Designation: E162 – 22

An American National Standard

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

This standard is issued under the fixed designation E162; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This fire-test-response standard describes the measurement of surface flammability of materials. It is not intended for use as a basis of ratings for building code purposes (see Appendix X1).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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 of products and materials is inherently hazardous, and adequate safeguards for personnel and property shall be employed in conducting these tests. This test method may involve hazardous materials, operations, and equipment. Specific information about hazard is given in Section .

NOTE 1—There is no similar or equivalent ISO standard.

1.6 *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]

C1186 Specification for Flat Fiber-Cement Sheets

C1288 Specification for Fiber-Cement Interior Substrate Sheets

D3675 Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source

E84 Test Method for Surface Burning Characteristics of Building Materials

E176 Terminology of Fire Standards

E1546 Guide for Development of Fire-Hazard-Assessment Standards

2.2 *ISO Standards*[3]

ISO 13943 Fire Safety—Vocabulary

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to the terminology contained in Terminology E176 and ISO 13943. In case of conflict, the definitions given in Terminology E176 shall prevail.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flashing, n*—flame fronts of 3 seconds or less in duration.

3.2.1.1 *Discussion*—All flame fronts, however temporary, are to be taken into account.

3.2.2 *radiant panel index, I_s, n*—the radiant panel index is 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 materials employs a radiant heat source consisting of a 12 by 18-in. (305 by 457 mm) panel, in front of which an inclined 6

[1] This test method is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.22 on Surface Burning.

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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 Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.

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

by 18-in. (152 by 457 mm) 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 A factor derived from the rate of progress of the flame front and another derived from 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 provides a laboratory test procedure for measuring and comparing the surface flammability of materials when exposed to a prescribed level of radiant heat energy. It is intended for use in measurements of the surface flammability of materials exposed to fire. The test is conducted using small specimens that are representative, to the extent possible, of the material or assembly being evaluated. (Example: in terms of their thickness, layering, and any potential substrate.)

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.[4-7]

5.3 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.

5.4 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 example criteria, concepts and procedures incorporated into Guide E1546 shall be taken into consideration.

6. Apparatus

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

6.1.1 *Radiant Panel with Air and Gas Supply*—The radiant heat energy source shall be a panel of a porous material mounted in a cast iron or steel frame, exposing a radiating surface of 12 by 18 in. (305 by 457 mm) and shall be capable of operating at temperatures up to 1500 °F (815 °C). 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 1200 ft^3/h (9.4 L/s) air at a pressure of 2.8 in. of water (700 Pa); 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. Observation marks shall be filed on the surface of the specimen holder to correspond with 3-in. (76 mm) interval lines on the specimen.

6.1.3 *Framework for Support of the Specimen Holder*—The framework shall have two transverse rods of stainless steel, each 0.50 ± 0.13 in. (12.7 ± 3.3 mm) 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 0.125 in. (3.2 mm) of the values given in Fig. 1.

6.1.4 *Pilot Burner*—The pilot burner shall be a length of stainless steel tubing approximately 8 in. to 9 in. (203 mm to 229 mm) long with nominally 0.125 in. (3.2 mm) inside diameter by nominally 0.19 in. (4.8 mm) outside diameter. As an option, to prolong the service life of the pilot burner, the part of the burner that is exposed to radiant energy can be protected with a porcelain tube nominally 0.20 in. (5.2 mm) inside diameter by nominally 0.28 in. (7.14 mm) outside diameter. The burner shall be mounted horizontally and at a slight angle to the intersection of the horizontal plane of the burner with the plane of the specimen. The burner shall also be capable of being moved out of position when not in use. The pilot shall provide a 2 in. to 3 in. (51 mm to 76 mm) flame of acetylene gas premixed with air in an aspirating type fitting. The position of the burner tip shall be such that the pilot flame shall contact or shall be within 0.5 in. (12.7 mm) of contacting the upper central surface of the specimen.

6.1.5 *Stack*—The stack shall be made from nominally 0.040 in. (1.0 mm) 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 and connected in parallel shall be mounted in the stack and supported with porcelain insulators as indicated in Fig. 1 and Fig. 3. The thermocouples shall be Chromel-Alumel Type K, shielded against high heat with insulation resisting up to 2190 °F (1200 °C), and with wire gauges in the range of 0.014 in. to 0.020 in. (0.36 mm to 0.51 mm; 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 unit heat input rate of the calibration burner shall be determined periodically for the specific test apparatus, using the procedure in Annex A1.

6.1.7 *Data Collection System*—For collecting test data, use one of the following:

[4] Robertson, A. F., "Surface Flammability Measurements by the Radiant Panel Method," *Symposium on Fire Test Methods, ASTM STP 344*, ASTM, 1962, pp. 33–46.

[5] Robertson, A. F., Gross, D., and Loftus, J., "A Method for Measuring Surface Flammability of Materials Using a Radiant Energy Source," *Proceedings*, ASTM, Vol 56, 1956, pp. 1437–1453.

[6] Gross, D. and Loftus, J. J., "Surface Flame Propagation on Cellulosic Materials Exposed to Thermal Radiation," *Journal of Research*, NBS, Vol 67C, 1963, pp. 251–258.

[7] Magee, R. S. and McAlevy III, R. F., "The Mechanism of Flame Spread," *Journal of Fire and Flammability*, Vol 2, 1971, pp. 271–297.