

NFPA 256  
Fire Tests  
of Roof  
Coverings  
1987 Edition



## NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on the procedures for requesting Technical Committees to issue Formal Interpretations, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Secretary, Standards Council, National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

A statement, written or oral, that is not processed in accordance with Section 16 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.

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 which is not in compliance with applicable laws and this document may not be construed as doing so.

### Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

---

**Licensing Provision** — This document is copyrighted by the National Fire Protection Association (NFPA).

**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 rulemaking process. **B.** Once this NFPA Code or Standard has been adopted into law, all printings of this document by public authorities with lawmaking or rulemaking 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 non-exclusive 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 rulemaking powers may apply for and may receive a special royalty when 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 to 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.)

---

### Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.





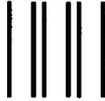
NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY CARD**

FIRST CLASS    PERMIT NO. 3376    QUINCY, MA

POSTAGE WILL BE PAID BY ADDRESSEE

**National Fire Protection Association**  
Batterymarch Park  
Quincy, MA 02269-9904



NO POSTAGE  
NECESSARY  
IF MAILED  
IN THE  
UNITED STATES

**BUSINESS REPLY CARD**

FIRST CLASS    PERMIT NO. 3376    QUINCY, MA

POSTAGE WILL BE PAID BY ADDRESSEE

**National Fire Protection Association**  
Batterymarch Park  
Quincy, MA 02269-9904



© 1987 NFPA, All Rights Reserved

## **NFPA 256**

### **Standard Methods of Fire Tests of Roof Coverings**

**1987 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 17-20, 1986, in Denver, Colorado. It was issued by the Standards Council on December 10, 1986, with an effective date of December 30, 1986, and supersedes all previous editions.

The 1987 edition of this standard has been approved by the American National Standards Institute.

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.

#### **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, May 1958. It was adopted by ASTM as a standard later in 1958 and published by ASTM as E108-58. It was also published by Underwriters Laboratories Inc., as No. 790, September 1958. Revised NFPA editions have been published in 1964, 1970, 1976, 1981, and 1987.

### Committee on Fire Tests

**Sanford Davis, Chairman**  
NBS/Ctr. for Fire Research

**John A. Blair, Secretary**  
E. I. Dupont De Nemours & Co.  
Rep. Society of the Plastics Industry

**Jesse J. Beitel**, Southwest Research Institute  
**Irwin A. Benjamin**, Benjamin/Clark Assoc., Inc.  
**David Brackett**, Gypsum Assn.  
**B. J. Callahan**, Factory Mutual Research Corp.  
**William J. Christian**, Underwriters Laboratories Inc.  
**Wells Denyes**, Eastman Chemical Products Inc.  
Rep. Man-Made Fiber Producers Assn.  
**Philip J. DiNunno**, Hughes Assoc., Inc.  
**Gerard R. Dufresne**, U.S. Testing Co., Inc.  
(Vote limited to textile materials & related prod.)  
**Buell B. Dutton**, Building and Zoning Consultants  
**Richard G. Gewain**, American Iron & Steel Inst.  
**Peter Higginson**, Underwriters Labs of Canada  
**Alfred J. Hogan**, Cypress Gardens, FL  
Rep. IAFC

**Joan Koonce**, Cone Mills Corp.  
Rep. American Textile Mfrs. Inst., Inc.  
(Vote limited to textile materials & related prod.)  
**Gerald E. Lingenfelter**, American Ins. Services Group Inc.  
**George E. Meyer**, Warnock Hersey Int'l. Inc.  
**James A. Milke**, University of Maryland  
**E. E. Miller**, Industrial Risk Insurers  
**Shirley C. Reznikoff**, Arizona State University  
**John Ed Ryan**, Nat'l. Forest Products Assn.  
**Herman H. Spaeth**, Novato, CA  
**Richard P. Thornberry**, The Code Consortium  
**Lewis W. Vaughan**, Vaughan-Walter Assoc., Inc.  
Rep. Canadian Steel Construction Council

#### Alternates

**J. S. Barritt**, Industrial Risk Insurers  
(Alternate to E. E. Miller)  
**J. R. Beyreis**, Underwriters Laboratories Inc.  
(Alternate to W. J. Christian)  
**Delbert F. Boring**, American Iron & Steel Inst.  
(Alternate to R. G. Gewain)

**J. P. Carroll**, Society of the Plastics Industry  
(Alternate to J. A. Blair)  
**Robert W. Glowinski**, Nat'l. Forest Products Assn.  
(Alternate to J. E. Ryan)  
**Norman S. Pearce**, Underwriters Labs of Canada  
(Alternate to P. Higginson)

#### Nonvoting

**A. J. Bartosic**, Rohm & Haas Co.

*This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.*

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.

### Contents

<b>Chapter 1 General</b> .....	<b>256- 4</b>
1-1 Scope .....	256- 4
<b>Chapter 2 Equipment and General Test Procedures</b> .....	<b>256- 5</b>
2-1 Apparatus .....	256- 5
2-2 Test Flame .....	256- 5
2-3 Supply Air .....	256- 5
<b>Chapter 3 Preparation of Test Specimens</b> .....	<b>256- 6</b>
3-1 Construction of Test Decks .....	256- 6
3-2 Application of Roofing on Test Roof Deck .....	256- 8
3-3 Storage and Conditioning of Test Roof Decks .....	256- 8
<b>Chapter 4 General Conditions</b> .....	<b>256- 8</b>
<b>Chapter 5 Intermittent Flame Exposure Test</b> .....	<b>256- 8</b>
5-1 General .....	256- 8
5-2 Procedure .....	256- 8
5-3 Application of Flame .....	256- 8
5-4 Air Current .....	256- 9
5-5 Observations .....	256- 9
<b>Chapter 6 Spread of Flame Test</b> .....	<b>256- 9</b>
6-1 General .....	256- 9
6-2 Procedure .....	256- 9
6-3 Application of Flame .....	256- 9
6-4 Observations .....	256- 9
<b>Chapter 7 Burning Brand Test</b> .....	<b>256- 9</b>
7-1 General .....	256- 9
7-2 Procedure .....	256- 9
7-3 Size and Construction of Brands .....	256- 9
7-4 Ignition of Brands .....	256-10
7-5 Test Conditions .....	256-10
7-6 Duration of the Test .....	256-11
7-7 Test Results .....	256-11
7-8 Observations .....	256-11
<b>Chapter 8 Flying Brand Test</b> .....	<b>256-11</b>
8-1 General .....	256-11
8-2 Procedure .....	256-11
8-3 Application of Flame .....	256-11
8-4 Air Current .....	256-11
<b>Chapter 9 Rain Test</b> .....	<b>256-11</b>
9-1 General .....	256-11
9-2 Procedure .....	256-11
9-3 Application of Water .....	256-11
<b>Chapter 10 Conditions of Classification</b> .....	<b>256-12</b>
10-1 Conditions to be Met .....	256-12
<b>Index</b> .....	<b>256-13</b>

**NFPA 256**  
**Standard Methods of**  
**Fire Tests of Roof Coverings**  
**1987 Edition**  
**Chapter 1 General**

**1-1 Scope.**

1-1.1 These methods are intended to measure the relative fire characteristics of roof coverings under 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:

- (a) Intermittent Flame Exposure Test (see Chapter 5).
- (b) Spread of Flame Test (see Chapter 6).
- (c) Burning Brand Test (see Chapter 7).
- (d) Flying Brand Test (see Chapter 8).

(e) Rain Test (see Chapter 9).

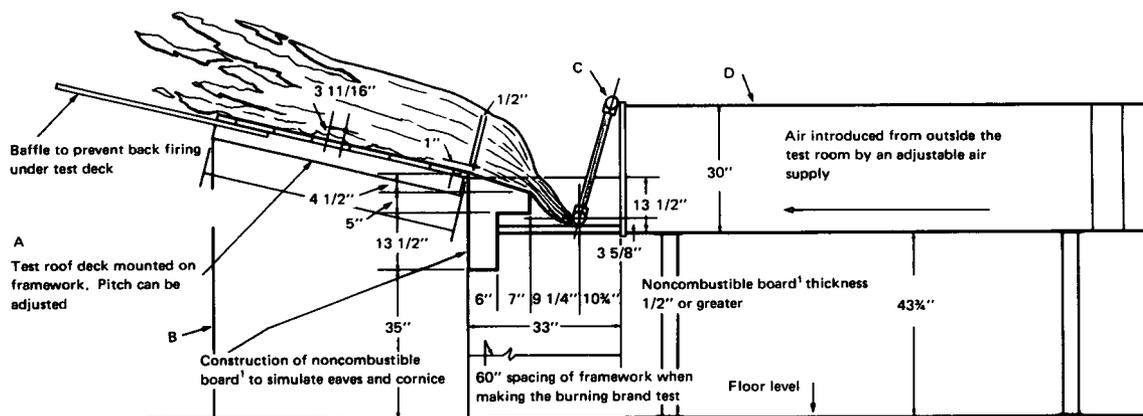
**1-1.2 Three classes of fire test exposure are described:**

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

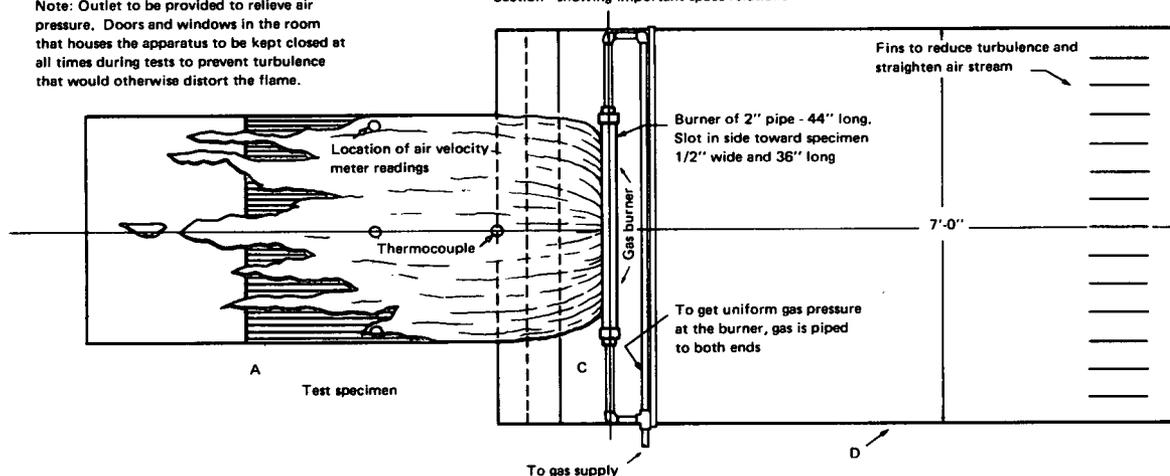
1-1.2.2 Class B tests shall be applicable to roof coverings that are effective against moderate test exposure, afford a moderate degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand hazard.

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

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



Note: Outlet to be provided to relieve air pressure. Doors and windows in the room that houses the apparatus to be kept closed at all times during tests to prevent turbulence that would otherwise distort the flame.



For SI Units: 1 in. = 25.4 mm, 1 ft = .305 m

<sup>1</sup>Johns Manville Marinite or equivalent.

Figure 1. Schematic Drawing of Fire Test Apparatus.

## Chapter 2 Equipment and General Test Procedures

### 2-1 Apparatus.

2-1.1 The essential elements of the fire test apparatus are illustrated in Figure 1. These shall include a test roof deck A, an adjustable frame B (see Figure 2) on which the test roof deck is mounted, a gas burner C as a source of flame, a wind tunnel D, an air velocity meter<sup>1</sup>, a gas pressure gage, a control valve, and an adjustable air supply.

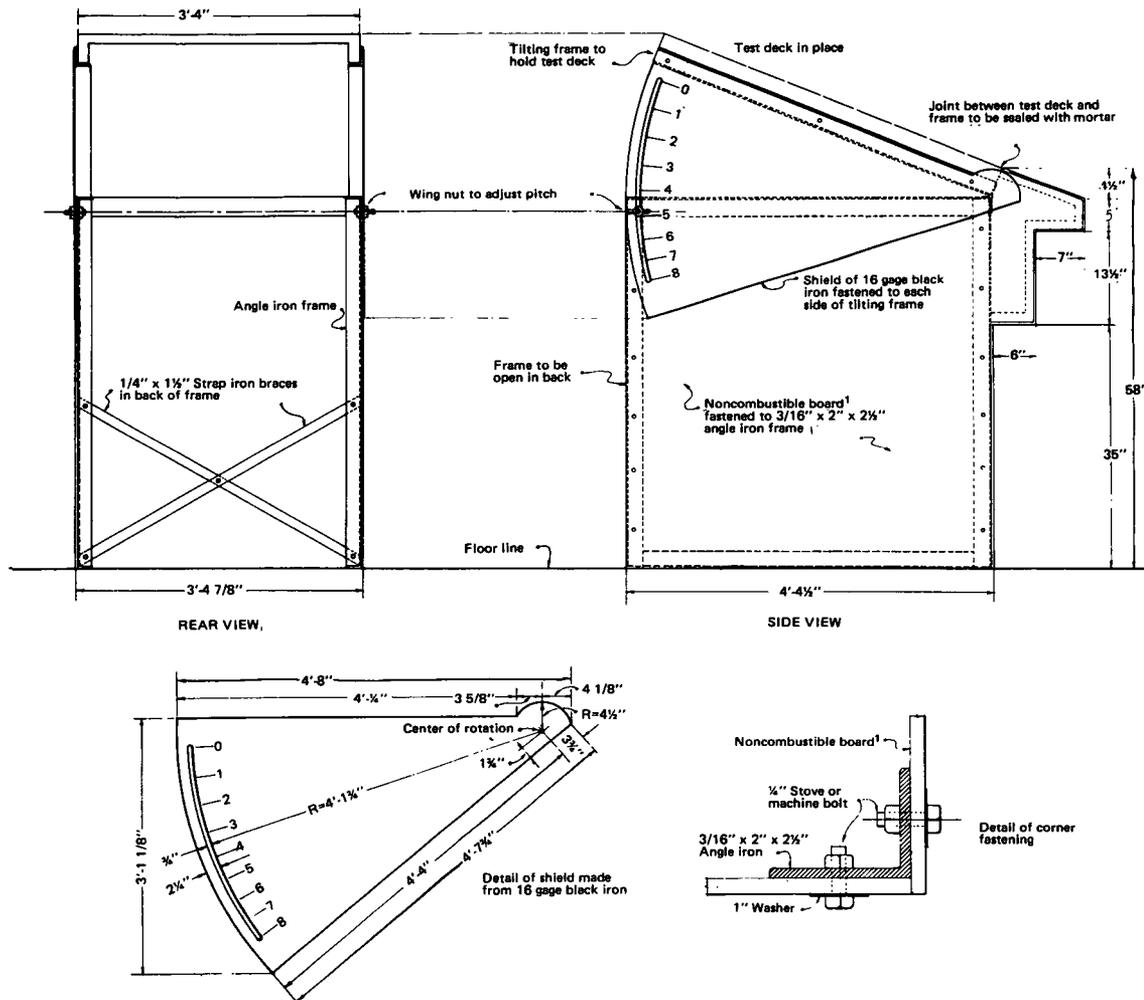
2-1.2 Figure 3 illustrates the essential elements of the rain test apparatus.

2-2 Test Flame. Control of the shape and size of the flame depends upon minimizing air turbulence in the immediate vicinity of the apparatus. To do this it is important that:

(a) Free outlet to outside air beyond and above the test apparatus so as to exhaust air introduced into the test room by the blower shall be provided, and

(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 air supplied by the blower shall be maintained between 50°F (10°C) and 90°F (32.2°C).



For SI Units: 1 in. = 25.4 mm, 1 ft = .305 m

Figure 2. Detail of Tilting Frame to Hold Test Roof Deck.

<sup>1</sup>Any direct reading instrument with a scale graduated in increments of not more than 20 ft/min (6 m/min) or any timed instrument with a scale graduated in increments of not more than 20 ft/min (6 m/min) for a timed interval of 1 min shall be used.

<sup>1</sup>Johns Manville Marinite or equivalent.

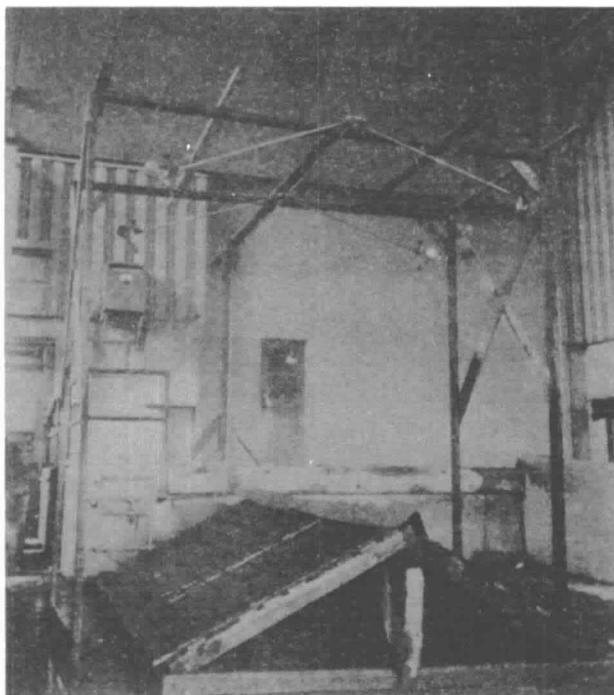


Figure 3. Rain Test Apparatus.

### Chapter 3 Preparation of Test Specimens

#### 3-1 Construction of Test Decks. (Also see Figures 4a, 4b, 4c, and 4d.)

3-1.1 The test deck for the intermittent flame exposure, burning brand tests, flying brand test and rain test shall be  $3\frac{1}{3}$  ft (1.02 m) wide by  $4\frac{1}{3}$  ft (1.32 m) long and shall be made of No. 1, white pine lumber not less than 8 nor more than 12 percent moisture content.

*Exception: As specified in 3-1.2 through 3-1.5.*

3-1.1.1 The lumber shall be free from large or loose knots, sapwood, rot, or pitchpockets, and shall contain no edge knots.

3-1.1.2 Individual deck boards shall be of nominal 1-by 8-in. (25.4 × 200-mm) lumber (S4S).

3-1.1.3 The boards shall be laid across the shorter dimension of the test deck spaced  $\frac{1}{4}$  in. (6.4 mm) apart and shall be securely nailed to two nominal 2-by 4-in. (50 × 100-mm) wood battens located under and flush with the outer edges of the deck [see Figure 4(d)].

3-1.1.4 Decks so constructed shall be even and uniform.

3-1.2 Where the roof covering is intended to be installed over other than solid deck, the test decks shall be constructed of nominal 1-by 4-in. (25.4 × 100-mm) lumber (S4S) spaced a minimum of  $\frac{1}{8}$  in. (41.3 mm) apart and shall be securely nailed to two nominal 2-by 4-in. (50 × 100-mm) wood battens. The lumber shall be of the same quality as specified in 3-1.1.

3-1.3 Roof coverings may 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.*

3-1.3.1 Plywood, if used, shall be Exterior Type C-C Plugged or higher grade, conforming to U.S. Product Standard PS1-83 for Construction and Industrial Plywood.

3-1.3.2 These decks shall have  $\frac{1}{8}$ -in. (3.2-mm) vertical and horizontal joints located as specified in 3-1.4 through 3-1.5.3 with all vertical joints centered on nominal 2-by 4-in. (50 × 100-mm) wood battens.

3-1.3.3 If wood battens or tongue and groove joints are specified for horizontal joints, this shall be so noted in reporting the tests.

3-1.4 Decks constructed of panel-type material for intermittent flame tests shall have a  $\frac{1}{8}$ -in. (3.2-mm) horizontal joint 8 in. (20.32 mm) from and parallel to the  $3\frac{1}{3}$  ft (1.02 m) long leading edge.

3-1.4.1 In addition, a  $\frac{1}{8}$ -in. (3.2-mm) vertical joint centered on the deck and extending from the leading edge of the deck to the  $\frac{1}{8}$ -in. (3.2-mm) horizontal joint shall be provided.

3-1.4.2 Since the lower  $1\frac{1}{2}$  in. (38.1 mm) of this joint are not protected by the 2-by 4-in. (50 × 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 by 4 (50 × 100 mm) to the leading edge of the deck by a piece of sheet steel, 2 in. (50.8 mm) in width.

3-1.5 For Class A and Class B burning brand tests on decks other than 1-by 8-in. nominal (25.4 × 200-mm) lumber, the  $\frac{1}{8}$ -in. (3.2-mm) horizontal joint shall be  $22\frac{1}{2}$  in. (572 mm) from and parallel to the leading edge of the deck.

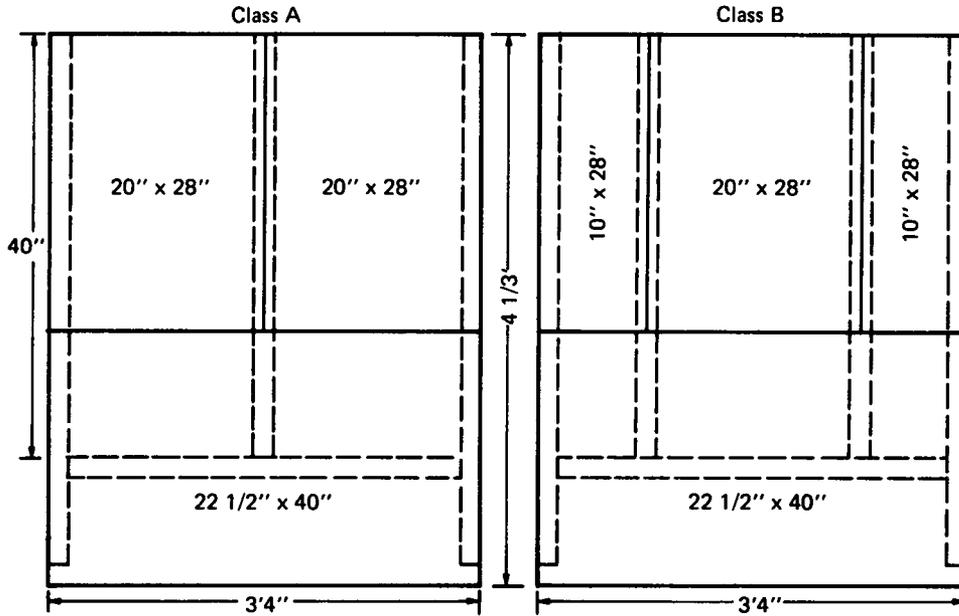
3-1.5.1 Class A test decks shall have a  $\frac{1}{8}$ -in. (3.2-mm) vertical joint centered on the deck which extends above the horizontal joint.

3-1.5.2 For Class B test decks, two  $\frac{1}{8}$ -in. (3.2-mm) vertical joints, extending above the horizontal joint with each vertical joint located 10 in. (254 mm) from and parallel to the edge of the deck, shall be provided.

3-1.5.3 For Class C burning brand test, five evenly spaced horizontal joints, with a minimum width of  $\frac{1}{8}$  in. (3.2 mm) between joints in the plywood shall be provided.

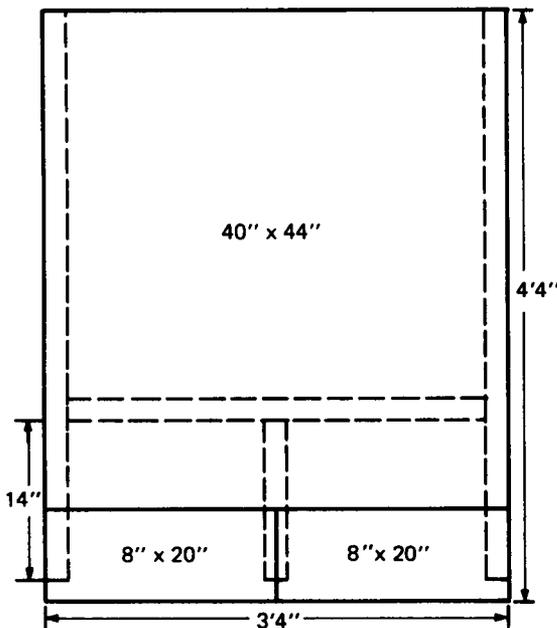
3-1.6 For the spread of flame tests, the deck shall be constructed in the same manner as specified for the intermittent flame test, except that (1) the vertical and horizontal joints need not be provided, and (2) the length of the deck shall be as specified in 3-1.6.1.

3-1.6.1 The length of the test deck shall be 13 ft (4.0 m) for Class C tests, 8 ft (2.4 m) for Class B tests, and 6 ft (1.8 m) for Class A tests.



For SI Units: 1 in. = 25.4 mm

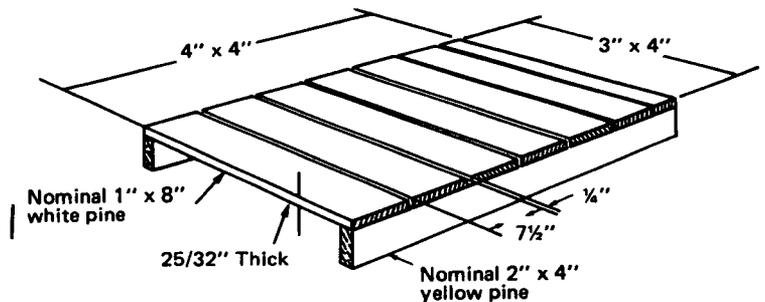
Figures 4(a) and 4(b). Plywood Decks — Burning Brand Tests. Plywood overhangs 2 × 4s by 1¼ in. at leading edge. 2 × 4 supports are indicated by dotted lines. Plywood joint width — ½ in.



For SI Units: 1 in. = 25.4 mm

Figure 4(c). Plywood Deck — Intermittent Flame Test Class A or Class B.

Plywood overhangs 2 × 4s by 1¼ in. at leading edge. 2 × 4 supports are indicated by dotted lines. Plywood joint width — ½ in.



For SI Units: 1 in. = 25.4 mm

Figure 4(d). Construction of Test Deck

**3-1.6.2** For tests of materials intended to be installed only over noncombustible decks, a noncombustible deck of the applicable length in 3-1.6.1 may be used. *This deviation shall be noted in the report.*

### 3-2 Application of Roofing on Test Roof Deck.

**3-2.1** Representative samples of roof covering materials for Class A tests shall be applied to 16 test decks (two each for intermittent flame, spread of flame, and flying brand tests, four for the burning brand test and six for the rain test).

**3-2.2** Representative samples of roof covering materials for Class B or Class C tests shall be applied to 14 test decks (two each for the spread of flame, intermittent flame, burning brand and flying brand tests and six for the rain test).

**3-2.3** The roof covering materials under investigation shall be applied in accordance with the manufacturer's instructions and shall extend to and shall be flush with the edges of the deck.

*Exception: A 1-in. (25.4-mm) overhang is permitted at the leading edge.*

**3-2.4** The materials shall be applied to the test decks not less than 30 days nor more than 60 days after their manufacture into a finished product.

### 3-3 Storage and Conditioning of Test Roof Decks.

**3-3.1** The completed test roof deck shall be stored indoors for not more than 60 days at temperatures not lower than 60°F (15.5°C) nor more than 90°F (32.2°C).

**3-3.2** In order to ensure conformance with moisture content, a piece of lumber of the same sheathing stock from which the test was constructed shall be tacked to the assembly in such a manner that it can be easily removed just before the deck is tested; it shall be large enough to be oven tested for moisture content<sup>1</sup> in accordance with 3-1.1.

**3-3.3** The test roof decks shall be stored so that each will be surrounded by freely circulating air.

## Chapter 4 General Conditions

**4-1** The intermittent flame exposure test, the spread of flame test, the burning brand test, the rain test, and the flying brand test shall be conducted on all roof coverings. (See Chapter 9 for rain test requirements.)

*Exception: Intermittent flame and burning brand tests need not be performed on materials intended for use over noncombustible decks.*

<sup>1</sup>The moisture determination shall be made on two pieces about 3 in. (7.62 cm) square cut from the selected sample, after at least 2 in. (50.8 mm) has been removed from the end. These shall be dried at 212°F (100°C) to 220°F (104.4°C) for not less than 16 nor more than 24 hours. The weight of the sample before and after drying shall be recorded. The moisture content shall be calculated on the basis of the dried weight.

**4-2** In all of the fire tests described below, 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. This is to prevent air or the test flame from traveling under the material being tested.

**4-3** In these tests, all decks shall be subjected to an air current which flows uniformly over the top surface of the roof covering. The velocity of the air current shall be  $12 \pm \frac{1}{2}$  mph ( $19.3 \pm .8$  Km/h) at points midway up the surface of the roof covering.

**4-4** Prepared roof coverings shall be tested at a slope of 5 in. (12.7 cm) per horizontal ft (30.5 cm).

**4-5** Builtup roof coverings shall be tested at the maximum slope recommended by the manufacturer but not to exceed 5 in. (12.7 cm) per horizontal ft (30.5 cm).

**4-6** The slope used shall be noted in the report.

## Chapter 5 Intermittent Flame Exposure Test

**5-1 General.** This test shall be performed on a minimum of two test decks.

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

### 5-2 Procedure.

**5-2.1** A test deck 4 ft 4 in. (1.32 m) long shall be mounted on the framework at the required incline (see Sections 4-4 through 4-6) and the blower shall be adjusted to produce the specified air current.

**5-2.2** The test deck shall be subjected to a luminous gas flame that is approximately the width of the deck at its bottom edge and which uniformly bathes the top surface of the material being tested.

*Exception: The two upper corners of the top surface may not be uniformly bathed by the luminous gas flame.*

**5-2.3** The gas supply shall be regulated so that the flame develops a temperature of  $1400 \pm 50^\circ\text{F}$  ( $760 \pm 10^\circ\text{C}$ ) in Class A and Class B tests and  $1300 \pm 50^\circ\text{F}$  ( $704.4 \pm 10^\circ\text{C}$ ) in Class C tests.

**5-2.4** The temperature shall be determined by a No. 14 B&S gage chromel-alumel wire thermocouple located 1 in. (25.4 mm) above the surface and  $\frac{1}{2}$  in. (12.7 mm) toward the source of flame from the lower edge of the first board of the test deck.

**5-2.5** If the conditions in 5-2.1 through 5-2.4 are satisfied, the flame will extend approximately to the upper edge of the test deck with licks of flame extending approximately another 1 to 2 ft (30.5 to 61 cm).

**5-3 Application of Flame.** The flame shall be applied intermittently for the specified periods and specified time intervals between applications, as indicated below.

Method of Test	Flame On, min.	Flame Off, min.	No. of Test Cycles
Class A . . . . .	2	2	15
Class B . . . . .	2	2	8
Class C . . . . .	1	2	3

**5-4 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. The air current need not be maintained for more than 1 hour for a Class A or B test or ½ hour for a Class C test.

**5-5 Observations.** During and after the intermittent flame test, including "on" and "off" periods of flame application, observations shall be made for the appearance of sustained flaming on the underside of the test deck, production of flaming or glowing brands, displacement of portions of the test sample, and exposure or falling away of portions of the roof deck.

## Chapter 6 Spread of Flame Test

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

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

**6-2 Procedure.** A test deck, having a length as prescribed in 3-1.6.1, shall be mounted in the same manner, and a luminous gas flame shall be used as described for both in Section 5-2 for the intermittent flame tests.

### 6-3 Application of Flame.

**6-3.1** 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 the shorter.

**6-3.2** For Class C test the gas flame shall be applied for a period of 4 minutes and then removed.

**6-4 Observations.** During and after the application of the test flame, observations of the test sample shall be made for the distance to which flaming of the material has spread, production of flaming or glowing brands, and displacement of portions of the test sample.

## Chapter 7 Burning Brand Test

**7-1 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.

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

**7-2 Procedure.** A 4½ ft (1.32 m) long test deck shall be mounted in the same manner as described in Section 5-2 for the intermittent flame test.

*Exception:* The framework shall be 60 in. (1.52 m) from the air duct outlet (see Figure 1) and the gas piping and burner shall be removed so as not to obstruct the air flow.

### 7-3 Size and Construction of Brands.

**7-3.1 General.** The brands (as shown in Figure 5) shall be constructed as follows, and shall be conditioned in an oven at 105 °F (40.55 °C) to 120 °F (48.9 °C) for at least 24 hours.

#### 7-3.2 Class A Test Brand.

**7-3.2.1** The Class A test brand shall consist of a grid 12 in. (30.5 cm) square and approximately 2¼ in. (57.1 mm) thick, made of dry Douglas fir lumber free from knots and pitchpockets.

**7-3.2.2** Thirty-six (36), nominal 1- by 1- by 12-in. (25.4- × 25.4-mm × 30.5-cm) strips, dressed on all four sides to ¾- by ¾-in. (19- × 19-mm) and placed in three layers of 12 strips each, with strips spaced ¼ in. (6.4 mm) apart shall be used.

**7-3.2.3** These strips shall be placed at right angles to those in adjoining layers and shall be nailed<sup>1</sup> at each end of each strip on one face and in a diagonal pattern (as shown in Figure 5) on the other face.

**7-3.2.4** The dry weight of the finished brand shall be 2000 ± 150 grams at time of test.

#### 7-3.3 Class B Test Brand.

**7-3.3.1** The Class B brand shall consist of a grid 6 in. (15.24 cm) square and approximately 2¼ in. (57.1 mm) thick, made of dry Douglas fir lumber free from knots and pitchpockets.

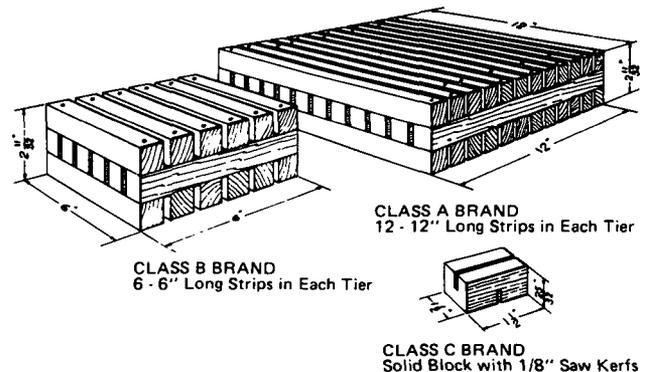


Figure 5. Brands for Classes A, B, and C Tests.

<sup>1</sup>Nails used in the construction of Class A and B brands shall be No. 16, 1½ in. (38.1 mm) long bright, flat head, diamond-point, wire nails. Sixty-eight nails weighing approximately 42 grams shall be used for Class A brand and 32 nails weighing approximately 21 grams shall be used for the Class B brand.

**7-3.3.2** Eighteen (18), nominal 1- by 1- by 6-in. (25.4-cm × 25.4-mm × 15.24-cm) strips, dressed on all four faces to ¾- by ¾-in. (19- × 19-mm) and placed in three layers of six strips each, with strips placed ¼ in. (6.4 mm) apart shall be used.

**7-3.3.3** These strips shall be placed at right angles to those in adjoining layers and shall be nailed<sup>1</sup> at each end of each strip on one face and in a diagonal pattern (as shown in Figure 5) on the other face.

#### 7-3.4 Class C Test Brand.

**7-3.4.1** The Class C test brand shall consist of a piece of dry nonresinous white pine lumber, free from knots and pitchpockets, 1½- by 1½- by 2½<sub>32</sub>-in. (38.1- × 38.1- × 19.8-mm) thick with a saw kerf ⅛ in. (3.2 mm) wide, ½ the thickness of the brand across the center of the top and bottom faces.

**7-3.4.2** The saw kerf on opposite faces shall be at right angles to each other.

**7-3.4.3** The dry weight of the finished brand shall be 9¼ ± 1¼ grams at time of test.

#### 7-4 Ignition of Brands.

**7-4.1** Before application to the test deck, the brands shall be ignited so as to burn freely in still air.

**7-4.2** 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.

**7-4.3** The flame temperature of the igniting flame shall be 1630 ± 50°F (887 ± 28°C) and shall be measured 2⅞ in. (5.9 cm) above the top of the burner, which shall be shielded from drafts.

**7-4.4** The test brands shall be subjected to the required size of flame of the gas burner for the following required 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 present each surface to the flame in the following manner and sequence:

Each 12- by 12-in. (30.5- × 30.5-cm) face for 30 seconds.

Each 2¼- by 12-in. (5.71- × 30.5-cm) face for 45 seconds.

Each 12- by 12-in. (30.5- × 30.5-cm) 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 present each surface to the flame in the following manner and sequence:

Each 6- by 6-in. (15.24- × 15.24-cm) face for 30 seconds.

Each 2¼- by 6-in. (5.71- × 15.24-cm) face for 30 seconds.

Each 6- by 6-in. (15.24- × 15.24-cm) 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 present each of the 1½- by 1½-in. (38.1- × 38.1-mm) faces to the flame for 1 minute.

#### 7-5 Test Conditions.

##### 7-5.1 Class A Tests.

**7-5.1.1** 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. (10.16 cm) from either side or 12 in. (30.5 cm) from the top or bottom edge of the deck.

**7-5.1.2** The brand shall be placed so that the strips in both the upper and lower layers are parallel to the direction of air flow and the upper edge of the brand shall be located 3 in. (7.62 cm) above the horizontal joint in the test deck.

**7-5.1.3** The brand shall be secured to the deck by a No. 18 B&S gage soft iron wire.

**7-5.1.4** If the roof covering is being investigated 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. (7.62 cm) above the horizontal panel joint in the test deck.

##### 7-5.2 Class B Tests.

**7-5.2.1** A brand shall be placed on the surface of the test deck at each of the two locations considered most vulnerable (point of minimum coverage over deck joint) with respect to ignition of the deck.

**7-5.2.2** Each brand shall be positioned with its upper edge 1½ in. (38.1 mm) above the selected joint in the deck boards, but in no case shall it be closer than 6 in. (15.24 cm) from each side or 12 in. (30.5 cm) from the top or bottom edge of the deck.

**7-5.2.3** The brands shall be placed so that the strips in both the upper and lower layers are parallel to the direction of air flow.

**7-5.2.4** The brands shall be secured to the deck by a No. 18 B&S gage soft iron wire.

**7-5.2.5** 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.

**7-5.2.6** 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

<sup>1</sup>Nails used in the construction of Class A and B brands shall be No. 16, 1½ in. (38.1 mm) long bright, flat head, diamond-point, wire nails. Sixty-eight nails weighing approximately 42 grams shall be used for Class A brand and 32 nails weighing approximately 21 grams shall be used for the Class B brand.

brands shall be located 1½ in. (38.1 mm) above the horizontal panel joint in the test deck.

### 7-5.3 Class C Tests.

**7-5.3.1** At 1- to 2-minute intervals, a brand shall be placed on the surface of the test deck at each of 25 locations considered most vulnerable (points of minimum coverage over deck joints) with respect to ignition of the deck.

**7-5.3.2** Each brand shall be positioned with its upper edge ½ in. (12.7 mm) above the selected joint in the deck boards but in no case shall it be closer than 6 in. (15.24 cm) from each side or 12 in. (30.5 cm) from the top or bottom edge of the deck.

**7-5.3.3** No brand shall be placed closer than 4 in. (10.16 cm) to the point where a previous brand was located.

**7-5.3.4** The brands shall be secured by a No. 18 B&S gage 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 air flow.

**7-5.3.5** In addition to the above, when the roof covering is comprised of the lapped courses, no brand shall be placed closer than ½ in. (12.7 mm) from the bottom edge of the lapped course above nor shall it be closer than 2 in. (50.8 mm) to a joint in the roof covering material in the same course. Loose or unfastened portion of the roof covering which can be bent up to 90 degrees without injury to fastenings holding other portions of roof covering shall be cut away.

**7-5.3.6** If the roof covering is applied to plywood or other panel-type decks, the brands shall be placed so that as many of the 25 brands as possible are centered over panel joints in the test deck.

**7-6 Duration of the Test.** Each individual test, whether it be a 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. The air current need not be maintained for more than 1½ hours for Class A or B tests.

### 7-7 Test Results.

**7-7.1** 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.

**7-7.2** If brands are replaced, they shall not be located in the same area as the disregarded brand.

**7-8 Observations.** During and after the burning brand tests, observations for the appearance of sustained flaming on the underside of the test deck, production of flaming or glowing brands of roof covering material, displacement of the test sample, and the exposure or falling away of portions of the roof deck shall be made.

## Chapter 8 Flying Brand Test

**8-1 General.** This test shall be performed on a minimum of two test decks.

**8-2 Procedure.** A test deck, 4 ft 4 in. (1.32 m) long, shall be mounted in the same manner and luminous gas flame shall be used as described in Section 5-2 for the intermittent flame test.

### 8-3 Application of Flame.

**8-3.1** The Class A and Class B test gas flame shall be applied continuously for 10 minutes.

**8-3.2** The Class C test flame shall be applied continuously for 4 minutes.

**8-4 Air Current.** Maintain the 12 mph (19.3 Km/h) 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 be developed.

## Chapter 9 Rain Test<sup>1</sup>

### 9-1 General.

**9-1.1** The rain test shall be conducted where the fire retardant characteristics of the roof covering may be adversely affected by prolonged exposure to the weather.

**9-1.2** Asphalt shingles meeting ASTM Designation D-225 (reapproved 1970) D3018-1972 or Underwriters Laboratories Inc., *Standard for Safety* UL55B, 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.

**9-1.3** This test shall be conducted on six test decks.

### 9-2 Procedure.

**9-2.1** Test decks 4 ft 4 in. (1.32 m) long shall be mounted in a framework at a slope of 4 in. (10.16 cm) per horizontal ft (30.5 cm).

**9-2.2** Approximately 7 ft (2.13 m) above the test decks, spray nozzles that deliver an average of 0.7 in. (17.8 mm) of water per hour at a temperature between 35°F (2.0°C) and 60°F (15.5°C) for the test deck area shall be mounted.

### 9-3 Application of Water.

**9-3.1** The test decks shall be exposed to 12 1-week cycles.

**9-3.2** Each cycle shall consist of 96 hours of water exposure and 72 hours of drying time at 140°F (60.0°C).

<sup>1</sup>This method referenced is described as Method A in ASTM D2898-77, *Methods of Test for Durability of Fire Retardant Treatment of Wood*.

**9-3.3** The final drying cycle shall be controlled so that the moisture content of the deck lumber is between 8 and 12 percent.

**9-3.4** The intermittent flame, burning brand, and the flying brand tests shall then be repeated.

## Chapter 10 Conditions of Classification

**10-1 Conditions to be Met.** A roof covering material must meet the following conditions when subjected to the particular class of fire tests.

**10-1.1** At no time during or after the intermittent flame, spread of flame, or burning brand tests shall:

(a) Any portion of the roof covering material be blown or fall off the test deck in the form of flaming or glowing brands that continue to glow after reaching the floor, or

(b) The roof deck be exposed, or

(c) Portions of the roof deck fall away in the form of particles that continue to glow after reaching the floor.

**10-1.2** At no time during the Class A, Class B, or Class C intermittent flame for the Class A or Class B 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.

**10-1.3** In the Class C burning brand tests, there may be sustained flaming on the underside of the deck; but it shall not involve more than 20 percent of the brands applied.

**10-1.4** At the conclusion of the spread of flame tests, the flaming shall not have spread beyond 6 ft (1.82 m) for Class A, 8 ft (2.44 m) for Class B, or 13 ft (3.96 m) (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.

**10-1.5** In the flying brand test, no flying, flaming brands, or particles that continue to glow after reaching the floor shall be produced.

## Index

© 1987 National Fire Protection Association, All Rights Reserved.

The copyright in this index is separate and distinct from the copyright in the document which it indexes. The licensing provisions set forth for the document are not applicable to this index. This index may not be reproduced in whole or in part by any means without the express written permission of the National Fire Protection Association, Inc.

- A-
- Air temperature** ..... 2-3
- Apparatus** ..... 2-1, Fig. 1
- B-
- Burning brand test** ..... 4-1, Chap. 7
- Conditions
- Of classification ..... 10-1.2, 10-1.3
- Test ..... 7-5
- Class A ..... 7-5.1
- Class B ..... 7-5.2
- Class C ..... 7-5.3
- Construction ..... Figs. 4(a) and 4(b)
- Duration ..... 7-6
- Ignition of brands ..... 7-4
- Class A ..... 7-4.4(a)
- Class B ..... 7-4.4(b)
- Class C ..... 7-4.4(c)
- Flame temperature ..... 7-4.3
- Joints ..... 3-1.5.3
- Observations ..... 7-8
- Procedure ..... 7-2
- Results of tests ..... 7-7
- Size and construction of brands ..... 7-3
- Class A ..... 7-3.2
- Class B ..... 7-3.3
- Class C ..... 7-3.4
- C-
- Class A test**
- Applicability ..... 1-1.2.1
- Class B test**
- Applicability ..... 1-1.2.2
- Class C test**
- Applicability ..... 1-1.2.3
- Conditions**
- General ..... Chap. 4
- Of classification ..... Chap. 10
- D-
- Decks, preparation of** ..... Chap. 3
- Application of roofing on ..... 3-2
- Construction ..... 3-1, Fig. 4(d)
- Joints ..... 3-1.3.2
- Burning brand test ..... 3-1.5
- Intermittent flame test ..... 3-1.4
- Spread of flame test ..... 3-1.6
- Storage and conditioning ..... 3-3
- E-
- Equipment** ..... see Apparatus
- F-
- Flame, test**
- General procedures ..... 2-2
- Flying brand test** ..... Chap. 8
- Air current ..... 8-4
- Application of flame ..... 8-3
- Conditions of classification ..... 10-1.5
- Procedure ..... 8-2
- Flame spread tests** ..... see Spread of flame tests
- Frame, tilting** ..... Fig. 2
- G-
- General Conditions** ..... see Conditions, General
- I-
- Intermittent flame exposure test** ..... 4-1, Chap. 5
- Air current ..... 5-4
- Application of flame ..... 5-3
- Conditions of classification ..... 10-1.1
- Construction of decks ..... Fig. 4(c)
- Observations ..... 5-5
- Procedure ..... 5-2
- P-
- Preparation of test specimens** ..... Chap. 3
- R-
- Rain test** ..... Chap. 9
- Apparatus ..... Fig. 3
- Application of water ..... 9-3
- Exemptions ..... 9-1.2
- Procedure ..... 9-2
- Roof decks**
- Application of roofing ..... 3-2
- Class A ..... 3-2.1
- Class B and C ..... 3-2.2
- Storage and conditioning ..... 3-3
- Moisture content ..... 3-3.2
- Temperature ..... 3-3.1
- Tilting frame ..... Fig. 2
- S-
- Scope of standard** ..... 1-1
- Specimens, preparation of** ..... Chap. 3
- Spread of flame test** ..... 4-1, Chap. 6
- Application of flame ..... 6-3
- Conditions of classification ..... 10-1.1, 10-1.4
- Observations ..... 6-4
- Procedure ..... 6-2
- Supply air, temperature** ..... 2-3
- T-
- Test decks** ..... see Decks
- Test roof decks** ..... see Roof decks
- Test procedures** ..... see also specific type such as
- Burning brand test, Procedure
- General ..... Chap. 2

## **SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS**

**Contact NFPA Standards Administration for final date for receipt of proposals  
on a specific document.**

### **INSTRUCTIONS**

**Please use the forms which follow for submitting proposed amendments.  
Use a separate form for each proposal.**

1. For each document on which you are proposing amendment indicate:
  - (a) The number and title of the document
  - (b) The specific section or paragraph.
2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.
3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.
4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.
5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.
6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

**NOTE:** The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

- (a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and
- (b) identification of the document, paragraph of the document to which the proposal is directed, and
- (c) a statement of the problem and substantiation for the proposal, and
- (d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

**FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS**

**Mail to: Secretary, Standards Council  
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269**

Date 5/18/85 Name John B. Smith Tel. No. 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) Document Title: Protective Signaling Systems NFPA No. & Year NFPA 72D

b) Section/Paragraph: 2-7.1 (Exception)

2. Proposal recommends: (Check one)  new text  
 revised text  
 deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Delete exception.

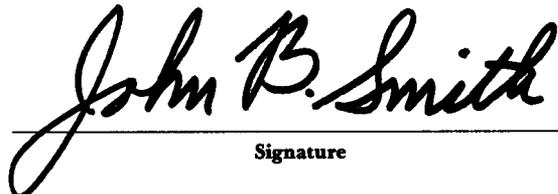
4. Statement of Problem and Substantiation for Proposal:

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5.  This Proposal is original material.  
 This Proposal is not original material; its source (if known) is as follows: \_\_\_\_\_

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

  
Signature

**PLEASE USE SEPARATE FORM FOR EACH PROPOSAL**