

NFPA®

253

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

2019



IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

NFPA® codes, standards, recommended practices, and guides (“NFPA Standards”), 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 NFPA 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 NFPA Standards. The NFPA also makes no guaranty or warranty as to the accuracy or completeness of any information published herein.

In issuing and making NFPA Standards 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 NFPA Standards. 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.

REVISION SYMBOLS IDENTIFYING CHANGES FROM THE PREVIOUS EDITION

Text revisions are shaded. A **Δ** before a section number indicates that words within that section were deleted and a **Δ** to the left of a table or figure number indicates a revision to an existing table or figure. When a chapter was heavily revised, the entire chapter is marked throughout with the **Δ** symbol. Where one or more sections were deleted, a **•** is placed between the remaining sections. Chapters, annexes, sections, figures, and tables that are new are indicated with an **N**.

Note that these indicators are a guide. Rearrangement of sections may not be captured in the markup, but users can view complete revision details in the First and Second Draft Reports located in the archived revision information section of each code at www.nfpa.org/docinfo. Any subsequent changes from the NFPA Technical Meeting, Tentative Interim Amendments, and Errata are also located there.

REMINDER: UPDATING OF NFPA STANDARDS

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the “Codes & Standards” section at www.nfpa.org.

ADDITIONAL IMPORTANT NOTICES AND DISCLAIMERS CONCERNING NFPA® STANDARDS

Updating of NFPA Standards

Users of NFPA codes, standards, recommended practices, and guides (“NFPA Standards”) should be aware that these documents may be superseded at any time by the issuance of a new edition, may be amended with the issuance of Tentative Interim Amendments (TIAs), or be corrected by Errata. It is intended that through regular revisions and amendments, participants in the NFPA standards development process consider the then-current and available information on incidents, materials, technologies, innovations, and methods as these develop over time and that NFPA Standards reflect this consideration. Therefore, any previous edition of this document no longer represents the current NFPA Standard on the subject matter addressed. NFPA encourages the use of the most current edition of any NFPA Standard [as it may be amended by TIA(s) or Errata] to take advantage of current experience and understanding. An official NFPA Standard at any point in time consists of the current edition of the document, including any issued TIAs and Errata then in effect.

To determine whether an NFPA Standard has been amended through the issuance of TIAs or corrected by Errata, visit the “Codes & Standards” section at www.nfpa.org.

Interpretations of NFPA Standards

A statement, written or oral, that is not processed in accordance with Section 6 of the Regulations Governing the Development of NFPA Standards 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 referenced in, related to, or asserted in connection with an NFPA Standard. The users of NFPA Standards bear the sole responsibility for determining the validity of any such patent rights, as well as the risk of infringement of such rights, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on NFPA Standards.

NFPA adheres to the policy of the American National Standards Institute (ANSI) regarding the inclusion of patents in American National Standards (“the ANSI Patent Policy”), and hereby gives the following notice pursuant to that policy:

NOTICE: The user’s attention is called to the possibility that compliance with an NFPA Standard may require use of an invention covered by patent rights. NFPA takes no position as to the validity of any such patent rights or as to whether such patent rights constitute or include essential patent claims under the ANSI Patent Policy. If, in connection with the ANSI Patent Policy, a patent holder has filed a statement of willingness to grant licenses under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, copies of such filed statements can be obtained, on request, from NFPA. For further information, contact the NFPA at the address listed below.

Law and Regulations

Users of NFPA Standards 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

NFPA Standards are copyrighted. They are 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 these documents available for use and adoption by public authorities and private users, the NFPA does not waive any rights in copyright to these documents.

Use of NFPA Standards 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 Standards, contact NFPA at the address below.

For Further Information

All questions or other communications relating to NFPA Standards 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 standards 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; email: stds_admin@nfpa.org.

For more information about NFPA, visit the NFPA website at www.nfpa.org. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/docinfo.

Copyright © 2018 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

2019 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. It was issued by the Standards Council on November 5, 2018, with an effective date of November 25, 2018, and supersedes all previous editions.

This edition of NFPA 253 was approved as an American National Standard on November 25, 2018.

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 E648, *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 included 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.

The 2011 edition was revised to create uniformity with other fire test standards. Provisions for laminate floor mounting were added to Chapter 5.

The 2015 edition was revised to provide clarity on airflow rates and updated examples of test apparatuses.

The 2019 edition has been revised to reference the latest test methods and to address modern materials used for simulated concrete flooring.

Technical Committee on Fire Tests

Barry L. Badders, Jr., *Chair*
Intertek Testing Services, TX [RT]

Farid Alfawakhiri, American Iron and Steel Institute, IL [M]
Benjamin R. Bagwell, Glen Raven Custom Fabrics, NC [M]
Benjamin H. Caldwell, Bjarke Ingels Group (BIG), NY [SE]
Karen C. Carpenter, Southwest Research Institute, TX [RT]
Gordon H. Damant, Inter-City Testing & Consulting Corp. of California, CA [SE]
Rick D. Davis, National Institute of Standards & Technology (NIST), MD [RT]
Richard L. Day, Michigan State Fire Marshal's Office, MI [E]
Scott E. Dillon, Crane Engineering, MN [SE]
William E. Fitch, Phyrefish.com, FL [SE]
Richard G. Gann, Gaithersburg, MD [SE]
Marcelo M. Hirschler, GBH International, CA [SE]
Paul A. Hough, Armstrong World Industries, Inc., PA [M]
William E. Koffel, Koffel Associates, Inc., MD [SE]
Sergei V. Levchik, Israel Chemicals Ltd. (ICL-IP), NY [M]
 Rep. ACC-North American Flame Retardant Alliance
Robert J. Luedeka, Polyurethane Foam Association, TN [M]
 Rep. Upholstered Furniture Action Council

James Andrew Lynch, The Fire Solutions Group, PA [SE]
John Martell, Professional Fire Fighters of Maine/IAFF, ME [L]
 Rep. International Association of Fire Fighters
Rodney A. McPhee, Canadian Wood Council, Canada [M]
Kathleen A. Newman, Firetect, CA [M]
Arthur J. Parker, JENSEN HUGHES, MD [SE]
 Rep. JENSEN HUGHES
Michael Schmeida, Gypsum Association, OH [M]
David T. Sheppard, U.S. Bureau of Alcohol, Tobacco, Firearms & Explosives, MD [RT]
Dwayne E. Sloan, UL LLC, NC [RT]
Stanislav I. Stoliarov, University of Maryland, MD [SE]
Leo Subbarao, Fire Department City of New York, NY [U]
Kuma Sumathipala, American Wood Council, VA [M]
Peter J. Willse, Global Asset Protection Services, LLC, CT [I]
Dong Zeng, FM Global, MA [I]
 Rep. FM Global

Alternates

Erik H. Anderson, Koffel Associates, Inc., MD [SE]
 (Alt. to William E. Koffel)

Jesse J. Beitel, JENSEN HUGHES, MD [SE]
 (Alt. to Arthur J. Parker)

Richard J. Davis, FM Global, MA [I]
 (Alt. to Dong Zeng)

Timothy Earl, GBH International, MI [SE]
 (Alt. to Marcelo M. Hirschler)

Sam W. Francis, American Wood Council, PA [M]
 (Alt. to Kuma Sumathipala)

Stephen Paul Fuss, U.S. Bureau of Alcohol, Tobacco, Firearms & Explosives, MD [RT]
 (Alt. to David T. Sheppard)

Justin A. Geiman, Fire and Risk Alliance LLC, MD [SE]
 (Alt. to James Andrew Lynch)

Karl Dana Houser, Intertek, PA [RT]
 (Alt. to Barry L. Badders, Jr.)

Marc L. Janssens, Southwest Research Institute, TX [RT]
 (Alt. to Karen C. Carpenter)

Cori Leffler, Firetect, CA [M]
 (Alt. to Kathleen A. Newman)

Ineke Van Zeeland, Canadian Wood Council, Canada [M]
 (Alt. to Rodney A. McPhee)

Matthew T. Vinci, International Association of Fire Fighters, DC [L]
 (Alt. to John Martell)

Robert J. Wills, American Iron and Steel Institute, AL [M]
 (Alt. to Farid Alfawakhiri)

Luke C. Woods, UL LLC, MA [RT]
 (Alt. to Dwayne E. Sloan)

Joe Ziolkowski, American Furniture Manufacturers Association, NC [M]
 (Alt. to Robert J. Luedeka)

Nonvoting

Robert H. Barker, American Fiber Manufacturers Association, VA [M]
 Rep. American Fiber Manufacturers Association

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

Andrew Lock, U.S. Consumer Product Safety Commission, MD [C]
 Rep. U.S. Consumer Product Safety Commission

Tracy L. Vecchiarelli, 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– 5	Chapter 7 Test Procedure	253– 12
1.1 Scope.	253– 5	7.1 Pretest Heating.	253– 12
1.2 Purpose.	253– 5	7.2 Sample Mounting.	253– 13
1.3 Application.	253– 5	7.3 Ignition of Pilot Burner.	253– 13
1.4 Summary of Test Method.	253– 5	7.4 Flame Propagation of Specimen.	253– 13
Chapter 2 Referenced Publications	253– 6	7.5 Completion of Test.	253– 13
2.1 General.	253– 6	7.6 Data Collection and Recording.	253– 13
2.2 NFPA Publications. (Reserved)	253– 6	7.7 Removal of Specimen.	253– 13
2.3 Other Publications.	253– 6	7.8 Subsequent Testing.	253– 13
2.4 References for Extracts in Mandatory Sections.	253– 6	7.9 Extent of Flame Travel After a Prescribed Period.	253– 13
Chapter 3 Definitions	253– 6	Chapter 8 Calculations	253– 13
3.1 General.	253– 6	8.1 General.	253– 13
3.2 NFPA Official Definitions.	253– 6	8.2 Formulas.	253– 13
3.3 General Definitions.	253– 6	Chapter 9 Report	253– 13
Chapter 4 Test Apparatus	253– 7	9.1 Required Information.	253– 13
4.1 Radiant Panel Test Apparatus.	253– 7	Annex A Explanatory Material	253– 14
4.2 Test Chamber.	253– 7	Annex B Procedure for Calibration of Apparatus	253– 14
4.3 Radiant Heat Energy Source.	253– 7	Annex C Sample Data Logs	253– 15
4.4 Specimen Holder.	253– 8	Annex D Commentary on Critical Radiant Flux Test	253– 16
4.5 Pilot Burner.	253– 9	Annex E Precision and Bias	253– 18
4.6 Thermocouples.	253– 10	Annex F Safety Precautions	253– 18
4.7 Exhaust Hood.	253– 10	Annex G Informational References	253– 18
4.8 Dummy Specimen.	253– 10	Index	253– 20
4.9 Timer.	253– 10		
Chapter 5 Test Specimens	253– 10		
5.1 Sampling Procedure.	253– 10		
5.2 Specimen Size and Mounting.	253– 10		
5.3 Specimen Conditioning.	253– 12		
Chapter 6 Radiant Heat Energy Flux Profile Standardization	253– 12		
6.1 Procedure.	253– 12		

NFPA 253

Standard Method of

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

2019 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 Standards.” They can also be viewed at www.nfpa.org/disclaimers or obtained on request from NFPA.

UPDATES, ALERTS, AND FUTURE EDITIONS: New editions of NFPA codes, standards, recommended practices, and guides (i.e., NFPA Standards) are released on scheduled revision cycles. This edition may be superseded by a later one, or it may be amended outside of its scheduled revision cycle through the issuance of Tentative Interim Amendments (TIAs). An official NFPA Standard at any point in time consists of the current edition of the document, together with all TIAs and Errata in effect. To verify that this document is the current edition or to determine if it has been amended by TIAs or Errata, please consult the National Fire Codes® Subscription Service or the “List of NFPA Codes & Standards” at www.nfpa.org/docinfo. In addition to TIAs and Errata, the document information pages also include the option to sign up for alerts for individual documents and to be involved in the development of the next edition.

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

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex G. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

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

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 develops in corridors or exit enclosures of buildings and is not intended for routine use in estimating flame spread behavior of floor covering in building areas other than corridors or exit enclosures.

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 for establishing appropriate safety and health practices and determining 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.

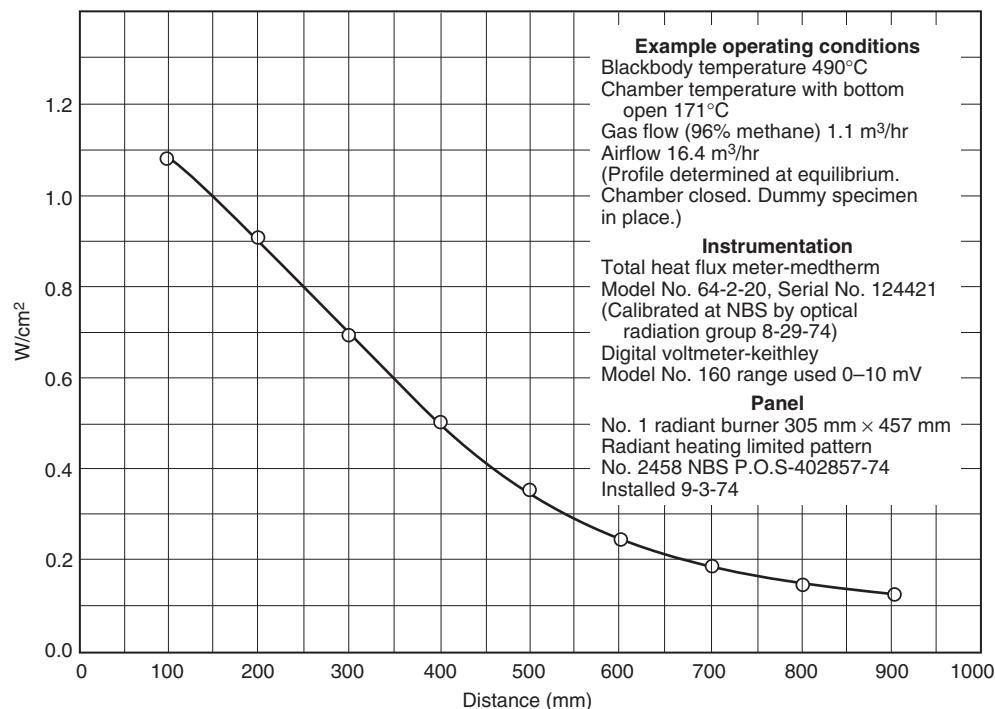
1.4 Summary of Test Method. The basic elements of the test chamber include an air-gas-fueled radiant heat energy panel inclined at 30 degrees to and directed at a horizontally mounted floor covering system specimen.

1.4.1 The radiant panel generates a radiant energy flux distribution along the 1000 mm 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.



▲ FIGURE 1.4.3 Standard Radiant Heat Energy Flux Profile.

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. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM C1186, *Standard Specification for Flat Fiber-Cement Sheets*, 2008 (2016).

ASTM C1288, *Standard Specification for Fiber-Cement Interior Substrate Sheets*, 2017.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016a.

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

2.4 References for Extracts in Mandatory Sections.

NFPA 101®, *Life Safety Code*®, 2018 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster's *Collegiate*

Dictionary, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2 Shall. Indicates a mandatory requirement.

3.2.3 Should. Indicates a recommendation or that which is advised but not required.

3.2.4 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase “standards development process” or “standards development activities,” the term “standards” includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1 Blackbody Temperature. The temperature of a perfect radiator having a surface with an emissivity of unity and, therefore, a reflectivity of zero (0).

▲ **3.3.2 Critical Radiant Flux.** The level of incident radiant heat energy in units of W/cm² on a floor-covering system at the most distant flameout point. [101, 2018]