

NFPA 256

Standard Methods of Fire Tests of Roof Coverings

1998 Edition



National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

Copyright ©
National Fire Protection Association, Inc.
One Batterymarch Park
Quincy, Massachusetts 02269

IMPORTANT NOTICE ABOUT THIS DOCUMENT

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.

NOTICES

All questions or other communications relating to this document 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, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

Users of this document should be aware that this document may be amended from time to time through the issuance of Tentative Interim Amendments, and that an official NFPA document at any point in time consists of the current edition of the document together with any Tentative Interim Amendments then in effect. In order to determine whether this document is the current edition and whether it has been amended through the issuance of Tentative Interim Amendments, 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 above.

A statement, written or oral, that is not processed in accordance with Section 5 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.

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 this document, and the NFPA disclaims liability for the infringement of any patent resulting from the use of or reliance on this document. Users of this document 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.

Users of this document should consult applicable federal, state, and local laws and regulations. NFPA does not, by the publication of this document, intend to urge action that is not in compliance with applicable laws, and this document may not be construed as doing so.

Licensing Policy

This document is copyrighted by the National Fire Protection Association (NFPA). By making this document available for use and adoption by public authorities and others, the NFPA does not waive any rights in copyright to this document.

1. Adoption by Reference—Public authorities and others are urged to reference this document in laws, ordinances, regulations, administrative orders, or similar instruments. Any deletions, additions, and changes desired by the adopting authority must be noted separately. Those using this method are requested to notify the NFPA (Attention: Secretary, Standards Council) in writing of such use. The term "adoption by reference" means the citing of title and publishing information only.

2. Adoption by Transcription—**A.** Public authorities with lawmaking or rule-making powers only, upon written notice to the NFPA (Attention: Secretary, Standards Council), will be granted a royalty-free license to print and republish this document in whole or in part, with changes and additions, if any, noted separately, in laws, ordinances, regulations, administrative orders, or similar instruments having the force of law, provided that: (1) due notice of NFPA's copyright is contained in each law and in each copy thereof; and (2) that such printing and republication is limited to numbers sufficient to satisfy the jurisdiction's lawmaking or rule-making process. **B.** Once this NFPA Code or Standard has been adopted into law, all printings of this document by public authorities with lawmaking or rule-making powers or any other persons desiring to reproduce this document or its contents as adopted by the jurisdiction in whole or in part, in any form, upon written request to NFPA (Attention: Secretary, Standards Council), will be granted a nonexclusive license to print, republish, and vend this document in whole or in part, with changes and additions, if any, noted separately, provided that due notice of NFPA's copyright is contained in each copy. Such license shall be granted only upon agreement to pay NFPA a royalty. This royalty is required to provide funds for the research and development necessary to continue the work of NFPA and its volunteers in continually updating and revising NFPA standards. Under certain circumstances, public authorities with lawmaking or rule-making powers may apply for and may receive a special royalty where the public interest will be served thereby.

3. Scope of License Grant—The terms and conditions set forth above do not extend to the index of this document.

(For further explanation, see the Policy Concerning the Adoption, Printing, and Publication of NFPA Documents, which is available upon request from the NFPA.)

Copyright © 1998 NFPA, All Rights Reserved

NFPA 256

Standard Tests of

Fire Tests of Roof Coverings

1998 Edition

This edition of NFPA 256, *Standard Methods of Fire Tests of Roof Coverings*, was prepared by the Technical Committee on Fire Tests and acted on by the National Fire Protection Association, Inc., at its Fall Meeting held November 17–19, 1997, in Kansas City, MO. It was issued by the Standards Council on January 16, 1998, with an effective date of February 6, 1998, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 256 was approved as an American National Standard on February 6, 1998.

Origin and Development of NFPA 256

The test procedure covered by this standard was developed prior to 1920 by Underwriters Laboratories Inc. The test procedure was put in standard form by the E5 Committee on Fire Standards of the American Society for Testing and Materials, adopted by ASTM as a tentative standard in 1955, and revised in 1956. It was adopted by the NFPA on May 22, 1958, on recommendation of the Committee on Fire Tests and was subsequently published as NFPA 256, in May 1958. It was adopted by ASTM as a standard later in 1958 and published by ASTM as E 108-58. It was also published by Underwriters Laboratories Inc., as No. 790, September 1958. Revised NFPA editions were published in 1964, 1970, 1976, 1981, and 1987. The 1993 edition of NFPA 256 was revised editorially to bring this document into conformance with its ASTM and UL counterparts.

The 1998 edition adds a new Chapter 13, “Report of Results.” This was done to clarify and to identify the required elements that relate to both specimen preparation and test results.

Technical Committee on Fire Tests

Jesse J. Beitel, *Chair*
Hughes Assoc. Inc., MD [SE]

April L. Berkol, ITT Sheraton Corp., NY [U]

Rep. American Hotel & Motel Assn.

John A. Blair, The DuPont Co., DE [M]

Rep. Society of the Plastics Industry Inc.

William P. Chien, State of New York Dept. of Fire Prevention & Control, NY [E]

William E. Fitch, Omega Point Laboratories Inc., TX [RT]

Sam W. Francis, American Forest & Paper Assn., PA [M]

Thomas W. Fritz, Armstrong World Industries Inc., PA [M]

James R. Griffith, Southwest Research Inst., TX [RT]

Marcelo M. Hirschler, GBH Int'l, CA [SE]

Alfred J. Hogan, Reedy Creek Improvement District, FL [E]

Rep. Fire Marshals Assn. of North America

Wayne D. Holmes, HSB Professional Loss Control Inc., CT [I]

Karl D. Houser, Gypsum Assn., DC [M]

William E. Koffel, Koffel Assoc. Inc., MD [SE]

James R. Lawson, U.S. Nat'l Inst. of Standards and Technology, MD [RT]

Gerald E. Lingenfelter, American Ins. Services Group Inc., NY [I]

William S. Metes, Underwriters Laboratories Inc., IL [RT]

George E. Meyer, Warnock Hersey, Inc., CA [RT]

John W. Michener, Milliken Research Corp., SC [M]

Rep. American Textile Mfrs. Inst. Inc.

James A. Milke, University of Maryland, MD [SE]

James C. Norris, Union Carbide Corp., TN [M]

John Roberts, Underwriters Laboratories of Canada, ON, Canada [RT]

T. Hugh Talley, Hugh Talley Co., TN [M]

Rep. Upholstered Furniture Action Council

David K. Tanaka, Factory Mutual Research Corp., MA [I]

Richard P. Thornberry, The Code Consortium, Inc., CA [SE]

Robert J. Wills, American Iron & Steel Inst., AL [M]

Peter J. Gore Willse, Industrial Risk Insurers, CT [I]

Rep. Industrial Risk Insurers

Alternates

Delbert F. Boring, Jr., American Iron & Steel Inst., OH [M]

(Alt. to R. J. Wills)

Tony Crimi, Underwriters Laboratories of Canada, ON, Canada [RT]

(Alt. to J. Roberts)

Philip J. DiNenno, Hughes Assoc. Inc., MD [RT]

(Alt. to J. J. Beitel)

Richard G. Gann, U.S. Nat'l Inst. of Standards and Technology, MD [RT]

(Alt. to J. R. Lawson)

Richard D. Gottwald, Society of the Plastics Industry Inc., DC [M]

(Alt. to J. A. Blair)

Marc L. Janssens, Southwest Research Inst., TX [RT]

(Alt. to J. R. Griffith)

Gene V. Paolucci, Yasuda Fire & Marine Insurance Co. of America, NY [I]

(Alt. to G. E. Lingenfelter)

R. Joseph Pearson, Inchcape Testing Services NA Inc., NY [RT]

(Alt. to G. E. Meyer)

William A. Thornberg, Industrial Risk Insurers, CT [I]

(Alt. to P. J. G. Willse)

James J. Urban, Underwriters Laboratories Inc., IL [RT]

(Alt. to W. S. Metes)

Kay M. Villa, American Textile Mfrs. Inst. Inc., DC [M]

(Alt. to J. W. Michener)

Joe Ziolkowski, American Furniture Mfrs. Assoc., NC [M]

(Alt. to T. H. Talley)

Nonvoting

Robert H. Barker, American Fiber Mfrs. Assn., DC [M]

(Alt. to T. L. Jilg)

James F. Hoebel, U.S. Consumer Product Safety Commission, MD

Tod L. Jilg, Hoechst Celanese Corp., NC [M]

Rep. to American Fiber Mfrs. Assn.

Herman H. Spaeth, Novato, CA
(Member Emeritus)

Walter P. Sterling, NFPA Staff Liaison

This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in membership may have occurred. A key to classifications is found at the back of this 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 General	256- 4	Chapter 7 Spread of Flame Test	256- 9
1-1 Scope	256- 4	7-1 General	256- 9
1-2 Definitions	256- 4	7-2 Procedure	256- 9
1-3 Units	256- 4	7-3 Application of Flame	256- 9
		7-4 Observations	256- 9
Chapter 2 Equipment and General Test Procedures	256- 4	Chapter 8 Burning Brand Test	256- 9
2-1 Apparatus	256- 4	8-1 General	256- 9
2-2 Test Flame	256- 4	8-2 Procedure	256-10
2-3 Supply Air	256- 4	8-3 Size and Construction of Brands	256-10
		8-4 Ignition of Brands	256-10
Chapter 3 Calibration	256- 4	8-5 Test Conditions	256-10
3-1 Air Current	256- 4	8-6 Duration of the Test	256-11
3-2 Flame Temperature	256- 5	8-7 Test Results	256-11
3-3 Rain Test	256- 5	8-8 Observations	256-11
3-4 Frequency of Calibration	256- 6	Chapter 9 Flying Brand Test	256-11
Chapter 4 Preparation of Test Specimens	256- 6	9-1 General	256-11
4-1 Construction of Test Decks	256- 6	9-2 Procedure	256-11
4-2 Application of Roofing on Test Roof Deck	256- 8	9-3 Application of Flame	256-11
4-3 Storage and Conditioning of Test Roof Decks	256- 8	9-4 Air Current	256-12
		Chapter 10 Rain Test	256-12
Chapter 5 General Conditions	256- 8	10-1 General	256-12
5-1 Tests	256- 8	10-2 Procedure	256-12
5-2 Mortar	256- 8	10-3 Application of Water	256-12
5-3 Air Current	256- 8	Chapter 11 Weathering Test	256-12
5-4 Roof Coverings	256- 8	11-1 General	256-12
5-5 Built-up Coverings	256- 8	Chapter 12 Conditions of Classification	256-12
5-6 Slope	256- 9	12-1 Conditions to Be Met	256-12
Chapter 6 Intermittent Flame Exposure Test	256- 9	Chapter 13 Report of Results	256-12
6-1 General	256- 9	13-1 Data	256-12
6-2 Procedure	256- 9	Chapter 14 Referenced Publications	256-13
6-3 Application of Flame	256- 9	Appendix A Explanatory Material	256-13
6-4 Air Current	256- 9	Appendix B Referenced Publications	256-13
6-5 Observations	256- 9	Index	256-14

NFPA 256

Standard Tests of Roof Coverings

Fire Tests of Roof Coverings

1998 Edition

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

Information on referenced publications can be found in Chapter 14 and Appendix B.

Chapter 1 General

1-1 Scope.

1-1.1 These methods are intended to measure the relative fire characteristics of roof coverings under a simulated fire originating outside the building. They shall be applicable to roof coverings intended for installation on either combustible or noncombustible decks, when applied as intended for use.

The following methods are included in this standard:

- (a) Intermittent Flame Exposure Test (*see Chapter 6*)
- (b) Spread of Flame Test (*see Chapter 7*)
- (c) Burning Brand Test (*see Chapter 8*)
- (d) Flying Brand Test (*see Chapter 9*)
- (e) Rain Test (*see Chapter 10*)
- (f) Weathering Test (*see Chapter 11*)

1-1.2 Three classes of fire test exposure are described.

1-1.2.1 Class A. Class A tests shall be applicable to roof coverings that are effective against severe test exposure, that afford a high degree of fire protection to the roof deck, that do not slip from position, and that do not present a flying brand hazard.

1-1.2.2 Class B. Class B tests shall be applicable to roof coverings that are effective against moderate test exposure, that afford a moderate degree of fire protection to the roof deck, that do not slip from position, and that do not present a flying brand hazard.

1-1.2.3 Class C. Class C tests shall be applicable to roof coverings that are effective against light test exposure, that afford a light degree of fire protection to the roof deck, that do not slip from position, and that do not present a flying brand hazard.

1-1.3 It is the intent of the tests to demonstrate the relative performance of materials under the test exposure involved. These tests shall not be construed as having determined suitability for use after fire exposure.

1-2 Definitions.

Shall. Indicates a mandatory requirement.

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

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an

appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

1-3 Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection.

1-3.1 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value is considered to be approximate.

1-3.2 The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the approximate number of significant digits.

Chapter 2 Equipment and General Test Procedures

2-1 Apparatus.

2-1.1* Figure 2-1.1 (a) illustrates the essential elements of the fire test apparatus. These elements shall include a test roof deck, an adjustable frame [*see Figure 2-1.1(b)*] on which the test roof deck is mounted, a gas burner as a source of flame, a wind tunnel, an air velocity meter, a gas pressure gauge, a control valve, and an adjustable air supply.

2-1.2 Figure 2-1.2 illustrates the essential elements of the rain test apparatus.

2-2 Test Flame. Control of the shape and size of the flame depends on minimizing air turbulence in the immediate vicinity of the apparatus. To do this, the following conditions shall be met:

- (a) Free outlet to outside air beyond and above the test apparatus shall be provided to exhaust air introduced into the test room by the blower.
- (b) All openings into the test room other than those mentioned in 2-1.1, such as doors and windows, shall be closed.

2-3 Supply Air. The temperature of the room shall be between 50°F and 90°F (10°C and 32.2°C).

Chapter 3 Calibration

3-1 Air Current.

3-1.1 The test apparatus shall be set up for the intermittent flame test, and a smooth, noncombustible calibration deck 4 ft 4 in. (1320 mm) long shall be positioned on the framework at an incline of 0.416:1 [5 in. (127 mm) per horizontal ft (305 mm)].

3-1.2 The air velocity shall be measured in three locations: midway up the slope of the calibration deck, at its center, and 3 in. (76 mm) from each edge.

3-1.3 The center of the air-measuring device shall be positioned $3\frac{3}{4}$ in. $\pm 1\frac{1}{8}$ in. (95 mm \pm 3 mm) above the surface. The airflow through and around the instrument shall be as free and undisturbed as possible.

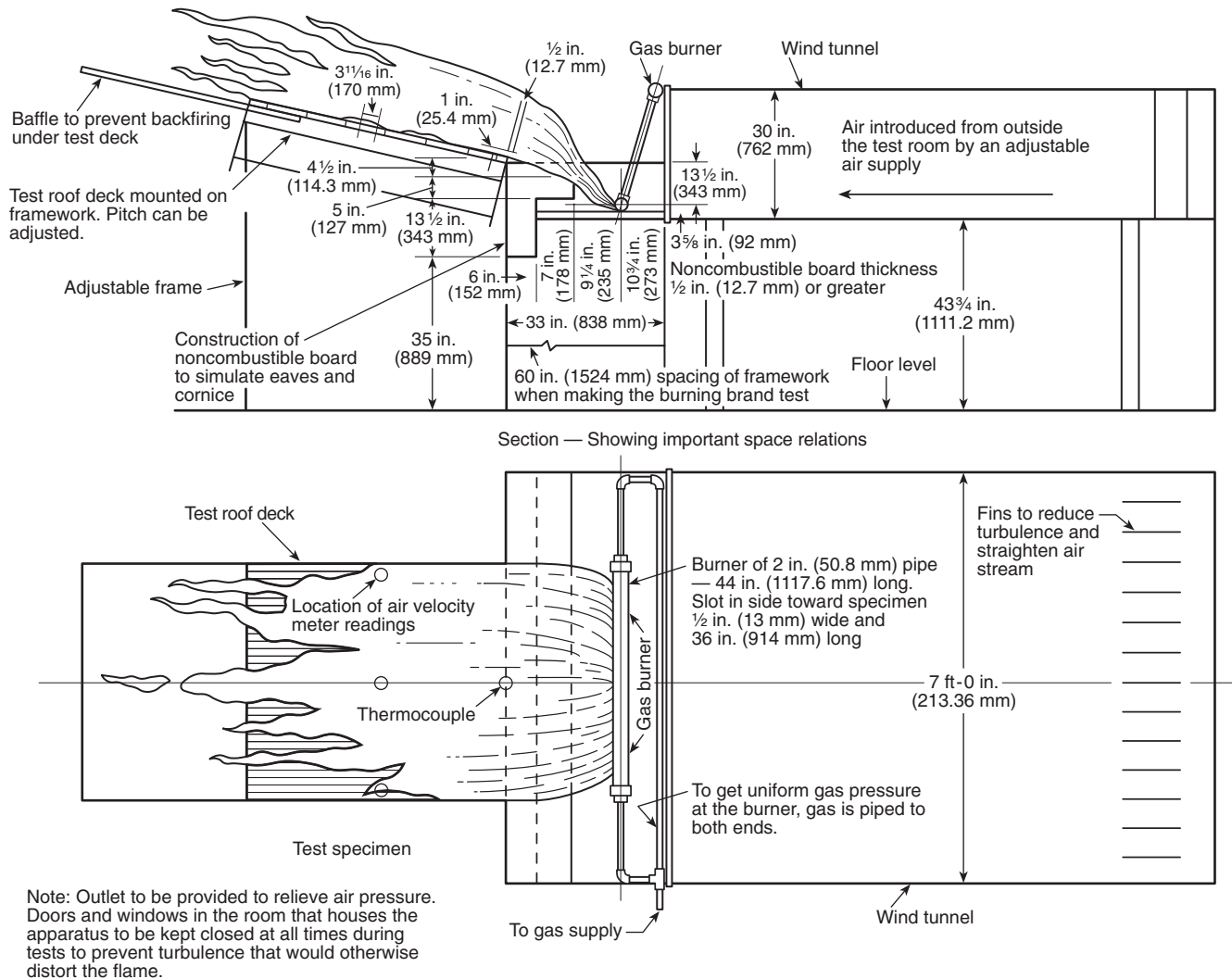


Figure 2-1.1(a) Schematic drawing of fire test apparatus.

3-1.4 The air supply system shall be adjusted to produce a 1-minute average velocity of 1056 ft ± 44 ft/min (5.36 m ± 0.2 m/min) at each of the three locations detailed in 3-1.2.

3-2 Flame Temperature.

3-2.1 The test apparatus shall be set up for the intermittent flame test in accordance with 3-1.1, and the air velocity shall be adjusted in accordance with 3-1.4.

3-2.2 The temperature shall be measured with a No. 14 gauge (1.6-mm diameter) Type K wire thermocouple located 1 in. (25 mm) above the surface and 1/2 in. (13 mm) toward the source of the flame from the lower front edge of the calibration deck.

3-2.3 The gas flow shall be adjusted to produce a 2-minute average flame temperature of 1400°F ± 50°F (760°C ± 28°C) for Class A and Class B and 1300°F ± 50°F (704°C ± 28°C) for Class C tests. The response of the thermocouple to the test flame shall be allowed to stabilize before the 2-minute average

flame temperature is measured. The average shall be based on readings taken at 5-second intervals.

3-2.4 The top surface of the leading edge of the calibration deck shall be flush with the top edge of the simulated eave within a tolerance of 0 in. ± 1/2 in. (0 mm ± 13 mm).

3-2.5 If the preceding conditions are satisfied, the flame shall be approximately the width of the deck at its bottom edge, and the top surface of the calibration deck shall be uniformly bathed except for the two upper corners. The flame shall extend approximately to the upper edge of the calibration deck with licks of flame extending another 1 to 2 ft (300 to 600 mm).

3-3 Rain Test.

3-3.1 The horizontal projected area over which each nozzle discharges water to the nearest square foot (0.1 m²) shall be measured. The discharge of water for each nozzle shall be measured for 1 minute.

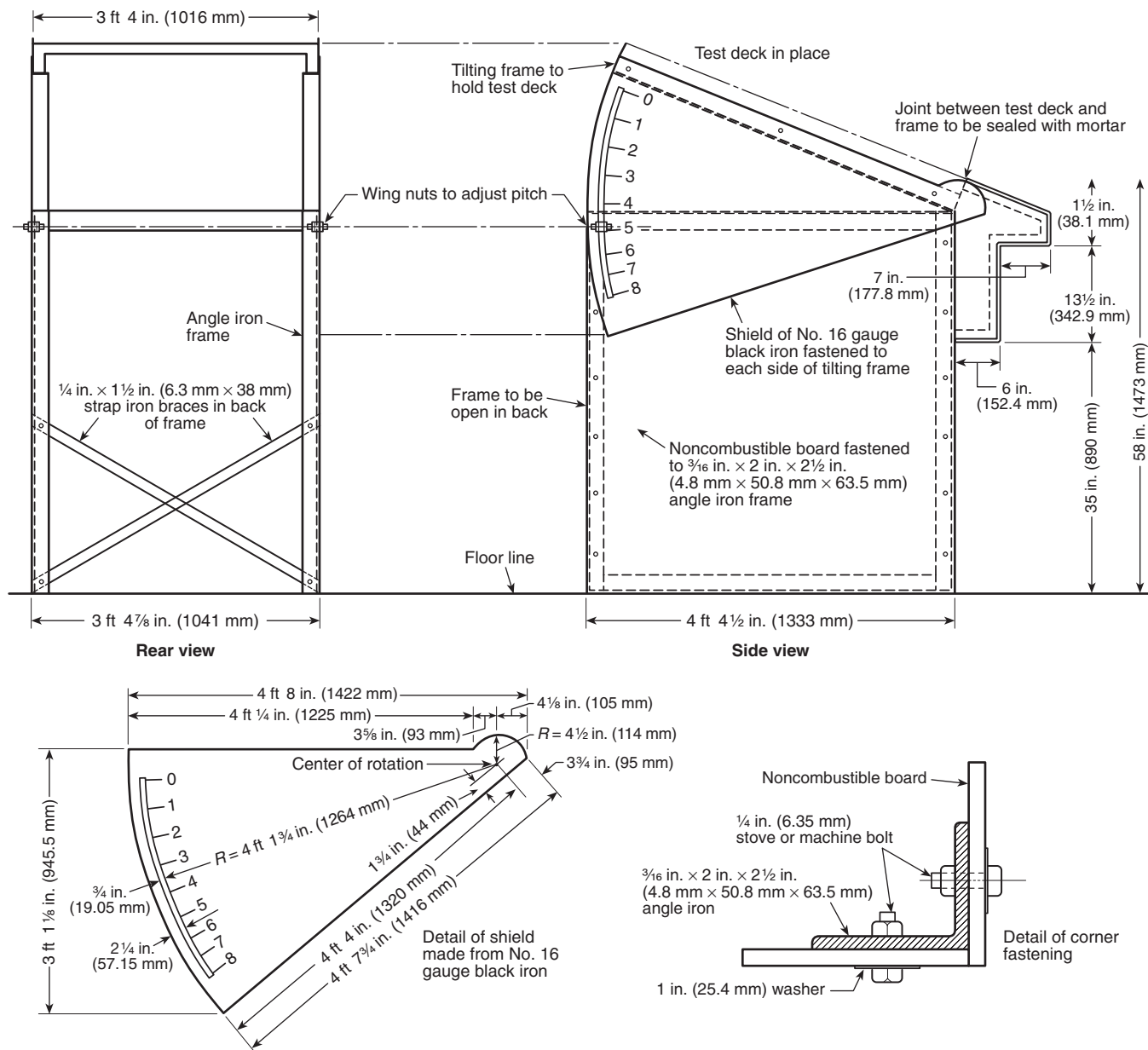


Figure 2-1.1(b) Detail of tilting frame to hold test roof deck.

3-3.2 The total water utilized during the test shall be monitored (a commercial water meter is suitable for the purpose). For a 7-day cycle, the water usage shall be 73 U.S. gal \pm 1.7 U.S. gal/ft² (2974 L \pm 40 L/m²) or 0.435 U.S. gal/ft²/hr (17.7 L/m²/hr).

3-4 Frequency of Calibration.

3-4.1 The apparatus shall be calibrated for air velocity and flame temperature prior to each day's use. The apparatus shall be calibrated for flame temperature when shifting from Class A or B to Class C tests or vice versa.

3-4.2 Any indication of off-limit condition, such as unusual flame appearance or flame contour, excess turbulence, unusual noise, and other conditions, shall be cause for calibration prior to further use.

3-4.3 The water flow from each nozzle shall be visually checked for obvious water obstruction in the nozzle and uneven spray pattern each day during the water cycle, and adjustments shall be made when necessary.

3-4.4 A review of the total water flow shall be made at the end of each day and at the end of each water cycle. The cause of any off-limit conditions shall be corrected.

Chapter 4 Preparation of Test Specimens

4-1 Construction of Test Decks. [Also see Figures 4-1(a), 4-1(b), 4-1(c), and 4-1(d).]

4-1.1 The test deck for the intermittent flame exposure, burning brand tests, flying brand test, rain test, and weathering test

shall be 3 ft 4 in. \times 4 ft 4 in. (1020 mm \times 1320 mm) and shall be made of No. 1 white pine lumber with a moisture content of at least 8 percent and not more than 12 percent.

Exception: As specified in 4-1.2 through 4-1.5.

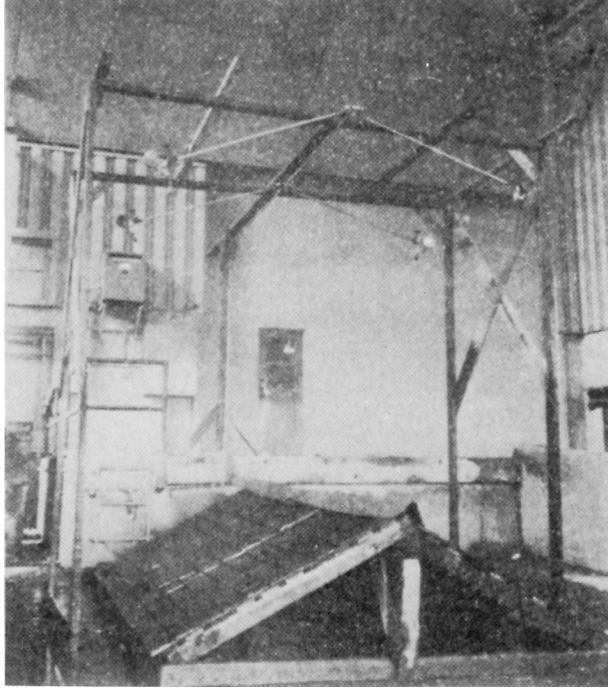


Figure 2-1.2 Rain test apparatus.

4-1.1.1 The lumber shall be free of large or loose knots, sapwood, rot, or pitch pockets and shall contain no edge knots.

4-1.1.2 Individual deck boards shall be of nominal 1 in. \times 8 in. (25 mm \times 200 mm) lumber (S4S).

4-1.1.3 The boards shall be laid across the shorter dimension of the test deck spaced $\frac{1}{4}$ in. (6 mm) apart and shall be securely nailed to two nominal 2 in. \times 4 in. (50 mm \times 100 mm) wood battens located under and flush with the outer edges of the deck. [See Figure 4-1(d).]

4-1.1.4 Decks so constructed shall be even and uniform.

4-1.2 Where the roof covering is intended to be installed over other than solid deck, the test decks shall be constructed of nominal 1 in. \times 4 in. (25 mm \times 100 mm) lumber (S4S) spaced a minimum of $1\frac{5}{8}$ in. (41 mm) apart and shall be securely nailed to two nominal 2 in. \times 4 in. (50 mm \times 100 mm) wood battens. The lumber shall be of the same quality as specified in 4-1.1.

4-1.3 Roof coverings shall be permitted to be applied to panel-type test decks such as plywood, wafer board, particle board, or oriented strand board in the minimum thickness recommended by the manufacturer. This deviation shall be noted in the report.

4-1.3.1 Plywood, if used, shall be exterior Type C-C plugged or higher grade, conforming to PS1, *Construction and Industrial Plywood*.

4-1.3.2 These decks shall have $\frac{1}{8}$ -in. (3-mm) vertical and horizontal joints located as specified in 4-1.4 through 4-1.5.3 with all vertical joints centered on nominal 2 in. \times 4 in. (50 mm \times 100 mm) wood battens.

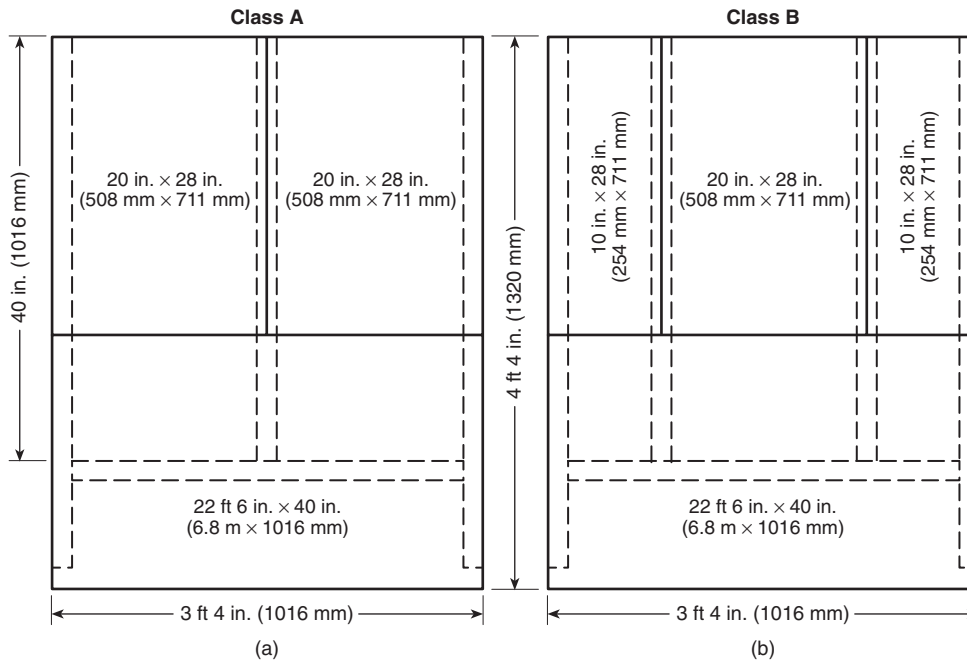


Figure 4-1 Plywood deck burning brand tests. Plywood overhangs 2 \times 4s by $\frac{1}{4}$ in. at leading edge. Dotted lines indicate 2 \times 4 supports. Plywood joint width, $\frac{1}{8}$ in. (3mm).

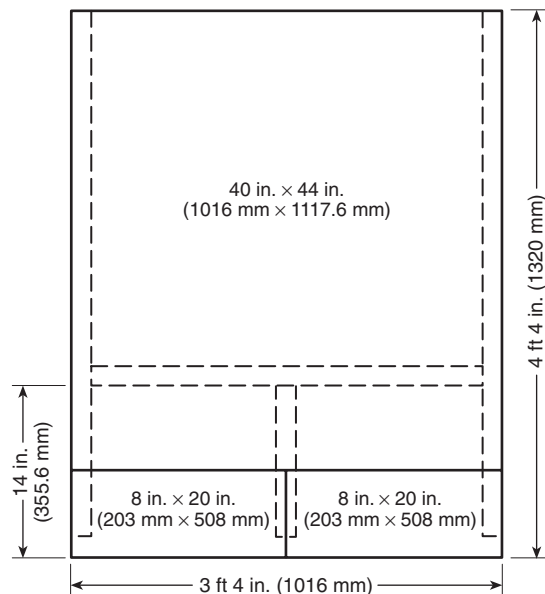


Figure 4-1(c) Plywood deck intermittent flame test, Class A or Class B. Plywood overhangs 2 × 4s by 1 1/4 in. at leading edge. Dotted lines indicate 2 × 4 supports. Plywood joint width, 1/8 in. (3 mm).

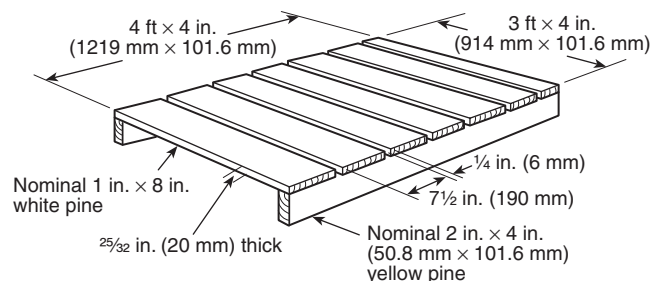


Figure 4-1(d) Construction of test deck for other than wood shingles and shakes.

4-1.3.3 If wood battens or tongue and groove joints are specified for horizontal joints, it shall be so noted in reporting the tests.

4-1.4 Decks constructed of panel-type material for intermittent flame tests shall have a 1/8-in. (3-mm) horizontal joint 8 in. (203 mm) from and parallel to the 3 ft 4 in. (1020 mm) long leading edge.

4-1.4.1 In addition, a 1/8-in. (3-mm) vertical joint centered on the deck and extending from the leading edge of the deck to the 1/8-in. (3-mm) horizontal joint shall be provided.

4-1.4.2 Since the lower 1 1/2 in. (38 mm) of this joint is not protected by the 2 in. × 4 in. (50 mm × 100 mm) batten, due to the mounting arrangement on the carriage, the underside of this joint shall be covered from the end of the 2 in. × 4 in. (50 mm × 100 mm) to the leading edge of the deck by a piece of sheet steel, nominally 2 in. (50 mm) in width.

4-1.5 For Class A and Class B burning brand tests on decks other than 1 in. × 8 in. (25 mm × 200 mm) nominal lumber, the 1/8-in. (3-mm) horizontal joint shall be 22 1/2 in. (570 mm) from and parallel to the leading edge of the deck.

4-1.5.1 Class A test decks shall have a 1/8-in. (3-mm) vertical joint centered on the deck that extends above the horizontal joint.

4-1.5.2 For Class B test decks, two 1/8-in. (3-mm) vertical joints, extending above the horizontal joint with each vertical joint located 10 in. (250 mm) from and parallel to the edge of the deck, shall be provided.

4-1.5.3 For a Class C burning brand test, five evenly spaced horizontal joints, with a minimum width of 1/8 in. (3 mm) between joints in the plywood, shall be provided.

4-1.6 For the spread of flame tests, the deck shall be constructed in the same manner as specified for the intermittent flame test, except that the vertical and horizontal joints need not be provided and the length of the deck shall be as specified in 4-1.6.1.

4-1.6.1 The length of the test deck shall be 13 ft (4000 mm) for Class C tests, 9 ft (2700 mm) for Class B tests, and 8 ft (2400 mm) for Class A tests.

4-1.6.2 For tests of materials intended to be installed only over noncombustible decks, a noncombustible deck of the applicable length as specified in 4-1.6.1 shall be permitted to be used. This deviation shall be noted in the report.

4-2 Application of Roofing on Test Roof Deck.

4-2.1 Representative samples of roof covering materials shall be applied to test decks as specified in Table 4-2.1.

4-2.2 The roof covering materials under investigation shall be applied in accordance with the manufacturer's instructions and shall extend to and be flush with the edges of the deck.

Exception: A 1-in. (25-mm) overhang is permitted at the leading edge.

4-3 Storage and Conditioning of Test Roof Decks. The completed test roof decks shall be stored indoors at a temperature of at least 60°F (16°C) and at most 90°F (32°C). The completed test roof decks shall be conditioned to a constant mass. The moisture content of the sample immediately prior to the test shall be measured and recorded.

Chapter 5 General Conditions

5-1 Tests. The required tests, the applicable number of test decks, and the types of test assemblies are detailed in Table 4-2.1.

5-2* Mortar. In the fire tests described in the following sections, mortar (cementitious mixture, lime, and water) shall be troweled into the joint formed by the leading edge of the roof covering material and the framework of the carriage.

5-3 Air Current. In these tests, all decks shall be subjected to an air current as calibrated in Chapter 3.

5-4 Roof Coverings. Prepared roof coverings shall be tested at a slope of 0.416:1 [5 in. (127 mm) per horizontal foot (305 mm)].

5-5 Built-up Coverings. Built-up roof coverings shall be tested at the maximum slope recommended by the manufacturer but shall not exceed 0.416:1 [5 in. (127 mm) per horizontal foot (305 mm)].

Table 4-2.1 Required Tests and Test Assemblies

Material to Be Tested	Minimum Required Number of Test Assemblies					
	Intermittent Flame Test	Spread of Flame Test	Burning Brand Test	Flying Brand Test	Rain Test	Weathering Test
I. Other than wood shakes or shingles, for installation on combustible decks						
Class A	2	2	4	NA ^a	NA	NA
Class B	2	2	2	NA	NA	NA
Noncombustible decks only ^b	NA	2	NA	NA	NA	NA
II. Wood shakes and shingles ^c						
Class A	3 (2) [5]	3	6 (2) [5]	3 (2) [5]	6	15
Class B or Class C	3 (2) [5]	3	3 (2) [5]	3 (2) [5]	6	15

Note: Where roof covering materials exhibit variable performance, more than the minimum number of test decks are subject to being required.

^a NA — Test is not required.

^b The flying brand, rain, and weathering tests are subject to being required. (See Sections 9-1, 10-1.1, and 11-1.)

^c Number in parentheses is number of samples from rain test to be tested. Number in brackets is number of samples from weathering test to be tested.

5-6 Slope. The slope used shall be noted in the report.

Chapter 6 Intermittent Flame Exposure Test

6-1 General. This test shall be performed on a minimum of two test decks.

Exception: Where the roof covering materials exhibit a variable performance, more than two test decks shall be required.

6-2 Procedure.

6-2.1 A test deck 4 ft 4 in. (1320 mm) long shall be mounted on the framework at the required incline (see Sections 5-4 through 5-6), and the blower shall be adjusted to produce the specified air current.

6-2.2 The test deck shall be subjected to a luminous gas flame as calibrated in accordance with Section 3-2.

6-3 Application of Flame. The flame shall be applied intermittently for the specified periods and specified time intervals between applications, as indicated in Table 6-3.

Table 6-3 Flame Applications

Method of Test	Flame On (minutes)	Flame Off (minutes)	No. of Test Cycles
Class A	2	2	15
Class B	2	2	8
Class C	1	2	3

6-4 Air Current. The air current shall be maintained throughout the test and after the last application of flame until all evidence of flame, glow, and smoke has disappeared from both the exposed surface of the material being tested and the underside of the test deck, or until failure occurs. In no case shall the air current or test duration be maintained for more than 1 hour after the last flame cycle for a Class A or B test or 1/2 hour after the last flame cycle for a Class C test.

6-5 Observations. During and after the intermittent flame test, including “on” and “off” periods of flame application, observations shall be made for the following conditions:

- (a) Appearance of sustained flaming on the underside of the test deck
- (b) Production of flaming or glowing brands
- (c) Displacement of portions of the test sample
- (d) Exposure or falling away of portions of the roof deck

Chapter 7 Spread of Flame Test

7-1 General. This test shall be performed on a minimum of two test decks.

Exception: Where the roof covering materials exhibit a variable performance, more than two test decks shall be required.

7-2 Procedure. A test deck of a length as specified in 4-1.6.1 shall be mounted in the same manner and shall use a luminous gas flame as described in Section 6-2 for the intermittent flame tests.

7-3 Application of Flame.

7-3.1 For Class A and Class B tests, the gas flame shall be applied continuously for 10 minutes or until the flame (actual flaming of the material being tested) permanently recedes from a point of maximum spread, whichever is shorter.

7-3.2 For a Class C test the gas flame shall be applied for a period of 4 minutes, or until recession occurs, and then it shall be removed.

7-4 Observations. During the application of the test flame, the test sample shall be observed for the following conditions:

- (a) Distance to which flaming of the material has spread
- (b) Production of flaming or glowing brands
- (c) Displacement of portions of the test sample

Chapter 8 Burning Brand Test

8-1 General. This test shall be performed on a minimum of four test decks for Class A fire test exposure and two test decks for Class B or Class C fire test exposure.

Exception: Where the roof covering materials exhibit a variable performance, more than the minimum number of test decks shall be required.

8-2 Procedure. A 4-ft 3-in. (1320-mm) long test deck shall be mounted in the same manner as specified in Section 6-2 for the intermittent flame test.

Exception: The framework shall be 60 in. (1520 mm) from the air duct outlet [see Figure 2-1.1(a)], and the gas piping and burner shall be removed so as not to obstruct the airflow.

8-3 Size and Construction of Brands.

8-3.1 General. The brands (as shown in Figure 8-3.1) shall be constructed as follows and shall be conditioned in an oven with temperatures between 105°F and 120°F (55°C and 48.9°C) for at least 24 hours.

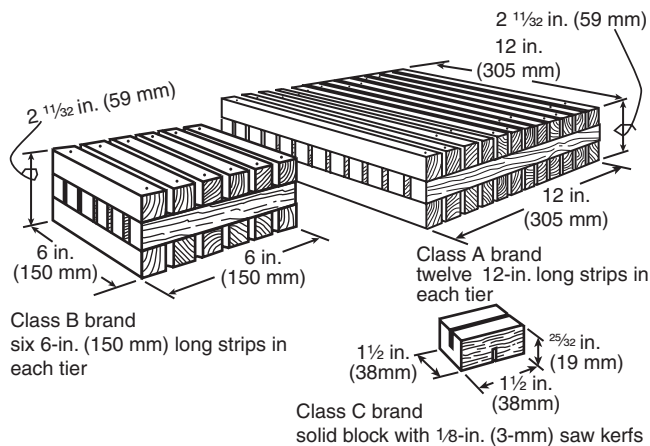


Figure 8-3.1 Brands for Class A, B, and C tests.

8-3.2* Class A Test Brand.

8-3.2.1 The Class A test brand shall consist of a grid 12 in. (305 mm) square and approximately 2 1/4 in. (57 mm) thick, made of dry Douglas fir lumber, free of knots and pitch pockets.

8-3.2.2 The following materials shall be used: 36 nominal 1 in. x 1 in. x 12 in. (25 mm x 25 mm x 305 mm) strips, dressed on all four sides to 3/4 in. x 3/4 in. (19 mm x 19 mm) and placed in three layers of 12 strips each, with strips spaced 1/4 in. (6 mm) apart.

8-3.2.3 These strips shall be placed at right angles to those in adjoining layers and shall be nailed at each end of each strip on one face and in a diagonal pattern (as shown in Figure 8-3.1) on the other face.

8-3.2.4 The dry weight of the finished brand shall be 2000 g ± 150 g at time of test.

8-3.3* Class B Test Brand.

8-3.3.1 The Class B test brand shall consist of a grid 6 in. (150 mm) square and approximately 2 1/4 in. (57 mm) thick, made of dry Douglas fir lumber, free of knots and pitch pockets.

8-3.3.2 The following materials shall be used: 18 nominal 1 in. x 1 in. x 6 in. (25 mm x 25 mm x 150 mm) strips, dressed on all four faces to 3/4 in. x 3/4 in. (19 mm x 19 mm) and placed in three layers of 6 strips each, with strips placed 1/4 in. (6 mm) apart.

8-3.3.3 These strips shall be placed at right angles to those in adjoining layers and shall be nailed at each end of each strip on one face and in a diagonal pattern (as shown in Figure 8-3.1) on the other face.

8-3.4 Class C Test Brand.

8-3.4.1 The Class C test brand shall consist of a piece of dry, nonresinous, white pine lumber, free of knots and pitch pockets, 1 1/2 in. x 1 1/2 in. x 25/32 in. (38 mm x 38 mm x 19 mm) thick, with a saw kerf 1/8 in. (3 mm) wide, one-half the thickness of the brand across the center of the top and bottom faces.

8-3.4.2 The saw kerf on opposite faces shall be at right angles to each other.

8-3.4.3 The dry weight of the finished brand shall be 9 1/4 g ± 1 1/4 g at time of test.

8-4 Ignition of Brands.

8-4.1 Before application to the test deck, the brands shall be ignited so as to burn freely in still air.

8-4.2 The brands shall be considered to be free burning after they have been subjected to the flame of a gas burner of such size that, during the process of ignition, the brands are nearly enveloped in the burner flame.

8-4.3 The flame temperature of the igniting flame shall be 1630°F ± 50°F (887°C ± 28°C) and shall be measured with a No. 14 gauge (1.6-mm diameter) Type K thermocouple 2 5/16 in. (59 mm) above the top of the burner, which shall be shielded from drafts.

8-4.4 The test brands shall be subjected to the required size of flame of the gas burner for the following periods of time.

- (a) Class A test brands shall be exposed to the flame for 5 minutes, during which time they shall be rotated so as to expose each surface to the flame in the following manner and sequence:
 1. Each 12 in. x 12 in. (305 mm x 305 mm) face for 30 seconds
 2. Each 2 1/4 in. x 12 in. (57 mm x 305 mm) face for 45 seconds
 3. Each 12 in. x 12 in. (305 mm x 305 mm) face again for 30 seconds
- (b) Class B test brands shall be exposed to the flame for 4 minutes, during which time they shall be rotated so as to expose each surface to the flame in the following manner and sequence:
 1. Each 6 in. x 6 in. (150 mm x 150 mm) face for 30 seconds
 2. Each 2 1/4 in. x 6 in. (57 mm x 150 mm) face for 30 seconds
 3. Each 6 in. x 6 in. (150 mm x 150 mm) face again for 30 seconds
- (c) Class C test brands shall be exposed to the flame for 2 minutes, during which time they shall be rotated so as to expose each of the 1 1/2 in. x 1 1/2 in. (38 mm x 38 mm) faces to the flame for 1 minute.

8-5 Test Conditions.

8-5.1 Class A Tests.

8-5.1.1 A brand shall be placed on the surface of each test deck at the location considered most vulnerable (point of minimum coverage over deck joint) with respect to ignition of the deck, but in no case shall it be closer than 4 in. (100 mm) from either side or 12 in. (305 mm) from the top or bottom edge of the deck.

8-5.1.2 The brand shall be placed so that the strips in both the upper and lower layers are parallel to the direction of airflow, and the upper edge of the brand shall be located 3 in. (75 mm) above the horizontal joint in the test deck.

8-5.1.3 The brand shall be secured to the deck by a No. 18 gauge (1.02-mm diameter) soft iron wire.

8-5.1.4 If the roof covering is being tested as applied to plywood or other panel-type decks, the brand shall be placed so that it is centered laterally with respect to the vertical panel joint in the test deck, and the upper edge of the brand shall be located 3 in. (75 mm) above the horizontal panel joint in the test deck.

8-5.2 Class B Tests.

8-5.2.1 A brand shall be placed on the surface of the test deck at each of the two locations that are considered most vulnerable (point of minimum coverage over deck joint) with respect to ignition of the deck.

8-5.2.2 Each brand shall be positioned with its upper edge $1\frac{1}{2}$ in. (38 mm) above the selected joint in the deck boards, but in no case shall it be closer than 6 in. (150 mm) from each side or 12 in. (305 mm) from the top or bottom edge of the deck.

8-5.2.3 The brands shall be placed so that the strips in both the upper and lower layers are parallel to the direction of airflow.

8-5.2.4 The brands shall be secured to the deck by a No. 18 gauge (1.02-mm diameter) soft iron wire.

8-5.2.5 The second brand shall be applied 30 minutes after placing of the first brand or sooner if all burning resulting from the first brand has ceased.

8-5.2.6 If the roof covering is applied to plywood or other panel-type decks, the brands shall be placed so that they are centered laterally with respect to the vertical panel joints in the test deck, and the upper edge of the brands shall be located $1\frac{1}{2}$ in. (38 mm) above the horizontal panel joint in the test deck.

8-5.3 Class C Tests.

8-5.3.1 At 1- to 2-minute intervals, a brand shall be placed on the surface of the test deck at each of the 20 locations that are considered most vulnerable (points of minimum coverage over deck joints) with respect to ignition of the deck.

8-5.3.2 Each brand shall be positioned with its upper edge $\frac{1}{2}$ in. (13 mm) above the selected joint in the deck boards, but in no case shall it be closer than 6 in. (150 mm) from each side or 12 in. (305 mm) from the top or bottom edge of the deck.

8-5.3.3 No brand shall be placed closer than 4 in. (100 mm) from a point where a previous brand was located.

8-5.3.4 The brands shall be secured by a No. 18 gauge (1.02-mm diameter) soft iron wire stretched across the width of the deck and placed in the saw kerf of the brand. The saw kerf on the deck side of the brand shall be parallel to the direction of airflow.

8-5.3.5 In addition to the previous requirements, where the roof covering comprises lapped courses, no brand shall be placed closer than $\frac{1}{2}$ in. (13 mm) from the bottom edge of the lapped course above nor shall it be closer than 2 in. (50

mm) from a joint in the roof covering material in the same course. Loose or unfastened portions of the roof covering that can be bent up to 90 degrees without injury to fastenings holding other portions of roof covering shall be cut away.

8-5.3.6 If the roof covering is applied to plywood or other panel-type decks, the brands shall be placed so that as many of the 20 brands as possible are centered over panel joints in the test deck.

8-5.3.7 For treated wood shingles, 20 ignited brands shall be placed on each deck at 1- or 2-minute intervals. For treated wood shakes, 20 ignited brands shall be distributed at 1- or 2-minute intervals on each pair of decks. Each brand shall be centered over the $\frac{1}{4}$ -in. (6-mm) joint approximately $\frac{1}{2}$ in. (13 mm) below the butt of the shake or shingle in the course above. No brand shall be placed closer than 4 in. (100 mm) from the point where a previous brand was located. Positioning and securing of brands shall otherwise be in accordance with 8-5.3.1.

8-6 Duration of the Test. Each individual test, whether Class A, Class B, or Class C, shall be continued until the brand is totally consumed and until all evidence of flame, glow, and smoke has disappeared from both the exposed surface of the material being tested and the underside of the test deck, or until failure occurs, but shall not be continued for more than $1\frac{1}{2}$ hours.

8-7 Test Results.

8-7.1 The results of tests in which the brands do not show progressive and substantially complete consumption after application to the test deck shall be disregarded.

8-7.2 If brands are replaced, they shall not be located in the same area as the disregarded brand.

8-8 Observations. During and after the burning brand tests, observations shall be made for the following conditions:

- (a) Appearance of sustained flaming on the underside of the test deck
- (b) Production of flaming or glowing brands of roof covering material
- (c) Displacement of the test sample
- (d) The exposure or falling away of portions of the roof deck

Chapter 9 Flying Brand Test

9-1 General. This test shall be performed where there is a possibility that during the test exposure the roof covering will break into flaming particles that support combustion on the floor. (See Table 4-2.1.)

9-2 Procedure. A test deck 4 ft 4 in. (1320 mm) long shall be mounted in the same manner, and a luminous gas flame shall be used as specified in Section 5-2 for the intermittent flame test.

9-3 Application of Flame.

9-3.1 The Class A and Class B test gas flame shall be applied continuously for 10 minutes.

9-3.2 The Class C test gas flame shall be applied continuously for 4 minutes.

9-4 Air Current. Maintain the 12 mph (5.36 m/sec) air current until all evidence of flame, glow, and smoke has disappeared from the exposed surface of the material being tested to determine if flying brands will develop. On treated wood shakes, the velocity of the air current shall be increased to 18.0 mph \pm 0.75 mph (8.0 m/sec \pm 0.3 m/sec) after the gas flame is extinguished.

Chapter 10 Rain Test

10-1* General.

10-1.1 The rain test shall be conducted where the fire-retardant characteristics of the roof covering is adversely affected by water.

10-1.2 Asphalt shingles meeting the requirements of ASTM D 225, *Standard Method for Steam Distillation of Bituminous Protective Coatings*, ASTM D 3018, *Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules*, or UL55B, *Class C Asphalt Organic-Felt Sheet Roofing and Shingles*, and slate, concrete, clay tile, and metal roofing that have been shown not to be adversely affected by prolonged exposure to the weather shall be exempt from the rain test.

10-1.3 This test shall be conducted on six test decks. (See Table 4-2.1.)

10-2 Procedure.

10-2.1 Test decks 4 ft 4 in. (1320 mm) long shall be mounted in a framework at a slope of 0.33:1 [4 in. (100 mm) per horizontal foot (300 mm)].

10-2.2 Approximately 7 ft (2130 mm) above the test decks, spray nozzles shall be mounted that deliver an average of 0.7 in. (17.8 mm) of water per hour at a temperature between 35°F and 60°F (2.0°C and 15.5°C) for the test deck area.

10-3 Application of Water.

10-3.1 The test decks shall be exposed to 12 one-week cycles.

10-3.2 Each cycle shall consist of 96 hours of water exposure and 72 hours of drying time at 140°F (60°C).

10-3.3 An alternative test cycle shall be permitted to be utilized, at the manufacturer's option, whereby two sets of six decks shall be alternately exposed to 7 days (168 hours) of water exposure, followed by 2 days (48 hours) draining, and 5 days (120 hours) drying at 140°F (60°C). This cycle shall be repeated seven times, with the exception that the seventh water exposure shall be reduced to 6 days (144 hours).

10-3.4 The final drying cycle shall be controlled so that the moisture content of the deck lumber is between 8 percent and 12 percent.

10-3.5 The intermittent flame, burning brand, and the flying brand tests shall then be repeated.

Chapter 11 Weathering Test

11-1 General. This test shall apply to materials or constructions where the fire-retardant characteristics of the roof covering are adversely affected by weather. (See Table 4-2.1.) The test shall be conducted on 3 ft 4 in. \times 4 ft 4 in. (1020 mm \times 1320 mm) test decks that shall be mounted outdoors facing south at an incline of 0.416:1 [5 in. (127 mm) per horizontal foot

(305 mm)]. After one, two, three, five, and ten years of exposure, three test decks shall be brought indoors and conditioned until the deck lumber attains a moisture content between 8 percent and 12 percent. For plywood decks, the moisture content shall be not greater than 8 percent. These decks shall then be subjected to intermittent flame, burning brand, and flying brand tests. (See Table 4-2.1.)

Chapter 12 Conditions of Classification

12-1 Conditions to Be Met. When subjected to a Class A, B, or C fire test, as defined in 1-1.2, a roof covering material shall meet the following conditions.

12-1.1 At no time during or after the intermittent flame, spread of flame, or burning brand tests shall the following conditions exist:

- (a) Any portion of the roof covering material be blown off or fall off the test deck in the form of flaming or glowing brands that continue to glow after reaching the floor
- (b) The roof deck be exposed
- (c) Portions of the roof deck fall away in the form of particles that continue to glow after reaching the floor

12-1.2 At no time during Class A, Class B, or Class C intermittent flame and burning brand tests shall there be sustained flaming of the underside of the deck. If flaming does occur, another series of tests shall be conducted during which no sustained flaming shall occur.

12-1.3 At the conclusion of the spread of flame tests, the flaming shall not have spread beyond 6 ft (1820 mm) for Class A, 8 ft (2440 mm) for Class B, or 13 ft (3960 mm) (the top of the deck) for Class C. There shall have been no significant lateral spread of flame from the path directly exposed to the test flame.

12-1.4 In the flying brand test, no flying, flaming brands or particles that continue to glow after reaching the floor shall be produced.

12-1.5 For roof covering materials intended only for use on noncombustible decks, exposure of the roof deck during the spread of flame test shall not constitute failure.

Chapter 13 Report of Results

13-1 Data. The following shall be reported for each test specimen:

- (a) Description of the roof covering being tested including construction details of the test deck, manufacturers' application limits, shelf life of the roof covering, and other relevant information
- (b) Storage conditions of test roof deck
- (c) Moisture content of the test deck materials and roof covering materials (if moisture absorbing) at the time of testing
- (d) Type and class of test
- (e) Slope of test deck
- (f) Details of the calibration including velocity measurements, flame temperature measurements, heat supply rate, and total water use for rain test
- (g) Details of rain test cycle (if applicable)