



## CAPITAL TESTING AND CERTIFICATION SERVICES

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# TEST REPORT

**Test Method:** ASTM E84-23d, Surface Burning Characteristics of Building Materials

**Rendered To:** AHF Products  
3840 Hempland Rd  
Mountville, PA 17554

**Product Description:** 2.5mm 20mil LVT

**Report Number:** T-17548

**Original Issue Date:** 08/16/2024

**Test Date:** 07/29/2024

**Pages:** 7



TL-224

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## I. SCOPE

This test report contains the results of a specimen tested in accordance with ASTM E84, *Surface Burning Characteristics of Building Materials*. The ASTM E84 test method is intended to provide comparative measurements of surface flame spread and smoke density measurements with that of select grade red oak and fiber-cement board surfaces under the specific fire exposure conditions. The results of ASTM E84 testing are commonly used by building code officials and regulatory agencies to determine whether interior finish materials are suitable for their intended application. This standard is often used interchangeably with UL 723, NFPA 255, and UBC 8-1.

## II. TEST SPECIMENS

Test specimens should be representative of the material which the test is intended to examine. All test specimens should be 20 – 24 inches in width and 24 feet (+12 inches, - 6 inches) in length. The test specimen can be provided in a continuous, unbroken length or multiple sections that will be butted together. Prior to testing, the specimens are conditioned to a constant weight in an environment that is held at 73.4 ± 5°F and 50 ± 5% relative humidity.

TEST SPECIMEN INFORMATION	
Product Description	2.5mm 20mil LVT; Lot: UN041724. *
Samples Selected By	Client
Date Received	04/22/2024
Conditioning Time (days)	14
Specimen Size (in.)	24 x 96
Continuous / Sectioned	Sectioned
Number of Sections	3
Total Weight (lbs.)	138.0
Average Thickness (in.)	0.357
Color	Brown
Exposed Surface	Grain printed side
Mounting Method	ASTM E2204-22: Section 8.2 - Sample material was mounted onto ¼" cement board by Capital Testing. Bostik Lock A100 Cove™ was used and applied with a 1/16" x 1/16" x 1/16" square notch trowel following the wall application instructions specified by the adhesive manufacturer. The client provided the adhesive used. Each panel consisted of four rows of sample material butted together side-by-side. The first and third row consisted of two 48" x 6" boards butted end-to-end. The second and fourth row consisted of one 24" x 6", one 48" x 6", and one 24" x 6" boards butted end-to-end.

\* Information provided by the Client



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### III. PROCEDURE

The tunnel is preheated to a minimum of 150°F as measured by a thermocouple embedded 1/8 inch below the tunnel floor and 23-1/4 feet downstream of the centerline of the burner. The tunnel is then cooled to 105 ± 5°F as measured by a thermocouple embedded 1/8" below the tunnel floor and 13 feet downstream of the centerline of the burner.

After the tunnel has cooled to the required temperature range, the tunnel lid is lifted, and the test specimen is placed on the ledges of the tunnel. The specimen is mounted in a ceiling orientation with the side that will be exposed to the flame facing downward. A 1/4-inch fiber-cement board is placed on the backside of the specimens to protect the tunnel lid during testing.

Once the sample has been loaded into the test chamber, the lid is lowered, and a 240 ft/min airflow is established. The test specimen is preheated for approximately 2 minutes prior to applying the 88-kW burner. The burner is positioned at the front end of the tunnel. It has two ports that point upward toward the face of the specimen. After the 2-minute preheat, the burner is ignited, and it remains on for the duration of the 10-minute test. The flame is tracked by an observer, referred to as the Reader, as it progresses down the length of the tunnel. Smoke density is measured with the use of the photometer system on the exhaust duct. Temperature data is recorded throughout the test by a thermocouple probe that is 23 feet from the centerline of the burner and approximately 1 inch below the sample surface.

### IV. CALCULATION OF RESULTS

The results of ASTM E84 testing are reported as Flame Spread Index (FSI) and Smoke Developed Index (SDI).

The Flame Spread Index is derived by plotting the flame spread distance versus time. Only progressive flame spread is plotted. The total area ( $A_T$ ) under the flame spread distance-time plot is determined by ignoring any flame front recession. FSI values are rounded to the nearest multiple of 5. The calculation of FSI is described below:

$$\text{When } A_T \leq 97.5 \text{ ft}\cdot\text{min:} \quad \text{FSI} = 0.515 * A_T$$

$$\text{When } A_T > 97.5 \text{ ft}\cdot\text{min:} \quad \text{FSI} = 4900 / (195 - A_T)$$

The Smoke Developed Index is derived by plotting the photoelectric cell readings versus time. The area under the curve for the tested material is then divided by the area under the curve for heptane (the material used for smoke calibration). The resulting value is then multiplied by 100. SDI values that are less than 200 are rounded to the nearest multiple of 5. SDI values that are greater than 200 are rounded to the nearest multiple of 50.



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## V. TEST RESULTS

FLAME SPREAD INDEX (FSI)	SMOKE DEVELOPED INDEX (SDI)
<b>20</b>	<b>400</b>

Test Date	07/29/2024
Equipment Operator	Chris Kaiser
Flame Spread Reader	Tony Norris
Ignition Time (sec)	54
FSI (unrounded)	17.901**
SDI (unrounded)	414.4
Maximum Temperature (°F)	534.8
Time to Maximum Temperature (min)	9.393
Maximum Flame Spread Distance (ft)	4.3**
Time to Maximum Distance (min)	3.809**

## VI. OBSERVATIONS

During Testing: Blistering of the exposed surface at time of ignition. Charred debris on the tunnel floor. Debris continued to burn on the tunnel floor.

After Testing: Charred sample material debris on the tunnel floor to 5'. Burned through the sample material to the cement board substrate to 6'. Charring of the sample material to 9'. Cracking and blistering of the sample material exposed surface to 14'. Separation of the sample material from the cement board substrate from 16' to 24'. Discoloration of the sample material exposed surface to 24'. The charred sample material debris on the tunnel floor continued to glow and the sample material in testing position continued to burn after the test was concluded and the burner port was extinguished.

Yes  No Flames were present after the test concluded and the burner was extinguished.

Yes  No Smoldering/glowing was present after the test concluded and the burner was extinguished.

## VII. REMARKS

Weights and thicknesses reported include the sample material, adhesive, and cement aboard substrate.

\*\*Due to electrical noise, the Maximum FS, Max FS Time, FS Area, and Raw FSI reported on the data sheet (page 5) is incorrect. The correct value of the maximum flame spread is 4.3 ft, the time to the maximum flame spread is 3.809 minutes, the FS Area is 34.758 ft-min, and the FSI (unrounded) is 17.901. The corrected values are shown in the table above. The final rounded FSI did not change.

Note: Reported observation distances are relative to the entire length of the test specimen. Reported flame spread distances do not include the first 4-1/2 feet of material due to the length of the burner flame.



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## VIII. DATA SHEET AND GRAPHS

Test Method  Project #  Date  Time (Test Start)  Test No.

Specimen ID

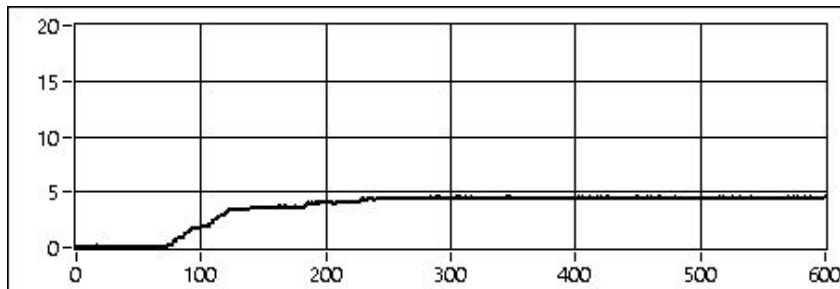
Specimen Description

Mounting Procedure

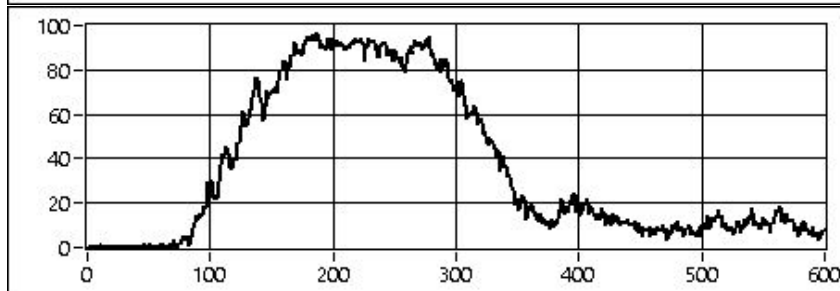
Fuel (CF)  Time to 980F (min)  Max Temp (F)  Time to Max Temp (min)

FS Area  Maximum FS  MAX FS Time (min)

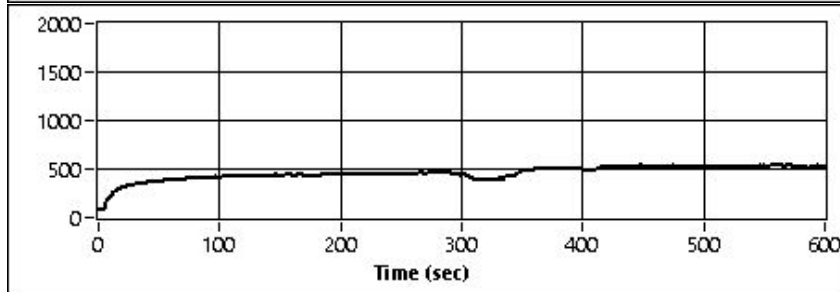
Smoke Area (%A min)  Calibration Smoke Area  Raw SD  Raw FSI



FI Spread



Smoke (%A)



23 ft Temp

Final FSI  Final SD

Test Room Temperature (°F): 76.2

Test Room Humidity (%RH): 47.5



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### IX. DISCUSSION

#### ASTM E84 Standard Language and Disclaimers

The following language was taken directly from the ASTM E84 standard. It has been included for information purposes.

*The purpose of this test method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke developed index are reported. However, there is not necessarily a relationship between these two measurements.* – ASTM E84-23d, Section 1.3

*The use of supporting materials on the underside of the test specimen has the ability to lower the flame spread index from those which might be obtained if the specimen could be tested without such support. These test results do not necessarily relate to indices obtained by testing materials without such support.* – ASTM E84-23d, Section 1.4

*Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place.* – ASTM E84-23d, Section 1.5

*This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled 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.* – ASTM E84-23d, Section 1.8

*This test method does not provide for the following: Measurement of heat transmission through the tested surface; the effect of aggravated flame spread behavior of an assembly resulting from the proximity of combustible walls and ceilings; or classifying or defining a material as noncombustible, by means of a flame spread index by itself.* – ASTM E84-23d, Section 4.3

#### Classification

ASTM E84 results are frequently used by code officials and regulatory agencies to determine whether a product is suitable for its intended application. The test standard itself does not establish specific performance criteria or contain a classification system. The most commonly used classification system can be found in the International Code Council publication International Building Code (IBC), the National Fire Protection Association publication NFPA 101 (Life Safety Code), and the National Fire Protection Association publication NFPA 5000 (Building Construction and Safety Code).

Class	Flame Spread Index (FSI)	Smoke Developed Index (SDI)
A	0 - 25	0 - 450
B	26 - 75	0 - 450
C	76 - 200	0 - 450

Class A, B and C correspond to Type I, II, and II respectively in other codes such as SBCCI, BOCA and ICBO. The classifications above do not preclude a material being otherwise classified by the authority having jurisdiction (AHJ).



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### X. AUTHORIZED SIGNATURES

#### Report Written By:

Chris Kaiser  
Lab Technician II

08/07/2024

Date

#### Reviewed and Approved By:

Chris Palumbo  
Sr. Manager of Product Testing

08/16/2024

Date

### XI. REVISION HISTORY

Revision Number	Date	Summary
0	08/16/2024	Original Report Issued

### XII. ACCREDITATION

Capital Testing and Certification Services is an ISO/IEC 17025 accredited testing laboratory whose scope includes ASTM E84. Accrediting Body: International Accreditation Service, Inc. (IAS). Testing Laboratory TL-224.