose for Use in Linear Accelerator Pulsed Radiation Effects Tests[1]

This standard is issued under the fixed designation F 526; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers a calorimetric measurement of the dose delivered in a single pulse of electrons from an electron linear accelerator used as an ionizing source in radiation-effects testing. The test method is designed for use with pulses of electrons in the energy range from 10 to 50 MeV and is only valid for cases in which both the calorimeter and the test specimen to be irradiated are" thin" compared to the range of these electrons in the materials of which they are constructed.

1.2 The procedure described can be used in those cases in which (*1*) the dose delivered in a single pulse is 5 Gy [2] (500 rad) or greater, or (*2*) multiple pulses of a lower dose can be delivered in a time short compared to the thermal time constant of the calorimeter. The minimum dose per pulse that can be acceptably monitored depends on the variables of the particular test, including pulse rate, pulse uniformity, and the thermal time constant of the calorimeter.

1.3 A determination of the dose is made directly for the material of which the calorimeter block is made. The dose in other materials can be calculated from this measured value by formulas presented in this test method. The need for such calculations and the choice of materials for which calculations are to be made shall be subject to agreement by the parties to the test.

1.4 The values stated in SI units are to be regarded as the standard. The values in parenthesis are provided for information only.

1.5 *This standard does not purport to address 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 230 Temperature Electromotive Force (EMF) Tables for Standardized Thermocouples[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *thermal time constant of a calorimeter*—the time for the temperature excursion of the calorimeter resulting from a radiation pulse to drop to 1/*e* of its initial maximum value.

4. Summary of Test Method

4.1 *Single-Pulse Method*—This method consists of (*1*) irradiating, with a single pulse of high-energy electrons from an electron linear accelerator (linac), a small block of material to which either a thermistor or a thermocouple made from small-diameter wire is attached; (*2*) recording and measuring the resulting signal from a bridge circuit or directly from the thermocouple; (*3*) calculating the dose deposited in the block based on the temperature rise and the specific heat of the material; and (*4*) if required, calculating the equivalent dose in other specified materials.

4.2 *Multiple-Pulse Method*—If the dose available in a single pulse is not large enough to give measurable results, the linac is pulsed repeatedly within a time short compared to the thermal time constant of the calorimeter. This method is similar to the single-pulse method except that the average dose delivered in each pulse is calculated from the measured cumulative dose of all the pulses.

5. Significance and Use

5.1 An accurate measure of the dose during radiation-effects testing is necessary to ensure the validity of the data taken, to enable comparison to be made of data taken at different facilities, and to verify that components or circuits are tested to the radiation specification applied to the system for which they are to be used.

[1] This test method is under the jurisdiction of ASTM Committee F01 on Electronics, and is the direct responsibility of Subcommittee F01.11 on Quality and Hardness Assurance.

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[2] In 1975 the General Conference on Weights and Measures adopted the unit gray (symbol—Gy) for absorbed dose; 1 Gy = 100 rad.

[3] *Annual Book of ASTM Standards*, Vol 14.03.

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