

NFPA 253

Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

2006 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA DOCUMENTS

NOTICE AND DISCLAIMER OF LIABILITY CONCERNING THE USE OF NFPA DOCUMENTS

NFPA codes, standards, recommended practices, and guides, of which the document contained herein is one, are developed through a consensus standards development process approved by the American National Standards Institute. This process brings together volunteers representing varied viewpoints and interests to achieve consensus on fire and other safety issues. While the NFPA administers the process and establishes rules to promote fairness in the development of consensus, it does not independently test, evaluate, or verify the accuracy of any information or the soundness of any judgments contained in its codes and standards.

The NFPA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making this document available, the NFPA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is the NFPA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

The NFPA has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does the NFPA list, certify, test or inspect products, designs, or installations for compliance with this document. Any certification or other statement of compliance with the requirements of this document shall not be attributable to the NFPA and is solely the responsibility of the certifier or maker of the statement.

ADDITIONAL NOTICES AND DISCLAIMERS

Updating of NFPA Documents

Users of NFPA codes, standards, recommended practices, and guides should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of Tentative Interim Amendments. An official NFPA document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments and any Errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments or corrected through the issuance of Errata, consult appropriate NFPA publications such as the National Fire Codes® Subscription Service, visit the NFPA website at www.nfpa.org, or contact the NFPA at the address listed below.

Interpretations of NFPA Documents

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Patents

The NFPA does not take any position with respect to the validity of any patent rights asserted in connection with any items which are mentioned in or are the subject of NFPA codes, standards, recommended practices, and guides, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on these documents. Users of these documents are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

NFPA adheres to applicable policies of the American National Standards Institute with respect to patents. For further information contact the NFPA at the address listed below.

Law and Regulations

Users of these documents should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of its codes, standards, recommended practices, and guides, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

This document is copyrighted by the NFPA. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of safe practices and methods. By making this document available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to this document.

Use of NFPA documents for regulatory purposes should be accomplished through adoption by reference. The term “adoption by reference” means the citing of title, edition, and publishing information only. Any deletions, additions, and changes desired by the adopting authority should be noted separately in the adopting instrument. In order to assist NFPA in following the uses made of its documents, adopting authorities are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. For technical assistance and questions concerning adoption of NFPA documents, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA codes, standards, recommended practices, and guides and all requests for information on NFPA procedures governing its codes and standards development process, including information on the procedures for requesting Formal Interpretations, for proposing Tentative Interim Amendments, and for proposing revisions to NFPA documents during regular revision cycles, should be sent to NFPA headquarters, addressed to the attention of the Secretary, Standards Council, NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

For more information about NFPA, visit the NFPA website at www.nfpa.org.

Copyright © 2005, National Fire Protection Association, All Rights Reserved

NFPA 253

Standard Method of Test for

Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

2006 Edition

This edition of NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, was prepared by the Technical Committee on Fire Tests and acted on by NFPA at its June Association Technical Meeting held June 6–10, 2005, in Las Vegas, NV. It was issued by the Standards Council on July 29, 2005, with an effective date of August 18, 2005, and supersedes all previous editions.

This edition of NFPA 253 was approved as an American National Standard on August 18, 2005.

Origin and Development of NFPA 253

Experience suggests that during the early stages of a fire floor covering systems seldom act as a fire spread medium. However, in a few fires involving multiple-occupancy buildings, the floor covering materials in corridors were primarily responsible for fire spread over a considerable distance. Those situations caused grave concern and pointed to the need for a realistic test to evaluate the flame spread of floor covering systems.

The inception of the flooring radiant panel test was at the Armstrong Cork Company in 1966. In 1972, conceptualization of critical radiant flux (W/cm^2 at extinguishment) as a measure of flame spread hazard was underway at the National Bureau of Standards (NBS). It was determined in the course of NBS work on model corridor fire tests that the radiant energy levels incident on the floor covering had a considerable influence on whether or not flaming combustion would propagate. Accordingly, it was natural to apply the critical radiant flux concept, and, in 1973, the NBS prepared a draft of the flooring radiant panel test.

In 1975, the Technical Committee on Fire Tests began its evaluation of the proposed test methods, which culminated in the adoption of the test as an official NFPA standard in May 1978. The standard was revised in 1984 and 1990.

The 1995 edition included significant improvements based on work conducted by the National Institute of Standards and Technology (NIST) and the carpet industry. Those findings improved the overall application of the standard and provided measured improvement in test precision. Other changes included a new pilot burner and reduction of the variation in the airflow through the chamber, which reduced the variability of data. Revisions also were made to eliminate “permissive” language. The revisions created closer harmony with ASTM E 648, *Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source*.

The 2000 edition was a reconfirmation of the 1995 edition.

The 2006 edition includes a complete editorial rewrite for compliance with the *Manual of Style for NFPA Technical Committee Documents*. Further organizational and editorial changes were made to clarify the requirements of the test method. Provisions regarding safety precautions were moved to the annexes, and additional details were provided on simulating a concrete floor during the test.

Technical Committee on Fire Tests

William E. Fitch, *Chair*

Omega Point Laboratories Inc., TX [RT]

Jesse J. Beitel, Hughes Associates, Inc., MD [SE]
April L. Berkol, Starwood Hotels & Resorts Worldwide, Inc., NY [U]
 Rep. American Hotel & Lodging Association
Robert G. Bill, Jr., FM Global, MA [I]
John A. Blair, The Dupont Company, DE [M]
 Rep. Society of the Plastics Industry Inc.
Gordon H. Damant, Inter-City Testing & Consulting Corp. of California, CA [SE]
Thomas W. Fritz, Armstrong World Industries, Inc., PA [M]
Pravinray D. Gandhi, Underwriters Laboratories Inc., IL [RT]
James R. Griffith, Southwest Research Institute, TX [RT]
Gordon E. Hartzell, Hartzell Consulting, Inc., TX [SE]
Marcelo M. Hirschler, GBH International, CA [SE]
Alfred J. Hogan, Reedy Creek Improvement District, FL [E]
 Rep. International Fire Marshals Association

William E. Koffel, Koffel Associates, Inc., MD [SE]
James R. Lawson, National Institute of Standards & Technology, MD [RT]
Rodney A. McPhee, Canadian Wood Council, Canada [M]
Frederick W. Mowrer, University of Maryland, MD [SE]
David T. Sheppard, U.S. Department of Justice, MD [RT]
 Rep. American Forest & Paper Association
Kuma Sumathipala, American Forest & Paper Association, DC [M]
T. Hugh Talley, Hugh Talley Company, TN [M]
 Rep. Upholstered Furniture Action Council
Rick Thornberry, The Code Consortium, Inc., CA [SE]
Robert A. Wessel, Gypsum Association, DC [M]
Robert J. Wills, American Iron and Steel Institute, AL [M]
Peter J. Willse, GE Global Asset Protection Services, CT [I]

Alternates

Robert M. Berhinig, Underwriters Laboratories Inc., IL [RT]
 (Alt. to P. D. Gandhi)
Delbert F. Boring, Jr., American Iron and Steel Institute, OH [M]
 (Alt. to R. J. Wills)
Richard J. Davis, FM Global, MA [I]
 (Alt. to R. G. Bill, Jr.)
Sam W. Francis, American Forest & Paper Association, PA [M]
 (Alt. to K. Sumathipala)
Richard G. Gann, National Institute of Standards and Technology, MD [RT]
 (Alt. to J. R. Lawson)
Paul A. Hough, Armstrong World Industries, Inc., PA [M]
 (Alt. to T. W. Fritz)

James K. Lathrop, Koffel Associates, Inc., CT [SE]
 (Alt. to W. E. Koffel)
James A. Milke, University of Maryland, MD [SE]
 (Alt. to F. W. Mowrer)
Arthur J. Parker, Hughes Associates, Inc., MD [SE]
 (Alt. to J. J. Beitel)
Ronald A. Schulz, GE Global Asset Protection Services, MI [I]
 (Alt. to P. J. Willse)
Ineke Van Zeeland, Canadian Wood Council, Canada [M]
 (Alt. to R. A. McPhee)
Joe Ziolkowski, American Furniture Manufacturers Association, NC [M]
 (Alt. to T. H. Talley)

Nonvoting

Robert H. Barker, American Fiber Manufacturers Association, VA [M]
 (Alt. to Nonvoting Principal)
Tod L. Jilg, Hoechst Celanese Corporation, NC [M]
 Rep. American Fiber Manufacturers Association

Rohit Khanna, U.S. Consumer Product Safety Commission, MD [C]

Milosh T. Puchovsky, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on fire testing procedures, for reviewing existing fire test standards and recommending appropriate action to NFPA, for recommending the application of and advising on the interpretation of acceptable test standards for fire problems of concern to NFPA technical committees and members, and for acting in a liaison capacity between NFPA and the committees of other organizations writing fire test standards. This Committee does not cover fire tests that are used to evaluate extinguishing agents, devices, or systems.

Contents

Chapter 1 Administration	253- 4	Chapter 7 Test Procedure	253-10
1.1 Scope	253- 4	7.1 Pretest Heating	253-10
1.2 Purpose	253- 4	7.2 Sample Mounting	253-10
1.3 Application	253- 4	7.3 Ignition of Pilot Burner	253-10
1.4 Summary of Test Method	253- 4	7.4 Flame Propagation of Specimen	253-10
Chapter 2 Referenced Publications	253- 4	7.5 Completion of Test	253-10
2.1 General	253- 4	7.6 Data Collection and Recording	253-10
2.2 NFPA Publications. (Reserved)	253- 4	7.7 Removal of Specimen	253-10
2.3 Other Publications	253- 4	7.8 Subsequent Testing	253-10
2.4 References for Extracts in Mandatory Sections. (Reserved)	253- 4	Chapter 8 Calculations	253-11
Chapter 3 Definitions	253- 5	8.1 General	253-11
3.1 General	253- 5	8.2 Formulas	253-11
3.2 NFPA Official Definitions	253- 5	Chapter 9 Report	253-11
3.3 General Definitions	253- 5	9.1 Required Information	253-11
Chapter 4 Test Apparatus	253- 6	Annex A Explanatory Material	253-11
4.1 Radiant Panel Test Apparatus	253- 6	Annex B Procedure for Calibration of Apparatus	253-11
4.2 Test Chamber	253- 6	Annex C Mounting Methods	253-12
4.3 Radiant Heat Energy Source	253- 6	Annex D Sample Data Logs	253-12
4.4 Specimen Holder	253- 7	Annex E Commentary on Critical Radiant Flux Test	253-13
4.5 Pilot Burner	253- 7	Annex F Precision and Bias	253-15
4.6 Thermocouples	253- 7	Annex G Safety Precautions	253-16
4.7 Exhaust Hood	253- 8	Annex H Informational References	253-16
4.8 Dummy Specimen	253- 8	Index	253-17
4.9 Timer	253- 9		
Chapter 5 Test Specimens	253- 9		
5.1 Sampling Procedure	253- 9		
5.2 Specimen Size and Mounting	253- 9		
5.3 Specimen Conditioning	253- 9		
Chapter 6 Radiant Heat Energy Flux Profile Standardization	253- 9		
6.1 Procedure	253- 9		

NFPA 253

Standard Method of Test for

Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

2006 Edition

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Documents." They can also be obtained on request from NFPA or viewed at www.nfpa.org/disclaimers.

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Information on referenced publications can be found in Chapter 2 and Annex H.

Chapter 1 Administration

1.1 Scope.

1.1.1 This fire test response standard describes a procedure for measuring critical radiant flux behavior of horizontally mounted floor covering systems exposed to a flaming ignition source in a graded, radiant heat energy environment within a test chamber.

1.1.2* This fire test response standard measures the critical radiant flux at flameout and provides a basis for estimating one aspect of fire exposure behavior for floor covering systems.

1.2 Purpose.

1.2.1* The standard was developed to simulate an important fire exposure component in fires that develop in corridors or exitways of buildings and is not intended for routine use in estimating flame spread behavior of floor covering in building areas other than corridors or exitways.

1.2.2 This fire test response standard is designed to provide a basis for estimating one aspect of the fire exposure behavior of a floor covering system installed in a building corridor.

1.2.3 The test environment simulates conditions that have been observed and defined in full-scale corridor experiments.

1.3 Application.

1.3.1 This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and is not to be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions.

1.3.2 The results of the test are permitted to be used as elements of a fire hazard assessment or a fire risk assessment that takes into account all factors that are pertinent to an assessment of the fire hazard or fire risk of a particular end use.

1.3.3* This standard does not purport to address all safety problems associated with its use.

1.3.4 The user of this standard is responsible to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

1.3.5 The fundamental assumption inherent in the test is that critical radiant flux is one measure of the sensitivity to flame spread of floor covering systems located in a building corridor.

1.3.6 The test is suitable for regulatory statutes, specification acceptance, design purposes, or development and research.

1.3.7 The test is applicable to floor covering system specimens that follow or simulate accepted installation practice.

1.3.8 Tests on the individual elements of a floor system are not valid for evaluation of the flooring system.

1.4 Summary of Test Method. The basic elements of the test chamber include an air-gas-fueled radiant heat energy panel inclined at 30 degrees to and directed at a horizontally mounted floor covering system specimen.

1.4.1 The radiant panel generates a radiant energy flux distribution along the 100 cm length of the test specimen from a nominal maximum of 1.0 W/cm² to a minimum of 0.1 W/cm².

1.4.2 The test is initiated by open-flame ignition from a pilot burner.

1.4.3 The distance burned to flameout is converted to W/cm² from the flux profile graph shown in Figure 1.4.3 and is reported as critical radiant flux W/cm².

1.4.4 The specimen can be mounted over underlayment or over a simulated concrete structural floor, bonded to a simulated structural floor, or otherwise mounted in a typical and representative way.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. (Reserved)

2.3 Other Publications.

2.3.1 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM Manual 7, *Manual on Quality Control of Materials*, 6th edition, 1990.

ASTM C 1186, *Standard Specification for Flat Non-Asbestos Fiber-Cement Sheets*, 2002.

ASTM E 136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2004.

ASTM E 171, *Standard Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials*, 1998.

2.3.2 Other Publication. Merriam-Webster's *Collegiate Dictionary*, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections. (Reserved)