



Standard Guide for Room Fire Experiments¹

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INTRODUCTION

This guide has been written to assist those planning to conduct full-scale compartment fire experiments. There are many issues that should be resolved before such an experimental program is initiated, and this guide is written with the objective of identifying some of these issues and presenting considerations that will affect each choice of procedure.

This guide deals with any or all stages of fire growth in a compartment. Whether it is a single- or multi-room experiment, observations can be made from ignition to flashover or beyond full-room involvement.

One major reason for conducting research on room fires is to learn about the room fire buildup process so the results of standard fire test methods can be related to performance in full-scale room fires, allowing the further refinement of these test methods or development of new ones.

Another reason concerns computer fire modeling. Full-scale tests can generate data needed for modeling. Comparisons of modeling with full-scale test results can serve to validate the model.

The various results among room fire tests reflect different experimental conditions. The intent of this guide is to identify these conditions and discuss their effects so meaningful comparisons can be made among the room fire experiments conducted by various organizations.

1. Scope

1.1 This guide addresses means of conducting full-scale fire experiments that evaluate the fire-test-response characteristics of materials, products, or assemblies under actual fire conditions.

1.2 It is intended as a guide for the design of the experiment and for the use and interpretation of its results. The guide is also useful for establishing laboratory conditions that simulate a given set of fire conditions to the greatest extent possible.

1.3 This guide allows users to obtain fire-test-response characteristics of materials, products, or assemblies, which are useful data for describing or appraising their fire performance under actual fire conditions.

1.3.1 The results of experiments conducted in accordance with this guide are also useful elements for making regulatory decisions regarding fire safety requirements. The use for regulatory purposes of data obtained from experiments conducted using this guide requires that certain conditions and criteria be specified by the regulating authority.

¹ This guide 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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1.4 The rationale for conducting room fire experiments in accordance with this guide is shown in 1.5 – 1.8.

1.5 Room fire experiments are a means of generating input data for computer fire models and for providing output data with which to compare modeling results.

1.6 One of the major reasons for conducting room fire experiments is as an experimental means of assessing the potential fire hazard associated with the use of a material or product in a particular application. This should be borne in mind when designing nonstandard experiments.

1.7 A rationale for conducting room fire experiments is the case when smaller-scale fire tests inadequately represent end-use applications.

1.8 A further rationale for conducting room fire experiments is to verify the results obtained with smaller scale tests, to understand the scaling parameters for such tests.

1.9 Room fire tests can be placed into four main categories: reconstruction, simulation, research, and standardization.

1.10 *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*

1.11 *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.*

1.12 *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

- D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials
- D4444 Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters
- D5424 Test Method for Smoke Obscuration of Insulating Materials Contained in Electrical or Optical Fiber Cables When Burning in a Vertical Cable Tray Configuration
- D5537 Test Method for Heat Release, Flame Spread, Smoke Obscuration, and Mass Loss Testing of Insulating Materials Contained in Electrical or Optical Fiber Cables When Burning in a Vertical Cable Tray Configuration
- E176 Terminology of Fire Standards
- E800 Guide for Measurement of Gases Present or Generated During Fires
- E906 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using a Thermopile Method
- E1321 Test Method for Determining Material Ignition and Flame Spread Properties
- E1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
- E1355 Guide for Evaluating the Predictive Capability of Deterministic Fire Models
- E1537 Test Method for Fire Testing of Upholstered Furniture
- E1590 Test Method for Fire Testing of Mattresses
- E1822 Test Method for Fire Testing of Stacked Chairs
- E2067 Practice for Full-Scale Oxygen Consumption Calorimetry Fire Tests
- E2257 Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies
- E3057 Test Method for Measuring Heat Flux Using Directional Flame Thermometers with Advanced Data Analysis Techniques

2.2 UL Standards:³

- UL 1040 Fire Test of Insulated Wall Construction
- UL 1715 Fire Test of Interior Finish Material

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 Underwriters Laboratories, Inc., 333 Pfingsten Rd., Northbrook, IL 60062.

2.3 ICBO Standards:⁴

- Uniform Building Code Standard UBC 8-2 Standard Test Method for Evaluating Room Fire Growth Contribution of Textile Wallcoverings (now withdrawn)
- Uniform Building Code Standard UBC 26-3 Room Fire Test Standard for Interior of Foam Plastic Systems (now withdrawn)

2.4 FM Standard:⁵

- FM Approval 4880 (2017) Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials

2.5 ISO Standards:⁶

- ISO 9705-1 (2016) Reaction to Fire Tests—Room Corner Test for Wall and Ceiling Lining Products — Part 1: Test Method for A Small Room Configuration
- ISO 13943 Fire Safety—Vocabulary
- ISO/IEC 17025 (2017) Testing and Calibration Laboratories
- GUM, Guide to the Expression of Uncertainty in Measurement

2.6 NFPA Standards:⁷

- NFPA 265 Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings
- NFPA 286 Standard Method of Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
- NFPA 555 Guide on Methods for Evaluating Potential for Room Flashover

2.7 Other Standard:⁸

- DASMA 107 (2018) Standard for Rolling Sheet Doors

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide and associated with fire issues, refer to the terminology contained in Terminology E176 and ISO 13943. In case of conflict, the terminology in Terminology E176 shall prevail.

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

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

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

3.1.5 *total heat released, n*—integrated value of the rate of heat release, for a specified time period.

3.2 Definitions of Terms Specific to This Standard:

⁴ The issuing organization, the International Conference of Building Officials, no longer exists.

⁵ Available from Factory Mutual Research Corporation, 1151 Boston-Providence Turnpike, P.O. Box 9102, Norwood, MA 02662.

⁶ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

⁷ Available from National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

⁸ Available from Door and Access Systems Manufacturers Association International, 1300 Summer Avenue, Cleveland, OH 44115-2851.