

**DECKING**  
**SFM STANDARD 12-7A-4**

**12-7A-4.1 Application.** The minimum design, construction and performance standards set forth herein for unloaded decks are those deemed necessary to establish conformance to the provisions of these regulations. Materials and assemblies that meet the performance criteria of this standard are acceptable for use in Very High Fire Hazard Zones as defined in California Building Code, Chapter 7A.

**12-7A-4.2 Scope.** This standard determines the performance of decks (or other horizontal ancillary structures in close proximity to primary structures) when exposed to direct flames and brands. The under-deck flame exposure test is intended to determine the heat release rate (HRR) and degradation modes of deck or other horizontal boards when exposed to a burner flame simulating combustibles beneath a deck. The burning brand exposure test is intended to determine the degradation modes of deck or other horizontal boards when exposed to a burning brand on the upper surface.

**12-7A-4.3 Referenced Document.**

ASTM D4933. Guide for moisture conditioning of wood and wood-based materials

ASTM E108. Standard Test Methods for Fire Tests of Roof Coverings, California Building Code, Chapter 7A

**12-7A-4.4 Definitions.**

1. **Deck boards.** Horizontal members that constitute the exposed surface of the ancillary structure.
2. **Heat release rate.** The net rate of energy release as measured by oxygen depletion calorimetry.

**12-7A-4.5 Test Assembly.**

1. **Size.** The overall size of the test deck shall be 2 × 2 ft (610 × 610 mm) unless width variation of deck boards requires an increase in overall deck width (i.e., the direction of joists) in order to meet the overall dimensions. The length of individual deck boards shall be 2 feet (610 mm).
2. **Joists.** The deck is supported by two sets of 2 × 6 Douglas-fir joists, 28 inches (710 mm) long, and constructed with a 16-inch (406 mm) center-to-center spacing. The joists shall be conditioned to 6 percent equilibrium moisture content as per ASTM D4933. A comparable species that may be more commonly used for structural framing of decks in a given region can be substituted for Douglas-fir.
3. **Deck board spacing and fastening.** Edge-to-edge spacing is  $\frac{3}{16}$  inch (5 mm), with boards attached to the joists with 2-inch (50 mm) deck screws inserted into deck boards spaced 1.5 inches (38 mm) from the front and back edges of the deck boards. The front deck board shall be flush with the ends of the joists, and the rear deck board shall overhang the end of the joists by 1 inch (25 mm).
  - 3.1 Boards manufactured for tongue and groove edge connections are to be spaced as per the manufacturer's recommendation.
  - 3.2 Alternate fastening schedules can be used if specified by the deck board manufacturer.
  - 3.3 If 2 × 6 deck boards are used, a total of 5 boards shall be used for each deck. Changing the board width could change the number of deck boards.

**12-7A-4.6 Materials.**

1. All deck board materials are to have cross-sectional dimensions equivalent to use in service.
2. Material tested must be representative of commercially available products.
3. If solid wood deck boards are used, the species or lumber group shall be identified.
4. If the material is "plastic lumber" or other composites, the type and amounts of the plastic(s) and the wood-plastic ratio shall be determined.
5. All materials are to be conditioned to equilibrium to 6 percent EMC conditions prior to testing as specified in ASTM D4933.

**12-7A-4.7 PART A. Under-flame Test.**

**12-7A-4.7.1 Equipment.**

1. **Burner.** A 12 × 12 inch (300 × 300 mm) sand burner shall be used to provide an output of  $80 \pm 4$  kW using a regulated propane gas source. Burner output can be determined from HRR or calculated from propane flow rate, temperature and pressure.
2. **Oxygen depletion calorimeter.** The system includes a hood, associated ducting and instrumentation to provide HRR data by oxygen depletion calorimetry.

**12-7A-4.7.2 Test system preparation. See Figure 12-7A-4-1.**

1. **Deck support assembly.** Assembly that holds the test deck over the burner.
2. **Baffle panels and joist support.** Horizontal metal plates to support the deck joists along their full length, and also to confine burner flames to the underside of the deck boards located between the support joists.
3. **Back wall.** Ceramic fiber board or another noncombustible panel product for the back wall material. Total height of the back wall is 8 feet (2.4 m).
4. **Ledger board.** A 4-foot (1.2 m) long simulated 2 × 6 ledger board shall be constructed of layers of ceramic fiber board (or other noncombustible panel product) and attached to the wall at a height slightly below the overhang of the rear deck board of the test deck.

**12-7A-4.7.3 Conduct of tests.**

1. **Airflow.** The test is conducted under conditions of ambient airflow.
2. **Number of tests.** Conduct the test on three replicate assemblies.
3. **Burner output verification.** Without a deck in the apparatus, set the output of the burner to  $80 \pm 4$  kW. Conduct a verification run of 3 minutes to assure the heat release rate, and then turn off the burner.
4. **Measurement of heat release rate.** HRR is measured during the tests with a properly calibrated oxygen depletion calorimeter. Since HRR is typically a post-test analysis, this criterion for Acceptance may be determined at the end of the test.
5. **Burner configuration.** Center the burner directly under the middle deck board, midway between the joists. The distance from the top of the burner to the bottom of the deck boards shall be 27 inches (690 mm).

6. **Procedure.**

- 6.1 Ignite the burner, controlling for a constant  $80 \pm 4$  kW output.
- 6.2 Continue the exposure for a 3-minute period. Extinguish the burner.
- 6.3 Continue observation for an additional 40 minutes or until all combustion has ceased. The test shall be terminated immediately if flaming combustion accelerates uncontrollably (runaway combustion) or structural failure of any deck board occurs.

7. **Observations.** Note physical changes of the deck boards during the test, including structural failure of any deck board, location of flaming and glowing ignition, and loss of material (i.e., flaming drops of particles falling from the deck). It is desirable to capture the entire test with a video recorder to allow review of the details of performance.

**12-7A-4.7.4 Report.** The report shall include a description of the deck board material and the time of any degradation (peak heat release rate, structural failure, flaming drops or particles falling from the deck) during the test.

**12-7A-4.7.5 Conditions of acceptance.** Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.

1. Peak heat release rate of less than or equal to  $25 \text{ kW/ft}^2$  ( $2.3 \text{ kW/m}^2$ ).
2. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
3. Absence of structural failure of any deck board.
4. Absence of falling particles that are still burning when reaching the burner or floor.

**12-7A-4.8 PART B. Burning Brand Exposure.**

**12-7A-4.8.1 Equipment.**

1. **Wind tunnel.** The wind tunnel shall have the capability of providing 12 mph (5.4 m/s) airflow over the deck assembly.
2. **Anemometer.** Device for measuring airflow across the deck.
3. **Burner.** Gas-fueled burner for brand ignition.

**12-7A-4.8.2 Test system preparation.** See Figure 12-7A-4-2. The ASTM E108 "A" brand roof test apparatus is to be used, with the following modifications:

1. **Deck support.** The deck shall be supported horizontally with the center 60 inches (150 mm) from the front opening of the wind tunnel and the joists parallel to the airflow and resting on two transverse metal supports. The top surfaces of these supports, no more than 3 inches (75 mm) wide, are at the same height as the floor of the wind tunnel.
2. **Fragments.** Burning fragments shall be free to fall to the floor of the room.

**12-7A-4.8.3 Conduct of tests.**

1. **Number of tests.** Conduct the test on three replicate assemblies.
2. **Procedure.** Adhere to ASTM E108 "Standard Test Methods for Fire Tests of Roof Coverings" (burning brand test, "A" brand), with apparatus modified as described above in "Test system preparation" and the following procedure:
  - 2.1 The air velocity shall be calibrated using the 60-inch (1.5 m) framework spacing, with the deck positioned 60 inches (1.5 m) from the front opening of the wind tunnel. All other measurement details shall be followed as specified in Sections 4.4.2, 4.4.3 and 4.4.4 of ASTM E 108. Although ASTM E108 specifies calibration to be conducted with the 33-inch (840 mm) framework spacing used for the intermittent flame test set up, tests have shown that at the nominal 12 mph setting, there was no difference in measured velocity between the 33- and 60-inch framework spacing.
  - 2.2 Ignite the "A" brands as specified in Section 9.4 of ASTM E108, with the exception of the ignition sequence:
    - (1) Each 12- × 12-inch (300 × 300 mm) face for 30 s
    - (2) Each 2.25- × 12-inch (57 × 300 mm) edge for 30 s
  - 2.3 Center the burning brand laterally on the deck with the front edge 2.5 inches (64 mm) from the entering air edge of the deck.
  - 2.4 Continue the exposure for a 40-minute period or until all combustion of the deck boards ceases or a board collapses.
  - 2.5 Heat Release Rate is not monitored because of the impracticability with the specified airflow.
3. **Observations.** Note physical changes of the deck boards during the test, including deformation from the horizontal plane, location of flaming and glowing combustion, and loss of material (i.e., flaming drops of particles falling from the deck). It is desirable to capture the entire test with a video recorder to allow review of the details of performance.

**12-7A-4.8.4 Report.** The report shall include description of the deck board material, and the time of any degradation (accelerated combustion, board collapse, flaming drops or particles falling from the deck).

**12-7A-4.8.5 Conditions of Acceptance.** Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.

1. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
2. Absence of structural failure of any deck board.
3. Absence of falling particles that are still burning when reaching the burner or floor.

