Designation: D3675 – 22

Standard Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source[1]

This standard is issued under the fixed designation D3675; 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 is a fire test response standard.

1.2 This test method describes the measurement of surface flammability of flexible cellular materials.

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

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

1.6 Specific information about hazards is given in Section 7.

NOTE 1—There is no known ISO equivalent to this standard.

1.7 The values stated in SI units are to be regarded as the standard. The values stated in inch-pound units, in parentheses, are for information only and are approximations (see also IEEE/ASTM SI-10).

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

E84 Test Method for Surface Burning Characteristics of Building Materials

E162 Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source

E176 Terminology of Fire Standards

E456 Terminology Relating to Quality and Statistics

E1317 Test Method for Flammability of Surface Finishes

E1321 Test Method for Determining Material Ignition and Flame Spread Properties

E1546 Guide for Development of Fire-Hazard-Assessment Standards

IEEE/ASTM SI-10 Standard for Use of the International System of Units (SI): The Modern Metric System

2.2 *ISO Standards:*[3]

ISO 13943 Fire Safety—Vocabulary

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms relating to plastics, the definitions in this test method are in accordance with Terminology D883. For terms relating to fire, the definitions in this test method are in accordance with Terminology E176 and ISO 13943. In case of conflict, the definitions given in Terminology E176 shall prevail. For terms relating to precision and bias and associated issues, the terms used in this test method are in accordance with the definitions in Terminology E456.

3.1.2 *flame front, n*—the leading edge of a flame propagating through a gaseous mixture or across the surface of a liquid or solid.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flashing, n*—flame fronts of three seconds or less in duration.

3.2.2 *radiant panel index, I_s, n*—the product of the flame spread factor, F_s and the heat evolution factor, Q.

4. Summary of Test Method

4.1 This test method of measuring surface flammability of flexible cellular materials employs a radiant panel heat source consisting of a 300 by 460-mm (12 by 18-in.) panel in front of

[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.

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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] Available from International Standardization Organization, P.O. Box 56, CH-1211; Geneva 20, Switzerland.

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

which an inclined 150 by 460-mm (6 by 18-in.) specimen of the material is placed. The orientation of the specimen is such that ignition is forced near its upper edge and the flame front progresses downward.

4.2 Factors derived from the rate of progress of the flame front and the rate of heat liberated by the material under test are combined to provide a radiant panel index.

5. Significance and Use

5.1 This test method is intended for use when measuring surface flammability of flexible cellular materials exposed to fire. The test method provides a laboratory test procedure for measuring and comparing the surface flammability of materials when exposed to a prescribed level of radiant heat energy. The test is conducted using specimens that are representative, to the extent possible, of the material or assembly being evaluated. For example, if an assembly is required to be tested, such specimens shall replicate the type and thickness of all the layers present in the assembly being evaluated.

5.2 The rate at which flames will travel along surfaces depends upon the physical and thermal properties of the material, product, or assembly under test, the specimen mounting method and orientation, the type and level of fire or heat exposure, the availability of air, and properties of the surrounding enclosure. **(1-6)**[4, 5]

5.3 Test Method E162 is a generic version of this test method, using an apparatus that is substantially the same as the one used in this test method. However, Test Method E162 is normally intended for application to specimens other than flexible cellular materials.

5.3.1 The pilot burner in this test method is different from the pilot burner in Test Method E162.

5.4 In this procedure, the specimens are subjected to one or more specific sets of laboratory fire test conditions. If different test conditions are substituted or the end-use conditions are changed, it is not always possible by or from this test to predict changes in the fire-test-response characteristics measured. Therefore, the results are valid only for the fire test exposure conditions described in this procedure.

5.5 If the test results obtained by this test method are to be considered as part of an overall assessment of fire hazard in a building or structure, then the criteria, concepts and procedures incorporated into Guide E1546 shall be taken into consideration.

6. Apparatus

6.1 The apparatus shall be essentially as shown in Fig. 1 and shall include the following:

6.1.1 *Radiant Panel with Air and Gas Supply*—The radiant heat energy source shall be a panel that consists of a porous material mounted in a suitable frame, exposing a radiating surface of 300 by 460 mm (12 by 18 in.). The radiant heat energy source shall be capable of operating at temperatures up to 820°C (1500°F). The panel shall be equipped (see Fig. 1) with a venturi-type aspirator for mixing gas and air at approximately atmospheric pressure; a centrifugal blower, or equivalent, capable of providing 9.4 dm^3/s (1200 ft^3/hour) air at a pressure of 0.7 kPa (2.8 in. water); an air filter to prevent dust from obstructing the panel pores; a pressure regulator and a control and shut-off valve for the gas supply.

6.1.2 *Specimen Holder*—The specimen holder shall conform in shape and dimension to Fig. 2 and be constructed from heat-resistant chromium steel, or other suitable noncombustible material which will not be affected by the heat input during the test. Observation marks shall be filed on the surface of the specimen holder to correspond with 75-mm (3-in.) interval lines on the specimen.

6.1.2.1 The calibration process (see A1.2) shall be conducted with the specimen holder to be used in the tests to ensure that the physical characteristics of the construction material do not affect the test results.

6.1.3 *Framework for Support of the Specimen Holder*—The framework shall have two transverse rods of stainless steel, each 12.5 mm ± 3.0 mm (0.5 ± 0.13 in.) in diameter, with a stop to center the specimen holder directly in front of the radiant panel. The support and bracing members shall be constructed from metal stock. Since the angle of the specimen and its position with respect to the panel are critical, the framework dimensions specifying these conditions shall be within 3.0 mm (0.13 in.) of the values given in Fig. 1.

6.1.4 *Pilot Burner*—The pilot burner shall be a porcelain tube 203-230 mm (8-9 in.) in length, nominally 6.3 mm (0.25 in.) in diameter, with two holes 1.5 ± 0.1 mm (0.059 ± 0.004 in.) in diameter equally spaced in the tube (see Fig. 3). The burner shall be mounted horizontally and at an angle of 15 to 20° to the intersection of the horizontal plane of the burner with the plane of the specimen with the outlet end of the burner spaced 32 ± 2 mm (1.25 ± 0.1 in.) from the specimen (see Fig. 3). The pilot shall provide a 150 to 180-mm (6 to 7-in.) flame of acetylene gas premixed with air in an aspirating type fitting. Properly adjusted, the pilot flame shall have 25-mm (1-in.) inner blue cones and should impinge on the upper central surface of the specimen within 13 mm (0.5 in.) of the edge of the specimen support frame. Flow rates of 0.015 dm^3/s (0.032 ft^3/min) of acetylene and 0.075 dm^3/s (0.16 ft^3/min) of air have been found to provide the desired flame.

6.1.5 *Stack*—The stack shall be made from nominally 1.0-mm (0.040-in.) sheet steel with shape and dimensions as shown in Fig. 1. The position of the stack with respect to the specimen and radiant heat panel shall also comply with the requirements of Fig. 1.

6.1.6 *Thermocouples*—Eight thermocouples of equal resistance shall be mounted in the stack and supported with porcelain insulators as indicated in Fig. 1 and Fig. 4. The thermocouples shall be Chromel-Alumel Type K, shielded against high heat with insulation resisting up to 1200°C (2190°F), and with wire gages in the range of 0.36-0.51 mm (0.14-0.20 in.) (30 AWG-24 AWG) diameter and shall be connected in parallel, or recorded individually and then averaged, such that a mean temperature profile of the stack is achieved. The mean stack thermocouple temperature rise for

[4] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[5] Also see Test Method E162.