



CAPITAL TESTING AND CERTIFICATION SERVICES

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TEST REPORT

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

Rendered To: CRD
70 Walden Pond Dr
Nashua, NH 03064

Product Description: Water Soluble Paper

Report Number: T-17057

Original Issue Date: 06/08/2023

Test Date: 05/26/2023

Pages: 9



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 $73.4 \pm 5^{\circ}\text{F}$ and $50 \pm 5\%$ relative humidity.

TEST SPECIMEN INFORMATION	
Product Description	Water soluble paper attached to six 2' x 4' frames; Paper is 0.005 in thick. *
Samples Selected By	Client
Date Received	05/10/2023
Conditioning Time (days)	16
Specimen Size (in.)	24 x 48
Continuous / Sectioned	Sectioned
Number of Sections	6
Total Weight (lbs.)	23.1
Average Thickness (in.)	0.784
Color	White
Exposed Surface	Side with the sample material closer to the metal frame surface
Mounting Method	Sample material was mounted onto 24" x 48" metal frames by the client. Sample material was mounted using metal rods that press fit the material in between channels in the frame.

* 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)
20	0

Test Date	06/02/2023
Equipment Operator	Chris Kaiser
Flame Spread Reader	Chris Palumbo
Ignition Time (sec)	6
FSI (unrounded)	21.088
SDI (unrounded)	2.2
Maximum Temperature (°F)	568.2
Time to Maximum Temperature (min)	9.87
Maximum Flame Spread Distance (ft)	4.2
Time to Maximum Distance (min)	0.387

VI. OBSERVATIONS

During Testing: Sample material fallout onto the tunnel floor. Fallout continued to glow on the tunnel floor.

After Testing: Sample material fallout on the tunnel floor to 8'. Sample material was burned through to 8'. Cracked through the sample material to 10'. Discoloration of the exposed surface to 24'.

- 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

Total weight and average thickness reported include the sample material, frame, and mounting rods.

Some small tears in the paper material were present upon receipt. The client was informed of the damage that occurred during shipment. The undamaged and least damaged panels were placed closest to the burner during the test. The damage to the panels did not appear to have any impact on the test.

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

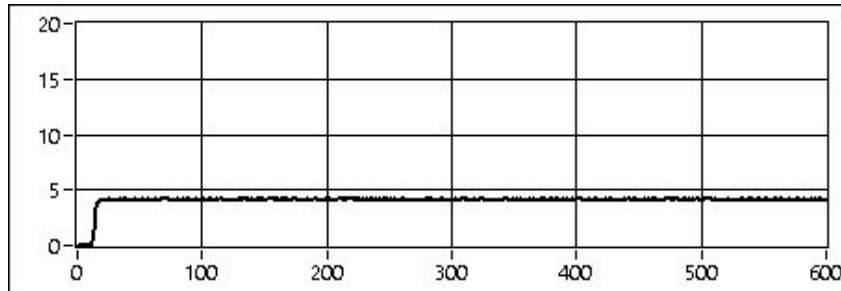
Specimen Description

Mounting Procedure

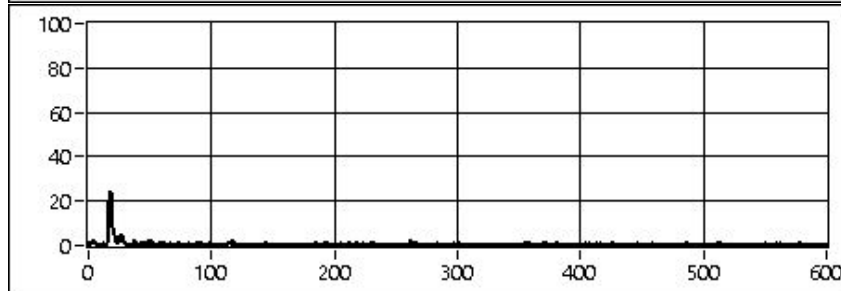
Fuel (CF) Time to 980F (min) Max Temp (F) Time to Max Temp (min)

FS Area Maximum FS MAX FS Time (min)

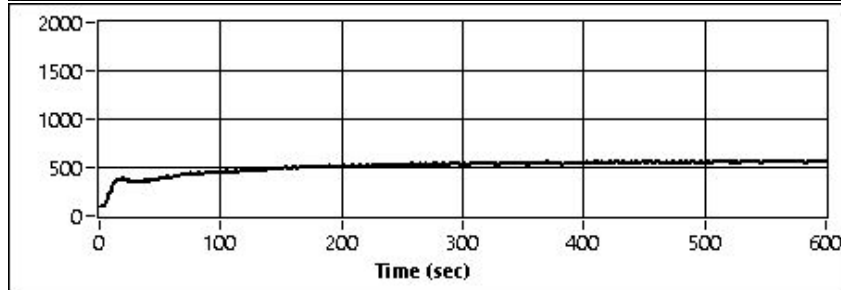
Smoke Area (%A min) Calibration Smoke Area Raw SD Raw FSI



FI Spread



Smoke (%A)



23 ft Temp

Final FSI Final SD

Test

Room Temperature (°F): 73.5

Test Room Humidity (%RH): 46.1



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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 E84-22, 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 E84-22, 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 E84-22, 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 E84-22, 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 E84-22, 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

06/08/2023

Date

Reviewed and Approved By:

Chris Palumbo
Sr. Manager of Product Testing

06/08/2023

Date

XI. REVISION HISTORY

Revision Number	Date	Summary
0	06/08/2023	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.



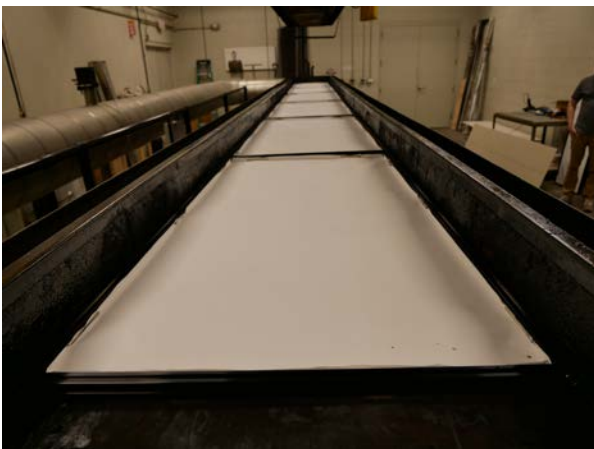
APPENDIX I - PHOTOS



Specimens prior to testing (face side)



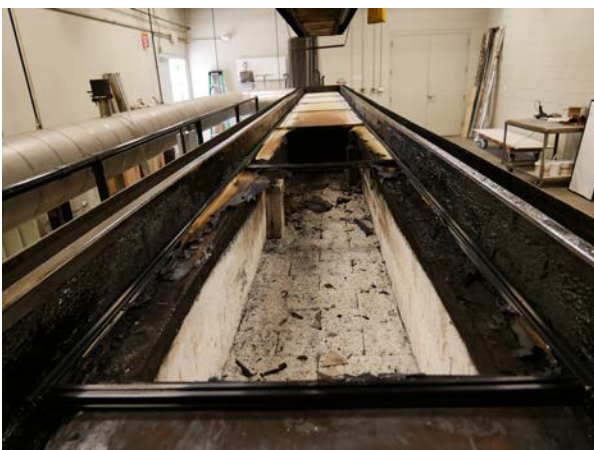
Metal rods used for securing the sample material



Specimens in testing position before testing (0' - 12')



Specimens in testing position before testing (12' - 24')



Specimens in testing position after testing (0' - 12')



Specimens in testing position after testing (12' - 24')



APPENDIX I - PHOTOS



Specimens after testing (0' - 4')



Specimens after testing (4' - 8')



Specimens after testing (8' - 12')



Specimens after testing (12' - 16')



Specimens after testing (16' - 20')



Specimens after testing (20' - 24')