



Standard Methods for Vibration Testing of Shipping Containers¹

This standard is issued under the fixed designation D 999; 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 These methods cover vibration tests of filled shipping containers. Such tests may be used to assess the performance of a container, with its interior packing and means of closure, both in terms of its strength and of the protection it provides its contents when it is subjected to vibration such as it experiences in transportation. These procedures are suitable for testing containers of any form, material, kind, design of interior packing, means of closure, and any size and weight. They are not intended for determining the response of products to vibration for product design purposes, nor are they intended for tests of products in their operational configuration as other more suitable procedures are available for these purposes.^{2,3}

1.2 The following methods appear:

Method A1—Repetitive Shock Test (Vertical Motion).

Method A2—Repetitive Shock Test (Rotary Motion).

Method B—Single Container Resonance Test.

Method C—Palletized Load, Unitized Load, or Vertical Stack Resonance Test.

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 precautionary statements are given in Section 6.

1.4 These methods fulfill the requirements of International Organization for Standardization standards ISO 8318 and ISO 2247. *The ISO standards may not meet the requirements for these methods.*

2. Referenced Documents

2.1 ASTM Standards:

D 4169 Practice for Performance Testing of Shipping Containers and Systems⁴

¹ These methods are under the jurisdiction of ASTM Committee D-10 on Packaging and are the direct responsibility of Subcommittee D10.22 on Handling and Transportation.

Current edition approved Feb. 10, 1996. Published April 1996. Originally published as D 999 – 48 T. Last previous edition D 999 – 91.

² Military Standard Environmental Test Methods, MIL-STD-810D, Method 514, Vibration, available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, PA 19120.

³ International Electrotechnical Commission Recommendation, Publication 68-2-6, Part 2, Test F: Vibration, Basic Environmental Testing Procedures for Electronic Components and Electrical Equipment, available from American National Standards Institute, Inc., 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁴ *Annual Book of ASTM Standards*, Vol 15.09.

D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing⁴

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality of a Lot or Process⁵

2.2 ISO Standards:

ISO 2247 Packaging—Complete, filled transport packages—Vibration test at fixed low frequency⁶

ISO 8318 Packaging—Complete, filled transport packages—Vibration tests using a variable frequency⁶

3. Terminology

3.1 Definitions:

3.1.1 *resonance*—a vibration of large amplitude in a mechanical system caused by a relatively small periodic stimulus of the same or nearly the same period as the natural vibration period of the system.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *double amplitude*—the maximum value of a sinusoidal quantity (peak-to-peak).

3.2.2 *octave*—the interval between two frequencies having a ratio of two (2).

3.2.3 *repetitive shock*—impacts of a package on a test platform which occur cyclically from input vibration.

4. Significance and Use

4.1 Shipping containers are exposed to complex dynamic stresses when subjected to vibration present in all transportation vehicles. Approximating the actual damage, or lack of damage, experienced in shipping may require subjecting the container(s) and contents to vibration inputs.

4.2 Resonant responses during shipment can be severe and may lead to package or product failure. Identification of critical frequencies, and the nature of package stresses can aid in minimizing the effect of these occurrences.

4.3 Vibration tests should be based on representative field data. When possible, the confidence level may be improved by comparing laboratory test results with actual field shipment data.

4.4 Exposure to vibration can affect the shipping container, its interior packaging, means of closure, and contents. These tests allow analysis of the interaction of these components. Design modification to one or more of these components may

⁵ *Annual Book of ASTM Standards*, Vol 14.02.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.