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FIRE TESTS OF ROOF COVERINGS 1982

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SC-FM-81

Standard Methods of
Fire Tests of Roof Coverings

NFPA 256-1982

1982 Edition of NFPA 256

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., on November 18, 1981, at its Fall Meeting in Toronto, Ontario, Canada. It was issued by the Standards Council on December 9, 1981 with an effective date of December 29, 1981 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.

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 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, and reconfirmed at the 1981 Fall Meeting.

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Contents

Standard Methods of
Fire Tests of Roof Coverings

NFPA 256-1982

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 which 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 which 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 which 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.

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[1], a gas pressure gage, a control valve, and a variable speed blower.

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

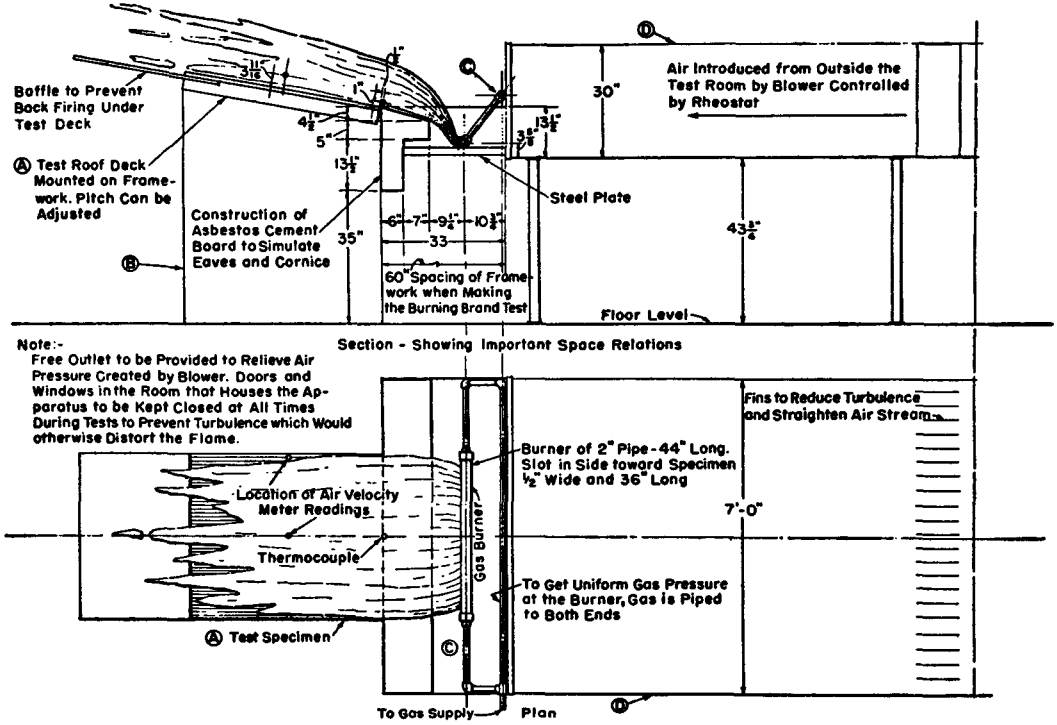
2-2 Test Flame. Control of the shape and size of the flame depends upon minimizing air turbulence in the immediate vicinity of the apparatus. To do this it is important that:

(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.

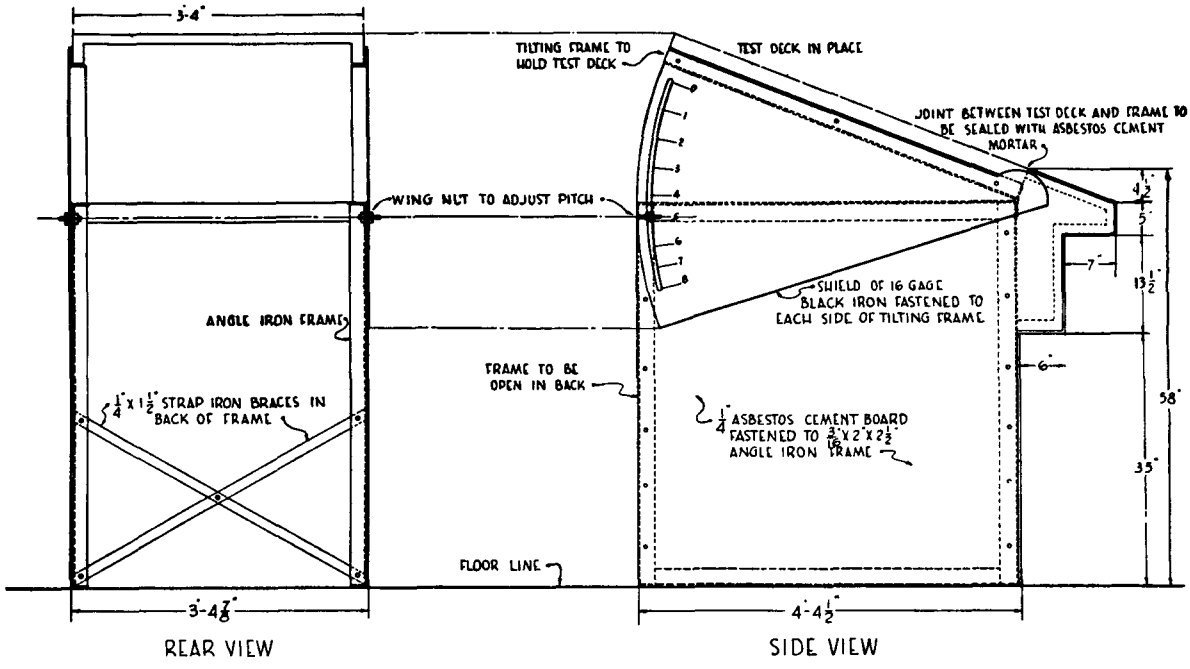
2-3 Supply Air. The temperature of the air supplied by the blower shall be maintained between 50°F (10°C) and 90°F (32.2°C).

[1]Any instrument which permits reading velocity directly without the use of a timing device shall be suitable.



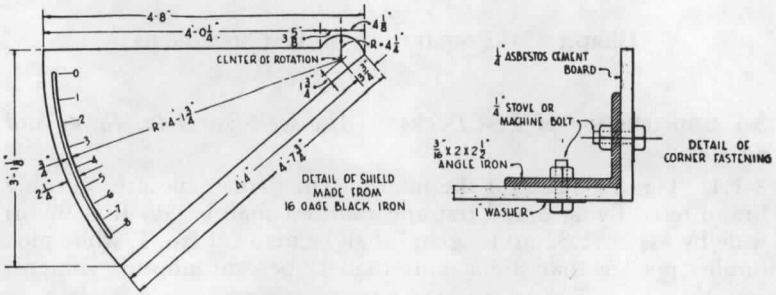
For SI Units: 1 in. = 25.4 mm, 1 ft = .305 m

Figure 1. Schematic Drawing of Fire Test Apparatus.



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

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



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

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

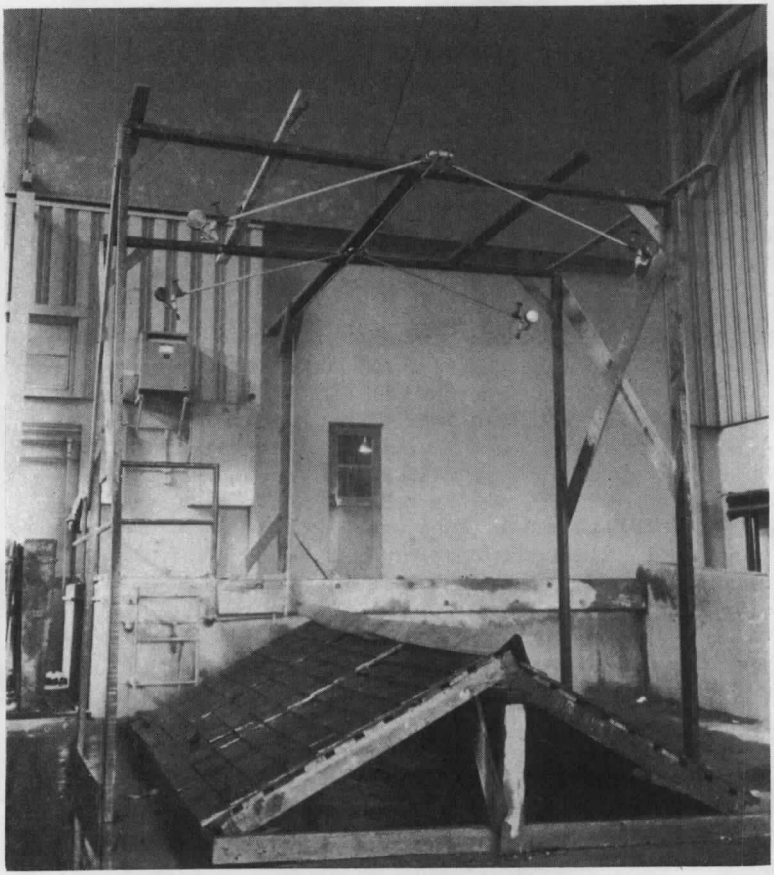


Figure 3. Rain Test Apparatus.

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 3⅓ ft (1.02 m) wide by 4⅓ 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 ¼ 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*).

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

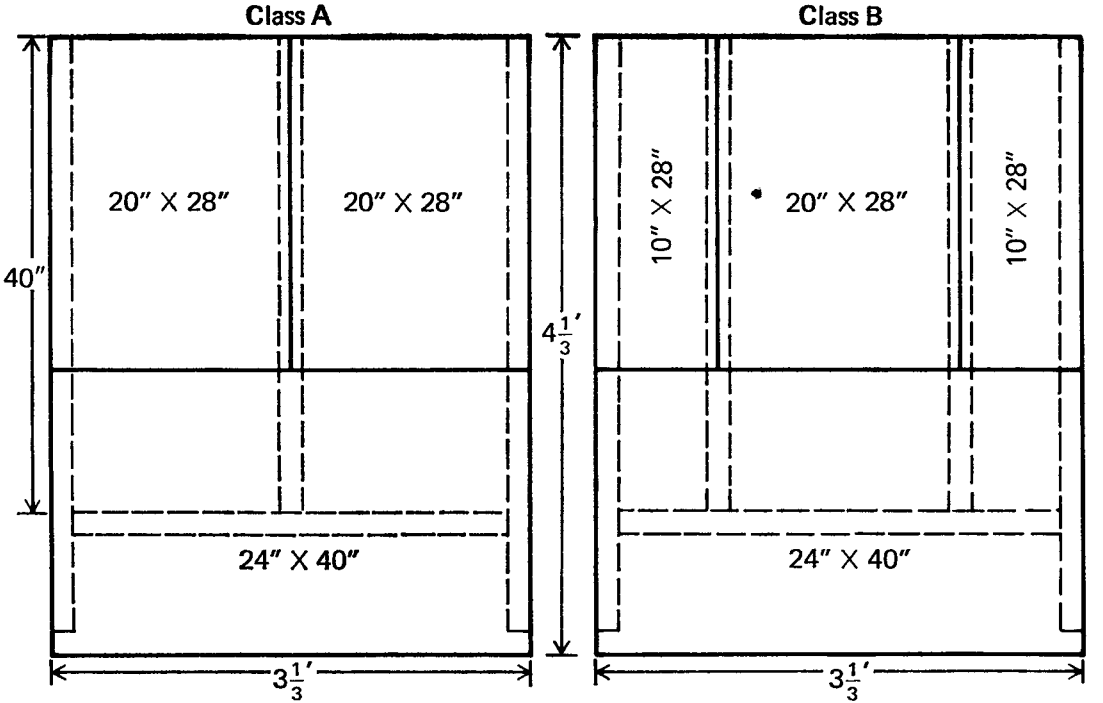
3-1.2 Where the roof covering is intended to be installed over other than solid deck, the test decks shall be constructed of nominal 1- by 4-in. (25.4- × 100-mm) lumber (S4S) spaced a minimum of 1⅝ in. (41.3 mm) apart and shall be securely nailed to two nominal 2- by 4-in. (50- × 100-mm) wood battens. The lumber shall be of the same quality as specified in 3-1.1.

3-1.3 Roof covering may be applied to the test decks of 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 PS1-74 for Construction and Industrial Plywood.

3-1.3.2 These decks shall have ⅛-in. (3.2-mm) vertical and horizontal joints located as specified in 3-1.1.3 with all vertical joints centered on nominal 2- by 4-in. (50- × 100-mm) wood battens.

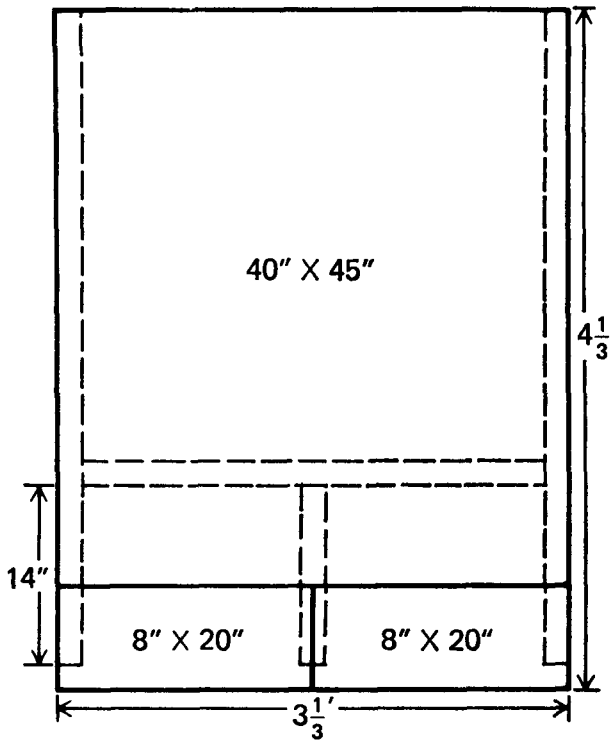
3-1.3.3 If wood battens or tongue and groove joints are specified for horizontal joints, this shall be so noted in reporting the tests.



For SI Units: 1 in. = 25.4 mm

Figures 4(a) and 4(b). Plywood Decks — Burning Brand Tests.

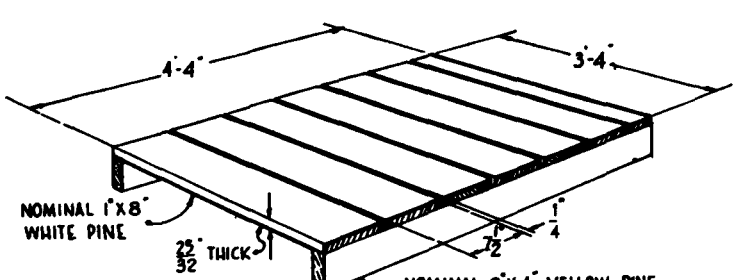
Plywood overhangs 2 × 4s by 1¼ in. at leading edge. 2 × 4 supports are indicated by dotted lines. Plywood joint width — ⅛ in.



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 — ⅛ in.



For SI Units: 1 in. = 25.4 mm

Figure 4(d). Construction of Test Deck for Other than Wood Shingles and Shakes

3-1.4 The decks for intermittent flame tests shall have a ⅛-in. (3.2-mm) horizontal joint 8 in. (20.32 mm) from and parallel to the 3⅓ ft (1.02 mm) long leading edge.

3-1.4.1 In addition, a ⅛-in. (3.2-mm) vertical joint centered on the deck and extending from the leading edge of the deck to the ⅛-in. (3.2-mm) horizontal joint shall be provided.

3-1.4.2 Since the lower 1½ 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 ⅛-in. (3.2-mm) horizontal joint shall be 24 in. (61 cm) from and parallel to the leading edge of the deck.

3-1.5.1 Class A test decks shall have a ⅛-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 ⅛-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 ⅛ in. (3.2 mm) between joints in the plywood shall be provided.

3-1.6 For the spread of flame test, the test deck shall be constructed in the same manner as specified for the intermittent flame test, and shall be 3⅓ ft (1.02 m) wide and 13 ft (3.96 m) long. If the roof covering is intended to be applied only to plywood decks, two vertical joints, ⅛ in. (3.2 mm) wide, centered vertically on the deck and extending from 8 ft (2.44 m) above the leading edge to 12 ft (3.66 m) above the leading edge shall be provided.

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[1] 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.

[1]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.

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.*)

4-2 In all of the fire tests described below, mortar (asbestos-fibered gypsum 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 ± ½ mph (19.3 ± .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 Built-up 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 which 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 ± 50°F (760 ± 28°C) in Class A and Class B tests and 1300 ± 50°F (704.4 ± 28°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 ½ 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.

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 13 ft (3.96 m) long test deck 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 4⅓ 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[1] 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.

[1]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.

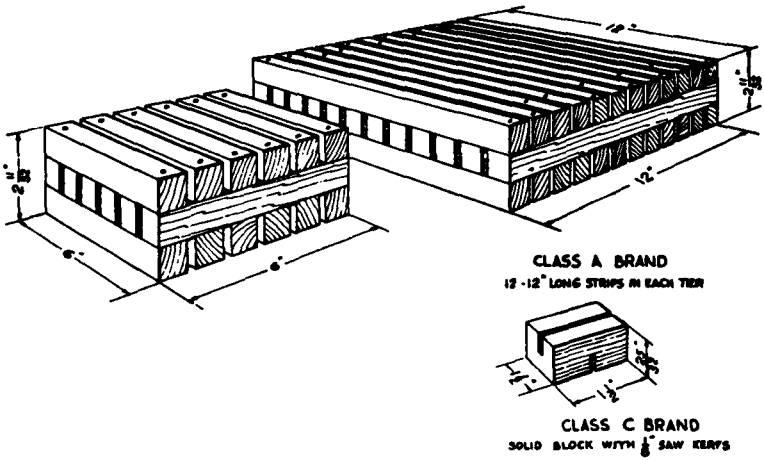


Figure 5. Brands for Classes A, B, and C Tests.

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.

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[1] 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 $^{25}/_{32}$-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.

[1]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.

7-3.4.2 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 They 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 2$\frac{5}{16}$ 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 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.

7-7 Test Results.

7-7.1 The results of tests shall be disregarded in which the brands do not show progressive and substantially complete consumption after application to the test deck.

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.