



Designation: D 1670 – 98

## Standard Test Method for Failure End Point in Accelerated and Outdoor Weathering of Bituminous Materials<sup>1</sup>

This standard is issued under the fixed designation D 1670; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the determination of failure due to cracking of bituminous materials undergoing accelerated or outdoor weathering, on electrically conductive backings.

1.2 *This standard does not purport to address 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. Summary of Test Method

2.1 Dry, weathered, bituminous-coated test panels are grounded and a feeler electrode is passed over the bituminous surface. Before re-exposure, a photographic record is made of all panels showing sparking in 15 or more positions. The photographs are covered with a grid, and when sparking has occurred in 26 or more grid squares, failure is reported.

### 3. Significance and Use

3.1 The extent of cracking or pitting of bituminous films is a measure of the extent of deterioration due to weathering. Failure due to cracking is more accurately determined electrically than visually.

3.2 Failure determined by this test method will depend not only on the characteristics of the asphalt and the extent of weathering, but also on the film thickness, and the amount and type of mineral filler present.

### 4. Apparatus

4.1 *Any Spark-Generating Apparatus*,<sup>2</sup> capable of delivering a 5-kV peak voltage and of operating at 60 Hz.

4.2 *Photographic Equipment*—A supply of sheets of matte surface, regular weight, photo copy paper<sup>3</sup> cut to the dimensions of the test panel, developer, and fixing chemicals.

4.3 *Counting Grid* as shown in Fig. 1: Photocopy the grid on a transparency film that is suitable for use with plain paper copiers. Trim the outside edges to the exact dimensions of the test panel making sure that the grid and the bituminous film on the test panel are aligned.

Outside dimensions, in. (mm)	2 $\frac{3}{4}$ by 5 $\frac{7}{8}$ (69.8 by 149.1) or panel size
Grid dimensions, in. (mm)	1 $\frac{7}{8}$ by 4 $\frac{7}{8}$ (47.6 by 123.8)
Number of squares in grid	260 (10 by 26)
Size of squares, in. (mm)	$\frac{3}{16}$ (4.76)

### 5. Calibration of the Spark-Generating Apparatus

5.1 *Voltage*—Calibrate the peak voltage of the spark generator to  $5 \pm 0.5$  kV according to the manufacturer's instructions.

### 6. Detection of Cracks in Weathered Film

6.1 At the end of an exposure period, remove the test panel from the weathering unit or outdoor exposure site. Allow the panels to dry thoroughly and bring them to room temperature.

6.2 Ground each panel at the back surface or the conductive edge. The test feeler (see Fig. 2 for example) of the spark instrument should be passed over the complete surface of the bituminous film in 5 to 10 s. The number of sparks should be noted during the pass. If the number of sparkthrough points on any panel is less than 15, at least  $\frac{3}{16}$  in. apart, set the panel aside for re-exposure. Make a photographic record of the rest of the specimens showing sparking in 15 or more positions. Place one of the photocopy sheets (cut to the exact dimensions of the test panel) emulsion side down on the panel, making sure that the sheet and the panel are aligned, and pass the test feeler of the spark gap instrument over the back of the paper.<sup>4</sup> The complete passage from top to bottom shall be within 5 to 10 s.

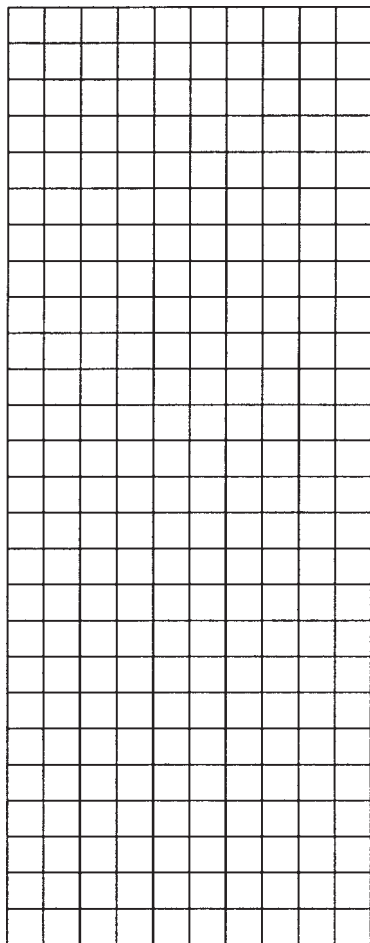
<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D-8 on Roofing, Waterproofing, and Bituminous Materials and is the direct responsibility of Subcommittee D08.02 on Prepared Roofings, Shingles, and Siding Materials.

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<sup>2</sup> The sole source of supply of the apparatus known to the committee at this time is Electro-Technic Model BD-40B Spark Generator, available from Electro-Technic Products Co., 4642 N. Ravenswood Ave., Chicago, IL 60642. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

<sup>3</sup> Thermal facsimile paper with ultra-high sensitivity rating has also been found satisfactory for the same purpose. This paper is available nationwide from office supply stores or catalogs.

<sup>4</sup> A discussion of the photographic method of recording failures is given in "A New Method for Evaluating Failure of Bituminous Materials Due to Weathering," by Hunter, J. B., Gezemski, F. C., and Laskaris, L., *ASTM STP 94*, ASTM, 1949, pp. 144–152.



**FIG. 1 Counting Grid**

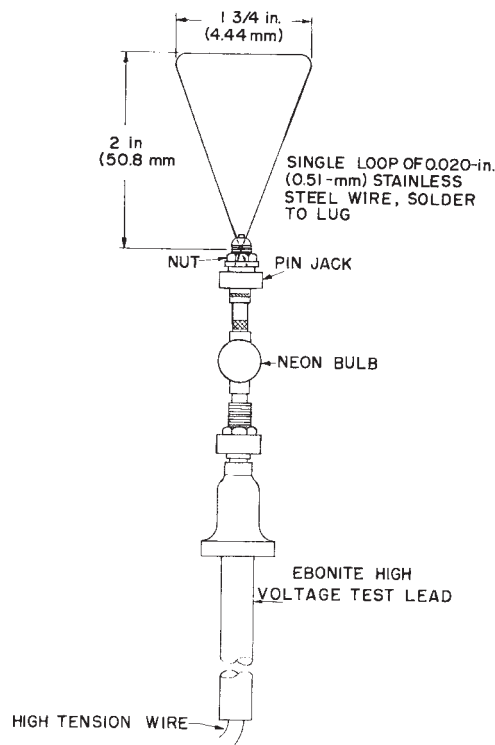
Stroke the feeler across the surface from side to side to ensure complete recording of all cracks. Then, if necessary, develop the paper in the manner of an ordinary photographic print.

6.3 Cover each photograph with the transparent counting grid so that the outer dimensions of the grid and the outer dimensions of the photographic paper are aligned, and the inner grid is centered in the area of the bituminous material. Record the number of squares in which spots appear following the guidelines shown in Fig. 3.

6.4 Continue the exposure of the panels until sparking occurs in at least 26 grid squares.

### 7. Report

7.1 Designate the failure end point of the specimen as the exposure time after which sparkthrough points first occurred in



**FIG. 2 Feeler**

26 of the grid squares. This number of failure points is equivalent to a 10 % failure.

### 8. Precision <sup>5</sup>

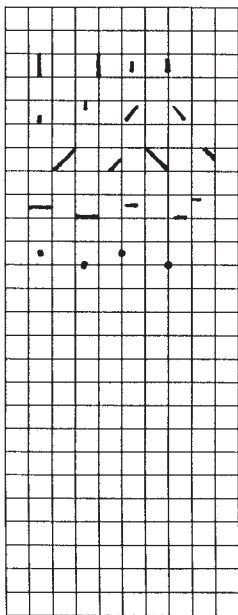
8.1 The following criterion shall be used for judging the acceptability of results (95 % probability):

8.1.1 The values reported by each of two laboratories, representing the arithmetic average of duplicate determinations, shall not be considered suspect unless the reported counts differ by more than 19 %.

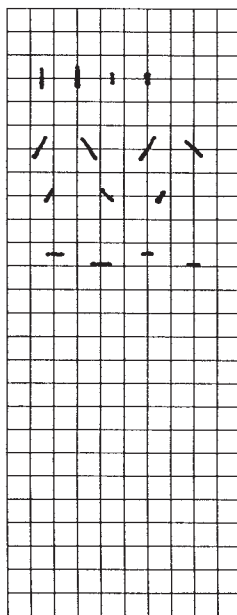
### 9. Keywords

9.1 accelerated weathering; bituminous materials; failure end point; outdoor weathering

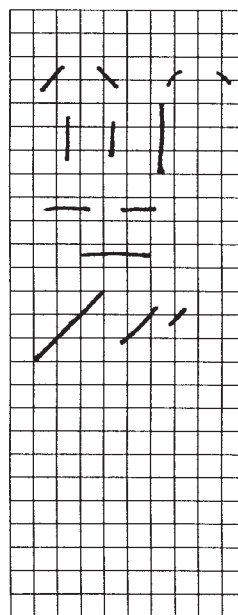
<sup>5</sup> A copy of the research report used to develop the precision statement is available from ASTM Headquarters. Request RR: D08-1009.



COUNT THESE SPOTS  
AS ONE (1)



COUNT THESE SPOTS  
AS TWO (2)



COUNT THESE SPOTS  
AS THREE (3)

**FIG. 3 Guidelines to Determine Cracks (Spots) Weathered Bituminous Films**

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