



Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber, With the Test Specimen Oriented Horizontally¹

This standard is issued under the fixed designation E1995; 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 provides a means of measuring smoke obscuration resulting from subjecting essentially flat materials, products, or assemblies (including surface finishes), not exceeding 25 mm (1 in.) in thickness, in a horizontal orientation, exposed to specified levels of thermal irradiance, from a conical heater, in the presence of a pilot flame, in a single closed chamber. Optional testing modes exclude the pilot flame.

NOTE 1—The equipment used for this test method is technically equivalent to that used in ISO 5659-2 and in NFPA 270.

1.3 The principal fire-test-response characteristic obtained from this test method is the specific optical density of smoke from the specimens tested, which is obtained as a function of time, for a period of 10 min.

1.4 An optional fire-test-response characteristic measurable with this test method is the mass optical density (see [Annex A1](#)), which is the specific optical density of smoke divided by the mass lost by the specimens during the test.

1.5 The fire-test-response characteristics obtained from this test are specific to the specimen tested, in the form and thickness tested, and are not an inherent property of the material, product, or assembly.

1.6 This test method does not provide information on the fire performance of the test specimens under fire conditions other than those conditions specified in this test method. For limitations of this test method, see [5.5](#).

1.7 Use the SI system of units in referee decisions; see [IEEE/ASTM SI-10](#). The inch-pound units given in parentheses are for information only.

1.8 *This test method 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.

1.9 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. See also [6.2.1.2](#), Section 7, and [11.7.2](#).

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 *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

[D2843](#) Test Method for Density of Smoke from the Burning or Decomposition of Plastics

[D4100](#) Test Method for Gravimetric Determination of Smoke Particulates from Combustion Of Plastic Materials (Withdrawn 1997)³

[D5424](#) Test Method for Smoke Obscuration of Insulating Materials Contained in Electrical or Optical Fiber Cables When Burning in a Vertical Cable Tray Configuration

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

E84 Test Method for Surface Burning Characteristics of Building Materials
E176 Terminology of Fire Standards
E603 Guide for Room Fire Experiments
E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
E906 Test Method for Heat and Visible Smoke 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
E1474 Test Method for Determining the Heat Release Rate of Upholstered Furniture and Mattress Components or Composites Using a Bench Scale Oxygen Consumption Calorimeter
E1537 Test Method for Fire Testing of Upholstered Furniture
E1590 Test Method for Fire Testing of Mattresses
IEEE/ASTM SI-10 Practice for Use of the International System of Units (SI): The Modernized Metric System
 2.2 *ANSI/AHA Standard*.⁴
A135.4 Basic Hardboard
 2.3 *ISO Standards*.⁵
ISO Guide 52—Glossary of Fire Terms and Definitions
ISO 3261 Fire Tests—Vocabulary
ISO 5659-2 Determination of Specific Optical Density by a Single-Chamber Test
ISO 5725 Precision of Test Methods—Determination of Repeatability and Reproducibility for Standard Test Method by Interlaboratory Tests
 2.4 *British Standards*.⁶
BS 6809 Method of Calibration of Radiometers for Use in Fire Testing
 2.5 *NFPA Standards*.⁷
NFPA 270 Standard Test Method for Measurement of Smoke Obscuration Using a Conical Radiant Source in a Single Closed Chamber

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology **E176** and ISO 3261. In case of conflict, the definitions given in Terminology **E176** shall prevail.

3.2 *Definitions of Terms Specific to This Standard*:

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

3.2.2 *continuous (as related to data acquisition), adj*—conducted at data collection intervals of 5s or less.

⁴ Available from American Hardboard Association, 1210 West Northwest Highway, Palatine, IL 60067, United States.

⁵ Available from International Standardization Organization, P.O. Box 56, CH-1211; Geneva 20, Switzerland, or from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁶ Available from British Standards Institute (BSI), 389 Chiswick High Rd., London W4 4AL, U.K.

⁷ Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, <http://www.nfpa.org>.

3.2.3 *essentially flat surface, n*—surface where the irregularity from a plane does not exceed ± 1 mm.

3.2.4 *exposed surface, n*—that surface of the specimen subjected to the incident heat.

3.2.5 *flaming mode, n*—the mode of testing that uses a pilot flame.

3.2.6 *ignition, n*—the initiation of combustion.

3.2.6.1 *Discussion*—The combustion may be evidenced by glow, flame, detonation, or explosion. The combustion may be sustained or transient.

3.2.7 *mass optical density, n*—the ratio of the optical density of smoke and the mass loss of the test specimen, multiplied by the volume of the test chamber and divided by the length of the light path.

3.2.7.1 *Discussion*—The mass optical density as determined in this test method is not an intrinsic material property; it is a function of the test procedure and conditions used.

3.2.8 *Nonflaming mode, n*—the mode of testing that does not use a pilot flame.

3.2.9 *sample, n*—an amount of the material, product, or assembly, to be tested, which is representative of the item as a whole.

3.2.10 *smoke obscuration, n*—the reduction in visibility due to smoke (ISO Guide 52).

3.2.11 *specimen, n*—the actual section of material, product, or assembly, to be placed in the test apparatus.

3.2.12 *time to ignition, n*—time between the start of the test and the presence of a flame on the specimen surface for a period of at least 4s.

4. Summary of Test Method

4.1 This test method assesses the reduction of light by smoke obscuration from a burning sample. The test method employs a conically-shaped, electrically-heated, radiant-energy source to produce irradiance levels of 25 and 50 kW/m², averaged over the center of the exposed surface of an essentially flat specimen, and mounted horizontally inside a closed chamber. The equipment is suitable for testing at irradiance levels of up to 50 kW/m².

4.2 The specimen is 75 by 75 mm (3 by 3 in.), at a thickness not exceeding 25 mm (1 in.) and is mounted horizontally within a holder.

4.3 The exposure is conducted in the presence or in the absence of a pilot flame (see details in 6.3.6). If a pilot flame is used for ignition, the test is deemed to be in the “flaming” mode; if a pilot flame is not used, the test is deemed to be in the “nonflaming” mode.

4.4 The test specimens are exposed to flaming or nonflaming conditions within a closed chamber. A photometric system with a vertical light path is used to measure the varying light transmission as smoke accumulates. The light transmittance measurements are used to calculate the specific optical density of the smoke generated during the test.

4.5 The specimens are exposed to two conditions, out of the four standard exposure conditions, to be chosen by the test