Designation: D1171 – 16ε1

Standard Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors (Triangular Specimens)[1]

This standard is issued under the fixed designation D1171; 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.

ε1 NOTE—Corrected 7.2.2 editorially in November 2016.

1. Scope

1.1 This test method permits the estimation of the relative ability of rubber compounds used for applications requiring resistance to outdoor weathering.

1.2 This test method is not applicable to materials ordinarily classed as hard rubber, but is adaptable to molded or extruded soft rubber materials and sponge rubber for use in window weatherstripping as well as similar automotive applications.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D518 Test Method for Rubber Deterioration—Surface Cracking (Withdrawn 2007)[3]

NOTE 1—The procedures in Test Method D518 have been incorporated as Procedures B1, B2, and B3 in Test Methods D1149.

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

3. Summary of Test Method

3.1 Procedures are given for preparing triangular cross-section specimens, for mounting them in strained condition around specified circular mandrels, and for rating the effect of exposure as evidenced by the appearance of surface cracks. The type, time, temperature, and other conditions of exposure are not given but shall be agreed upon by the purchaser and the seller and shall be completely described in the test reports.

3.2 Two techniques are described, the exposure rating and the quality-retention rating.

4. Significance and Use

4.1 Molded or extruded rubber products must withstand the effects of ozone cracking and outdoor weathering for satisfactory use. This test enables a simple comparison of performance to be made under specified test conditions in an outdoor test. No direct correlation between test performance and service performance can be claimed due to the wide range of service conditions.

5. Apparatus

5.1 *Mounting Mandrel*—A wood mandrel 50 mm (2 in.) in outside diameter, suitably coated with spar varnish or a clear lacquer. The mandrel may be supported by any convenient method.

5.2 *Fastening Wire*—Enameled copper wire.

6. Test Specimen

6.1 The triangular cross-section test specimen shall be a molded, extruded, or sponge section with a continuous skin or surface layer, 250 mm (10 in.) long, and cured in a straight position. The cross-sectional dimensions shall be as shown in Fig. 1. Duplicate specimens shall be tested.

6.2 It is recommended that the manufacturer observe a minimum rest period of 24 h between compound mixing and compound preparation, and a minimum rest period of ½ h between compound preparation and curing when preparing specimens. The finish of the specimens shall be as smooth as possible.

[1] This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.15 on Degradation Tests.

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

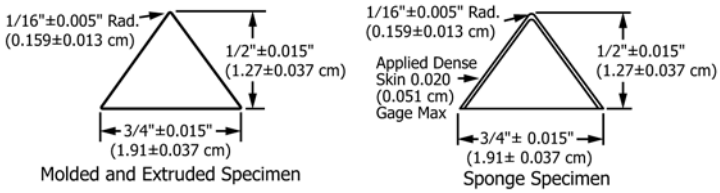


FIG. 1 Cross-Sectional Dimension of Test Specimens

METHOD A—EXPOSURE RATING

7. Procedure

7.1 *Mounting of Specimens*—Place bench marks on each specimen with a crayon, 190 mm (7.5 in.) apart and 32 mm (1.25 in.) from the ends. Form the specimens into a loop by placing the 19-mm (0.75-in.) sides together and tying securely with wire at the bench marks. Slip the complete loop over the mandrel. Place as many specimens on the mandrels as length of mandrel will permit.

7.2 *Exposure of Specimens:*

7.2.1 *Conditioning Period:*

7.2.1.1 *Outdoor Exposure*—After the specimens are mounted allow them to condition for 70 to 72 h at room temperature in an ozone free atmosphere. Do not touch the looped part after mounting until the test is completed.

7.2.2 *Angle and Direction and Positioning of Exposures*—Incline specimens exposed outdoors so that the portion of the loop diametrically opposite the tied ends shall face south at an angle of 45° with the horizontal as shown in Fig. 2.

7.2.3 *Test Conditions:*

7.2.3.1 *Outdoor Exposure*—The type, time, temperature, and other essential conditions of exposure shall be agreed upon by the purchaser and the seller.

7.3 *Rating of Exposed Specimens*—When the specified exposure period is completed, examine the specimens before removal from the mandrel, and evaluate the degree of cracking by comparison with the reference standards shown in Fig. 3 using a 2-power headgear binocular magnifier or equivalent. If the size of the cracks at 2× magnification is less than those shown on one photograph but greater than those shown on the next lower rating picture, give the lower rating.

8. Report

8.1 Report the following information:

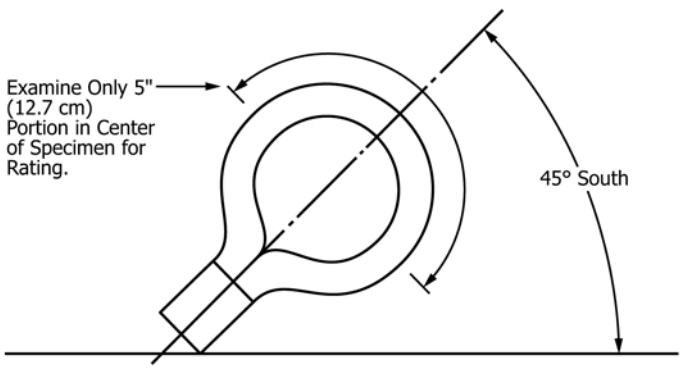


FIG. 2 Outdoor Exposure of Test Specimen

8.1.1 Description of the specimen, giving the identification number of compound and vulcanization data, if known, including date,

8.1.2 Date of start of exposure, and complete information describing conditions of exposure,

8.1.3 Rating number of exposed specimens, and

8.1.4 If desired, a photograph at 2× magnification.

METHOD B—QUALITY-RETENTION RATING

9. Procedure

9.1 If it is desired to apply a quality-retention rating value based on three observations of crack rating taken at three successive time intervals of exposure, use the following procedure:

9.1.1 Prepare the test specimens as described in Section 6, and mount and expose as described in 7.1 and 7.2 except that the time of exposure shall be six weeks. Other periods of outdoor exposure may be used if agreed upon by producer and consumer. Make the crack rating as described in 7.3 every second week or at three equal intervals. This will give three ratings.

9.1.2 The three crack-growth ratings shall be put together to give a three-digit number and Table 1 then used to find the percent quality retention. The three-digit crack-growth number in the crack-growth column corresponds to the quality retention in the right-hand column.

10. Report

10.1 Report the following information:

10.1.1 Description of the specimen, giving the identification number of the compound and date of vulcanization,

10.1.2 Date of start of exposure and complete information describing condition of exposure,

10.1.3 Crack rating number composed of three digits representing three readings taken each two weeks for six weeks or taken at three equal intervals, and

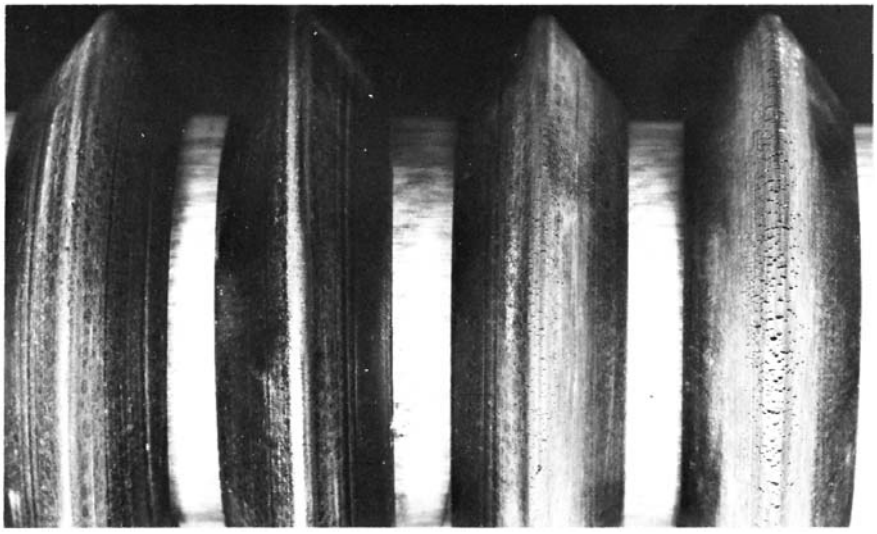
10.1.4 Quality-retention value in percent.

11. Precision and Bias

11.1 Both the exposure rating and the quality-retention rating are essentially rank order or qualitative comparison methods. Precision as normally expressed for quantitative-measurement test methods is not directly applicable.

12. Keywords

12.1 crack growth; cracking; ozone; ozone cracking; surface crack; triangular; weathering



Rating 0 Rating 1 Rating 2 Rating 3

FIG. 3 Ratings for Weathering Tests of Rubber Compounds (Specimens mounted on mandrel) (2×)

TABLE 1 Quality Retention Rating

Crack Growth	Quality Retention, %
000	100
001	95
011	90
111	85
002	80
012	75
112	70
022	65
122	60
222	55
003	45
013	40
113	35
023	30
123	25
223	20
033	15
133	10
233	5
333	0