



Standard Test Methods for Mechanical-Shock Fragility of Products, Using Shock Machines¹

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1. Scope

1.1 These test methods cover determination of the shock fragility of products. This fragility information may be used in designing shipping containers for transporting the products. It may also be used to improve product ruggedness. Unit or consumer packages, which are transported within an outer container, are considered to be the product for the purposes of these test methods. Two test methods are outlined, as follows:

1.1.1 Test Method A is used first, to determine the product's critical velocity change.

1.1.2 Test Method B is used second, to determine the product's critical acceleration.

1.2 The values stated in either inch-pound or SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *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. For specific precautionary statements, see Section 6.*

2. Referenced Documents

2.1 ASTM Standards:

D 996 Terminology of Packaging and Distribution Environments²

D 2463 Test Method for Drop Impact Resistance of Blow-Molded Thermoplastic Containers³

D 3580 Test Method for Vibration (Vertical Sinusoidal Motion) Test of Products²

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

D 5112 Test Method for Vibration (Horizontal Linear Motion) Test of Products²

E 122 Practice for Choice of Sample Size to Estimate a

Measure of Quality for a Lot or Process⁴

E 680 Test Method for Drop Weight Impact Sensitivity of Solid-Phase Hazardous Materials⁴

3. Terminology

3.1 *Definitions*—General definitions for packing and distribution are found in Terminology D 996.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *acceleration of gravity (g)*—386.1 in./s² (9.806 m/s²).

3.2.2 *critical acceleration (A_c)*—the maximum-faired acceleration level for a minimum velocity change of 1.57 ΔV_c (see 9.3), above which product failure (or damage) occurs. A product usually has a different critical acceleration for each direction in which it is tested.

3.2.3 *critical velocity change (V_c)*—the velocity change (see 9.2) below which product failure is unaffected by shock-pulse maximum-faired acceleration or waveform. A product usually has a different critical velocity change for each direction in which it is tested.

3.2.4 *damage*—product failure that occurs during a shock test. Damage can render the product unacceptable because it becomes inoperable or fails to meet performance specifications when its appearance is unacceptably altered, or some combination of these failure modes occurs.

3.2.5 *damage boundary*—See Annex A3.

3.2.6 *fairing*—The graphical smoothing of the amplitude of a recorded pulse still containing high frequency components even though electronic filtering may have been performed. This amplitude is used to evaluate the basic recorded pulse features with respect to the specified pulse. (see Figs. A1.1 and A2.1)

3.2.7 *shock pulse programmer*—a device used to control the parameters of the acceleration versus time shock pulse generated by a shock test machine.

3.2.8 *shock test machine drop height*—the distance through which the carriage of the shock test machine falls before striking the shock pulse programmer.

4. Significance and Use

4.1 These test methods are intended to provide the user with data on product shock fragility that can be used in choosing

¹ These test methods are under the jurisdiction of ASTM Committee D-10 on Packaging and are 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 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.