



Standard Test Method for Vibration (Horizontal Linear Motion) Test of Products¹

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1. Scope

1.1 This test method covers the determination of resonances of unpackaged products and components by means of horizontal linear motion applied at the surface on which the product is mounted. For vertical vibration testing of products see Test Method D 3580. Two alternate test methods are presented:

1.1.1 *Test Method A*—Resonance Search Using Sinusoidal Vibration, and

1.1.2 *Test Method B*—Resonance Search Using Random Vibration.

NOTE 1—These two test methods are not necessarily equivalent and may not produce the same results.

1.2 This information may be used to examine the response of products to vibration for product design purposes, or for the design of a container or interior package that will minimize transportation vibration inputs at the critical frequencies, when these product resonances are within the expected transportation environment frequency range. Since vibration damage is most likely to occur at product resonant frequencies, these may be thought of as potential product fragility points.

1.3 Information obtained from the optional sinusoidal dwell and random test methods may be used to assess the fatigue characteristics of the resonating components and for product modification. This may become necessary if a product's response would require design of an impractical or excessively costly shipping container.

1.4 This test method does not necessarily simulate vibration effects the product will encounter in operating or end-use environments. Other, more suitable test procedures should be used for this purpose.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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 applica-*

bility of regulatory limitations prior to use. For specific precautionary statements, see Section 6.

2. Referenced Documents

2.1 ASTM Standards:

D 996 Terminology of Packaging and Distribution Environments²

D 3580 Test Method of Vibration (Vertical Linear Motion) Test of Products²

D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing²

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process³

2.2 Military Standard:

MIL STD 810E, Method 514, Vibration⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, see Terminology D 996.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *decade*—the interval of two frequencies having a basic frequency ratio of 10 (1 decade = 3.322 octaves).

3.2.2 *decibel (dB)*—a logarithmic expression of the relative values of two quantities. For relative power measurements, the dB value equals 10 times the base-10 logarithm of the ratio of the two quantities, that is, $\text{dB} = 10 \log_{10} [P_1/P_2]$.

3.2.3 *horizontal linear motion*—motion occurring essentially along a straight horizontal line, with no significant vertical or off-axis components.

3.2.4 *mean-square*—the time average of the square of the function.

3.2.5 *octave*—the interval of two frequencies having a basic frequency ratio of 2 (1 octave = 0.301 decade).

3.2.6 *overall g rms*—the square root of the integral of power spectral density over the total frequency range.

3.2.7 *power spectral density (PSD)*—a term used to quantify the intensity of random vibration in terms of mean-square acceleration per unit of frequency. The units are g^2/Hz ($\text{g}^2/$

¹ This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.15 on Fragility Assessment.

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² *Annual Book of ASTM Standards*, Vol 15.09.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.