Designation: D3354 – 15

Standard Test Method for Blocking Load of Plastic Film by the Parallel Plate Method[1]

This standard is issued under the fixed designation D3354; 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 yields quantitative information regarding the degree of blocking (unwanted adhesion) existing between layers of plastic film. It is not intended to measure susceptibility to blocking.

1.2 By this procedure, the film-to-film adhesion, expressed as a blocking load in grams, will cause two layers of film with an area of contact of 100 cm^2 to separate. The test method is limited to a maximum load of 200 g.

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

1.4 *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 1—This test method is similar to ISO 11502 Method B, but is not technically equivalent.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D883 Terminology Relating to Plastics

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ISO Standard:*

ISO 11502 Determination of Blocking Resistance[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D883.

4. Summary of Test Method

4.1 Two pieces of film, which are in contact with each other, are placed between two 100-mm (4-in.) square blocks. The ends of the films that extend past the blocks are secured to the respective upper and lower block. The force required to overcome the adhesion (blocking force) between the two pieces of film or until they reach 1.9 cm of separation is measured in grams using a constant-rate-of-load or a constant-rate-of separation device.

5. Significance and Use

5.1 Blocking develops in film processing and storage when layers of smooth film are in intimate contact with nearly complete exclusion of air. Temperature, or pressure, or both, can induce or change the degree of adhesion of the surfaces.

5.2 The procedure of this test method closely simulates the operation of separating film in some end-use applications.

6. Apparatus

6.1 The parallel block faces shall be square and 100 ± 0.1 mm (on each edge with a flat and slightly knurled or sand-blasted finish of root mean square 125). A means must be provided to prevent the blocks from sliding when they are in contact during loading.

6.2 *Constant-Rate-of-Load Device*[4]:

6.2.1 An instrument with 100-cm^2 (4-$in.^2$) blocks which electronically times a loading rate of 90 grams per minute (±1) (see Fig. 1). The force required to separate the blocks is displayed electronically.

NOTE 2—On some constant-rate-of load devices, the weight is added by moving a weight axially along the beam with a precision-drive system. This may be accomplished using a stepper motor with a digital stepping drive with 60 cycles as its reference control. The load rate must be 90 grams per minute.

6.3 *Constant-Rate-of-Separation Testing Device*—A testing machine of the constant-rate-of crosshead-movement type and comprising essentially the following:

[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.

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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] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] The sole source of supply of the electro mechanical apparatus known to the committee at this time has discontinued production and the apparatus is no longer available. 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.

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

FIG. 1 Electro-Mechanical Device

6.3.1 *Fixed Member*—A fixed or essentially stationary member carrying one aluminum block 100 by 100 ± 1 mm with appropriate rigid adapter for mounting in a universal testing machine.

6.3.2 *Movable Member*—A movable member carrying a second aluminum block 100 by 100 ± 1 mm with rigid coupling for mounting in a universal testing machine.

6.3.3 *Drive Mechanism*—A drive mechanism for imparting to the movable member a uniform, controlled velocity with respect to the stationary member. The speed of testing, 5.1 mm/min, is the rate of separation of the two blocks when running idle (under no load). This rate of separation shall be maintained within 5 % of the no-load value when running under full-capacity load.

6.3.4 *Load Indicator*—A suitable load-indicating mechanism capable of showing the tensile load, the greater of 1 % of the indicated force or 5 grams, carried by the test specimen held by the block.

6.4 *Accessory Equipment*—May include a 100 by 180-mm template or die, double-faced pressure-sensitive tape.

7. Test Specimens

7.1 Cut unseparated test specimens with a 100 by 180-mm template with the longer length being in the machine direction. Due to variations in gage and blocking tendencies, it is desirable to select several sample locations across the width of the film. Five specimens shall be tested. If the test specimens are taken from a roll, care should be taken that the roll is in good condition. Best results are obtained when specimens are taken at least 25 mm below the outer surface of film rolls.

8. Conditioning

8.1 *Conditioning*—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.

8.2 *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.

Procedures

9. Procedure A—Constant-Rate-of-Load Device

9.1 Place double-coated tape over two parallel small faces of each aluminum block, or place the holding magnets on the blocks as if a sample were being mounted.

9.2 Operate the instrument several times, then determine the average of three “block” determinations as “test tare.”

9.3 Gently place the un-separated film specimen between the two plates with approximately 38 mm of film protruding from each end of the plate. Place both plates in contact with the film aligned with each other. Clamp the plates together with the positioning clamp on the side. When the plates are brought together, do not slide them sideways because this could possibly break the block between the film specimens.

9.4 Carefully separate the edges of the film and stick both protruding edges of the top film to the top plate and the bottom film edges to the bottom plate using the double-faced, pressure-sensitive tape, or holding magnets.

9.5 When the film is in place, gently release the positioning clamp. Push the “on” switch. It will automatically stop when the films separate or reach 19 mm separation.

9.6 Subtract the tare value from the maximum load shown on digital display and record this value.

9.7 Measure and record the thickness of both the upper and lower layers of the film.

9.8 Repeat the test five times using different specimens.

10. Procedure B—Constant-Rate-of-Separation Device

10.1 Adjust the crosshead speed to 5.1 mm per minute (±5 %).

10.2 Using a wide knife blade or spatula, lift the film specimen and transfer it carefully to a symmetrical position on the lower block with its long ends overlapping the block equally on each side.

10.3 Move the crosshead of the testing machine until the upper block is resting on the film specimen and is directly above the lower plate.

10.4 Carefully separate the ends of the double layer of film using the sharp edge of the knife blade, and peel back to the edges of the blocks on each side.

10.5 Tape the two ends of the upper layer of film to the upper block, and the two ends of the lower layer of the film to the lower block. Extend the tape an inch around the corners to the front and rear of the blocks so that the ends of the films are securely fastened to the appropriate blocks. Do not otherwise disturb the film or plates during this operation.

10.6 Start the crosshead travel and allow the testing machine to record the force required to completely separate the two layers of films or until 1.9 cm of separation. As the test proceeds, the force acting on the films will vary as the two films arch out, away from the blocks, and peel apart.

10.7 Record the maximum load in grams.

10.8 Measure and record the thickness of both the upper and lower layers of the film.

10.9 Repeat the test five times using different specimens.

11. Report

11.1 Report the following information:

11.1.1 Average load in grams of five test specimens as the blocking load of the sample.

11.1.2 Complete identification of film tested, including type, source, film thickness, process of manufacture, age, and any other pertinent facts.

11.1.3 Date of test.

11.1.4 Conditioning and testing environment, if different from those recommended in Section 8.

12. Precision and Bias[5]

12.1 *Precision*—Table 1 is based on round robins conducted in 1986 and 1987 in accordance with Practice E691, involving six materials tested by six laboratories. For each material, all samples were prepared at one source, but the individual specimens were prepared at the laboratories that tested them. Each test result was the average of five individual determinations. Each laboratory obtained two test results for each material. (**Warning—**The explanations of *r* and *R* (12.2 – 12.2.3) are only intended to present a meaningful way of considering the approximate precision of this test method. The data presented in Table 1 should not be applied to acceptance or rejection of materials, as these data apply only to the materials tested in the round robin and are unlikely to be rigorously representative of other lots, formulations, conditions, materials, or laboratories. Users of this test method should apply the principles outlined in Practice E691 to generate data specific to their materials and laboratory (or between specific laboratories). The principles of 12.2 – 12.2.3 would then be valid for such data.)

TABLE 1 Blocking

Material	Average	S_r [A]	S_R [B]	r [C]	R [D]
4	7.89	0.60	1.36	1.69	3.64
6	11.5	1.75	2.27	4.97	6.43
1	30.0	3.30	5.08	9.35	14.4
5	47.3	5.70	5.70	16.1	16.1
3	71.2	3.89	6.89	11.0	19.5
2	148	2.36	13.4	6.69	37.9

[A] S_r = within-laboratory standard deviation for the indicated material. It is obtained by pooling the within-laboratory standard deviations of the test result from all of the participating laboratories:

$$S_r = [[(S_1)^2+(S_2)^2 \ldots +(S_n)^2]/n]^{½} \quad (1)$$

[B] S_R = between-laboratories reproducibility, expressed as standard deviation:

$$S_R = [S_r^2+S_L^2]^{½} \quad (2)$$

where:

S_L = standard deviation of laboratory means.

[C] r = within-laboratory critical interval between two test results = 2.8 × S_r.

[D] R = between-laboratories critical interval between two test results = 2.8 × S_R.

12.2 *Concept of r and R in* Table 1—If S_r and S_R have been calculated from a large enough body of data, and for test results that were averages from testing five specimens for each test result, then:

12.2.1 *Repeatability, r*, is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory. Two test results shall be judged not equivalent if they differ by more than the *r* value for that material.

12.2.2 *Reproducibility, R*, is the interval representing the critical difference between two test results for the material, obtained by different operators using different equipment in different laboratories, not necessarily on the same day. Two test results shall be judged not equivalent if they differ by more than the *R* value for that material.

12.2.3 Any judgment in accordance with 12.2.1 or 12.2.2 would have an approximate 95 % (0.95) probability of being correct.

12.3 *Bias*—There are no recognized standards by which to estimate the bias of this test method.

13. Keywords

13.1 blocking; plastics

[5] Supporting data are available from ASTM Headquarters. Request RR:D20-1041 and D20-1143.

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue (D3354 – 11) that may impact the use of this standard. (April 1, 2015)

(1) Revised Footnote 4 found referenced in 6.2.