Designation: D813 – 07 (Reapproved 2019)

Standard Test Method for Rubber Deterioration—Crack Growth[1]

This standard is issued under the fixed designation D813; 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 This test method covers the determination of crack growth of vulcanized rubber when subjected to repeated bending strain or flexing. It is particularly applicable to tests of synthetic rubber compounds which resist the initiation of cracking due to flexing when tested by Method B of Test Methods D430. Cracking initiated in these materials by small cuts or tears in service, may rapidly increase in size and progress to complete failure even though the material is extremely resistant to the original flexing-fatigue cracking. Because of this characteristic of synthetic compounds, particularly those of the SBR type, this test method in which the specimens are first artificially punctured in the flex area should be used in evaluating the fatigue-cracking properties of this class of material.

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

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]

D430 Test Methods for Rubber Deterioration—Dynamic Fatigue

D1349 Practice for Rubber—Standard Conditions for Testing

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

D3767 Practice for Rubber—Measurement of Dimensions

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

3. Summary of Test Method

3.1 A molded test specimen with a pierced groove is repeatedly flexed on a DeMattia type machine with the flexing (bending) axis parallel to the groove. The cut length is measured at frequent intervals to determine the cut growth rate. The cut is initiated by a specially shaped piercing tool.

4. Significance and Use

4.1 The test gives an estimate of the ability of a rubber vulcanizate to resist crack growth of a pierced specimen when subjected to bending or flexing.

4.2 No exact correlation between these test results and service is implied due to the varied nature of service conditions.

5. Interference

5.1 Presence of significant concentrations of ozone will affect test results. Care should be taken that ambient ozone concentrations do not exceed 1 pphm.

6. Apparatus

6.1 *DeMattia Flexing Machine*—The essential features of the apparatus, one design of which is shown in Fig. 1, are as follows:

6.1.1 The machine has an adjustable stationary head or member provided with suitable grips for holding one end of the test specimens in a fixed position and a similar reciprocating member for holding the other end of each of the specimens.

6.1.2 The reciprocating member is so mounted that its motion is straight in the direction of and in the same plane as

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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.

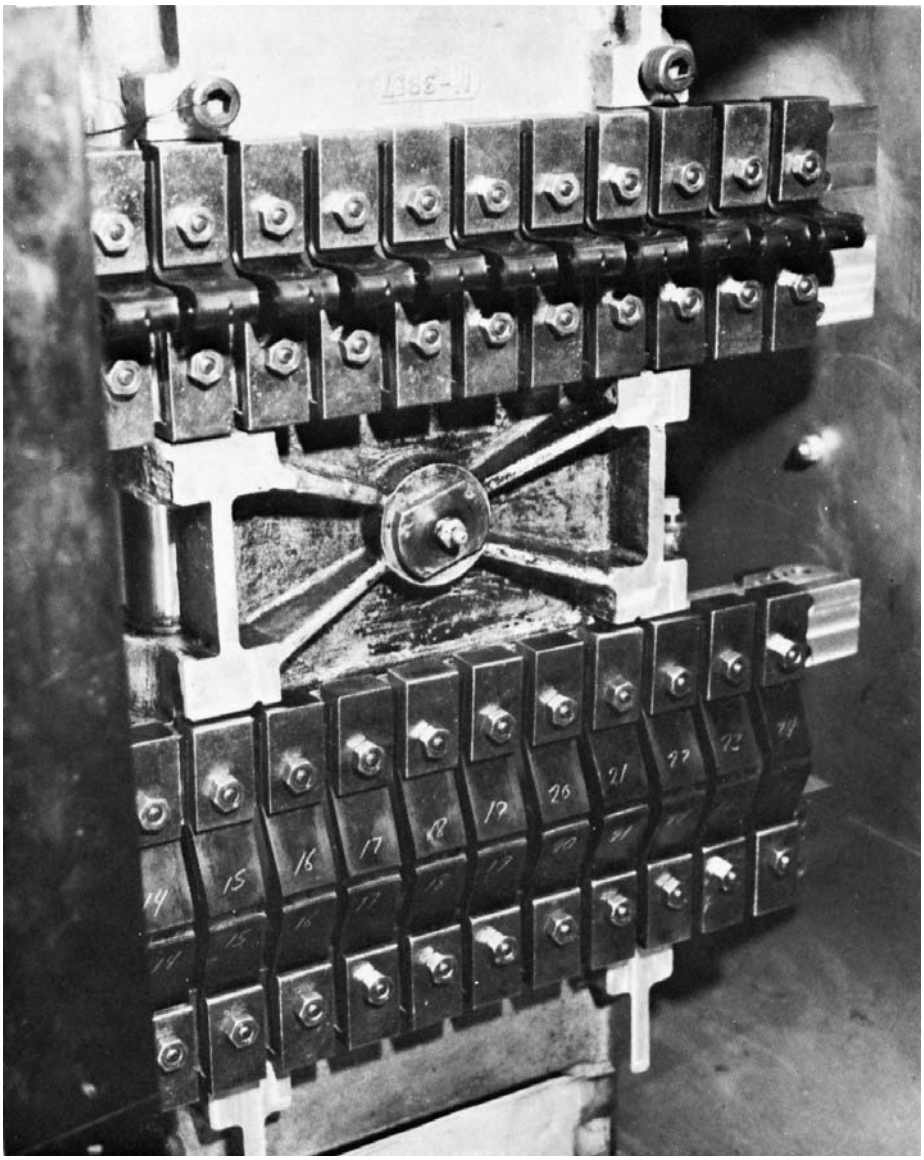

FIG. 1 DeMattia Tester with a Double Row of Specimens Mounted for Flex-Cracking Test

the center line between the grips. The travel of the moving member shall be adjustable and shall be obtained by means of a connecting rod and eccentric having a minimum length ratio of 10 to 1.

6.1.3 The eccentric shall be driven by a motor operating at constant speed under load and giving 5 ± 0.1 Hz (300 ± 10 cpm). Provision shall be made for a maximum travel of the moving grips of 100 mm (4 in.).

6.1.4 The machine may be designed so that all the specimens are mounted on a single bar and all are flexed at the same time. A double bar may also be used in which case those specimens mounted on one bar are being flexed while those on the other bar are being straightened. Such an arrangement improves the smoothness of operation.

6.2 *Mold*—A mold for curing individual test specimens is required, preferably of a multiple cavity design and having adequate overflow cavities. The cavity plate shall have a minimum thickness of about 20 mm (0.750 in.) and the cover plate a minimum thickness of 14.5 mm (0.575 in.). Refer to Practice D3182.

NOTE 1—The curing of wide samples from which specimens may be cut may be provided for by increasing the width of the cavity and maintaining all other dimensions.

6.3 *Measuring Scale* of suitable length, graduated in millimetres (or 0.01 in.) for measuring the length of cut growth.

6.4 *Micrometer,* to measure the thickness of the test specimen as specified in Practice D3767, Procedure A2.

7. Test Specimens

7.1 The test specimens shall consist of molded or cut strips, conforming to the shape and dimensions given in Fig. 2. They shall have a smooth surface and be free of surface irregularities and defects in the groove and adjacent area. The thickness shall