Standard Test Method for
Failure End Point in Accelerated and Outdoor Weathering of
Bituminous Materials

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 (ε) 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, 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 cut to the dimen-
sions 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\(\frac{1}{2}\) by 5\(\frac{1}{2}\) (69.9 by 149.1) or panel size |
| Grid dimensions, in. (mm)    | 1\(\frac{1}{2}\) by 4\(\frac{1}{4}\) (47.6 by 127.8) |
| Number of squares in grid    | 260 (10 by 26) |
| Size of squares, in. (mm)    | \(\frac{3}{4}\) (4.76) |

5. Calibration of the Spark-Generating Apparatus

5.1 Voltage—Calibrate the peak voltage of the spark genera-
tor to 5 ± 0.5 kV according to the manufacturer’s instruc-
tions.

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
eedge. 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 spark-through points on
any panel is less than 15, at least \(\frac{3}{4}\) 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. The
complete passage from top to bottom shall be within 5 to 10 s.
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

---

1 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.
published as D 1670 – 59 T. Last previous edition D 1670 – 90 (1994)\(^\epsilon\).

2 The sole source of supply of the apparatus known to the committee at this time is
Electrotechnic 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, which you may attend.

3 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.

4 A discussion of the photographic method of recording failures is given in “A
New Method for Evaluating Failure of Bituminous Materials Due to Weathering,”
144–152.
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 26 of the grid squares. This number of failure points is equivalent to a 10% failure.

8. Precision

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

---

5 A copy of the research report used to develop the precision statement is available from ASTM Headquarters. Request RR: D08-1009.
FIG. 3 Guidelines to Determine Cracks (Spots) Weathered Bituminous Films

COUNT THESE SPOTS AS ONE (1)
COUNT THESE SPOTS AS TWO (2)
COUNT THESE SPOTS AS THREE (3)

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.