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An American National Standard

Standard Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies[1]

This standard is issued under the fixed designation E2257; 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 is intended to evaluate, under specified fire-exposure conditions, the contribution to room fire growth provided by wall or ceiling materials and assemblies, or both. The method is not intended to evaluate the fire endurance of assemblies or fires originating in the wall assembly. The method provides a means to evaluate the effectiveness of thermal barriers in restricting the contribution of combustible materials in the wall assembly to fire growth in a room fire.

1.3 This test method, simulating a fire in the corner of a 2420 mm by 3630 mm (8 ft by 12 ft) room containing a single open doorway, provides a means to evaluate the relative performance of specified wall and ceiling materials or assemblies when they are used together in the same relationship within an enclosure, and simulating the manner in which they will be used.

1.4 This test method is intended to evaluate the contribution to fire growth provided by a surface product using a specified ignition source. It shall, however, be noted that the type, position and heat output of the ignition source will considerably influence fire growth. The thermal exposure conditions from the ignition source specified in this method will result in flashover during the 20 min duration for many common finish materials, in particular if specimens are mounted on the walls and the ceiling (standard configuration).

1.5 This test method provides a means for evaluating wall and ceiling finish materials and assemblies, including panels, tiles, boards, sprayed or brushed coatings, etc. This test method is not intended to evaluate flooring materials or furnishings.

1.6 This method shall be used in conjunction with Guide E603, which covers instrumentation and the general effect of various parameters, and Guide E2067, which deals with full-scale oxygen consumption calorimetry.

1.7 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.8 The text of this standard references notes and footnotes which provide explanatory information. These notes and footnotes (excluding those in figures) shall not be considered as requirements of the standard.

1.9 This standard is used to measure and describe 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.

1.10 *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.*

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

1.12 *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]

E84 Test Method for Surface Burning Characteristics of Building Materials

E136 Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C

E176 Terminology of Fire Standards

E603 Guide for Room Fire Experiments

E906/E906M Test Method for Heat and Visible Smoke

[1] This test method is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.21 on Smoke and Combustion Products.

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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.

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

Release Rates for Materials and Products Using a Thermopile Method
E1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
E2067 Practice for Full-Scale Oxygen Consumption Calorimetry Fire Tests

2.2 *ISO Standards:*
ISO 9705 Fire Tests—Reaction to Fire—Room Fire Test[3]
ISO 13943 Fire Safety—Vocabulary[3]

2.3 *NFPA Standards:*
NFPA 265 Standard Method of Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings[4]
NFPA 286 Standard Method of Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology E176 and ISO 13943. In case of conflict, the definitions given in Terminology E176 shall prevail.

3.1.1 *assembly, n*—a unit or structure composed of a combination of materials or products, or both. **E176**

3.1.2 *flashover, n*—the rapid transition to a state of total surface involvement in a fire of combustible materials within an enclosure.

3.1.2.1 *Discussion*—Flashover is a fluid-mechanical combustion instability within an enclosure that occurs when the surface temperatures of an enclosure and its contents rise rapidly, producing combustible gases and vapors, and the enclosure heat flux becomes sufficient to heat these gases and vapors to their ignition temperatures. At flashover, the volume occupied by hot combustion gases rapidly increases and ends up comprising more than 50 % of the enclosure's volume. Experimentally it is found that flashover occurs when the upper gas layer temperature surpasses 600 °C or when the radiant heat flux at the floor surpasses 20 kW/m^2. Visually, flashover often corresponds to a transition from flaming on a few surfaces to flames throughout the volume of the enclosure. **E176**

3.1.3 *heat flux, n*—heat transfer to a surface per unit area, per unit time.

3.1.3.1 *Discussion*—The heat flux from an energy source, such as a radiant heater, can be measured at the initiation of a test (such as Test Method E1354 or Test Method E906/E906M) and then reported as the initial test heat flux, with the understanding that the burning of the test specimen can generate additional heat flux to the specimen surface. The heat flux can also be measured at any time during a fire test, for example as described in Guide E603, on any surface, and with measurement devices responding to radiative and convective fluxes. Typical units are kW/m^2 , W/cm^2 , or BTU/(s ft^2). **E176**

3.1.4 *heat release rate, n*—the thermal energy released per unit time by an item during combustion under specified conditions. **E176**

3.1.5 *optical density of smoke, n*—a measure of the attenuation of a light beam through smoke, expressed as the common logarithm of the ratio of the incident flux, I_0, to the transmitted flux, I. **E176**

3.1.6 *oxygen consumption principle, n*—the expression of the relationship between the mass of oxygen consumed during combustion and the heat released. **E176**

3.1.7 *smoke, n*—the airborne solid and liquid particulates and gases evolved when a material undergoes pyrolysis or combustion.

3.1.7.1 *Discussion*—So-called chemical smokes are excluded from this definition. **E176**

3.1.8 *smoke obscuration, n*—reduction of light transmission by smoke, as measured by light attenuation. **E176**

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *specimen, n*—representative piece of the product, which is to be tested together with any substrate or treatment.

4. Summary of Test Method

4.1 This method uses a gas burner to produce a diffusion flame in contact with the walls and ceiling in the corner of a 2420 mm by 3630 mm by 2420 mm (8 ft by 12 ft by 8 ft) high room. The burner produces a prescribed net rate of heat output of 100 kW (5690 Btu/min) during the first 10 min, followed by 300 kW (17 060 Btu/min) during the next 10 min. The contribution of the wall and ceiling materials or assemblies to fire growth is measured in terms of the time history of the incident heat flux on the center of the floor, the time history of the temperature of the gases in the upper part of the room, the time to flashover, and the rate of heat release. The test is conducted with natural ventilation to the room provided through a single doorway 780 mm by 2015 mm (30 in. by 80 in.) in width and height. The combustion products are collected in a hood feeding into a plenum connected to an exhaust duct in which measurements are made of the gas velocity, temperature, light obscuration, and concentrations of oxygen, carbon dioxide, and carbon monoxide.

5. Significance and Use

5.1 This fire test is applicable to a description of certain fire performance characteristics in appraising wall and ceiling materials, products, or systems under specified fire-exposure conditions in an enclosure. The test indicates the maximum extent of fire growth in a room, the rate of heat release, and if they occur, the time to flashover, and the time to flame extension beyond the doorway following flashover. It determines the extent to which the wall and ceiling materials or assemblies contribute to fire growth in a room and the potential for fire spread beyond the room, under the particular conditions simulated. It does not measure the contribution of the room contents. (See Appendix X1, Commentary.)

5.2 Flashover shall be considered to have occurred when any two of the following conditions have been attained:

(a) Heat release rate exceeds 1 MW.

[3] Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland.

[4] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101.