



Designation: D6055 – 96 (Reapproved 2014)

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

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1. Scope

1.1 These test methods are suitable for testing the integrity of unitized loads and large cases and crates, but not individual drums or palletized drums, as well as the ability of the contents to endure normal handling, using standard mechanical handling equipment. Not all of the test methods are applicable to all products containers and loads. These test methods are applicable to common means of material handling, including pull pack, clamp truck, and spade lift-type handling equipment as follows:

1.1.1 *Test Method A—Fork Truck Handling*—For testing the ability of the shipping unit to withstand repeated handlings by this test method.

1.1.2 *Test Method B—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 test method.

1.1.3 *Test Method C—Clamp Handling Test*—For lifting by hydraulic clamp attachment, to determine the ability of the shipping unit to withstand squeeze clamp handling consisting of repeated side compression and lifting.

1.1.4 *Test Method D—Push-Pull Handling Test*—For testing the ability of a unitized load on a slip-sheet to withstand repeated handling by this test method.

1.1.5 *Test Method E—Grabhook Test*—For lifting by grabhooks to determine the ability of the shipping unit to withstand the horizontal pressures of grabhooks.

1.1.6 *Test Method F—Sling Tests*—For lifting by wire rope, cable, or woven fiber slings to determine the ability of the shipping unit to withstand the compression of slings.

1.2 Additional Test Methods:

1.2.1 Additional test methods that apply to mechanical handling and rough handling tests of unitized loads and large cases and crates include incline impact tests, described in Test Method D880; horizontal impact tests, described in Test Method D4003.

1.2.2 Practice D4169 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*:²

D880 Test Method for Impact Testing for Shipping Containers and Systems

D996 Terminology of Packaging and Distribution Environments

D4003 Test Methods for Programmable Horizontal Impact Test for Shipping Containers and Systems

D4169 Practice for Performance Testing of Shipping Containers and Systems

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

3. Terminology

3.1 *Definitions*—General terms in these test methods are defined in Terminology D996.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *clamp lift attachment*—a lift truck attachment used for clamp handling products packaged in flat-sided packages.

3.2.2 *forklift attachment*—a lift truck attachment used to handle large unitized or palletized loads.

3.2.3 *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.

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

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² 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.

3.2.4 *push-pull attachment*—a lift truck attachment used for push-pull handling products packaged using slip sheets.

3.2.5 *shipping unit*—the smallest complete unit that will be subjected to the distribution environment, for example, a shipping container and its contents.

3.2.6 *spade lift attachment*—a lift truck attachment used for top handling products packaged in interlocked double-cover boxes or folded cap- or folded flap-style cartons.

3.2.7 *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 These test methods 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 the shipping unit as to suitability for mechanical handling by standard user-specified load-handling equipment.

4.3 These test methods 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 may be expected to correlate at least in a qualitative way to damage observed in actual distribution handling systems.

5. Apparatus

5.1 *Fork Truck Test Apparatus*—In performing the fork truck handling test, use an actual lift truck with fork attachment to lift the shipping unit. The lift truck and blade(s) shall be capable of handling the size and quantity of products in accordance with current practice.

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 in accordance with current practice.

5.3 *Clamp Lift Handling Test Apparatus* —In performing the clamp handling test, use an actual lift truck with the appropriate load clamping device to lift the shipping unit. Provision shall 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 with the 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 grabhooks or slings supported by some form of truss.

6. Test Specimen and Number of Tests

6.1 Test several shipping units of a given design, if possible, to obtain replication of results. If in the instance of a number of cases wrapped or banded together, it is not possible to test an entire unitized load, then sufficient cases should be assembled such that the height and one base dimension are nearly the same as the proposed unitized load. For the clamp, spade lift, or push-pull test, use an entire unitized load. The same case or unitized load may often be used for all applicable tests if not tested to failure. Load the shipping unit for the test with the actual contents for which it was designed, or if this is not possible, with a dummy load simulating such contents in mass, shape, and position in the shipping unit.

7. Conditioning

7.1 It is recommended that atmospheres for conditioning be selected from those in accordance with Practice D4332. Unless otherwise specified, fiberboard and other paperboard containers shall be preconditioned and conditioned in accordance with the standard atmosphere specified in Practice D4332.

8. Acceptance Criteria

8.1 Reference Practice D4169 for acceptance criteria and the correlation to relative performance criteria.

9. Mechanical Handling Tests with Lift Trucks

9.1 *Test Method A—Fork Lift Test Procedure*

9.1.1 *Handling on Test Course:*

9.1.1.1 Use an actual lift truck equipped with user-specified fork attachments. See Annex A1 for recommended standard course for lift truck handling tests.

9.1.1.2 The operator is to lift and transport to each observation point in a manner typical of current practice.

9.1.1.3 The minimum number of handlings and fork type and size shall be specified by the user; however, it should be noted that the effects of temperature and humidity in the testing environment may vary greatly and, if so, may affect the strength of the shipping unit. For this reason, it may be useful to specify the minimum number of handlings based on test periods representing these extremes.

9.1.1.4 Examine the load during and after each test cycle to determine if failure occurred.

9.2 *Test Method B—Spade Lift Test Procedure:*

9.2.1 Use an actual lift truck equipped with the spade lift attachment to be used in actual practice. See Annex A1 for recommended standard course for lift truck handling test.

9.2.2 The operator is to engage, lift, and transport the load to each observation point in a manner typical of current practice.

9.2.3 If normal handling requirements specify two or more units high, the test should be conducted with an equivalent load on the test specimen. This test can be repeated for a predetermined number of handlings or until failure occurs. The minimum number of handlings required shall be specified by