Designation: D2923 – 08

StandardTest Method for Rigidity of Polyolefin Film and Sheeting[1]

This standard is issued under the fixed designation D2923; 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 describes two procedures for measuring the rigidity of polyolefin film and sheeting.

1.2 Procedure A prescribes a procedure using high-voltage static eliminators and the use of TFE-fluorocarbon[2]-coated plates to overcome the spurious effects of static electricity and friction.

1.3 Procedure B prescribes the use of a fine powder on uncoated plates to achieve a similar effect.

NOTE 1—Although the two procedures are designed to achieve similar effect, they may not achieve the same results.

1.4 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

1.5 *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.*

NOTE 2—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D618 Practice for Conditioning Plastics for Testing

D1898 Practice for Sampling of Plastics (Withdrawn 1998)[4]

3. Terminology

3.1 *Definitions:*

3.1.1 *rigidity*—that combination of thickness and inherent stiffness of a polyolefin film or sheet which resists flexure.

4. Summary of Test Method

4.1 The resistance to flexure of the sample is measured by a strain gauge affixed to the end of a beam, the opposite end of which flexes the sample by forcing it into a groove or slot in a horizontal platform upon which the sample rests. An indicating microammeter, wired to the strain gauge, is calibrated in grams of load sensed by the strain gauge. The rigidity is read directly from the meter and expressed as grams per centimetre of sample width.

5. Significance and Use

5.1 The rigidity of a polyolefin web can affect its machinability, particularly on those packaging machines where a cut portion of a web is required to remain flat momentarily without being supported on all sides.

5.2 Rigidity is not a simple property since it depends on two other properties of the sample: the thickness (gauge), and the stiffness which is an inherent property of the material of which the film or sheet is made. The combined effect of these two factors is the rigidity that influences performance on converting machines.

6. Interferences

6.1 Static electricity has considerable influence on the measured rigidity. It contributes to poor precision and accuracy, frequently giving results biased toward the high side.

6.2 To a lesser extent, precision and accuracy are adversely affected by the frictional properties of the sample, particularly when the coefficient of friction is close to 1.

6.3 The interference caused by the level of static electricity and friction of the specimen is overcome in Procedure A by electrically destaticizing the sample and using TFE-fluorocarbon-coated plates and in Procedure B by dusting the platform with a fine powder at the start of the test.

7. Apparatus

7.1 *Procedure A:*

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.19 on Film, Sheeting, and Molded Products.

Current edition approved Nov. 1, 2008. Published November 2008. Originally approved in 1970. Last previous edition approved in 2006 as D2923 - 06. DOI: 10.1520/D2923-08.

[2] This test method is based on the use of Teflon, a registered trademark of E. I. duPont de Nemours & Co.

[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] The last approved version of this historical standard is referenced on www.astm.org.

*A Summary of Changes section appears at the end of this standard

7.1.1 *Handle-O-Meter,* or equivalent, with TFE-fluorocarbon-coated plates complete with calibrating and augmenting weights.[5]

7.1.2 *Cutting Board or Template* suitable for preparing 203 by 203-mm (8.0 by 8.0-in.) specimens.

7.1.3 *High-Voltage Static Eliminator—*[6]*and Generator.*

7.2 *Procedure B:*

7.2.1 *Handle-O-Meter,* or equivalent, complete with calibrating and augmenting weights.

7.2.2 *Cutting Board or Template* suitable for preparing 203 by 203-mm (8.0 by 8.0-in.) specimens.

7.2.3 *Fine-Particle Silica,* starch, or equivalent, having an approximate nominal particle size of 50 µm or less.

8. Sampling

8.1 The material shall be sampled in accordance with Practice D1898-68 or a valid statistical sampling plan.

9. Test Specimens

9.1 Using a cutting board or template, cut a minimum of three 203 by 203-mm (8.0 by 8.0-in.) test specimens with the edges parallel to the machine and transverse directions of the film. Mark the specimens in the machine direction and transverse direction.

9.2 Condition the test specimens at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 10 % relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D618 unless otherwise specified by agreement or the relevant ASTM material specification. In cases of disagreement, the tolerances shall be ±1°C (±1.8°F) and ±5 % relative humidity.

9.3 *Test Conditions*—Conduct the tests at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 10 % relative humidity unless otherwise specified by agreement or the relevant ASTM material specification. In cases of disagreement, the tolerances shall be ±1°C (±1.8°F) and ±5 % relative humidity.

10. Calibration

10.1 Calibrate the Handle-O-Meter in accordance with the instructions described in Appendix X1.

10.2 Calibrate other equipment in accordance with the manufacturer's instructions.

11. Procedure

11.1 *Method A:*

11.1.1 Turn on the static eliminator.

11.1.2 Just before placing a test specimen on the instrument, slowly draw the specimen several times over the bar of the static eliminator.

11.1.3 With the penetrator beam raised above the slot, lay the test specimen on the platform of the instrument so that the length of the slot is at right angles to the machine direction of the specimen. For example, in measuring machine direction rigidity, the bottom edge of the penetrator beam, which is parallel to the slot length, will contact the film in a line perpendicular to the machine direction of the film.

11.1.4 Position the specimen on the platform so that one-third of the specimen is to the right of the slot.

11.1.5 With the specimen in the correct position and the toggle switch on RUN, press the momentary contact switch to start the test cycle.

11.1.6 Read the maximum value in grams (to the nearest 0.5 g) indicated on the meter.

NOTE 3—Readings in excess of the maximum meter value require use of an augmenting weight in accordance with the manufacturer's instructions. The proper reading with a 40-g augmenting weight is 40 g plus the maximum meter value.

NOTE 4—If the total reading is in excess of the maximum value plus augmenting weights, reduce the specimen width (measured distance along the slot) until an on-scale reading is obtained.

11.1.7 Upon completion of the cycle, rotate the specimen 90° and repeat 11.1.1 through 11.1.6 for measurement in the transverse direction.

11.1.8 Turn the specimen over so that the opposite side of the film is being forced into the opening and repeat 11.1.1 through 11.1.7.

11.1.9 Repeat 11.1.1 through 11.1.8 for the remaining specimens.

11.2 *Method B:*

11.2.1 Place a light "dust" layer of powder on the Handle-O-Meter platform.

11.2.2 Follow 11.1.3 to 11.1.9.

12. Calculation

12.1 Calculate the average Handle-O-Meter rigidity in the machine direction and transverse direction for each side as follows:

$$R_{MDN} = (r/n)/W \text{ or } R_{TDN} = (r/n)/W \quad (1)$$

where:

R_{MDN} = average machine direction rigidity for Side N, g/cm.
R_{TDN} = average transverse direction rigidity for Side N, g/cm.
N = 1 or 2
r = sum of meter readings for specimens tested, g,
n = number of specimens tested, and
W = specimen width along the slot, cm.

12.1.1 If the R_{MD} (or R_{TD}) for Side 1 is equal to R_{MD} (or R_{TD}) for Side 2, the average of the two may be taken as the R_{MD} (or R_{TD}) of the specimen. The two R_{MD}'s (or R_{TD}'s) shall be judged equal if they agree with each other within ±10 %, the error limits of the test.

13. Report

13.1 Report the following information:

13.1.1 The average Handle-O-Meter rigidity in each direction,

13.1.2 Specimen width,

[5] The sole source of supply of the Handle-O-Meter and auxiliary equipment known to the committee at this time is Thwing-Albert Instrument Co., 14 W. Collings Ave. West Berlin, NJ 08091, Tel: 856-767-1000, http://www.thwingalbert.com. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[6] Simco Shockless Bars are suitable for this test method.