



Standard Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates¹

This standard is issued under the fixed designation D 1083; 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 test methods are suitable for testing the integrity of large shipping cases and unitized loads as well as the ability of the contents to endure normal handling. Not all of the methods are applicable to all products, containers, and loads. The test methods described are applicable to common means of material handling including: forklift, pull pack, clamp truck, crane, and spade lift type handling systems as follows:

1.1.1 *Drop Test*—For measuring the ability of the case or unitized load to withstand rough handling and provide information useful in improving the design of the container (see 9.1.2 and 10.1).

1.1.2 *Spade Lift Test*—For lifting by spade lift attachment to determine the ability of the handling flap of the case or shipping unit to withstand repeated lifting and handling by this method (see 9.2).

1.1.3 *Clamp Lift Test*—For lifting by hydraulic clamp attachment, to determine the ability of the case or shipping unit, to withstand squeeze clamp handling consisting of repeated side compressions and lifting (see 9.3).

1.1.4 *Push-Pull Handling Test*—For testing the ability of the slip sheet tab to withstand repeated pulls by the gripper jaws without tearing (see 9.4).

1.1.5 *Grabhook Test*—For lifting by grabhooks to determine the ability of the case or unitized load to withstand the horizontal pressures of grabhooks (see 10.2).

1.1.6 *Sling Test*—For lifting by wire rope, cable, or woven fiber slings to determine the ability of the case or unitized load to withstand the compression of slings (see 10.3).

1.1.7 *Tip Test*—For determining the ability of tall or top heavy cases or crates to resist tipping over (see Section 11).

1.1.8 *Tipover Test*—For determining the ability of filled large shipping containers to resist the impacts associated with tipover hazards, and for determining the ability of the packaging and packing methods to provide protection to the contents, when the pack is tipped over (see Section 12).

NOTE 1—This test method fulfills the requirements of International Organization for Standardization standard ISO 8768. *The ISO standard may not meet the requirements for this test method.*

¹ These test methods are under the jurisdiction of ASTM Committee D-10 on Packaging and are the direct responsibility of Subcommittee D10.21 on Application of Performance Test Methods.

Current edition approved Sept. 15, 1991. Published November 1991. Originally published as D 1083 – 50 T. Last previous edition D 1083 – 88.

1.1.9 *Rolling Test*—For determining the ability of a complete, filled transport package to withstand the effects of rolling (see Section 13).

NOTE 2—This test method fulfills the requirements of International Organization for Standardization standard ISO 2876. *The ISO standard may not meet the requirements for this test method.*

1.2 Additional Test Procedures:

1.2.1 Additional tests that apply to mechanical handling of unitized loads and large cases and crates include incline impact tests, described in Test Method D 880 and horizontal impact tests, described in Test Method D 4003. Test Method D 4003 includes a special pallet marshalling test and Test Method D 1185 provides test methods for pallets and related structures.

1.2.2 Test Method D 4169 provides a series of options for selecting and running performance tests on all types of shipping containers and systems.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 775 Test Method for Drop Test for Loaded Boxes²

D 880 Test Method for Impact Testing for Shipping Containers and Systems²

D 996 Terminology of Packaging and Distribution Environments²

D 1185 Test Methods for Pallets and Related Structures Employed in Materials Handling and Shipping²

D 3332 Test Methods for Mechanical-Shock Fragility of Products, Using Shock Machines²

D 4003 Test Methods for Programmable Horizontal Impact Test for Shipping Containers and Systems²

D 4169 Practice for Performance Testing of Shipping Containers and Systems²

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

E 171 Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials²

² Annual Book of ASTM Standards, Vol 15.09.

2.2 ISO Standards:

ISO 2876 Packaging—Complete, Filled Transport Packages—Rolling Test³

ISO 8768 Packaging—Complete, Filled Transport Packages—Toppling Test³

3. Terminology

3.1 *Definitions*—General terms in these test methods are defined in Terminology D 996.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flat*—for purposes of drop tests, tip tests, tipover tests, and rolling tests, no two points on the surface differ in level by more than 0.080 in. (2 mm); however, where one of the dimensions of the test package in contact with the surface is greater than 40 in. (1000 mm), a maximum difference in surface level of 0.20 in. (5 mm) will be acceptable.

3.2.2 *large shipping case or crate*—shipping container constructed of any material, and of such size and weight to require mechanical handling. A case or crate of this type may weigh from 100 lb (45 kg) up to many tons and measure proportionately. The case or crate may be secured to or carried by a base or pallet. Frame members may be provided for rigidity throughout the container.

3.2.3 *rigid*—for purposes of drop tests, tip tests, and tipover tests, a surface that will not be deformed by more than 0.0040 in. (0.1 mm) when any area of 0.16 in.² (100 mm²) is loaded statically with 22 lb (10 kg) anywhere on the surface.

3.2.4 *rolling*—rotating a test package about its axis so as to impact on each face in turn.

3.2.5 *spade lift attachment*—a lift truck attachment used for “top handling” products packaged in interlocking flange cartons (I.F.C.) or folded cap or folded flap style cartons.

3.2.6 *unitized load*—consists of a number of packages (two or more) secured together as a shipping unit. These packages when unitized typically weigh more than 100 lb (45 kg). The unitized method may be shrink wrapping, stretch wrapping, banding, strapping, taping, or gluing. A base consisting of a pallet or slip sheet may or may not be used.

4. Significance and Use

4.1 The test methods described are designed for use in most cases with the actual equipment to be used in load handling.

4.2 These test methods may be used in evaluating cases, crates, or unitized loads as to suitability for mechanical handling by standard user specified load handling equipment.

4.3 The test methods given will allow the user to determine integrity and stability of the load as well as provide guidance to improve the design of the unit load where deficiencies are found.

4.4 Damage to products or packages observed during testing can be expected to correlate at least in a qualitative way to damage observed in actual distribution handling systems.

4.5 The results received from shock machine testing and free fall drop testing are different for certain products. Where this test is performed to satisfy a regulatory or contractual

requirement, its use is subject to approval by the agency concerned.

5. Apparatus

5.1 *Drop Test Apparatus*—In performing the drop test, the case or crate may be handled with any convenient equipment, such as a block and tackle, a hoist, or jacks with provision made for releasing the case or crate either by pulling supporting blocks from under it when tackle and jacks are used or by a release hook when a hoist is used. Other apparatus may be used for dropping a case or crate as follows:

5.1.1 Lift with heavy band iron or wire (to release, the band or wire is cut), or

5.1.2 Lift with a fork truck (while restraining the container, the fork truck is removed from under it), or

5.1.3 Use a tractor with block and tackle (blocks are pulled from under loaded container).

5.1.4 Perform the test upon a flat, horizontally level, concrete slab, pavement, or similarly unyielding surface, massive enough to be immovable and rigid enough to be non-deformable under test conditions, with a mass at least 50 times that of the load and large enough to ensure that the test package falls entirely upon the surface.

5.2 *Spade Lift Test Apparatus*—In performing the spade lift test, use an actual lift truck with spade lift attachment to lift the shipping unit under the lifting flap. The lift truck and blade(s) must be capable of handling the size and quantity of products as per current practice.

5.3 *Clamp Lift Test Apparatus*—In performing the clamp lift test, use an actual lift truck equipped with the appropriate load clamping device to lift the shipping unit. Provision must be made to measure the clamp force between the platens using a load cell(s) or other suitable device.

5.4 *Push-Pull Test Apparatus*—In performing the push-pull test, use an actual lift truck equipped with an appropriate gripper jaw for pulling the load by the slip sheet tab onto the load plate. Alternatively, any suitable pulling device equipped with a gripper jaw may be used.

5.5 *Grabhook Test and Sling Test Apparatus*—In lifting the case or crate with grabhooks or slings, a hoist with grabhooks or slings attached is the simplest and easiest, but the test may be made with a tackle or by lifting the case or crate with jacks and setting it into the grabhooks or slings supported by some form of truss.

5.6 *Tip Test and Tipover Test Apparatus*—In performing the tip or tipover test, the container may be handled with any convenient equipment, such as a forklift truck, a hoist, a block and tackle, by hand, or any means capable of applying a horizontal load to the vertical faces of the test package at a particular height above the center of gravity and of sufficient force to cause tipping without causing the package to slide on the horizontal surface. Perform the test upon a flat, horizontally level, concrete slab, pavement, or similarly unyielding surface, massive enough to be immovable and rigid enough to be non-deformable under test conditions, with a mass at least 50 times that of the load and large enough to ensure that the test package falls entirely upon the surface.

5.7 *Rolling Test Apparatus*—In performing the rolling test, the container may be handled with any convenient equipment,

³ Copies of the ISO standard are available through: American National Standards Institute, 1430 Broadway, New York, NY, 10018.