



Designation: D522/D522M – 17 (Reapproved 2021)

Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings¹

This standard is issued under the fixed designation D522/D522M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the determination of the resistance to cracking (flexibility) of attached organic coatings on substrates of sheet metal or rubber-type materials.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels](#)

[D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers](#)

[D2370 Test Method for Tensile Properties of Organic Coatings](#)

[D7091 Practice for Nondestructive Measurement of Dry](#)

[Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals](#)

3. Summary of Test Method

3.1 The coating materials under test are applied at uniform thickness to panels of sheet metal or rubber-type materials. After drying or curing the coated panels are bent over a mandrel and the resistance to cracking of the coating is determined. In Test Method A the coated panels are bent over a conical mandrel. In Test Method B the coated panels are bent over cylindrical mandrels of various diameters.

4. Significance and Use

4.1 Coatings attached to substrates are elongated when the substrates are dimensionally unstable, or are bent during the manufacture of articles or when the articles are abused in service. These test methods have been useful in rating attached coatings for their ability to resist cracking when elongated. They have been useful in evaluating the flexibility of coatings on flexible substrates. The elongation of coating films may also be tested using Test Method [D2370](#). The correlation between elongation determined in accordance with Test Methods D522/D522M and [D2370](#) is unknown.

5. Test Specimen

5.1 Substrates:

5.1.1 If the purpose of the test is to determine the percent of elongation of the coating material, the substrate shall be cold-rolled steel strip 0.8 mm [$\frac{1}{32}$ in.] (22 gage) thick.

5.1.2 If the purpose of the test is to rate the coated material for resistance to cracking, the substrate may be any type of sheet metal or rubber-type material (for example, steel, aluminum, tinplate, or synthetic rubber). The thickness of the sheet metal may be less than 0.8 mm [$\frac{1}{32}$ in.] and the thickness of the rubber-type materials may be as great as 13 mm [$\frac{1}{2}$ in.].

5.1.3 The recommended panel size is 100 mm [4 in.] in width and 150 mm [6 in.] in length. The maximum size that the conical mandrel can accommodate is 115 mm [$4\frac{1}{2}$ in.] wide and 190 mm [$7\frac{1}{2}$ in.] long.

5.1.4 The surface preparation of the substrate shall be agreed upon between the purchaser and the seller. Prior to the

¹ These test methods are under the jurisdiction of ASTM Committee [D01](#) on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee [D01.23](#) on Physical Properties of Applied Paint Films.

Current edition approved Nov. 1, 2021. Published November 2021. Originally approved in 1939. Last previous edition approved in 2017 as D522/D522M – 17. DOI: 10.1520/D0522_D0522M-17R21.

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.