



Designation: D 4986 – 98

Standard Test Method for Horizontal Burning Characteristics of Cellular Polymeric Materials¹

This standard is issued under the fixed designation D 4986; 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 fire-test-response test method describes a small-scale horizontally oriented burning test procedure for comparing the relative rate of burning and the extent and time of burning of cellular polymeric materials having a density less than 250 kg/m³.

1.2 The classification system described in the Appendix X1 is intended for quality assurance and the preselection of component materials for products.

1.3 *This standard measures and describes the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire hazard or fire risk assessment of the materials, products, or assemblies under actual fire conditions.*

1.4 *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. For a specific hazard statement, see Note 2.*

NOTE 1—This test method and ISO 9772 are equivalent. [ASTM D4986](https://standards.iteh.ai/catalog/standards/sist/451032dd-c)

2. Referenced Documents

2.1 ASTM Standards:

D 4483 Practice for Determining Precision for Test Method Standards in the Rubber and Carbon Black Industries²

D 5025 Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials³

E 176 Terminology to Fire Standards⁴

E 437 Specification for Industrial Wire Cloth and Screens (Square Opening Series)⁵

2.2 ISO Standard:

ISO 9772 Cellular Plastics—Determination of Horizontal

Burning Characteristics of Small Specimens Subjected to a Small Flame⁶

3. Terminology

3.1 Definitions—For definitions of fire-related terms used in this test method, refer to Terminology E 176E 176.

3.2 afterflame time, n—the length of time for which a material continues to flame, under specified conditions, after the ignition source has been removed.

3.3 afterglow time, n—the length of time for which a material continues to glow under specified test conditions, after the ignition source has been removed or cessation of flaming, or both.

3.4 flame, vb—to undergo combustion in the gaseous phase with emission of light.

3.5 glow, n—visible light, other than from flaming, emitted by a solid undergoing combustion.

4. Summary of Test Method

4.1 This test method for measuring the burning characteristics of cellular polymeric materials employs a small standard test specimen 50 by 150 mm. The specimen is supported horizontally. One end is exposed to a specified gas flame for 60 s and the extent of burning is measured.

5. Significance and Use

5.1 This test method provides a means of measuring the time and extent of burning for cellular polymeric materials. It also provides a means of measuring burning rates for materials that continue to burn past the specified gage marks.

5.2 This test method provides a means of comparing the burning characteristics of materials of like thickness density, cell size, and skin irregularities, including the effect of falling particles of cellular polymeric materials. It may be used for quality control, specification acceptance, and for research and development. Such materials may be filled or reinforced, rigid or flexible, cut or formed.

5.3 In this test method, the specimens are subjected to one or more specific sets of laboratory fire test exposure conditions.

⁶ Available from American National Standards Institute, 11 W. 42nd Street, 13th Floor, New York, NY 10036.

*A Summary of Changes section appears at the end of this standard.

If different test conditions are substituted or if the anticipated end-use conditions are changed, it may not be possible from this test method to predict changes in the performance characteristics measured. Therefore, the results are strictly valid only for the fire test exposure conditions described in this procedure.

5.4 This test method is not intended to be a criterion for fire hazard. The fire hazard created by materials depends upon the form and end use of the material. Assessment of fire hazard includes, but is not limited to, many factors such as flame spread, burning rate, ease of ignition, fuel contribution, heat evolution, products of combustion, and others.

6. Apparatus

6.1 *Test Chamber*—A laboratory hood free of induced or forced draft during test. The hood shall be totally enclosed, with a heat-resistant transparent window for observing the test. Alternatively, the test may be conducted in a cabinet placed inside the hood. The cabinet should be constructed of noncombustible materials and should have a transparent window for observing the test. The cabinet must provide adequate ventilation for characteristic burning, but must not allow drafts across the burning specimen; therefore, a suitable damper may be necessary.

6.2 *Laboratory Burner*—Burner shall be constructed in accordance with Specification D 5025D 5025.

6.3 *Wing Top*—Wing top, having an opening 48 ± 1 mm in length by 1.3 ± 0.05 mm in width fitted to the burner. (See Fig. 1.)

6.4 *Gas Supply*—Methane gas, technical grade or natural gas having a heat content of 37 ± 1 MJ/m³ with suitable regulator and meter for uniform gas flow.

6.5 *Wire Cloth*—Low-carbon, plain, steel wire, 6.4-mm mesh of 0.90 ± 0.05 -mm wire diameter. The cloth mesh and wire diameter shall be determined in accordance with Specification E 437E 437, Appendix X3. The wire cloth shall be cut to approximately 215 by 75 mm and shall be formed to provide a 90° bend at one end, 13 mm high. (See Fig. 1.)

6.6 *Support Fixture*—Any fixture that will support the wire cloth horizontally, 13 ± 1 mm above the burner wing top and 175 ± 25 mm above the base of the test chamber. Fig. 2 shows one acceptable arrangement.

6.7 *Timing Device(s)*—Accurate to ± 1 s.

6.8 *Linear Measuring Device*—Graduated in millimeters.

6.9 *Cotton*—A supply of dry, absorbent 100 % cotton.

6.10 *Desiccator*—Containing a suitable drying agent, capable of maintaining a relative humidity not exceeding 20 % at $23 \pm 2^\circ\text{C}$.

6.11 *Conditioning Room or Chamber*—Capable of being maintained at $23 \pm 2^\circ\text{C}$ and a relative humidity of 50 ± 5 %.

6.12 *Conditioning Oven*—A full-draft circulating air oven capable of being maintained at $70 \pm 2^\circ\text{C}$.

6.13 *Dial Gage Micrometer*—For measuring thicknesses with a 650-mm² pressure ft exerting a pressure of 0.175 ± 0.035 kPa.

7. Test Specimen

7.1 The standard test specimen shall be 150 ± 10 by 50 ± 1 mm, in the thickness appropriate to the objectives of the determination. Specimens tested in accordance with this test method are limited to a maximum thickness of 13 mm. Materials supplied in thicknesses over 13 mm, shall be cut to 13 ± 1 mm thickness with the skin on one side.

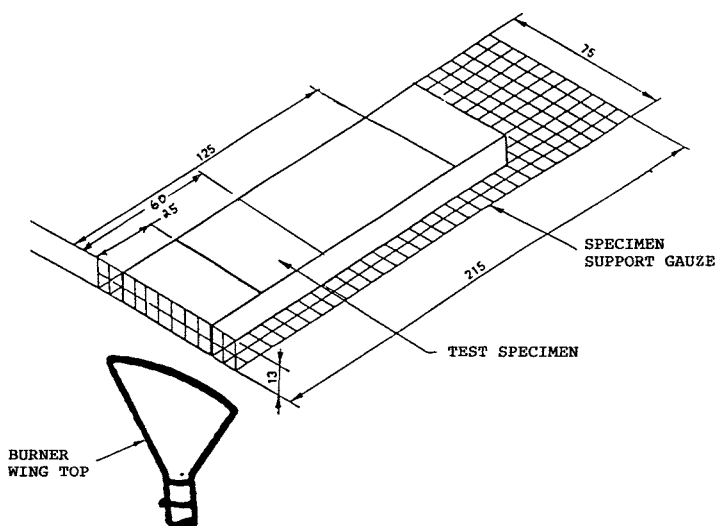
7.2 The surfaces of the specimen must be smooth and unbroken. Any loose particles shall be removed. The corner radius must not exceed 1.3 mm. Specimens with skin shall be tested skin side down.

7.3 Five specimens per type of conditioning are to be tested, ten specimens in all.

8. Conditioning

8.1 Condition specimen sets as follows:

8.1.1 Condition one set of five specimens for at least 48 h at a temperature of $23 \pm 2^\circ\text{C}$ and a relative humidity of 50 ± 5 % prior to testing.



NOTE—Dimensions in millimetres.
FIG. 1 Test Specimen and Specimen Support Gauze

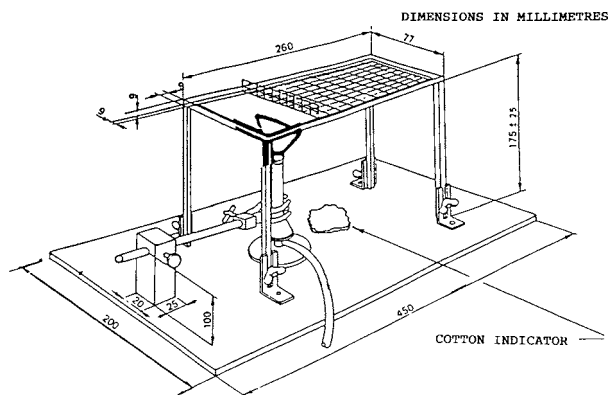


FIG. 2 Support Gauze Holder

8.1.2 Condition a second set of five specimens in a circulating air oven for 168 ± 2 h at $70 \pm 2^\circ\text{C}$, and then cool in a desiccator for at least 4 h at room temperature prior to testing.

8.2 All specimens shall be tested in a laboratory atmosphere of 15 to 35°C and 45 to 75 % relative humidity.

9. Procedure

NOTE 2—**Warning:** Conduct the burning test in an enclosed laboratory hood or cabinet free of induced or forced draft. An exhaust fan is required for removing the products of combustion which may be toxic, immediately after the test.

NOTE 3—To maintain a draft-free environment during the test, it may be necessary to install a damper in the exhaust duct which can be closed during the test.

9.1 Position the formed wire cloth in the support fixture so that the major section is horizontal and the upturned edge is nearest the burner. The bottom of the cloth shall be 13 ± 1 mm above the burner wing top and 175 mm above the base of the test chamber. Place 0.05 to 0.08 g of cotton thinned to an area approximately 75×75 mm and a maximum thickness of 6 mm, on the base of the test chamber under the front portion of the wire cloth having the upturned ends.

9.2 Mark the test specimen across its width with lines at 25 mm, 60 mm, and 125 mm from one end. Place the test specimen flat on the wire cloth with the 150 by 50-mm surface horizontal. The end of the specimen closer to the 60-mm mark is to be placed in contact with the upturned end of the wire cloth. (See Fig. 1.)

9.3 Place the burner, with wing top, remote from the specimen, ignite, and adjust it to produce a blue flame 38 mm high. Adjust the gas supply and the air ports of the burner until a yellow-tipped blue flame is produced, and then increase the air supply until the yellow tip just disappears. Measure the height of the flame, and, if necessary, readjust to obtain a flame 38 ± 2 mm high.

9.4 Place the burner under the upturned end of the wire cloth so that one edge of the flame is in line with the upturned end and the other edge of the flame extends into the front end of the specimen. (See Fig. 3.) The center of the wing top is to be in line with the longitudinal axis of the specimen.

9.5 Start the timing device(s) when the test flame is applied. Remove the flame after 60 s. Record the times when the flame reaches the 25-mm, 60-mm, or 125-mm mark, when the specimen extinguishes.

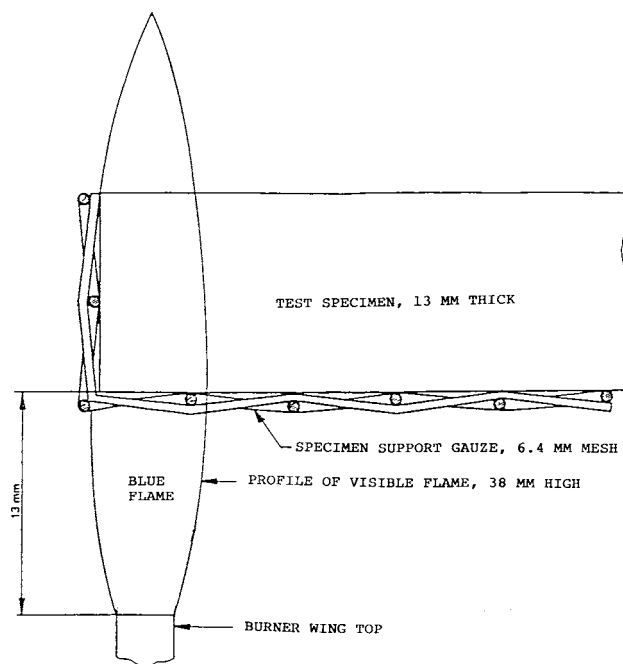


FIG. 3 Details of Flame and Relative Positions of Burner Wing Top, Test Specimen, and Specimen Support Gauze

9.6 If the specimen burns past the 125-mm mark, the time for the specimen to burn from the 25-mm mark to the 125-mm mark is to be determined. Record the time, in seconds, as the burning time, t . Calculate the burning rate as $600/t$ cm/min.

9.7 If the specimen ceases to burn, the duration of the total afterflame plus afterglow time after removal of the test flame is to be recorded. The furthest distance affected by burning (flaming plus glowing) is to be measured and recorded. Also, it is to be noted whether or not the cotton placed 175 mm below the test specimen was ignited by flaming particles.

9.8 If the specimen does not burn after removal of the test flame, record the duration of afterflame time as zero. The furthest distance affected by burning is to be measured and recorded. Note whether or not the cotton was ignited.

9.9 Repeat the procedure in 9.1 through 9.8 on the four remaining specimens for each set. If a new wire cloth is not used for each test, any material remaining on the wire cloth from previous tests is to be burned off and the wire cloth allowed to cool to room temperature before conducting the test.

NOTE 4—When the test chamber is in continuous use, heating of the chamber may affect test results.

10. Report

10.1 The complete report shall include the following:

10.1.1 *Material Identification*—The generic description, manufacturer, commercial designation, lot number, color, conditioning, density, thickness, and the presence or absence of skin.

10.1.2 The burning rate of each specimen that has burned to the 125-mm mark.

10.1.3 The duration of afterflame and afterglow time and the distance affected for each specimen.

10.1.4 Whether or not any of the specimens drip flaming particles that ignite cotton.