ASTM E84-91a
SURFACE BURNING CHARACTERISTICS

"FX-100" Intumescent Fire Retardant Coating

Report No. 14770 - 96872

March 24, 1994

Prepared For:
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SUBJECT: Omega Point Laboratories Test Report
FX-100 coating on plywood panels

The March 24, 1994 test was performed to show the fire performance of FX-100 when applied to standard decking material (1/2" CDX PINE PLYWOOD) with a worst case scenario included which involved the primary flame impingement being at a "joint" in the system. You will notice that there were six panels used, each 24 inches in length. This placed a joint at the point of contact of the test flame in the furnace.

Note that the test did prove similar performance as the U.L. E-84 performed on Douglas Fir where the flame impingement was not at a joint. The intumescent expansion performed well in that it covered over the small gap at the joints. The flame spread was almost identical to the U.L. test with the only difference being that slightly more smoke was evolved from the test sample when the joint was first exposed to the flame as the heat affected the ends of the test pieces until sufficient intumescent expansion insulated the material.

[Signature]

Michael D. Kiser
ABSTRACT

Test Material: "FX-100" Intumescent Fire Retardant Coating

Test Standard: ASTM E84-91a Standard Test Method for SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS (ANSI 2.5, NFPA 255,

Test Date: March 23, 1994

Test Sponsor: Flame Seal Products

Test Results: FLAME SPREAD INDEX = 5
SMOKE DEVELOPED INDEX = 40

The description of the test procedure and specimen evaluated, as well as the observations and results obtained, contained herein are true and accurate within the limits of sound engineering practice.

Omega Point Laboratories, Inc. authorizes the client named herein to reproduce this report only if reproduced in its entirety. The test specimen identification is as provided by the client and Omega Point Laboratories accepts no responsibility for any inaccuracies therein.

Conrad G. Hernandez
Test Engineer

Date: March 24, 1994

William E. Fitch, P.E. No. 55296
Executive Vice President

Date: March 24, 1994
I. INTRODUCTION

This report describes the results of the ASTM E84-91a Standard Test Method for SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS (1), a method for determining the comparative surface burning behavior of building materials. This test is applicable to exposed surfaces, such as ceilings or walls, provided that the material or assembly of materials, by its own structural quality or the manner in which it is tested and intended for use, is capable of supporting itself in position or being supported during the test period.

The purpose of the method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke density developed are reported, however, there is not necessarily a relationship between these two measurements.

"The use of supporting materials on the underside of the test specimen may lower the flame spread index from that which might be obtained if the specimen could be tested without such support... This method may not be appropriate for obtaining comparative surface burning behavior of some cellular plastic materials... 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."

This test method is also published under the following designations:

- ANSI 2.5
- NFPA 255
- UBC 42-1
- UL 723

This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

(1) American Society for Testing and Materials (ASTM), Committee E-5 on Fire Standards
II. PURPOSE

The ASTM E84-91a (25 foot tunnel) test method is intended to compare the surface flame spread and smoke developed measurements to those obtained from tests of mineral fiber cement board and select grade red oak flooring. The test specimen surface (18 inches wide and 24 feet long) is exposed to a flaming fire exposure during the 10 minute test duration, while flame spread over its surface and density of the resulting smoke are measured and recorded. Test results are presented as the computed comparisons to the standard calibration materials.

The furnace is considered under calibration when a 10 minute test of red oak decking will pass flame out the end of the tunnel in five minutes, 30 seconds, plus or minus 15 seconds. Mineral fiber cement board forms the zero point, while the red oak flooring flame spread and smoke developed ratings are set as 100.

III. DESCRIPTION OF TEST SPECIMENS

| Specimen Identification: | "FX-100" Intumescent Fire Retardant Coating |

| Date Received:          | 3/23/94  |
| Date Prepared:         | March 23, 1994 |
| Conditioning (73°F & 50% R.H.): | 0 days |
| Specimen Width (in):  | 24       |
| Specimen Length (ft): | 24       |
| Specimen Thickness:   | 1/2"     |
| Material Weight:      | N/A oz./sq. yd. |
| Total Specimen Weight: | 117.28 lbs. |
| Adhesive or coating application rate: | N/A |

Mounting Method:
The self-supporting sample was placed directly on the tunnel ledges, with the coated surface toward the flame.

Specimen Description:
The test sample consisted of six plywood panels, coated by Flame Seal Products with "FX-100" at a spread rate of 150 sq.ft. / gal. The panels each measured 24" x 48" x 1/2". The sample was delivered to the test laboratory on the test day, per client request.
IV. TEST RESULTS

The test results, computed on the basis of observed flame front advance and electronic smoke density measurements are presented in the following table. In recognition of possible variations and limitations of the test method, the results are computed to the nearest number divisible by five, as outlined in the test method.

While no longer a part of this standard test method, the Fuel Contributed Value has been computed, and may be found on the computer printout sheet in the Appendix.

<table>
<thead>
<tr>
<th>Test Specimen</th>
<th>Flame Spread Index</th>
<th>Smoke Developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral Fiber Cement Board</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Red Oak Flooring</td>
<td>n/a</td>
<td>100</td>
</tr>
<tr>
<td>&quot;FX-100&quot; Intumescent Fire Retardant Coating</td>
<td>5</td>
<td>40</td>
</tr>
</tbody>
</table>

The data sheets are included in the Appendix. These sheets are actual print-outs of the computerized data system which monitors the ASTM E84 apparatus, and contain all calibration and specimen data needed to calculate the test results.

V. OBSERVATIONS

The coating became intumescent at 0:08 (min:sec). Sample ignition was observed through the tunnel windows, and occurred at approximately 0:30 (min:sec). Char formed a thickness of 1" at 1:00 (min:sec), 1.5" at 1:15 (min:sec), 2" at 2:05 (min:sec), 3" at 3:25 (min:sec), and 4" at 4:15 (min:sec). Maximum flame spread of 2.0' occurred at 9:46 (min:sec).

After cooling and removal from the tunnel, the specimen was observed as follows: The coating was intumescent to 24', and was approximately 3" thick. Channels had formed in the intumescent coating at 2', 4', 6', 8', 10', 12', 16', and 20', thus exposing the substrate (plywood) and allowing char to form on the plywood. Partial consumption of the plywood was noticed between 4' and 5'.
APPENDIX

DATA SHEETS
ASTM E84

DATA SHEET

Client: Flame Seal Products, Inc.
Date: 10:24:14 03-23-1994
Test Number: 1
Project Number: 14770-96072
Operator: CSH/SR
Material TN:

"FX-100" Intumescent Fire Retardant Coating
6 panels @ 24" x 48" x 1/2" - of plywood coated with "FX-100 Coating"
@ spread rate of 150 sq. ft. / gal.

TEST RESULTS:

FLAMESPREAD INDEX = 5
SMOKE DEVELOPED INDEX = 40

SPECIMEN DATA . . .

Time to Ignition = 00:00 (Min:Sec)
Time to Max FS = 09:46 (Min:Sec)
Maximum FS = 2.0 (Feet)
Time To 980 F = Not Reached
Max Temp = 633 (deg F)
Time To Max Temp = 09:55 (Min:Sec)
Total Fuel Burned = 50.87 (cubic feet)

FS*Time Area = 11.3 (Ft*Min)
Smoke Area = 44.3 (%T*Min)
Fuel Area = 5665.2 (F*ft)
Fuel Contributed Value = 14
Unrounded FSI = 5.8170

CALIBRATION DATA . . .

Time to Ignition of Last Red Oak = 00:38 (Min:Sec)
Red Oak Smoke Area = 117.49 (%T*Min)
Red Oak Fuel Area = 9106 (F*ft)
Glass Fiber Board Fuel Area = 5086 (F*ft)