Designation: ~~D6905 – 03 (Reapproved 2012)~~ D6905 – 20

Standard ~~Test Method~~ Practice for Impact Flexibility of Organic Coatings[1]

This standard is issued under the fixed designation D6905; 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 a procedure for determining the ability of a coating film and its substrate to resist shattering, cracking, or chipping when the film and substrate are distended beyond their original form by impact.~~

~~1.2 This test method does not measure impact resistance but uses rapid impact to improve Test Methods D522, another test method for flexibility. Since the impact of the coating is almost instantaneous, all of the problems associated with time variables in the mandrel tests are eliminated.~~

~~1.3 This test method is similar in content but not technically equivalent to Test Method D2794.~~

~~1.4 The values stated in SI units are to be regarded as the 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.*~~

~~2. Referenced Documents~~

~~2.1 *ASTM Standards:*~~[2]

~~D522 Test Methods for Mandrel Bend Test of Attached Organic Coatings~~
~~D609 Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products~~
~~D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels~~
~~D1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to a Ferrous Base (Withdrawn 2006)~~[3]
~~D1400 Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base (Withdrawn 2006)~~[3]
~~D2240 Test Method for Rubber Property—Durometer Hardness~~
~~D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)~~

~~3. Terminology~~

~~3.1 *Definitions of Terms Specific to This Standard:*~~

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[1] This ~~test method~~ practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.23 on Physical Properties of Applied Paint Films.

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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.

3.1.1 *impact flexibility, n—of a coating*, the percent area increase required to produce cracking in the deformed coating.

4. Summary of Test Method

4.1 The organic coating under test is applied to suitable thin metal panels. After the coating has cured, a standard weight/indenter is dropped from a measured distance so as to strike the substrate which deforms the coating and the substrate. The percent elongation is the highest area of distensibility in which there is no film breaks that the film can stand.

5. Significance and Use

5.1 Coatings attached to substrates are subjected to damaging impacts during the manufacture of articles and their use in service. This impact resistance test method has been found to be useful in predicting the performance of organic coatings for their ability to resist cracking caused by impacts.

6. Apparatus

6.1 *Impact Flexibility Tester*[4],assembly illustrated in Figs. 1 and 2. The instrument contains a 1.63 kg (3.6 lb) weight/indenter, a rubber pad and an aluminum pad, Fig. 3. The round rod weight/indenter's two spherical ends (Marked "A" and "B") are shown in Figs. 4 and 5. The dimensions for the Spherical weight/indenter are shown in Table 1. The rod slides in a vertical, slotted guide and serves as a falling weight to impact a test panel with the "embossed" end. When positioned properly, the lifting knob on the weight/indenter coincides with the bottom of the guide tube.

7. Test Specimens

7.1 Apply uniform coatings of the material to be tested to metal panels treated as specified. Prepare a minimum of four coated panels for the material.

NOTE 1—The coatings should be applied in accordance with Practices D823, or as agreed upon between the producer and the user.

7.2 Cure the coated panels under conditions of humidity and temperature agreed upon between the producer and the user.

NOTE 2—The thickness of the dry coatings should be measured in accordance with Test Methods D1186, Test Method D1400 or any other test method as agreed upon between the producer and the user.

8. Conditioning

8.1 Unless otherwise agreed upon between the producer and the user, condition the coated test panels for at least 24 h at 23 ± 2°C (73.5 ± 3.5°F) and 50 ± 5 % relative humidity. Conduct the test in the same environment or immediately on removal therefrom.

TABLE 1 Table of Percent Area Increase

Spherical Segment	End	Base Diameter, mm (in.)	Segment Radius, mm (in.)	Segment Elevation, mm (in.)	%Area Increase
1	A	9.5 (0.375)	4.85 (0.194)	3.65 (0.146)	60
2	A	9.5 (0.375)	5.20 (0.208)	2.98 (0.119)	40
3	A	9.5 (0.375)	6.30 (0.252)	2.10 (0.084)	20
4	A	9.5 (0.375)	8.15 (0.326)	1.48 (0.059)	10
5	B	9.5 (0.375)	11.0 (0.440)	1.05 (0.042)	5
6	B	9.5 (0.375)	16.9 (0.676)	0.68 (0.027)	2
7	B	9.5 (0.375)	23.7 (0.947)	0.48 (0.019)	1
8	B	9.5 (0.375)	33.3 (1.332)	0.32 (0.013)	0.5

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

[3] The sole source of supply of the apparatus known to the committee at this time is the IM-172-GE Impact Tester, available from the Paul N. Gardner Company, Inc., 316 N.E. First Street, Pompano Beach, FL 33060. 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.

FIG. 1 Full View Impact Flexibility Tester

FIG. 2 Base View Impact Flexibility Tester

9. Procedure

9.1 Install the weight/indenter having the specific heads into the slotted guide tube. Install the aluminum plate with the top rubber anvil head in place on the base. This rubber anvil has a Shore A hardness of 60 ± 5. Determine hardness in accord with Test Method D2240. Replace rubber anvil if outside hardness specifications or if worn or damaged.

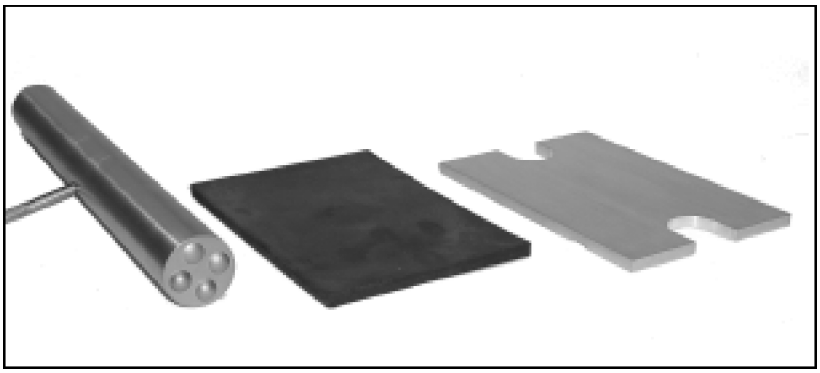

FIG. 3 Intregal Indenter, Rubber Pad, Aluminum Base

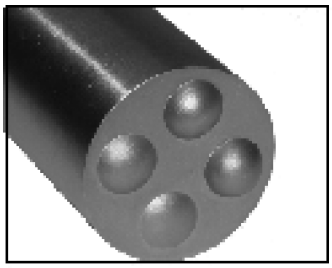

FIG. 4 Indenter End "A"

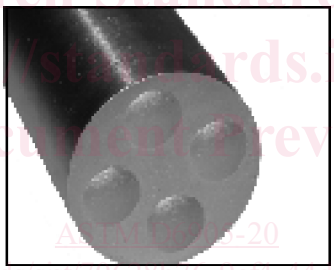

FIG. 5 Indenter End

~~9.2 With an uncoated panel in place on the rubber anvil, determine the height of drop for each end of the weight/indenter to show on the panel slight evenly spaced segment marks of the weight/indenter circumference. The heights so determined will always be used.~~

~~9.3 Place the coated panel to be tested face down against the rubber anvil and drop the weight/indenter from the determined height onto the panel so that the impression of the entire rim of the weight/indenter is made on the panel surface.~~

~~9.4 Remove the panel from the tester after the first bounce.~~

~~9.5 Replace the coated panel to be tested face down against the rubber anvil, reverse the weight/indenter and drop the weight/indenter from the above determined height.~~

~~9.6 Remove the panel from the tester after the first impact.~~

~~9.7 Using the naked eye or magnification, as agreed upon between the producer and the user, visually inspect the impact coating area to detect fine surface cracking and record the maximum percent elongation, that is, the area increase accommodated by the coating without cracking or other failure, using values in Table 1.~~

10. Report

10.1 Report the following for each coating tested:

10.1.1 The maximum percent elongation or flexibility which the film will stand,

10.1.2 Height the weight/indenter was raised from the panel surface,

10.1.3 Thickness of coating,

10.1.4 Substrate thickness and type of metal,

10.1.5 Method of panel preparation, and

10.1.6 Atmospheric conditions under which the coated panels were conditioned and tested.

11. Precision and Bias

11.1 *Precision*—The precision of the procedure in Test Method D6905 for measuring flexibility is being determined.

11.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in this test method, bias cannot be determined.

12. Keywords

12.1 cracking failure; extrusion indentation; impact failure; intrusion indentation

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