UL 790

Underwriters Laboratories Inc.

Standard for Safety

Standard Test Methods for Fire Tests of Roof Coverings

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UL Standard for Safety for Standard Test Methods for Fire Tests of Roof Coverings,UL 790

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Revisions: This Standard contains revisions through and including October 10, 2008.

Summary of Topics

This revision of ANSI/UL 790 is being issued to reflect the reaffirmation of ANSI approval of the Standard.

UL Standards for Safety are developed and maintained in the Standard Generalized Markup Language (SGML). SGML -- an international standard (ISO 8879-1986) -- is a descriptive markup language that describes a document's structure and purpose, rather than its physical appearance on a page. Due to formatting differences resulting from the use of UL's new electronic publishing system, please note that additional pages (on which no requirements have been changed) may be included in revision pages due to relocation of existing text and reformatting of the Standard.

Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The revisions dated October 10, 2008 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: http://ulstandardsinfonet.ul.com/ulforeword.html.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing or Classification and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
1	October 10, 2008
2-26	April 22, 2004

No Text on This Page

APRIL 22, 2004
(Title Page Reprinted: October 10, 2008)

UL 790

Standard for Standard Test Methods for Fire Tests of Roof Coverings

The first through seventh editions were titled Tests for Fire Resistance of Roof Covering Materials.

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Second Edition – April, 1969
Third Edition – May, 1973
Fourth Edition – December, 1978
Fifth Edition – October, 1983
Sixth Edition – October, 1995
Seventh Edition – September, 1997

Eighth Edition

April 22, 2004

The most recent designation of ANSI/UL 790 as a Reaffirmed American National Standard (ANS) occurred on October 7, 2008. The ANSI approval does not include the cover page, transmittal pages or title page.

This ANSI/UL Standard for Safety, which consists of the eighth edition, with revisions through October 10, 2008, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc. and is not part of the ANSI Standard.

The Department of Defense (DoD) has adopted UL 790 on March 21, 1984. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover the fire resistance performance of roof coverings exposed to simulated fire sources originating from outside a building on which the coverings are installed. They are applicable to roof coverings intended for installation on either combustible or noncombustible decks (see 1.7) when the roof coverings are applied as intended.

1.2 Three classes of fire exposure are described.

1.3 Class A roof coverings are effective against severe fire test exposures. Under such exposures, roof coverings of this class afford a high degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

1.4 Class B roof coverings are effective against moderate fire test exposures. Under such exposures, roof coverings of this class afford a moderate degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

1.5 Class C roof coverings are effective against light fire test exposures. Under such exposures, roof coverings of this class afford a light degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

1.6 Tests conducted in accordance with these requirements are intended to demonstrate the performance of roof coverings during the types and periods of fire exposure involved, but are not intended to determine the acceptability of roof coverings for use after exposure to fire. These fire test methods do not provide a basis to compare expected performance under all actual fire conditions but they do provide a basis for comparison of the response of roof coverings when subjected to fire sources that are described herein.

1.7 A combustible deck is formed of wood (sheathing boards or plywood). A noncombustible deck is formed of metal, concrete, or poured gypsum.

2 Units of Measurement

2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

PERFORMANCE

3 General

3.1 Representative samples of a roof covering material, assembled to test decks as described in Section 4, are to be subjected to the applicable tests described in Sections 6 – 11 as specified in Table 3.1.

Table 3.1
Required tests and test assemblies

Material to be tested	Required number of test assemblies[a]					
	Intermittent-flame test, Section 6	Spread-of-flame test, Section 7	Burning-brand test, Section 8	Flying-brand test, Section 9	Rain test, Section 10	Weathering test, Section 11
Other than wood shakes or shingles, for installation on:						
A. Combustible decks:						
1. Class A	2	2	4	NA	NA	NA
2. Class B or C	2	2	2	NA	NA	NA
B. Noncombustible decks only	NA	2	NA	NA	NA	NA
Wood shakes and shingles[b] :						
A. Class A	3 (2) [5]	3	6 (2) [5]	3 (2) [5]	6	15
B. Class B or C	3 (2) [5]	3	3 (2) [5]	3 (2) [5]	6	15

[a] NA – Test is not required.

[b] Number in parentheses is number of samples from Rain Test, Section 10, to be tested. Number in brackets is number of samples from Weathering Test, Section 11, to be tested.

4 Preparation of Samples

4.1 General

4.1.1 Representative samples of a roof covering material are to be applied, as described in 4.4.1, to test decks constructed in accordance with the applicable requirements of 4.2.1 – 4.3.2. The assemblies are to be conditioned in accordance with 4.5.1 prior to testing.

4.2 Intermittent-flame, burning-brand, and flying-brand test decks

4.2.1 Except as indicated in 4.2.2 and 4.2.3, the test deck for the Intermittent-Flame Test, Section 6, and the Burning-Brand Test, Section 8, is to be 3-1/3 feet (1 m) wide by 4-1/3 feet (1.3 m) long and is to be made of kiln-dried No. 1 white pine or Ponderosa pine lumber with not less than 8 nor more than 12 percent moisture content. The lumber is to be free from large or loose knots, sapwood, rot, or pitch pockets, and is to contain no edge knots. Individual deck boards are to be of nominal 1 by 8 inch (19.1 by 184 mm) lumber (dressed on four sides). If used for the Class C burning brand test, see 8.4.3.1 – 8.4.5.1, the width of the deck board is to be such that the brands will be located directly over the spaces between the boards. The deck boards are to be laid across the shorter dimension of the test deck, spaced 1/4 inch (6.4 mm) apart, and securely nailed to two nominal 2 by 4 inch (38 by 89 mm) wood battens located under and flush with the outer edges of the deck. Decks so constructed are to be even and uniform. Figures 4.1 and 4.2 illustrate the construction details of these decks.

Figure 4.1
Intermittent-flame and burning-brand pine board deck

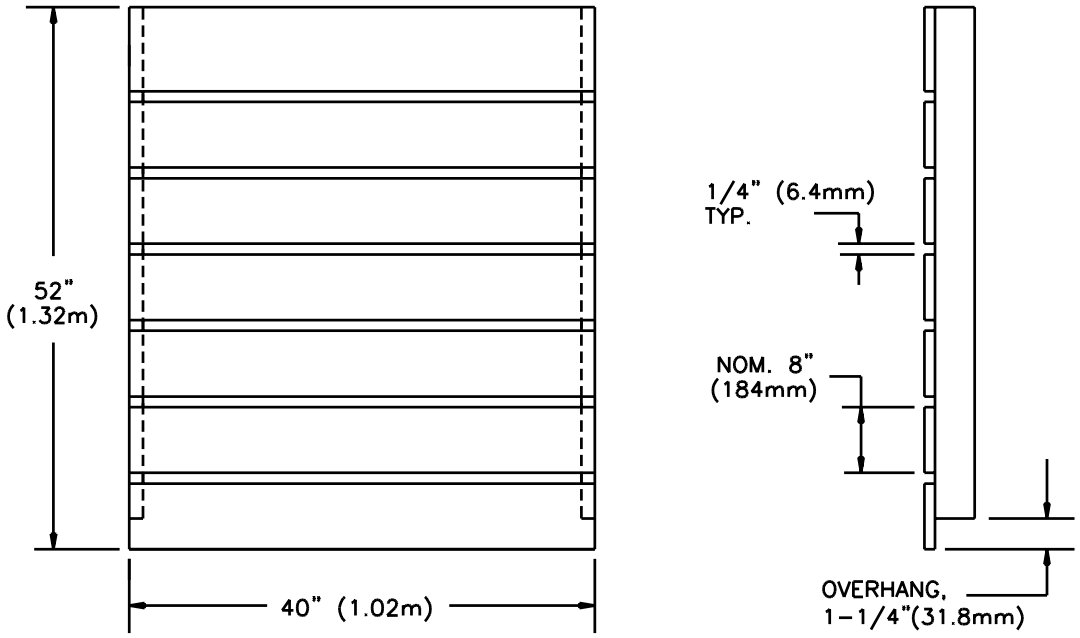

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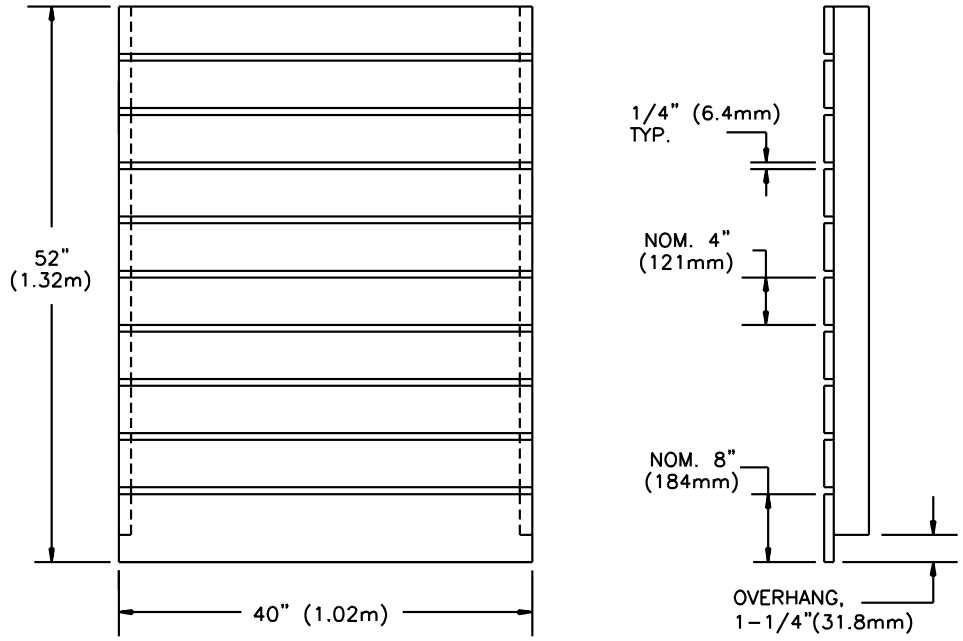
Figure 4.2
Class C burning brand deck with 3/4 inch pine boards



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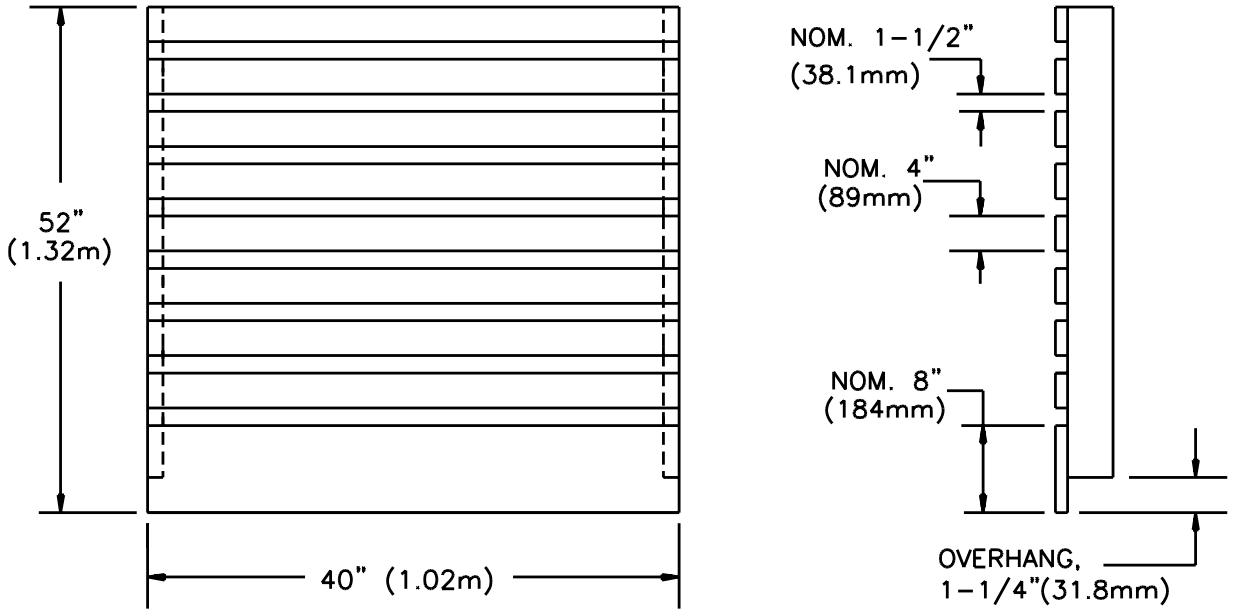
4.2.2 For the Intermittent-Flame Test, Section 6, Burning-Brand Test, Section 8, and Flying-Brand Test, Section 9, on treated wood shingles and shakes, the test decks are to be constructed of nominal 1 by 4 inch (19.1 by 89 mm) lumber (dressed on four sides), spaced 1-1/2 inches (38.1 mm) apart, and securely nailed to two nominal 2 by 4 inch (38 by 89 mm) wood battens. The lumber is to be of the quality specified in 4.1.1. Figure 4.3 illustrates the construction details of this deck.

Figure 4.3
Intermittent-flame, burning-brand and flying-brand deck for use with wood shingles and shakes

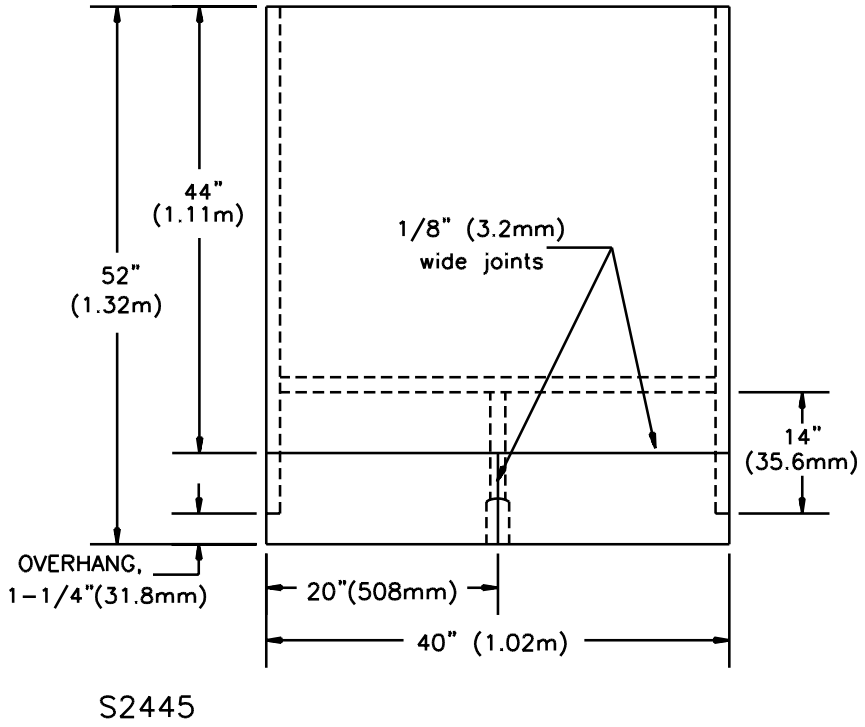


S2451

4.2.3 The roof covering shall be investigated while applied to plywood decks of the minimum thickness specified by the test sponsor. The plywood (A-C grade, Group 1, exterior) is to have face and back veneers of Douglas fir. A plywood deck is to have 1/8 inch (3.2 mm) vertical and horizontal joints, and all vertical joints are to be centered on nominal 2 by 4 inch (38 by 89 mm) wood battens. See 4.2.4 and 4.2.5. When recommended by the test sponsor the battens shall also be used for horizontal joints.

4.2.4 A plywood deck to be used for the intermittent flame test is to have a horizontal joint 8 inches (200 mm) from and parallel to the 3-1/3 foot (1.02 m)) long leading edge. In addition, a vertical joint that is centered on the deck and extends from the leading edge of the deck to the horizontal joint is to be provided. As the lower 1-1/2 inches (38 mm) of this joint is not protected by the nominal 2 by 4 inch (38 by 89 mm) batten due to the mounting arrangement on the carriage, the underside of this joint from the end of the 2 by 4 to the leading edge of the deck is to be covered by a piece of sheet steel 2 inches (50 mm) wide. Figure 4.4 illustrates the construction details of this deck.

Figure 4.4
Intermittent-flame plywood deck



4.2.5 A plywood deck to be used for a Class A or B burning-brand test is to be provided with a horizontal joint that is 22-1/2 inches (572 mm) from, and parallel to, the leading edge of the deck. A deck to be used for a Class A test is to have a vertical joint centered on the deck and extending above the horizontal joint. A deck to be used for a Class B test is to be provided with two vertical joints, extending above the horizontal joint, and each located 10 inches (254 mm) from and parallel to the side edges of the deck. A plywood deck to be used or a Class C burning-brand test is to have five horizontal joints, with at least 1/8 inch (3.2 mm) spacing between joints in the plywood. Figures 4.5 – 4.7 illustrate the construction details of these decks.

Figure 4.5
Class A burning-brand plywood deck

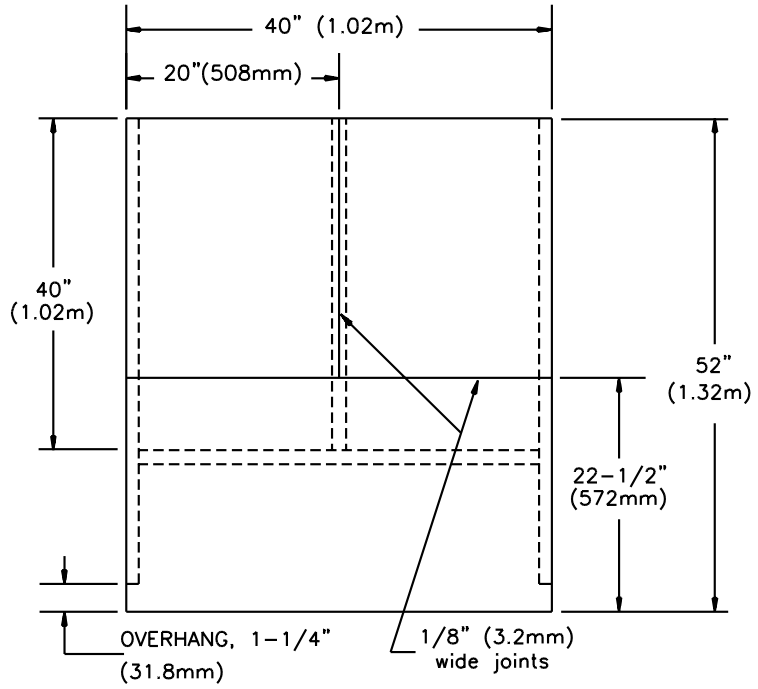


Figure 4.6
Class B burning-brand plywood deck

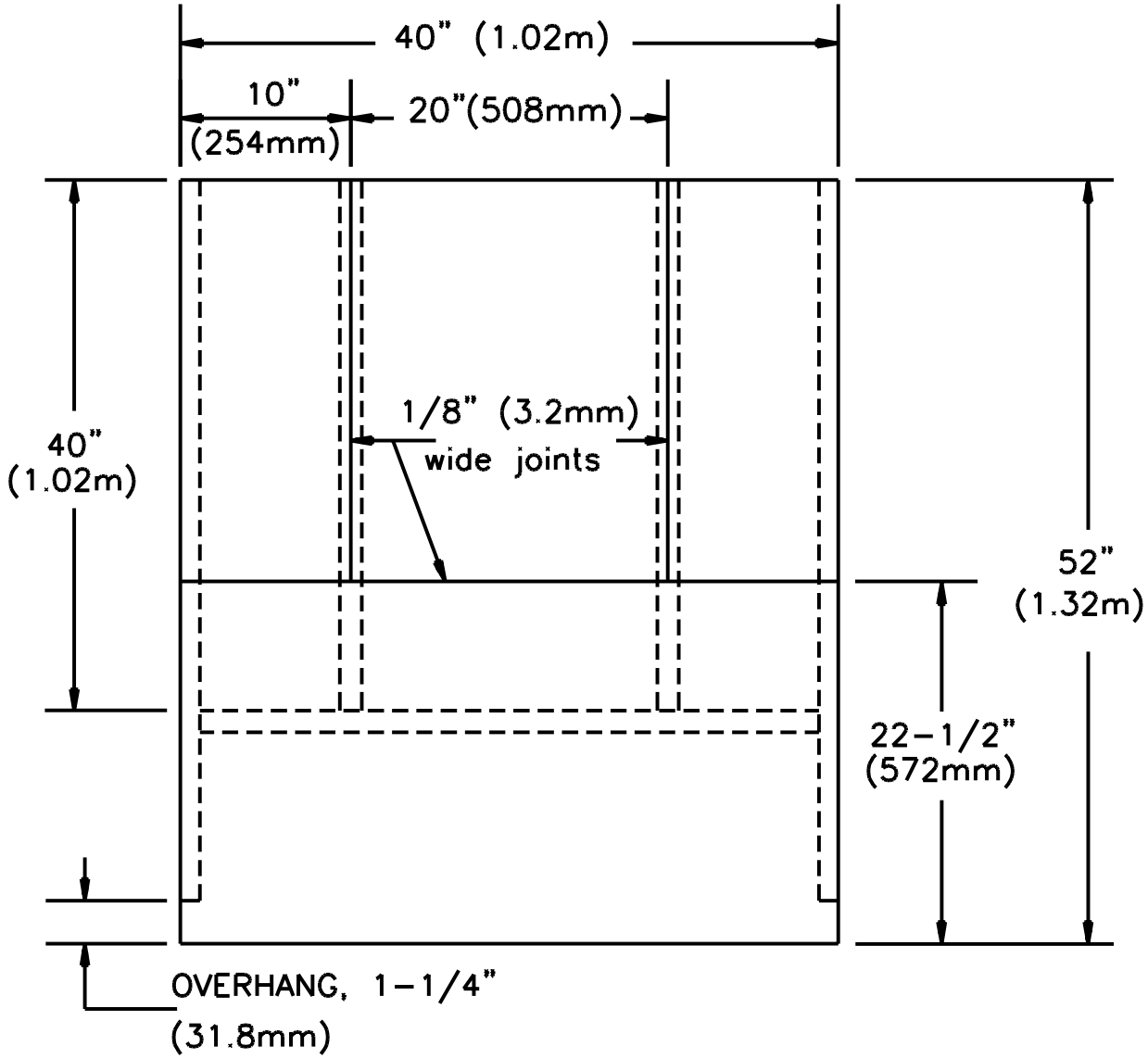


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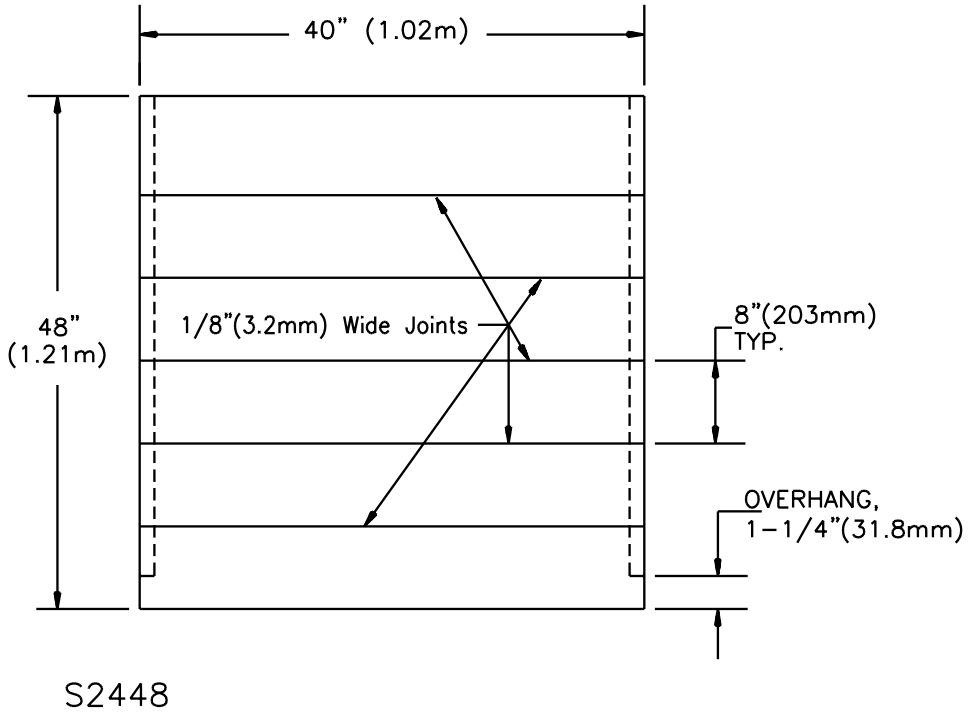
Figure 4.7
Class C burning-brand plywood deck



4.3 Spread-of-flame test decks

4.3.1 Unless the material to be tested is intended for use only on noncombustible decks, the test deck for the Spread-of-Flame Test, Section 7, on material other than wood shingles and shakes is to be constructed in accordance with either 4.2.1 or 4.2.3, except that:

a) The vertical and horizontal joints specified in 4.2.3 need not be provided,

b) The length of the deck is to be as specified in 4.3.2, and

c) American Plywood Association rated Standard Sheathing 32/16, 15/32 inch (11.9 mm) thick is an acceptable deck for materials or systems where minimal or no involvement of the plywood test deck occurs during the fire tests.

Figures 4.8 and 4.9 illustrate the construction details of these decks. For tests on materials intended for use only on noncombustible decks, a noncombustible deck of the applicable length specified in 4.3.2 is acceptable. The test deck for wood shingles and shakes is to be constructed in accordance with 4.2.2, but the length of the deck is to be as specified in 4.3.2. Figure 4.10 illustrates the construction details of this deck.

Figure 4.8
Spread-of-flame pine board deck

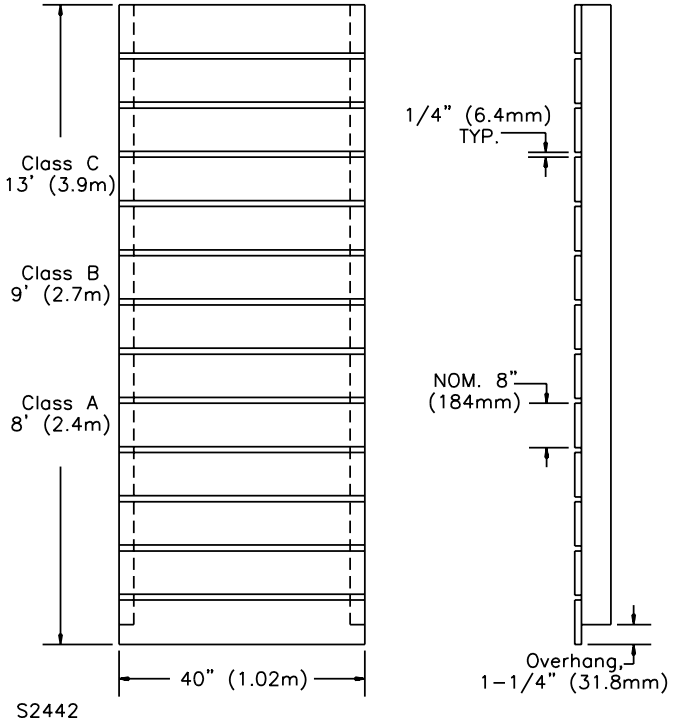


Figure 4.9
Spread-of-flame plywood deck

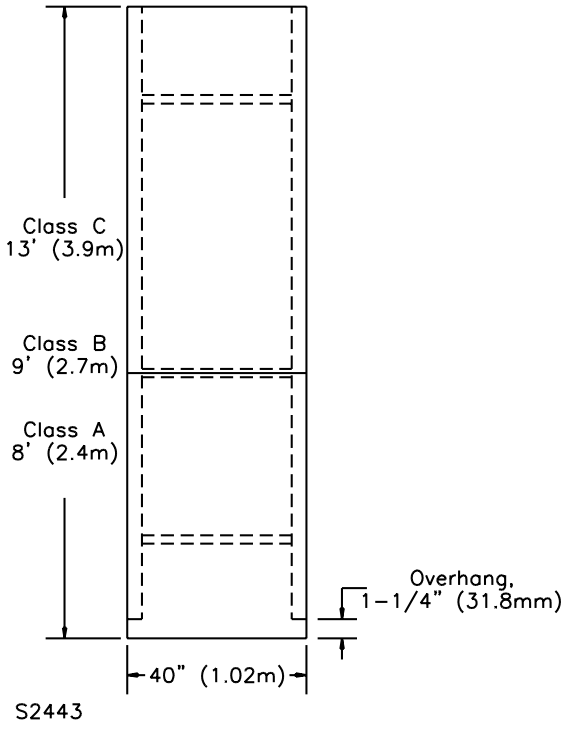
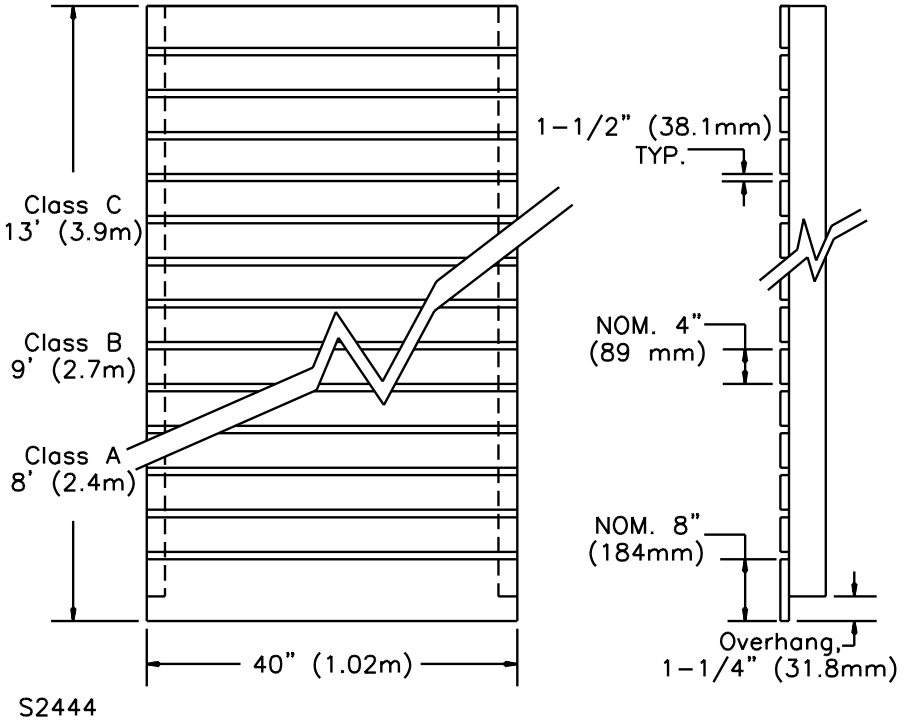


Figure 4.10
Spread-of-flame pine board deck for use with wood shingles and shakes



4.3.2 The length of the test deck is to be:

a) 13 feet (3.9 m) for Class C tests,

b) 9 feet (2.7 m) for Class B tests, and

c) 8 feet (2.4 m) for Class A tests.

4.4 Application

4.4.1 The roof covering material to be tested is to be applied, in accordance with the test sponsor's instructions, to the applicable number of test decks as specified in Table 3.1. The material is to extend to, and be flush with, the edges of the deck, except for a 1 inch (25.4 mm) overhang at the leading edge. For mechanically attached and fully adhered single-ply membrane roof covering systems it is not prohibited to pull the membrane taut over the edges of the assembly to fit snugly against the deck and secure it to the wood supports of the test deck. The use of a 1-in (25-mm) width metal batten strip or wire fastened on top of and along each side edge is not prohibited for mechanically attached single-ply membrane roof covering systems.

4.4.2 Spread of flame decks with insulated roof covering systems which utilize a rigid board insulation component are to be constructed with a joint in the insulation down the centerline of the test deck. When fire test experience with the respective roof covering system has demonstrated that the presence of the joint in the insulation will not affect test results it is not prohibited to conduct the tests without the joint.

4.4.3 Intermittent-flame and burning-brand decks with insulated roof covering systems which utilize a rigid board insulation component shall be constructed with joints in the insulation aligned with the joints of the plywood deck as shown in Figure 4.4 and Figures 4.5 – 4.7, respectively. Test decks constructed with pine boards in accordance with Figures 4.1 or 4.2 shall have at least one horizontal joint in the insulation board aligned directly over a space (joint) between the pine boards at the location most vulnerable (point of minimum coverage over the space) with respect to the application of the intermittent flame or placement of the burning brand(s). When recommended by the test sponsor the respective insulated roof covering system shall be constructed with joints in the insulation staggered with respect to the joints in the plywood or pine board deck.

4.5 Conditioning

4.5.1 The completed test assemblies are to be stored indoors at temperatures not lower than 16°C (60°F) nor higher than 32°C (90°F) for the period of time necessary to cure the material. Should storage conditions vary from those specified, the decks are to be stored until moisture determinations indicate that the deck lumber has no less than 8 percent nor more than 12 percent moisture content. Test decks are to be stored so that each will be surrounded by freely circulating air.

4.5.2 For a material expected to be hygroscopic in nature, its equilibrium moisture content is to be determined by heating a small sample to constant weight in an oven at 100°C (212°F). If its equilibrium moisture content is not between 8 and 12 percent (the moisture content prescribed for deck lumber), the material is to be conditioned in a cell at a temperature not exceeding 60°C (140°F) until its moisture content is equal to that prescribed for deck lumber (8 to 12 percent).

4.5.3 If the equilibrium moisture content of the material under the conditions described in 4.5.1 is under the range of 8 to 12 percent, the material is acceptable for application to the test deck and subjection to the fire tests at its equilibrium moisture content.

5 Test Apparatus and Set-Up – Intermittent-Flame, Spread-of-Flame, Burning-Brand, and Flying-Brand Tests

5.1 As illustrated in Figure 5.1, the apparatus used for the tests described in Sections 6 – 9 is to consist of the following:

a) A test deck to which the roof-covering materials to be tested are applied, mounted on a framework. The incline of the framework is to be adjustable.

b) A construction of noncombustible boards, mounted on the front of the framework to simulate eaves and cornices.

c) A gas burner (for intermittent-flame, spread-of-flame, and flying brand tests) consisting of a 44-inch (1.12-m) length of nominal 2 inch [2.38 inch (60.3 mm) OD] pipe having a 1/2-inch (12.7 mm) wide, 36-inch (0.91-m) long slot in the side toward the test deck. The burner is to be supplied with gas at both ends through nominal 1-inch [1.32 inch (33.4 mm) OD] pipe to provide uniform gas pressure at the burner assembly.

d) A blower and air duct for providing the required wind conditions. The air introduced by the blower is to be taken from outside the test room.

e) Adjustable fins mounted inside the air duct to straighten the air stream and reduce turbulence.

f) A baffle mounted on the back edge of the test deck to prevent backfiring under the deck.

g) Noncombustible boards extending from the sides and bottom of the air duct to the simulated-eaves-and-cornice construction mentioned in (b) (not used during burning brand test).

5.2 The tests are to be conducted in a room vented to the outside air to relieve the air pressure created by the blower. During these tests, all doors and windows in the room are to be closed, and the room otherwise controlled as necessary to prevent outside wind and weather conditions from affecting the test results. Calibration of the air current described is to be conducted with all vent and exhaust fan settings adjusted to that used during the conduct of the tests. Tests are not to be conducted if the room temperature is less than 10°C (50° F) or more than 32°C (90° F).

5.3 For these tests, mortar (cementitious mixture, lime, and water) is to be troweled into the joint formed by the leading edge of the roof covering material and the framework of the carriage, to prevent air or the test flame from traveling under the material being tested.

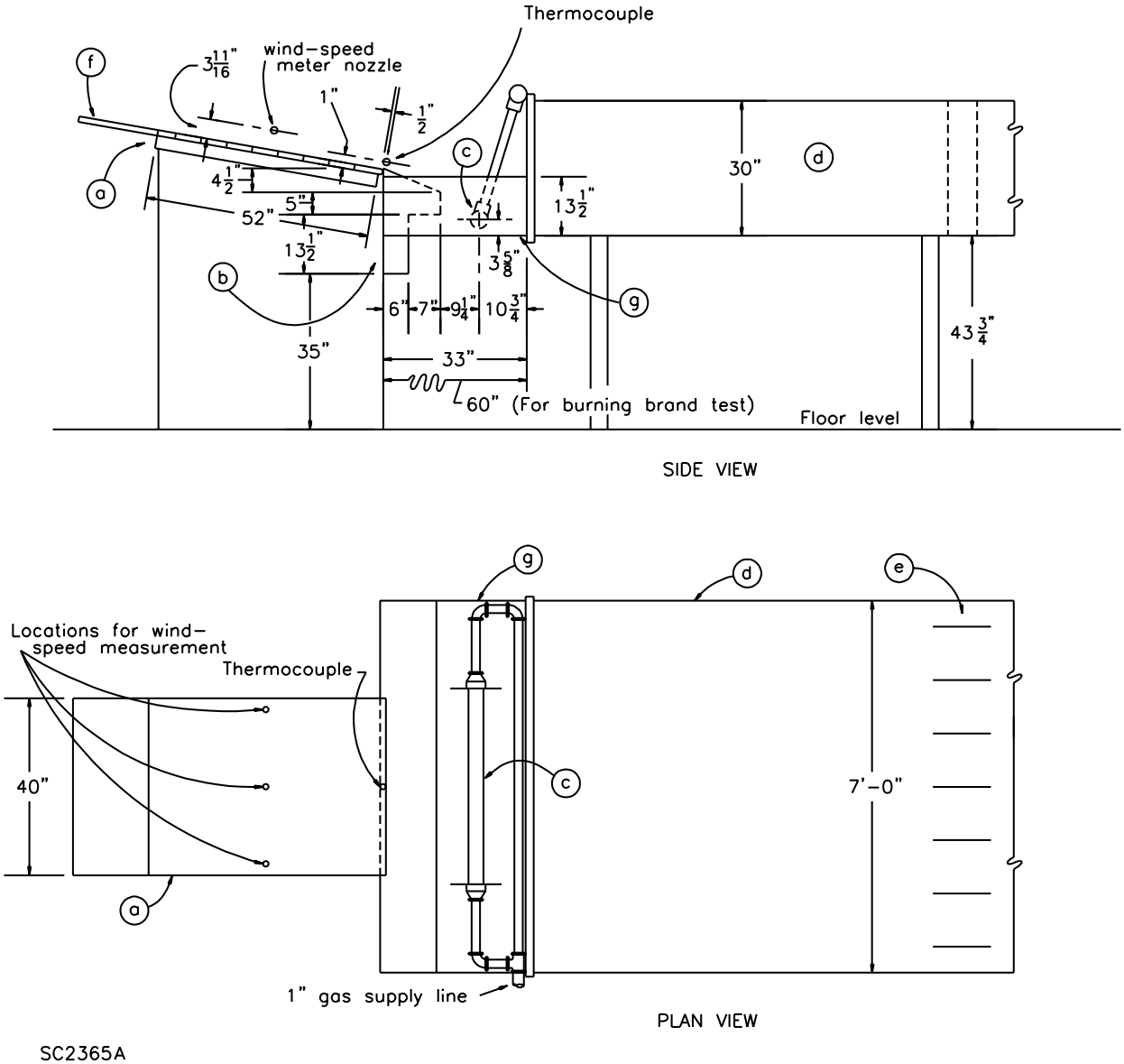
5.4 During the tests, the test decks are to be subjected to an air current that flows uniformly over the top surface of the roof covering material, as determined by a pretest calibration of the equipment using a bare 3-1/3 by 4-1/3 foot (1 by 1.3 m) plywood, gypsum- or cement-board deck. At points midway up the incline of the bare deck, with the deck positioned at an incline of 5 inches (127 mm) to the horizontal foot (0.3 m), the velocity of the air current is to be 12 ±1/2 miles per hour (19 ±0.8 km/h), as measured[a] at the center and at each of two locations measured 3 inches (76 mm) from each edge of the deck, with each measurement being 3-11/16 inches (94 mm) above the surface of the deck. Adjusting the time averaged air current velocity at each location by up to 5 percent from the initial measurements is not prohibited in order to comply with the flame pattern description (see 5.5) so long as the average velocity of all three locations is 12 ±0.5 mph (5.3 ±0.2 m/s).

[a]Any direct reading instrument with scale graduated in increments of not more than 20 feet per minute (6 m/min) or any timed instrument with scale graduated (for a 1-minute timed reading) in increments of not more than 5 feet per minute (1.5 m/min) is acceptable.

5.5 Calibration of the flame is to be conducted using a bare 3-1/3 by 4-1/3 foot (1 by 1.3 m) cement board deck positioned at an incline of 5 inches (127 mm) to the horizontal foot (0.3 m). The test deck is to be subjected to a luminous gas flame approximately triangular in shape, approximately 3 feet (0.9 m) wide at the leading edge of the deck, and gradually narrowing to a width of approximately 6 inches (152 mm) at the top of the deck. Licks of flame that extend approximately an additional 1 to 2 feet (0.3 to 0.6 m) are not prohibited. The gas supply is to be regulated so that the flame develops a temperature of 760 ±28°C (1400 ±50°F) for a Class A or B test, and 704 ±28°C (1300 ±50°F) for a Class C test[a]. The temperature is to be determined by a No. 14 B&S gage (2.1 mm^2) chromel-alumel wire thermocouple located 1 inch (25.4 mm) above the surface and 1/2 inch (12.7 mm) toward the source of flame from the lower edge the deck.

[a]It has been found that the gas flow corresponds to a heat supply rate within the range from 21,000 to 22,000 Btu per minute (369 to 387 kWh) for Class A or B samples and 18,000 to 19,000 Btu per minute (316 to 334 kWh) for Class C samples.

Figure 5.1
Apparatus for fire tests



Notes:

1. Letters indicate corresponding items in 5.1.
2. Conversion Factors

   1/16″ = 1.6 mm

   1″ = 25.4 mm

   1' = 0.3 m

5.6 For these tests, the test decks are to be at an incline of 5 inches per horizontal foot (127 mm per 0.3 m); except that roof covering systems intended for low slop (incline) applications are to be tested at the maximum incline recommended by the test sponsor, but not more than 5 inches per horizontal foot.

6 Intermittent-Flame Test

6.1 The test deck is to be mounted on the framework at the required incline. The flame is to be intermittently applied, at intervals as specified in Table 6.1.

Table 6.1
Flame application

Class	Flame on, minutes	Flame off, minutes	Number of test cycles
A	2	2	15
B	2	2	8
C	1	2	3

6.2 Following the last application of flame, air current is to be maintained until all evidence of flame, glow, and smoke has disappeared from the exposed surface of the material being tested or until unacceptable results occur, but in no case is the air current to be maintained for more than 1 hour for a Class A or B test or 1/2 hour for a Class C test.

6.3 During the test, including the on and off periods of flame application and the subsequent period of maintained air flow, the test deck is to be observed for the appearance of sustained flaming on the underside, production of flaming or glowing brands, displacement of portions of the test sample, and exposure or falling away of portions of the roof deck.

7 Spread-of-Flame Test

7.1 A test deck is to be mounted on the framework. The luminous gas flame described in 5.5 for the respective Class is to be applied to the test deck.

7.2 For a Class A or B test, the gas flame is to be applied continuously for 10 minutes or until the spread of flame (flaming of the material being tested) permanently recedes, as determined by prior test experience, from a point of maximum spread, whichever is the shorter duration. For a Class C test, the gas flame is to be applied for 4 minutes and then removed.

7.3 During and after the application of the test flame, the test sample is to be observed 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. The observation is to continue until the flame has permanently receded from a point of maximum spread.

8 Burning-Brand Test

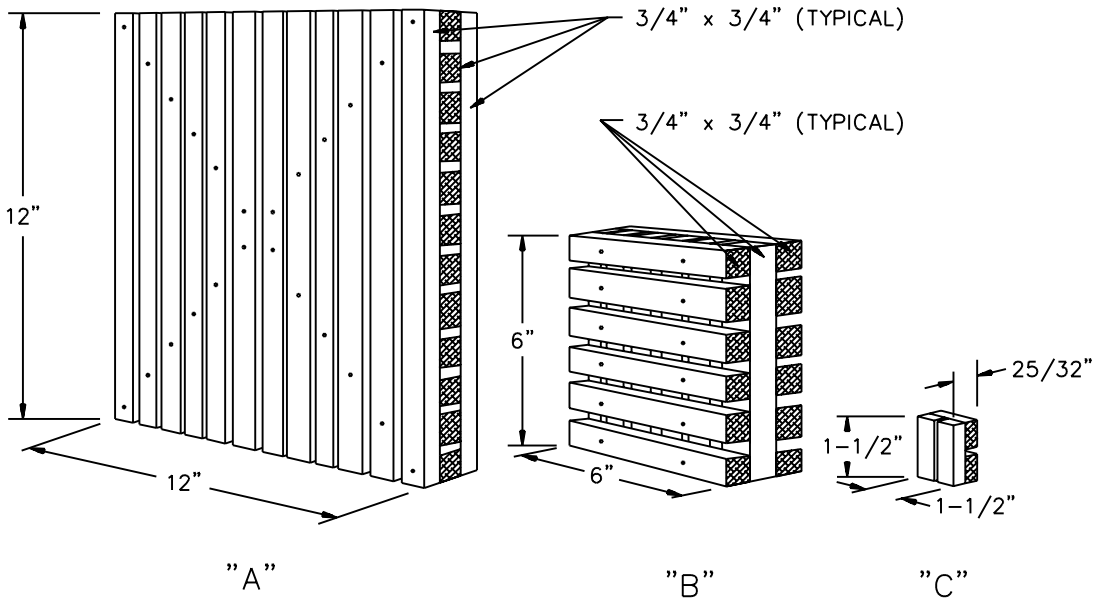
8.1 General

8.1.1 A test deck is to be mounted as described in 6.1, except that the framework is to be 60 inches (1.5 m) from the air duct outlet (see Figure 5.1), and the gas piping and burner are to be removed so as not to obstruct the air flow.

8.2 Size and construction of brands

8.2.1 The brands to be used in these tests are to be as shown in Figure 8.1 and are to be constructed as specified in 8.2.2 – 8.2.4. Prior to the test, the brands are to be conditioned in an oven at 40 to 49°C (105 to 120°F) for at least 24 hours.

Figure 8.1
″A,″ ″B,″ and ″C″ brands



1 in. = 25.4 mm

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8.2.2 The Class A brand is to consist of a grid, 12 inches (300 mm) square and approximately 2-1/4 inches (57 mm) thick, made of kiln-dried Douglas fir lumber that is free from knots and pitch pockets. The brand is to be made of 36 strips of lumber each 3/4 by 3/4 inch (19.1 by 19.1 mm) square by 12 inches (300 mm) long, placed in three layers of 12 strips each, with strips placed 1/4 inch (6.4 mm) apart. These strips are to be placed at right angles to those in adjoining layers and are to be nailed, using 1-1/2 inch (38.1 mm) long, No. 16 gage nails, or stapled, using No. 16 gage steel wire staples having a 7/32 inch (5.6 mm) crown and 1-1/4 inch (31.8 mm) legs, at each end of each strip on one face, and in a diagonal pattern, as shown in Figure 8.1, on the other face. The dry weight of the finished brand is to be 2000 ±150 grams at the time of the test.

8.2.3 The Class B brand is to consist of a grid, 6 inches (150 mm) square and approximately 2-1/4 inches (57 mm) thick, made of kiln-dried Douglas fir lumber that is free from knots and pitch pockets. The brand is to be made of 18 strips of lumber 3/4 by 3/4 inch (19.1 by 19.1 mm) square and 6 inches (150 mm) long, placed in three layers of six strips each, with strips spaced 1/4 inch (6.4 mm) apart. The strips are to be placed at right angles to those in adjoining layers and are to be nailed, using 1-1/2 inch (38.1 mm) long, No. 16 gage nails, or stapled, using No. 16 gage steel wire staples having a 7/32 inch (5.6 mm) crown and 1-1/4 inch (31.8 mm) legs, at each end of each strip on one face, as shown in Figure 8.1, and in a diagonal pattern on the other face. The dry weight of the finished brand is to be 500 ±50 grams at the time of the test.

8.2.4 The Class C brand is to consist of a piece of kiln-dried nonresinous white pine lumber that is free from knots and pitch pockets. The brand is to measure 1-1/2 by 1-1/2 by 25/32 inches (38.1 by 38.1 by 19.8 mm), and a saw kerf 1/8 inch (3.2 mm) wide is to be cut across the center of both the top and bottom faces to a depth of one-half the thickness of the brand, and at right angles to each other. The dry weight of the finished brand is to be 9-1/4 ±1-1/4 grams at the time of the test.

8.3 Ignition of brands

8.3.1 Before application to the test deck, the brands are to be ignited so as to burn freely in still air, as described in 8.3.2, 8.3.3, or 8.3.4, as applicable. The flame of the gas burner used to ignite the brands is to essentially envelop the brands during the process of ignition. The temperature of the igniting flame is to be 888 ±28°C (1630 ±50°F), measured 2-5/16 inches (58.7 mm) above the top of the burner. The burner is to be shielded from drafts.

8.3.2 Class A brands are to be exposed to the flame for 5 minutes, during which time they are to be rotated to present each surface to the flame as follows:

a) Each 12 by 12 inch (305 by 305 mm) face for 30 seconds,

b) Each 2-1/4 by 12 inch (57.2 by 305 mm) face for 45 seconds,

c) Each 12 by 12 inch face again for 30 seconds.

8.3.3 Class B brands are to be exposed to the flame for 4 minutes, during which time they are to be rotated to present each surface to the flame as follows:

a) Each 6 by 6 inch (152 by 152 mm) face for 30 seconds,

b) Each 2-1/4 by 6 inch (57.2 by 152 mm) face for 30 seconds,

c) Each 6 by 6 inch face again for 30 seconds.

8.3.4 Class C brands are to be exposed to the flame for 2 minutes, during which time they are to be rotated so as to present each of the 1-1/2 by 1-1/2 inch (38.1 by 38.1 mm) faces to the flame for 1 minute.

8.4 Test conditions

8.4.1 Class A test

8.4.1.1 A brand is to be placed on the surface of each test deck at the location most vulnerable (point of minimum coverage over deck joint) with respect to ignition of the deck, but in no case closer than 4 inches (102 mm) from either side or 12 inches (305 mm) from the top or bottom edge of the deck (see 8.4.1.2). The brand is to be placed so that the strips in both the upper and lower layers are parallel to the direction of air flow. The brand is to be secured to the deck by a No. 18 B&S gage (0.82 mm^2) soft-iron wire.

8.4.1.2 If the roof covering is applied to a pine board deck, the brand will be in the most vulnerable location when the upper edge of the brand is located 3 inches (76 mm) above a horizontal joint in the test deck. If the roof covering is applied to a plywood deck, the brand will be in the most vulnerable location when the brand is placed so that it is centered laterally with respect to the vertical joint in the test deck, and the upper edge of the brand is located 3 inches (76 mm) above the horizontal joint.

8.4.2 Class B test

8.4.2.1 A brand is to be placed on the surface of the test deck at each of the two most vulnerable (point of minimum coverage over deck joint) locations with respect to ignition of the deck (see 8.4.2.2). Each brand is to be positioned with its upper edge 1-1/2 inches (38.1 mm) above the selected joint in the deck boards, but in no case closer than 6 inches (152 mm) from each side or 12 inches (305 mm) from the top or bottom edge of the deck. The brands are to be placed so that the strips in both the upper and lower layers are parallel to the direction of air flow. They are to be secured to the deck by a No. 18 B&S gage (0.82 mm^2) soft-iron wire. The second brand is not to be applied until all burning resulting from the first brand has ceased.

8.4.2.2 If the roof covering is applied to a pine board deck, the brands will be in the most vulnerable location when the upper edge of each brand located 3 inches (76.2 mm) above a horizontal joint in the test deck. If the roof cover is applied to a plywood deck, the brands will be in the most vulnerable location when they are placed so that they are centered laterally with respect to a vertical joint in the test deck, and the upper edge of each brand is located 1-1/2 inches (38.1 mm) above the horizontal joint.

8.4.3 Class C test – asphalt shingles

8.4.3.1 Loose or unfastened portions of the shingles that can be bent up to 90 degrees without injury to the fastenings are to be cut away. Twenty ignited brands are then to be placed, at 1 or 2 minute intervals, in the areas of minimum coverage, 1/2 inch (12.7 mm) away from any cut edge of shingles in the course above that course on which the brand is placed. No brand is to be placed closer than 4 inches (102 mm) to the point where the previous brand was located.

8.4.3.2 Brands are to be located not closer than 2 inches (50.8 mm) to the joints between adjacent shingles on the same course. All brands are to be placed so that the center of each brand is directly over the space between the deck boards. Brands are to be held in position throughout the test by a No. 18 B&S gage (0.82 mm^2) soft-iron wire stretched across the width of the deck. The saw kerf on the deck side of the brand is to be parallel to the direction of the air flow. The wire is to be placed in the other saw kerf.

8.4.3.3 If the roof covering is applied to plywood decks, the brands are to be placed centrally over the joints in the plywood deck.

8.4.4 Class C test – sheet roofing, built-up, single-ply, spray-applied foam and other roof covering systems

8.4.4.1 Twenty ignited brands are to be placed, at 1 or 2 minute intervals, in the areas of minimum coverage. No brand is to be placed closer than 4 inches (102 mm) to the point where a previous brand was located. All brands are to be placed so that the center of each brand is directly over the space between the deck boards. See 8.4.3.2 for securing of brands in place and relative positioning of brand saw kerfs.

8.4.5 Class C test – treated wood shingles and shakes

8.4.5.1 Twenty ignited brands are to be placed on each treated wood shingles deck at 1 or 2 minute intervals. For treated wood shakes, 20 ignited brands are to be distributed at 1 or 2 minute intervals on each pair of decks. Each brand is to be centered over the 1/4 inch (6.4 mm) joint between shakes or shingles so that the top edge of the brand is approximately 1/2 inch (12.7 mm) below the butt of the shake or shingle in the course above. No brand is to be placed closer than 4 inches (102 mm) to the point where a previous brand was located. See 8.4.3.2 for securing of brands in place and relative positioning of brand saw kerfs.

8.5 Duration of test

8.5.1 Each individual test, whether Class A, B, or C, is to be continued until the brand is 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 unacceptable results occur, but not for more than 1-1/2 hours. The result of tests in which the brands do not show progressive and substantially complete consumption after application to the test deck are to be disregarded.

8.6 Observations

8.6.1 During the tests, observations are to be made 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.

9 Flying-Brand Test

9.1 This test applies to Class A, B and C treated wood shingles and shakes.

9.2 A test deck is to be mounted on the framework. The luminous gas flame as described in 5.5 for the respective Class is to be applied to the test deck.

9.3 The gas flame is to be applied continuously for:

a) 10 minutes for a Class A and B test, and

b) 4 minutes for a Class C test.

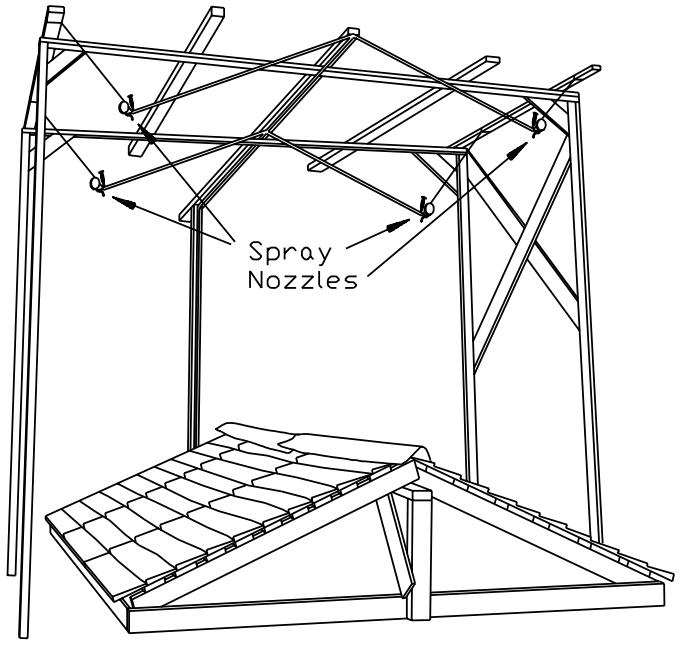
The air current is to be maintained until all evidence of flame, glow, and smoke has disappeared from the exposed surface of the material being tested to determine if flying brands will be developed that continue to flame or glow after reaching the floor of the test room. For treated wood shakes, the velocity of the air current is to be increased to 18 miles per hour (29 km/h) after the gas flame is extinguished.

10 Rain Test

10.1 The test decks are to be mounted in a framework at a slope of 4 inches (102 mm) per horizontal foot. Water is to be applied in a moderately fine spray uniformly over the exposed specimen surfaces by spray nozzles that deliver an average of 0.7 inch (18 mm) of water per hour at a temperature of 35 to 60°F (2 to 15 °C). The spray nozzles are to be mounted approximately 7 feet (2.1 m) above the test decks. See Figure 10.1. The test decks are to be exposed to twelve 1-week conditioning cycles. Each cycle is to consist of 96 hours of water exposure followed by 72 hours of drying time at 60°C (140°F). The final drying cycle is to be controlled so that the moisture content of the deck lumber is between 8 and 12 percent. The conditioned decks then are to be tested in accordance with Table 3.1.

10.2 An alternative test cycle is acceptable, at the manufacturer's option, whereby two sets of six decks are to be alternately exposed to 7 days (168 hours) of water exposures, followed by 2 days (48 hours) draining and 5 days (120 hours) curing at 60°C (140°F). This cycle is to be repeated seven times, except that the seventh water exposure is to be reduced to 6 days (144 hours).

Figure 10.1
Rain-test apparatus



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11 Weathering Test

11.1 The test decks are to be mounted outdoors at an incline of 5 inches (127 mm) to the horizontal foot, facing south. After each of 1, 2, 3, 5, and 10 years of exposures, three test decks are to be brought indoors and conditioned until the deck lumber attains a moisture content between 8 and 12 percent. From each set of decks, one deck is to be subjected to the Intermittent-Flame Test, Section 6, one to the Burning-Brand Test, Section 8, and one to the Flying-Brand Test, Section 9.

CONDITIONS OF ACCEPTANCE

12 General

12.1 At no time during 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,

b) The roof deck be exposed by breaking, sliding, cracking or warping of the roof covering, except for roof coverings restricted to use over a noncombustible deck, or

c) Portions of the roof deck fall away in the form of glowing particles.

With respect to (b), the deck is exposed whenever any portion of the deck is visible and without cover from the roof covering material or its residue. The portion of deck directly underneath burning brands and cracks or fissures, 1/8 inch (3.17 mm) wide or less, is excluded from this requirement.

12.2 For the purpose of the requirements of 12.1, any piece of roof covering that continues to glow or flame upon landing on the test room floor is a glowing or flaming brand, respectively.

12.3 At no time during the Class A, B, or C intermittent-flame or burning-brand tests shall there be sustained flaming of the underside of the deck. Sustained flaming is considered any flaming which continues uninterrupted for 5 seconds or more.

12.4 For the spread-of-flame tests, the flaming of the material shall not have spread beyond 6 feet (1.8 m) for Class A, 8 feet (2.4 m) for Class B, and 13 feet (3.9 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. Significant lateral spread shall be considered to have occurred when surface flaming beyond 1 foot from the lead edge extends outward to both lateral edges of the test deck assembly or to both inner edges of the metal batten strip, if used, along the side edges for single-ply membrane roof covering systems.

12.5 For the flying-brand test on treated wood shingles and shakes, flying, flaming, or glowing brands shall not be produced that continue to flame or glow after reaching the floor of the test room.

13 Report

13.1 The test report shall contain the following information:

a) Description of the roof covering being tested, including construction details of the test deck; and manufacturer's application limitations, shelf life, and the like of the roof covering as applicable,

b) Moisture content of the roof covering materials (if moisture absorbing) at the time of testing,

c) Type and class of test,

d) Slope of test deck,

e) Details of the calibration, including velocity measurements, flame temperature measurements, heat supply rate, and total water use for rain test,

f) Type of rain test cycle (if applicable),

g) Observations of the burning characteristics of the test deck during and after test exposure,

h) Results of each test relative to Conditions of Acceptance, Section 12, and

i) The class of roof covering achieved based on test results (Class A, B, or C).

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