



Standard Test Method for Determining the Heat Release Rate and Other Fire-Test- Response Characteristics of Wall Covering or Ceiling Covering Composites Using a Cone Calorimeter¹

This standard is issued under the fixed designation E1740; 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.

INTRODUCTION

This test method provides a means for measuring the fire-test-response characteristics of wall coverings, ceiling coverings, wall covering composites, and ceiling covering composites using a bench-scale oxygen consumption calorimeter.

1. Scope*

1.1 This fire-test-response test method covers determination of the ignitability and heat release rate of composites consisting of a wall covering or ceiling covering, a substrate, and all laminating adhesives, coatings, and finishes. Heat release information cannot be used alone to evaluate the flammability of wall coverings or ceiling coverings. The data are intended to be used for modeling or with other data to evaluate a material.

1.2 This test method provides for measurement of the time to sustained flaming, heat release rate, peak and total heat release, and effective heat of combustion at a constant initial test heat flux of 35 kW/m². Heat release data at different heat fluxes are also obtained by this test method. The specimen is oriented horizontally, and a spark ignition source is used.

1.3 The fire-test-response characteristics are determined using the apparatus and procedures described in Test Method [E1354](#).

1.4 The tests are conducted on bench-scale specimens combining the components used in the actual installation.

1.5 The values stated in SI units are to be regarded as the standard. See [IEEE/ASTM SI-10](#).

1.6 Fire testing of products and materials is inherently hazardous, and adequate safeguards for personnel and property shall be used in conducting these tests. This test method potentially involves hazardous materials, operations, and equipment.

1.7 *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.*

1.8 *Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests. Specific information about hazard is given in Section 6.*

1.9 *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.*

1.10 *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

[D123](#) Terminology Relating to Textiles

[D5865/D5865M](#) Test Method for Gross Calorific Value of Coal and Coke

[E84](#) Test Method for Surface Burning Characteristics of Building Materials

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.

Current edition approved Oct. 1, 2024. Published October 2024. Originally approved in 1995. Last previous edition approved in 2022 as E1740 – 22. DOI: 10.1520/E1740-24.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- E176** Terminology of Fire Standards
- E603** Guide for Room Fire Experiments
- E906/E906M** 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
- IEEE/ASTM SI-10** American National Standard for Use of the International System of Units (SI): The Modern Metric System
- 2.2 *NFPA Standard*.³
 - NFPA 265** Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Covering
 - NFPA 286** Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
- 2.3 *ISO Standards*.⁴
 - ISO 4880** Burning Behaviour of Textiles and Textile Products—Vocabulary
 - ISO 5660-1** Reaction-to-fire Tests—Heat Release, Smoke Production and Mass Loss Rate—Part 1: Heat Release Rate (Cone Calorimeter Method) and Smoke Production Rate (Dynamic Measurement)
 - ISO 13943** Fire Safety—Vocabulary

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method and associated with fire issues, refer to Terminology **E176** and ISO 13943. The definitions given in Terminology **E176** shall prevail in case of conflict. For definitions of terms used in this test method and associated with textile issues, refer to Terminology **D123** and ISO 4880. The definitions given in Terminology **D123** shall prevail in case of conflict.

3.1.1 *effective heat of combustion, n*—the amount of heat generated per unit mass lost by a material, product, or assembly, when exposed to specific fire test conditions (see *gross heat of combustion*).

3.1.1.1 *Discussion*—The effective heat of combustion depends on the test method and is determined by dividing the measured heat release by the mass loss during a specified period of time under the specified test conditions. Typically, the specified fire test conditions are provided by the specifications of the fire test standard that cites effective heat of combustion as a quantity to be measured. For certain fire test conditions, involving very high heat and high oxygen concentrations under high pressure, the effective heat of combustion will approximate the gross heat of combustion. More often, the fire test conditions will represent or approximate certain real fire

exposure conditions, and the effective heat of combustion is the appropriate measure. Typical units are kJ/g or MJ/kg.

3.1.2 *gross heat of combustion, n*—the maximum amount of heat per unit mass that theoretically can be released by the combustion of a material, product, or assembly; it can be determined experimentally only under conditions of high pressure and in pure oxygen (contrast *effective heat of combustion*).

3.1.3 *heat flux, n*—heat transfer to a surface per unit area, per unit time (see also *initial test heat flux*).

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/m², W/cm², or BTU/(s ft²).

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

3.1.5 *ignitability*—the propensity for ignition, as measured by the time to sustained flaming, in seconds, at a specified heating flux.

3.1.6 *initial test heat flux, n*—the heat flux set on the test apparatus at the initiation of the test (see also *heat flux*).

3.1.6.1 *Discussion*—The initial test heat flux is the heat flux value commonly used when describing or setting test conditions.

3.1.7 *oxygen consumption principle*—the expression of the relationship between the mass of oxygen consumed during combustion and the heat released.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *net heat of combustion, n*—the oxygen bomb (see Test Method **D5865/D5865M**) value for the heat of combustion, corrected for gaseous state of product water.

3.2.1.1 *Discussion*—The net heat of combustion differs from the gross heat of combustion in that the former assesses the heat per unit mass generated from a combustion process that ends with water in the gaseous state while the latter ends with water in the liquid state.

3.2.2 *orientation*—the plane in which the exposed face of the specimen is located during testing, which is horizontal facing up for this test.

3.2.3 *sustained flaming*—the existence of flame on or over the surface of the specimen for periods of 4 s or more.

3.2.4 *wall or ceiling covering, n*—a textile-, paper-, or polymeric (including vinyl)-based product designed to be attached to a wall or ceiling surface for decorative or acoustical purposes.

3.2.4.1 *Discussion*—Wall or ceiling coverings with ink or topcoat layers added as part of the manufacturing process are included in this definition.

³ Available from National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-9101.

⁴ Available from International Standardization Organization, P.O. Box 56, CH-1211, Geneva 20, Switzerland.