



Standard Test Method for Random Vibration Testing of Shipping Containers¹

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1. Scope

1.1 This test method covers the random vibration testing of filled shipping units. Such tests may be used to assess the performance of a container with its interior packing and means of closure in terms of its ruggedness and the protection that it provides the contents when subjected to random vibration inputs.

1.2 This test method provides guidance in the development and use of vibration data in the testing of shipping containers.

NOTE 1—Sources of supplementary information are listed in the Reference section (1-10).²

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.* Specific safety hazard statements are given in Section 6.

2. Referenced Documents

2.1 ASTM Standards:³

D996 Terminology of Packaging and Distribution Environments

D4169 Practice for Performance Testing of Shipping Containers and Systems

D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

2.2 ISO Standards:

ISO 13355 Packaging—Complete, filled transport packages and unit loads—Vertical random vibration test⁴

¹ This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.21 on Shipping Containers and Systems - Application of Performance Test Methods.

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² The boldface numbers in parentheses refer to the list of references at the end of this test method.

³ 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.

⁴ Available from International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.

3. Terminology

3.1 Definitions:

3.1.1 *General*—Definitions for the packaging and distribution environments are found in Terminology D996.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *bandwidth*—the difference, in Hz, between the upper and lower limits of a frequency band. For the purposes of this test method, the bandwidth may be considered equivalent to the frequency resolution of a spectrum analysis.

3.2.2 *closed-loop*—a condition of control where the input may be modified over time by the effect of the output or response of the system.

3.2.3 *decibel (dB)*—ten times the base 10 logarithm of a ratio of two power like quantities that is, a PSD. Two PSD levels that have a ratio of 2.0 differ by 3 dB. Two PSD levels that have a ratio of 0.5 differ by –3 dB.

3.2.4 *equalization*—adjustment or correction of the amplitude characteristics of an electronic control signal throughout a desired frequency range to maintain a desired vibration output spectrum and level.

3.2.5 *equalizer*—instrumentation used to conduct equalization.

3.2.6 *mean-square*—the time average of the square of a function.

3.2.7 *open loop*—a condition of control where the input of a system is preestablished and is not affected by the output or response of the system.

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

3.2.9 *periodic vibration*—an oscillation whose waveform repeats at equal increments of time.

3.2.10 *power spectral density (PSD)*—an expression of random vibration in terms of mean-square acceleration per unit of frequency. The units are g^2/Hz ($\text{g}^2/\text{cycles/s}$). Power spectral density is the limit of the mean square amplitude in a given rectangular band divided by the bandwidth, as the bandwidth approaches zero.

3.2.11 *random vibration*—an oscillation whose instantaneous amplitude is not prescribed for any given instant in time. The instantaneous amplitudes of a random vibration are prescribed by a probability distribution function, the integral of