Designation: D5331 – 03 (Reapproved 2016)

Standard Test Method for Evaluation of Mechanical Handling of Unitized Loads Secured with Stretch Wrap Films[1]

This standard is issued under the fixed designation D5331; 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 This test method covers evaluation and comparison of the ability of unitizing films to survive various methods of mechanical handling.

1.2 The test method described is applicable to common means of material handling, including the following: forklift, push/pull, clamp truck, crane, and spade lift-type handling systems.

1.3 The test levels may be varied to reflect known levels of intensity accurately for the specific unit load under testing.

1.4 The methodology of performing the mechanical handling tests is described in detail in Test Methods D6055 and Test Methods D6179. This test method will describe only sample preparation and evaluation in the special case of evaluating the performance of stretch film for load unitizing.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *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]

D996 Terminology of Packaging and Distribution Environments

D4169 Practice for Performance Testing of Shipping Containers and Systems

D6055 Test Methods for Mechanical Handling of Unitized Loads and Large Shipping Cases and Crates

D6179 Test Methods for Rough Handling of Unitized Loads and Large Shipping Cases and Crates

3. Terminology

3.1 *Definitions*—General definitions for packaging and distribution environments are found in Terminology D996.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *large shipping case or crate*—for the purposes of this test method, a 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) to many tons and measure proportionally. 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.

3.2.2 *spade lift attachment*—a lift truck attachment used for top handling products packaged in interlocking flange cartons (IFC) or folded cap or folded flap style cartons.

3.2.3 *unitized load*—for the purposes of this test method, consisting of a number of packages (two or more) wrapped or banded together as a shipping unit. When unitized, these packages typically weigh more than 100 lb (45 kg). The unitized method may be shrink 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 This test method is intended for use primarily as a means of comparing the performance of unitizing films. It can also be used to compare the effectiveness of different wrap cycles with the same wrapping materials. No direct correlation between these test results and actual field performance has been established.

4.2 This test method simulates mechanical handling anticipated during all distribution phases.

4.3 This test method leaves open to the discretion of the user the establishment of test levels and numbers of cycles constituting the test, so that the user might tailor the test to simulate a particular distribution environment. The section on mechanical handling over 100 pounds (45 kg) in Practice D4169 may provide some guidance in this regard.

[1] This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.25 on Palletizing and Unitizing of Loads.

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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.

5. Apparatus

5.1 *Load Wrapping Apparatus*—A machine or apparatus to wrap the test load. The wrap application method is preferably as near as possible to that used in an actual production situation (stretch wrapper or manual wrapping unit).

5.2 *Mechanical Handling Apparatus* —Refer to Section 5 of Test Methods D6055 and Test Methods D6179 for a complete description.

6. Procedure

6.1 Prepare the test loads. Arrange the units comprising the test load in layers and stack them on the pallet or slip sheet in the normal manner.

6.2 Wrap the test load with the unitizing film at a predetermined percent stretch and wrap cycle.

6.3 Allow the wrapped load to stand undisturbed for a minimum of 16 h before testing. This provides the stress retention forces in the stretched wrapping material with time to equilibrate.

7. Procedure

7.1 *Palletized Load Test Procedure* —Follow the procedures detailed in Method A of Test Methods D6055 and Method C of Test Methods D6179.

7.2 *Spade Lift Test Procedure*—Follow the procedures detailed in Method B of Test Methods D6055.

7.3 *Clamp Handling Test Procedures* —Follow the procedures detailed in Method C of Test Methods D6055.

7.4 *Push/Pull Handling Test Procedure* —Follow the procedures detailed in Method D of Test Methods D6055.

8. Report

8.1 Include the following information in the test report:

8.2 *Test Unit*—Complete description of the test load evaluated:

8.2.1 Dimensions of each unit (outside diameter),

8.2.2 Dimensions of unitized test load (circumference and height),

8.2.3 Number of individual units per test load, and

8.2.4 Weight of each unit and total test load.

8.3 *Wrap Materials:*

8.3.1 Supplier,

8.3.2 Film thickness, and

8.3.3 Roll width.

8.4 *Wrap Cycle*—Complete description of the wrap cycle used in the wrapping test load. Examples of wrap cycle descriptions in stretch film, spiral wrap are as follows:

8.4.1 Set dial for gear ratio for desired percent strength;

8.4.2 Actual measured percent stretch;

8.4.3 Overlap up;

8.4.4 Top dwell, revolutions;

8.4.5 Overlap down;

8.4.6 Bottom dwell, revolutions;

8.4.7 Total table rotation;

8.4.8 Film used (weight or unstretched footage, or both); and

8.4.9 Date and time wrapped and date and time testing began.

8.5 *Test Parameters:*

8.5.1 Complete description of the equipment used, including load handling attachment, any forces measured, and operator of the equipment;

8.5.2 Detailed record of the tests, including procedures used, height of rotational drop test, if used, covering both container and contents, together with any observation that may assist in interpreting the results correctly or aid in improving the design of the container or the method of packing and unitizing; also a record of the orientation of clamps or spade, if used, and the number of handlings for spade, clamp, or push-pull tests, if used.

8.6 *Unitizing Material Evaluation* —Description of the test specimen(s) after the test, a detailed description of any damage, and a summary of the criteria used to define damage. Some examples of damage modes are as follows:

8.6.1 Loss of adequate cling;

8.6.2 Tearing of material on corners;

8.6.3 Splitting of film on the sides of the test load, either horizontally or vertically;

8.6.4 Permanent load shifting, that is, a permanent shift of the layers of the unit load with respect to one another, resulting in a leaning or skewed load; and

8.6.5 Loss of test load integrity, that is, a shifting of layers to the point of toppling over or losing individual units out of the test load.

9. Precision and Bias

9.1 *Attribute Tests*— No statement is made about either the precision or bias of this test method since the results state merely whether this is in conformance with the criteria for success specified by the user of the test method.

10. Keywords

10.1 mechanical handling; stretch wrap materials; thin films; unitized loads