



## Standard Test Methods for Fire Tests of Roof Coverings<sup>1</sup>

This standard is issued under the fixed designation E108; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope\*

1.1 This fire-test-response standard covers the measurement of the relative fire characteristics of roof coverings exposed to simulated fire sources originating outside the building. It is applicable to roof coverings intended for installation on either combustible or noncombustible roof decks when applied as intended for use. The following test methods are included:

- 1.1.1 Intermittent flame exposure test.
- 1.1.2 Spread of flame test.
- 1.1.3 Burning brand test.
- 1.1.4 Flying brand test.
- 1.1.5 Rain test.

1.2 Three classes of fire test exposure are described:

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

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

1.2.3 *Class C Tests* are applicable to roof coverings that are effective against light fire exposure, afford a light degree of fire protection to the roof deck, do not slip from position, and are not expected to present a flying brand hazard.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled laboratory conditions, but does not by itself incorporate all factors required for fire hazard or fire risk*

*assessment of the materials, products or assemblies under actual fire conditions.*

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 Fire testing is inherently hazardous. Adequate safeguards for personnel and property shall be employed in conducting these tests.

1.7 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of this standard.

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

- D225 Specification for Asphalt Shingles (Organic Felt) Surfaced With Mineral Granules (Withdrawn 2012)<sup>3</sup>
- D226 Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
- D227 Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
- D312 Specification for Asphalt Used in Roofing
- D450 Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing
- D1227 Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
- D2178 Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
- D2626 Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
- D2898 Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
- D3018 Specification for Class A Asphalt Shingles Surfaced with Mineral Granules

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee E05 on Fire Standards and are the direct responsibility of Subcommittee E05.14 on External Fire Exposures.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

**D3158** Specification for Asphalt Saturated and Coated Organic Felt Used in Roofing (Withdrawn 1983)<sup>3</sup>

**D3378** Specification for Asphalt-Saturated and Coated Asbestos Felt Base Sheet Used in Roofing (Withdrawn 1985)<sup>3</sup>

**D3462** Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules

**D4442** Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials

**D4444** Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters

2.2 *UL Standards:*

**UL 55A** Materials for Built-Up Roof Coverings<sup>4</sup>

**UL790** Tests for Fire Resistance of Roof Covering Materials<sup>4</sup>

2.3 *NFPA Standards:*

**NFPA 256** Tests of Roof Coverings (Withdrawn 2008)<sup>5</sup>

2.4 *NIST Standards:*

Department of Commerce (DOC) Voluntary Product Standard PS-1 Structural Plywood

Department of Commerce (DOC) Voluntary Product Standard PS-2 Performance Standard for Wood-based Structural-use Panels

### 3. Terminology

3.1 *Definitions:*

3.1.1 *significant lateral spread*—surface flaming beyond 1-ft. from the lead edge, extending outward to both lateral edges of the test deck assembly or to both inner edges of metal batten strips, if used, along the side edges of the test deck assembly.

3.1.2 *sustained flaming*—any flaming which continues uninterrupted for 5 seconds or more.

3.1.3 *prepared roof covering*—products consisting of shingles, tiles, panels or rolled materials that are typically used for steep slope roof applications which are applied directly to the roof deck (usually with one or more layers of underlayment and with or without battens) in accordance with installation instructions supplied with the products.

### 4. Significance and Use

4.1 The test methods described herein are intended to provide a basis for relative comparison of roof coverings. The test methods include simulated fire exposure to the outside of the roof coverings, and, where applicable, a determination as to whether the fire performance characteristics of the roof coverings will be adversely affected by prolonged exposure to rain.

4.2 These test methods measure the surface spread of flame and the ability of the roof covering material or system to resist fire penetration from the exterior to the underside of a roof deck under the conditions of exposure.

4.3 These test methods also provide criteria to determine if the roof covering material will develop flying burning material, identified as flying brands, when subjected to a 12-mph (5.3-m/s) wind during the simulated fire exposure tests.

4.4 These test methods do not necessarily illustrate the expected performance of roof coverings under all actual fire conditions, but they do provide a basis for comparing roof covering materials when subjected to fire sources that are described herein.

4.5 These test methods do not provide any basis for determining the fire resistance characteristics when exposed to a fire originating in the building to which the roofing material is applied.

4.6 The test methods described herein involve calibrating the test equipment using a calibration deck inclined at a slope of 5 in. per horizontal ft (0.416:1). The tests described herein are performed on test decks inclined at slopes up to and including 5 in. per horizontal ft. The severity of the test exposure decreases as the slope of the test deck decreases below 5 in. per horizontal ft.

### 5. Apparatus and Calibration

5.1 The essential elements of the fire test apparatus used for tests described in Sections 8-11 are illustrated in Fig. 1. They 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 with respect to incline (slope) as well as the vertical position for fire testing decks with insulated roof coverings.

(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-in. (1.12 m) length of nominal 2 in. (2.38 in./60.3 mm OD) pipe having a 1/2-in. (12.7 mm) wide, 36-in. (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-in. (1.32 in./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.

(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 extended from the sides and bottom of the air duct to the simulated-eaves-and-cornices construction mentioned in (b) (not used during burning brand).

(h) Fire calibration exposure pattern (see 5.5.5).

5.1.1 During the test:

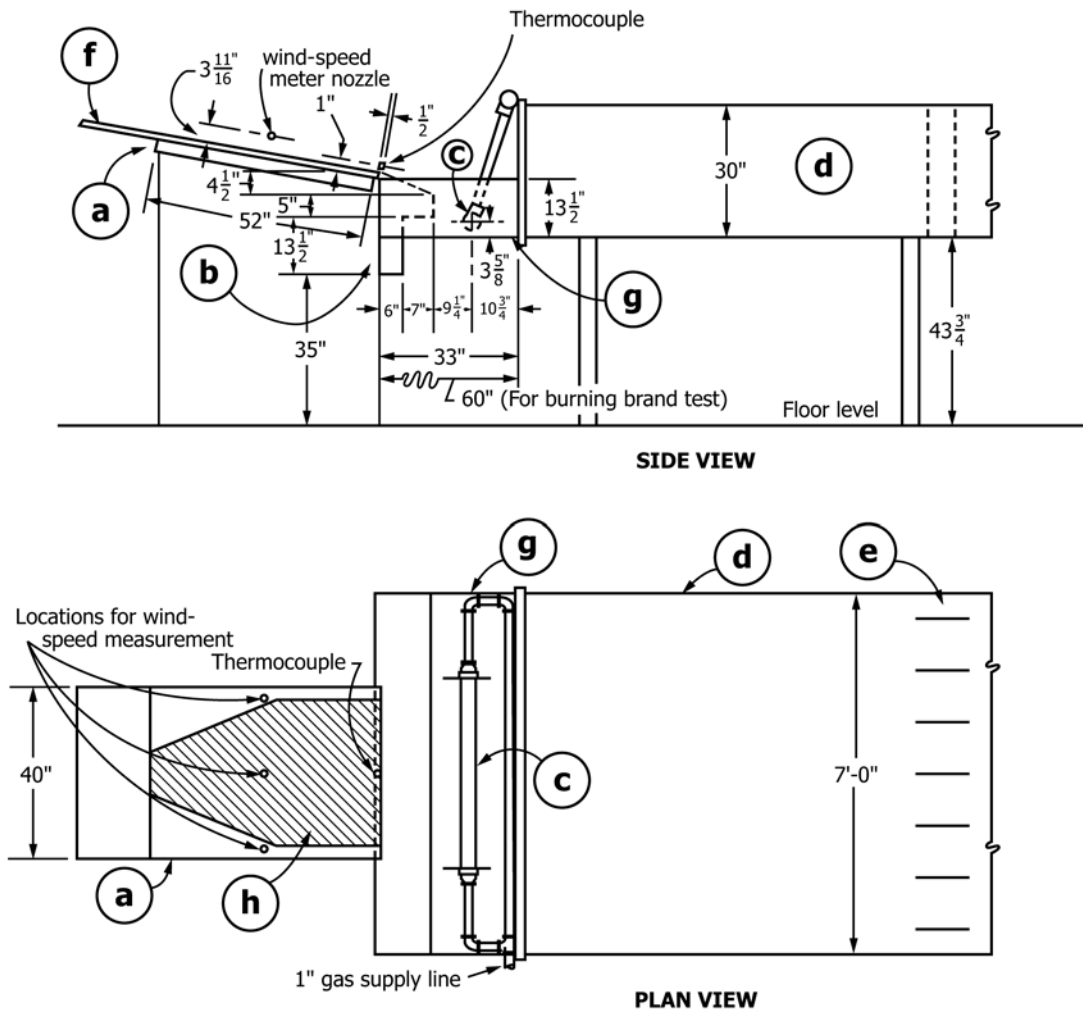
5.1.1.1 Provide free outlet to outside air beyond and above the test apparatus to exhaust air introduced into the test room by the blower, and

5.1.1.2 Close all openings into the test room other than those mentioned in 5.1.1, such as doors and windows.

5.2 The temperature of the air supplied by the blower shall be maintained between 50 and 90°F (10 and 32°C).

<sup>4</sup> Available from Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062.

<sup>5</sup> Available from National Fire Protection Assoc., 1 Batterymarch Park, Quincy, MA 02269.



(See Appendix X1 for metric equivalents.)

FIG. 1 Schematic Drawing of Fire Test Apparatus

5.3 Fig. 2 illustrates an example of the essential elements of a rain test apparatus.

#### 5.4 Calibrating Air Current:

5.4.1 Set up the test apparatus for the intermittent flame test and position a bare 3-ft, 4-in. by 4-ft, 4 in. (1 m by 1.3 m) plywood, gypsum board or fiber cement board calibration deck on the framework at an incline of 5 in. per horizontal ft (0.416:1).

5.4.2 Measure the air velocity midway up the slope of the calibration deck at its center and 3 in. (76 mm) from each edge.

NOTE 1—Any direct reading instrument with scale graduated in increments of not more than 20 ft/min (6 m/min) or any timed instrument with scale graduated (for a 1 min timed reading) in increments of not more than 5 ft/min (1.5 m/min) will be suitable.

5.4.3 Position the center of the air measuring device at a nominal  $3\frac{1}{16}$  in. (94 mm) above the surface. The air flow through and around the instrument shall be as free and undisturbed as possible.

5.4.4 Adjust the air supply system to produce a 1 min timed average velocity of  $1056 \pm 44$  ft/min corresponding to  $12 \pm 0.5$  mph ( $5.3 \pm 0.2$  m/s) at each of the three locations detailed in 5.4.2. In order to comply with 5.5.5, it shall be

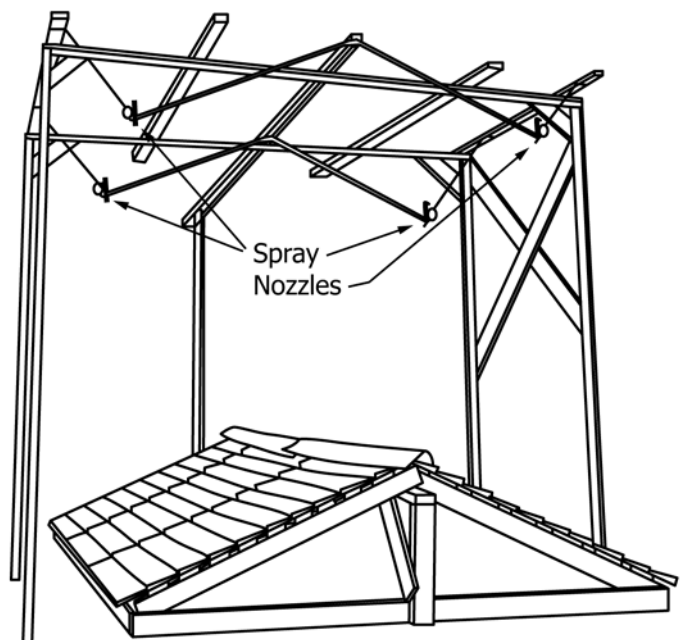


FIG. 2 Rain Test Apparatus