



Designation: **D4986 – 10 D4986 – 18**

Standard Test Method for Horizontal Burning Characteristics of Cellular Polymeric Materials¹

This standard is issued under the fixed designation D4986; 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 standard contains a test method ~~describes a small-scale horizontally oriented burning test procedure for comparing~~ for small-scale laboratory procedures to be used to determine the relative rate of burning and the extent and time of burning of horizontally oriented cellular polymeric materials having a density less than 250 kg/m³.

1.2 The results are intended to serve as a preliminary indication of their acceptability with respect to flammability for a particular application. The final acceptance of the material is dependent upon its use in the end-product that conforms with the standards applicable to such end-product.

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

1.4 *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.*

1.5 The values stated in SI units are to be regarded as standard.

1.6 *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.* For a specific hazard statement, see **Note 36.1.1**.

1.7 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.*

NOTE 1—This test method is equivalent to ISO 9772.

1.8 *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

[D883 Terminology Relating to Plastics](#)

[D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries](#)

[D5025 Specification for Laboratory Burner Used for Small-Scale Burning Tests on Plastic Materials](#)

[E176 Terminology of Fire Standards](#)

~~[E437E2016 Specification for Industrial Wire Cloth and Screens \(Square Opening Series\) \(Discontinued 2000\) Replaced by E2016 Woven Wire Cloth \(Withdrawn 2000\)](#)~~

2.2 *ISO Standard:*

[ISO 9772 Cellular Plastics—Determination of Horizontal Burning Characteristics of Small Specimens Subjected to a Small Flame](#)³

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties. Current edition approved Jan. 1, 2010; May 1, 2018. Published February 2010; June 2018. Originally approved in 1989. Last previous edition approved in 2003 as ~~D4986 – 03~~ D4986 – 10. DOI: 10.1520/D4986-10.10.1520/D4986-18.

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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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

3. Terminology

3.1 Definitions:

3.1.1 For definitions of fire-related terms used in this test method, refer to Terminology [E176](#). For definitions of terms relating to plastics in this test method, refer to Terminology [D883](#).

3.2 Definitions: Definitions of Terms Specific to This Standard:

3.1.1 For definitions of fire-related terms used in this test method, refer to Terminology [E176](#).

3.2.1 *afterflame, n*—flame that persists after the ignition source has been removed.

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

3.2.3 *afterglow, n*—persistence of glowing combustion after both removal of the ignition source and the cessation of any flaming (Terminology [E176](#)).

3.2.4 *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.

3.2.5 *flame, v*—to undergo combustion in the gaseous phase with emission of light.

3.2.6 *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 of the test specimen is exposed to a specified gas flame for 60 s and the s. The test method is used to measure the burning rate, the extent of burning is measured, and the times for afterglow and afterflame.

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 is suitable for quality control, specification acceptance, and for research and development. Examples include filled or reinforced, rigid or flexible, or cut or formed materials

5.3 In this test method, the specimens are subjected to one or more specific sets of laboratory fire test exposure conditions. If different test conditions are substituted or if the anticipated end-use conditions are changed, it is not always 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 with a minimum capacity of 0.5 m³, free of induced or forced draft during test. The hood shall be totally enclosed, testing. Use an enclosed laboratory hood with a heat-resistant transparent window for observing the test. Alternatively, conduct the test in a cabinet placed inside the hood. The cabinet shall be constructed of noncombustible materials and shall 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 is necessary in some cases. glass window. If a draft is noted with the exhaust fan off, further measures are needed to eliminate the draft, such as adding a positive closing damper. The inside surfaces of the chamber shall be of a dark color. When a light meter, facing towards the rear of the chamber is positioned in place of the test specimen, the light level shall be less than 20 lx.

6.1.1 *Warning*—Products of combustion are toxic. An exhaust fan shall be provided for removing the products of combustion immediately after the test.

6.2 *Laboratory Burner*—Burner shall be constructed in accordance with Specification [D5025](#).

6.3 *Wing Top*—Wing top, top made of copper or stainless steel, having an opening 48 ± 1 mm in length by 1.3 ± 0.05 mm in width fitted to the burner. (See [Fig. 1](#) and [Fig. 2](#).)

6.4 *Gas Supply*—Methane gas, technical grade or natural gas having a heat content of 37 ± 1 MJ/m³ Use technical-grade methane gas (min. 98 % pure) as the fuel with suitable regulator and meter for uniform gas flow.

6.4.1 The use of natural gas having an energy density of 37 ± 1 MJ/m³ has been found to provide similar results but is not acceptable as the referee gas in cases of dispute.

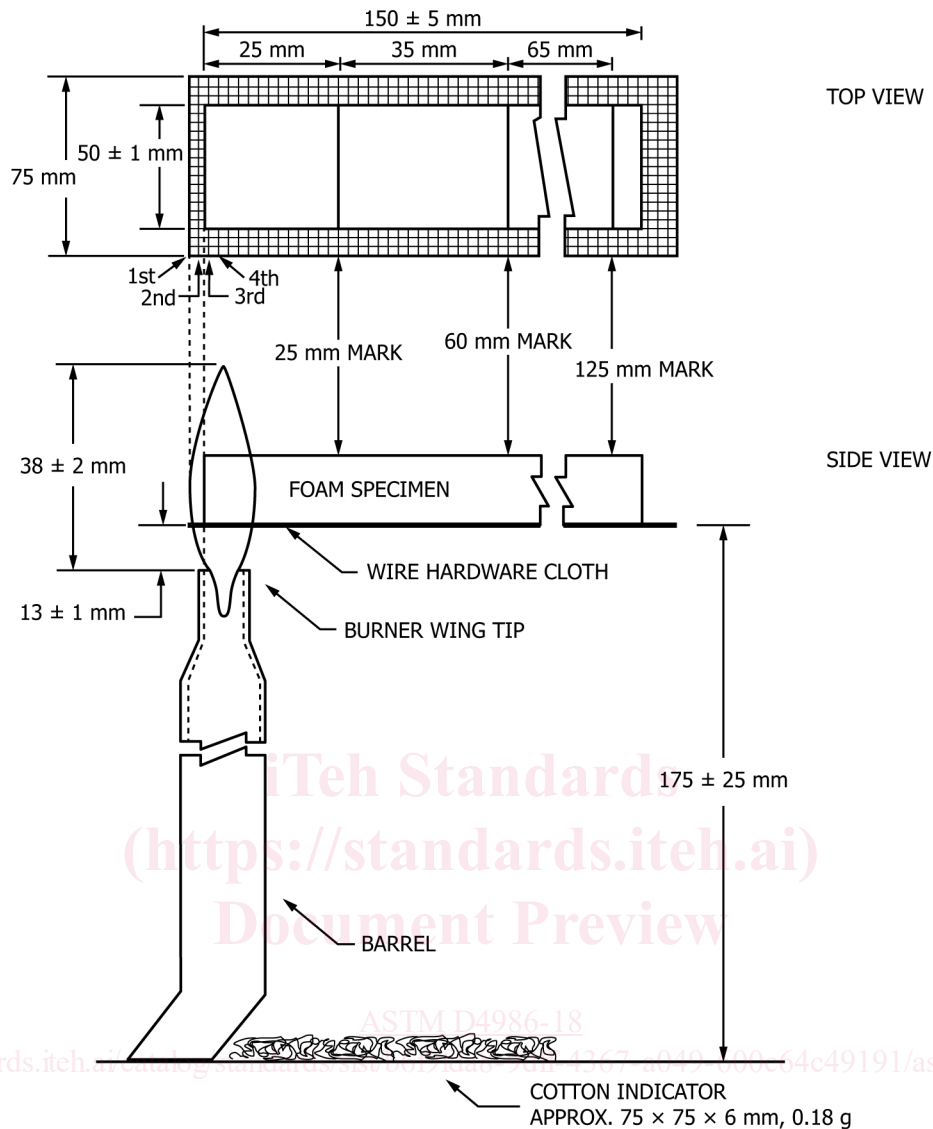


FIG. 2 — Details of Flame and Relative Positions of Burner Wing Top, Test Specimen, and Specimen Support Gauze

6.4.2 The use of other fuel gases such as butane, propane or acetylene is not suitable because they have higher energy per unit volume.

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 E437E2016, 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. Stopwatch or other suitable timing device capable of timing to the nearest 0.5 seconds.

6.8 *Linear Measuring Device*—Graduated in millimeters.

6.9 *Cotton*—A supply of dry, absorbent 100 % surgical 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 ± 10 %.

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

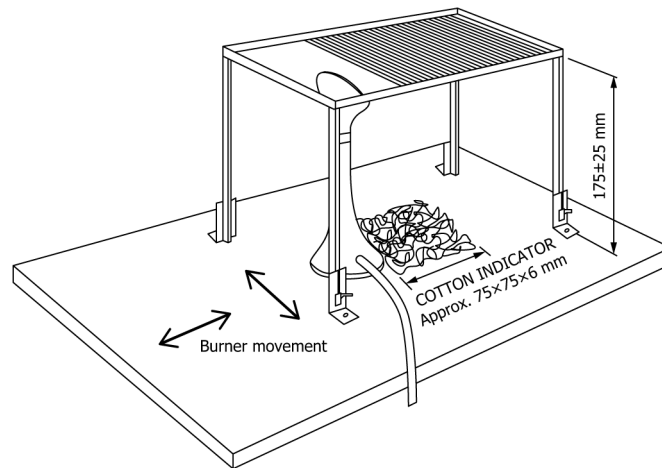


FIG. 1 —Test Specimen and Specimen-Support Gauze Holder

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

7. Test Specimen

7.1 Test specimens, for materials being considered in a range of colors, thicknesses and densities, shall have representative ranges of these colors, thicknesses and densities tested. Since the results of tests carried out on test specimens of difference colors, thicknesses, densities, molecular weights or containing different levels or amounts of additives are potentially different, the additional considerations indicated in 7.1.1 through 7.1.2 shall apply.

7.1.1 Test specimens in When conducting tests on test specimens at the minimum and maximum densities shall and melt flows, the test results shall only be considered representative of the complete range, if the test results yield the same flame test classification. If the burning characteristics are not essentially the same for all specimens representing the range, evaluation is to be limited only to the materials in the densities tested or additional test specimens in intermediate densities are to be tested to determine the range burning characteristics, including the same flame test classification.

7.1.2 Uncolored test specimens and test specimens with the highest level of organic and inorganic pigment loading by weight are considered representative of the color range, if the test results yield the same flame test classification. When certain pigments are known to affect flammability characteristics, they are also to be tested. Test specimens to be tested are those that: If the burning characteristics, including the flame test classification, are not essentially the same for all specimens representing the range tested, the test results shall be considered to apply only to those materials for which the actual color, thickness, density, molecular mass and level of additives have been tested. Additional specimens shall be tested for intermediate ranges of each property.

- (a) contain no coloring
- (b) contain the highest level of organic pigments being considered for the respective application
- (c) contain the highest level of inorganic pigments being considered for the respective application
- (d) contain pigments which are known to adversely affect flammability characteristics

7.2 The range of flammability characteristics is likely to be affected by the pigments and for each individual type of pigment, the flammability is likely to range between that corresponding to the highest level and that corresponding to no pigment. Testing as follows is required and is likely to cover the range of flammability performance:

- (a) contain no pigments (natural)
- (b) contain the highest level of organic pigments
- (c) contain the highest level of inorganic pigments
- (d) contain the highest level of carbon black (if carbon black is one of the additives in a pigment package)
- (e) contain pigments which are known to adversely affect flammability characteristics

7.3 All specimens shall be cut from a representative sample of the material. Care shall be taken to remove all dust and any particles from the surface.

7.4 The standard test specimen shall be 150 mm ± 10 mm long by 50 mm ± 1 mm wide. Materials supplied in thicknesses over 13 mm shall be cut to 13 mm ± 1 mm thickness with any skin on one side. Materials supplied in thicknesses of 13 mm or less shall be tested at the thickness supplied, without removing any skin. (See 7.67.7.) If materials with adhesive applied are to be tested, specimens having adhesive on one side only shall be used. (See 7.67.7.)

NOTE 2—Tests made on test specimens of different thicknesses, or directions of anisotropy are not comparable.