

## CHAPTER 12-7A

# MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

### EXTERIOR WALL SIDING AND SHEATHING SFM STANDARD 12-7A-1

**12-7A-1.1 Application.** The minimum design, construction and performance standards set forth herein for exterior wall siding and sheathing 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 as defined in *California Building Standards Code*.

**12-7A-1.2 Scope.** This standard evaluates the performance of exterior walls of structures when exposed to direct flames.

#### 12-7A-1.3 Referenced documents.

1. ASTM E 2257, Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies.
2. ASTM D 4442, Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM D 4444, Test Methods for Use and Calibration of Hand-Held Moisture Meters.
4. California Building Code, Chapter 7A.

#### 12-7A-1.4 Definitions.

1. **Siding (cladding).** Any material that constitutes the exposed exterior covering of an exterior wall and is applied over sheathing or is directly attached to the wall structural system.
2. **Sheathing.** The material placed on an exterior wall beneath cladding or siding and is directly attached to the wall structural system.

#### 12-7A-1.5 Summary of test method.

1. **Direct flame exposure.** This test method provides for the direct flame exposure of a wall specimen to a flame source centered at the base of a 4-foot by 8 foot (1220 mm by 2440 mm) test assembly.
2. **Gas burner.** The method employs a gas burner to produce a diffusion flame in contact with the test wall assembly.
3. **Heat output.** The gas burner produces a prescribed net rate of heat output of 8535 Btu/min (150 kW) for a period of 10 minutes, after which the flame exposure is terminated.
4. **Resistance to fire penetration.** The test method measures the ability of the wall system to resist fire penetration from the exterior to the unexposed side of the test assembly under the conditions of exposure. Observations are made for the appearance of sustained flaming or glow on the unexposed side and/or sustained glowing on the unexposed side at the end of a 60-minute observation period.

**12-7A-1.6 Equipment.** Unless otherwise noted, dimensions in the following descriptions shall be followed with a tolerance of  $\pm 0.5$  inch (13 mm).

1. **Wall assembly holding fixture.** The test specimen support assembly shown in Figure 1 is designed to permit rapid installation and removal of wall assemblies, and to prevent edge penetration of fire at the margins of the wall assembly. It includes a sturdy frame assembly to hold the specimen and a simulated soffit that is noncombustible. The frame assembly permits a 4-foot by 8-foot (1220 mm by 2440 mm) prefabricated wall section to be inserted and to be sealed in such a way that protects the edges from fire. Side shields are situated near the vertical edges and to within 12 inches (304 mm) of the top of the test wall assembly as shown in Figure 1 to aid in minimizing extraneous drafts to the surface of the assembly.

2. **Burner.**

- 2.1 **Burner details.** The ignition source for the test shall be a gas diffusion burner with a nominal 4-inch-wide by 39-inch-long (100 mm wide by 1000 mm long) porous top surface of a refractory material, as shown in Figure 2. With the exception of top surface dimensions, the essential configuration of the burner is comparable to the burner design described in ASTM E 2257. The burner enclosure shall be positioned so that it is centered relative to the width of the test wall. The distance from the bottom of the test specimen to the top surface of the burner shall be 12 inches  $\pm$  2 inches (300 mm  $\pm$  50 mm). The bottom of the test specimen shall be protected from burner fire exposure by the placement of a 4-foot-wide (1220-mm) thermal barrier consisting of nominal 0.75 inch (19 mm) cement board (or equivalent) between the burner enclosure and the test specimen. The burner enclosure shall be in contact with the protective barrier. The thermal barrier shall be positioned so that the top edge extends 3 inch  $\pm$  1 inch (76 mm  $\pm$  25 mm) above the top edge of the burner, and fastened to the base of the wall in such a manner to prevent obstruction of the burner flame caused by distortion away from the surface of the wall. Any gaps between the top edge of the thermal barrier and the test wall surface shall be filled with ceramic wool, or equivalent, prior to the test.

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Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of  $8535 \pm 454$  Btu/min ( $150 \pm 8$  kW) throughout the flame exposure.

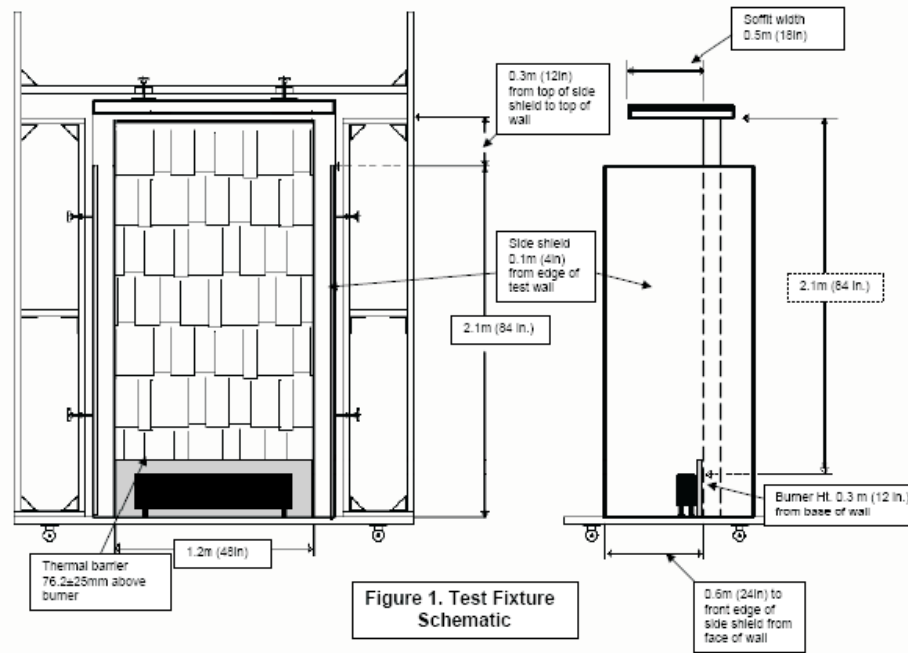
The burner shall be ignited by a pilot burner or a remotely controlled spark igniter.

**2.2. Burner output verification.** The gas supply to the burner shall be the same as used for testing.

1. Without a test specimen in the apparatus, place the gas burner in the configuration to be used

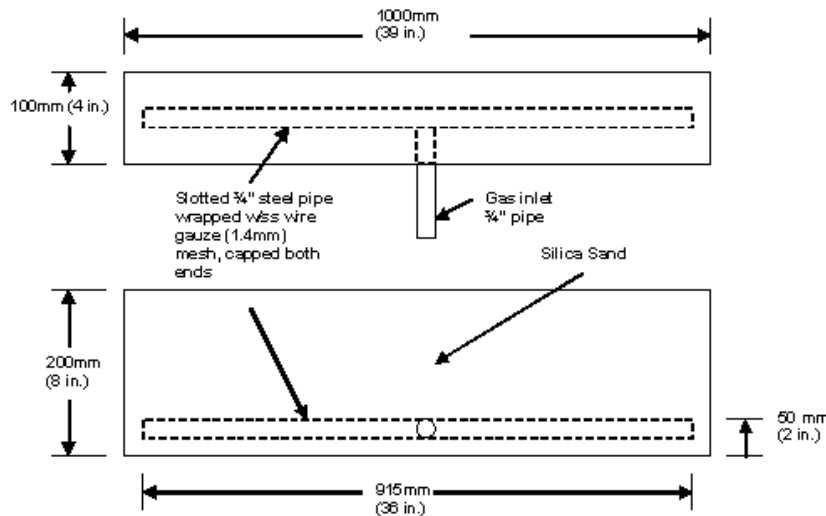
for testing and obtain a heat release rate value of 150 kW.

2. Take measurements at least once every 6 seconds and start 1 minute prior to ignition of the burner. Determine the average heat output over a period of at least 1 minute by the oxygen consumption method, or calculate the heat output from the gas mass flow and the net heat of combustion.
3. Perform verification prior to each day of testing.



**Figure 1. Test Fixture Schematic**

**FIGURE 1. TEST FIGURE SCHEMATIC**



**FIGURE 2. GAS BURNER IGNITION SOURCE**

#### 12-7A-1.7 Test assembly.

1. **Dimensions.** The test specimen's dimensions shall be 4 feet wide by 8 feet high (1220 mm by 2440 mm). The test specimen shall be representative of the end-use wall assembly except as specified in Items 3 and 4. The test specimen shall be mounted in the steel frame holding fixture assembly as shown in Figure 1.
2. **Joint details.** The test specimen shall incorporate joint detail(s) representative of actual installation.
3. **Wall assemblies without internal cavity spaces.** For wall assemblies without internal cavity spaces, the entire wall assembly shall constitute the test specimen to be tested. The wall assembly shall be constructed in accordance with manufacturer's specifications and/or building code requirements, where applicable. Other components of the wall assembly, such as building felt and sheathing, are employed to conform to the manufacturer's specifications and/or building codes.
4. **Wall assemblies with internal cavity spaces.** For wall assemblies with internal cavity spaces, the materials on what would be considered the interior (unexposed) side of the wall assembly shall be omitted from the test specimen. Materials such as insulation normally installed within the cavity space shall be omitted from the test specimen. The wall assembly used as the test specimen shall include the structural support elements and any sheathing, weather barrier and cladding attached to the exterior surface of the structural support elements.
5. **Layered materials.** For wall assemblies composed of layered materials, such as sheathing, siding (cladding) and underlayment, the installation of such layered materials shall be in accordance with the manufacturer's instructions, or in the absence of such instructions, applicable building code requirements. In the absence of manufacturer's specifications, the wall assembly shall include the following minimum components: nominal 2 x 4 studs spaced 16 inches (410 mm) on center, and the desired exterior siding material. If sheathing is used, tests shall be run on typical  $7/16$ -inch oriented strandboard (OSB) of Exposure 1 rating. Where specified by the manufacturer, sheathing material and installation shall be in accordance with the manufacturer's instructions. The sheathing shall have one vertical seam on a selected stud with a 0.125 inch (3 mm) gap.
6. **Edge protection.** Protect the vertical and horizontal edges of the test specimen with 12-mm-thick ceramic wool blanket (or equivalent) to eliminate the gap between the holder and the test specimen and prevent unwanted edge effects caused by heat transfer to the edges of the test specimen through the sample holder.
7. **Replicates.** Three matched test specimen assemblies shall be tested.
8. **Pre-test conditioning of test specimens.** The completed test specimens are to be stored indoors at temperatures not lower than 60°F (16°C) nor higher than 90°F (32°C) for the period of time necessary to cure or condition the assembly components. Test specimens are to be stored so that each will be surrounded by freely cir-

culating air. Pieces of any hygroscopic materials from the same stock from which the test specimen was constructed shall be tacked to the specimen during construction in such a manner that they are easily removed. These pieces shall be conditioned with the completed specimens. Prior to testing, the pieces of hygroscopic materials shall be tested for moisture content.

- 8.1. Make the moisture determination on two samples from each piece and report the average. For lumber and other wood-based materials, use Test Methods D 4442. Use of an appropriately calibrated moisture meter, as described in Test Methods D 4444, to determine the moisture content of wood or wood products is also permitted. For other hygroscopic materials, use test methods appropriate for those materials.
- 8.2. For lumber used in the construction of the supporting wall structure, the moisture content shall not be more than 12 percent. For wood sheathing, the moisture content shall not exceed 8 percent. For other hygroscopic materials, the moisture shall be within ranges specified by the manufacturer before the assembly is constructed. These specified ranges shall be typical for exposure at  $77 \pm 9^\circ\text{F}$  [ $25 \pm 5^\circ\text{C}$ ] and  $55 \pm 10\%$  relative humidity.

**12-7A-1.8 Weathering.** Weathering of materials shall be in accordance with California Building Code Section 703A Standards of Quality.

#### 12-7A-1.9 Conduct of tests.

1. **Test room environment.** The ambient temperature in the test room shall be above 60°F (15°C) and the relative humidity shall be less than 75 percent. The test room shall be draft-protected and equipped with an exhaust hood system for removal of products of combustion during testing.
2. **Airflow.** The horizontal airflow, measured at a horizontal distance of 20 inches (0.5 m) from the edge of the wall assembly, shall not exceed 1.64 ft/s (0.5 m/s).
3. **Placement of test frame.** Prior to testing, and without the test specimen in place, position the frame assembly under the exhaust hood and set the gas burner for the prescribed level of output.
4. **Placement of specimen.** Once the burner output is verified, position the specimen holder assembly at the desired test location under the collection hood.
5. **Test specimen.** Insert the test specimen into the frame assembly, sealing all edges with ceramic wool.
6. **Ignition.** Simultaneously ignite the gas burner and start the timer marking the beginning of the test. Control the burner to a constant  $150 \pm 8$  kW output. Control the hood duct flow to collect all products of combustion.
7. **Flame exposure.** Continue the flame exposure until flame penetration of the test specimen and sustained flaming on the unexposed side occurs or for a period of 10 minutes, then extinguish the burner.
8. **Observation.** If sustained flaming on the unexposed side of the test specimen has not occurred, observe the

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unexposed side of the test specimen for an additional 60 minutes for evidence of sustained flaming or glowing combustion on the unexposed side. Terminate the observation prior to the completion of the 60-minute observation period if all evidence of flame, glow and smoke has disappeared.

**Note:** An infrared thermometer has been found to be useful to detect the increase of temperature on the unexposed side of the test assembly.

9. **Documentation.** Perform photographic and/or video documentation before, during and after each test.

### 12-7A-1.10 Report. The report shall include the following:

1. Name and address of the testing laboratory.
2. Name and address of test sponsor.
3. Description of the test specimen including construction details of the wall system, including details of individual components (such as type, thickness, and installation method of any sheathing) and the manufacturer's installation details and limitations as applicable.
4. Number of specimens tested.
5. Description of weathering, as applicable.
6. Moisture content of hygroscopic elements of wall system construction at the time of testing.

7. Details of the burner verification, including heat supply rate.
8. Date of test, test identification number and date of report.
9. The test results shall include:
  - 9.1. A notation of the time and location of sustained flaming on the unexposed side of the test specimen during the test, along with the sequence number of the test specimen.
  - 9.2. A determination of the presence of glow on the unexposed side of the test specimen at the end of the 60-minute observation period.
  - 9.3. Observations of the burning characteristics of the exposed surface of the test wall during and after the flame exposure.

**12-7A-1.11 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 flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 70-minute test.