March 17, 2016

Mr. Brian Iverson
Roosevelt Energy Technology
14048 Terrace Road NE
Ham, MN 55304

Our Reference: SV30562/4787319376

Subject: Report Of Surface Burning Characteristics Tests On Samples As Submitted By Roosevelt Energy Technology

Dear Mr. Iverson

This is a Report summarizing the results of a test conducted under a preliminary investigation identified as Assignment No. 4787319376.

GENERAL:

Preliminary investigations are initiated to obtain information with respect to a product or products prior to submittal to UL LLC (UL) for Investigation, Classification and Follow-Up Service. This Report does not constitute evidence of such a submittal to UL. The results relate only to items tested.

METHOD:


The test determines the Surface Burning Characteristics of the material, specifically the flame spread and smoke developed indices when exposed to fire.
The maximum distance the flame travels along the length of the sample from the end of the ignition flame is determined by observation. The Flame Spread Index of the material is derived by plotting the progression of the flame front on a time-distance basis, ignoring any flame front recession, and using the equations described below:

A. \( CFS = 0.515 \ A_T \) when \( A_T \) is less than or equal to 97.5 minute-foot.

B. \( CFS = \frac{4900}{(195-A_T)} \) when \( A_T \) is greater than 97.5 minute-foot.

Where \( A_T \) = total area under the time distance curve expressed in minute-foot.

The Smoke Developed Index (SDI) is determined by rounding the Calculated Smoke Developed (CSD) as described in UL 723. The CSD is determined by the output of photoelectric equipment operating across the furnace flue pipe. A curve is developed by plotting the values of light absorption (decrease in cell output) against time. The CSD is derived by expressing the net area under the curve for the material tested as a percentage of the area under the curve for untreated red oak.

The CSD is expressed as:

\[
CSD = \left( \frac{A_m}{A_{ro}} \right) \times 100
\]

Where:

- \( CSD \) = Calculated Smoke Developed
- \( A_m \) = The area under the curve for the test material.
- \( A_{ro} \) = The area under the curve for untreated red oak.

SAMPLES:

The samples utilized in this investigation were neither prepared nor selected by a Laboratories' representative such that no verification of composition can be provided.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wood Studs with foam core</td>
</tr>
</tbody>
</table>

Each test sample consisted of four 5.5 in wide boards screwed together then butted end-to-end to form the required 24 ft. long surface.

Each test sample was supported by 2 in. hexagonal poultry netting supported by 1/4 in. diameter steel rods spaced 2 ft apart.

RESULTS:

The results are tabulated below are considered applicable only to the specific samples tested.
Data sheets and graphical plots of flame travel versus time and smoke developed versus time are also enclosed.

Table 1: Test Summary

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Test Code</th>
<th>Sample Description</th>
<th>CFS Calculated Flame Spread</th>
<th>FSI Flame Spread Index</th>
<th>CSD Calculated Smoke Developed</th>
<th>SDI Smoke Developed Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>03161610</td>
<td>Wood Studs with foam core</td>
<td>23.72</td>
<td>25</td>
<td>413.6</td>
<td>400</td>
</tr>
</tbody>
</table>

The Classification Marking of UL on the product is the only method provided by UL to identify products which have been produced under its Classification and Follow-Up Service. No use of a Classification Marking has been authorized as a result of this investigation.

Since the anticipated work has been completed, we have instructed our Accounting Department to terminate the investigation and invoice you for the charges incurred to date.

Should you have any questions, please contact the undersigned.

Very truly yours

[Signature]

Reviewed by:

[Signature]

John Wiesner
Engineer
Building Materials & Systems

James Smith
Staff Engineering Associate
Building Materials & Systems
TEST METHOD: The test was conducted in accordance with UL 723, Tenth Edition.

| Client Name          | Roosevelt Energy Technology | Test Duration | 10 minutes | Test No.: | 1 | Hot Test: | No |
|----------------------|------------------------------|---------------|------------|-----------|   |          |    |
| Mounting             | Rods & Wire                  | Test Type:    | Developmental | Burn-Out Required: | No |          |    |
| Test Sample          | Wood Studs with foam core    |               |            |           |   |          |    |

**FLAME SPREAD RESULTS**

<table>
<thead>
<tr>
<th>Distance (Feet)</th>
<th>Time (Sec)</th>
<th>Distance (Feet)</th>
<th>Time (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition</td>
<td>8</td>
<td>3</td>
<td>78</td>
</tr>
<tr>
<td>0.5</td>
<td>14</td>
<td>3.5</td>
<td>98</td>
</tr>
<tr>
<td>1</td>
<td>32</td>
<td>4</td>
<td>114</td>
</tr>
<tr>
<td>1.5</td>
<td>38</td>
<td>4.5</td>
<td>180</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>5</td>
<td>232</td>
</tr>
<tr>
<td>2.5</td>
<td>56</td>
<td>5.5</td>
<td>286</td>
</tr>
</tbody>
</table>

Calculated Flame Spread (CFS): 23.72

Flame Spread Index (FSI): 25

Time to Ignition (sec): 8

Maximum Flame Spread (ft): 5.5

Area Under the Flame Spread Curve (ft.-min): 46.1

**SMOKE RESULTS**

Calculated Smoke Developed (CSD): 413.6

Smoke Developed Index (SDI): 400

Area Under the Smoke Curve (Obs-min.): 328.57

Area Under Red Oak Curve (Obs-min.): 79.45

Post-Test Observations

Char (Feet From Burner): 9
Flame Spread / Smoke Results

Roosevelt Energy Technology
Wood Studs with foam core

Test Num.: 1
SV30562 / 4787319376
03161610

Flame Spread Index: 25
Smoke Developed Index: 400
Max. Flame Spread (ft.): 5.5