Fire Performance of ASTM E119
Evaluation of a Non-Load-Bearing Wall Assembly with Control Joint Backer for Safti-Seal Inc.

Indicative testing conducted in accordance with the test methodology described in ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials

Conducted For:
SAFTI-SEAL INC.
5806 119th Ave SE, Ste A #385
Bellevue, WA 98006

WFCi Report #12033r1

Test Dates: February 23, 2012
Original Report Issued: March 7, 2012
Revision Issued: July 28, 2017
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INTRODUCTION

This report documents the successful fire resistance test of a symmetrical, non-load-bearing wall assembly for Safti-Seal Inc. The wall assembly featured a Control Joint Backer (CJB) down the center of the partition, which was designed to form an insulating barrier for the wall assembly joint. Testing was performed on February 23, 2012, and was conducted in accordance with ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials. The test was conducted to evaluate the subject wall in an ‘as built’ scenario. This test assembly was designed to pass the two-hour fire endurance test, as well as the post-fire hose-stream test.

TEST ASSEMBLIES

WFCi personnel constructed a 10’ × 10’ wall assembly in accordance with the specifications provided by the client. The primary supporting structure consisted of 2 layers of drywall, 2 × 4 metal stud wall assembly with 2 CJB partitions (one on exposed side, one on unexposed side), and repeated layers of drywall. The test specimen was representative of the construction that the test was intended to assess. Further details of construction and composition will be discussed below and in Appendix A – Drawings and Appendix B – Photographs.

SUMMARY OF TEST METHOD

Testing was performed using a vertical fire resistance test configuration employing the fire endurance conditions and standard time-temperature curve described in ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials. The exposed surface of the panel assemblies was subjected to the standard E119 time-temperature curve, with temperature measurements taken inside the natural gas furnace using 9 thermocouples (TC_F) connected to a computerized data acquisition system. TC_F locations were symmetrically disposed and distributed to show the temperature near (within 6”) the exposed face of the test assembly.

Here are the following criteria to which these tests were judged, according to ASTM E119:

- Wall assembly will have sustained the applied load for the indicated time (2-hr, in this instance) without passage of flame or gases hot enough to ignite cotton waste
- Wall assembly will have not developed an opening that permits the projection of water from the hose stream beyond the unexposed surface (applicable for hose-stream portion of the test)
- Transmission of heat through the wall will not have risen the temperature on its unexposed side more than 139°C (average) above its initial temperature, or if a temperature higher than 30% (181°C) of the specified limit occurs at any one point (single-point) on the unexposed side of the assembly.

SAMPLE DESCRIPTION

WFCi personnel constructed a 10’ × 10’ wall assembly in accordance with the specifications provided by the client. The supporting structure consisted of (from exposed face layer to unexposed layer) 2 layers of Gypsum wall board (GWB), 2 × 4 metal stud (7) assembly with 2 vertical CJB joined to the center stud, and repeat GWB layers.
The CJB is a 25 gauge metal profile in the shape of a trough (or V-shape). The trough is filled with intumescent material that provides thermal protection to the interior of the wall assembly. Upon heating, the intumescent expands out from the trough, forming the insulative barrier, before finally being decomposed after successive heating.

The two-hour test assembly consisted (from exposed face layer to unexposed layer) of:

- 2 layers of \( \frac{5}{8} \)” GWB Type X with a unit weight of 2580 lb/1000 ft\(^2\). 1 \( \frac{7}{8} \)” screw spacing of 8” on edge, 12” in field.
- 7, 2 × 4 metal studs (3 \( \frac{5}{8} \)” × 1 \( \frac{1}{4} \)” flange, 0.022 mil [20 gauge (030 EQ)]) (on center) with 24” spacing (sides 12”). Along the center stud were joined two pieces of CJB, one on the exposed side, one on the unexposed side. The inclusion of this joint system allowed for a \( \frac{3}{8} \)” gap in the center of the 10’ × 10’ assembly. Center joint section is shown in Figure 1. Also, typical installation of the CJB is shown in Appendix A – Drawings.
- Repeated GWB layers.

Table 1 shows layered physical characteristics of the pieces of GWB, starting with the north side (piece 1), going across.

![Figure 1. Center wall joint with 2 CBJ pieces attached to drywall and metal stud.](image)

<table>
<thead>
<tr>
<th>Piece Number</th>
<th>Exposed Face GWB</th>
<th>Exposed Base GWB</th>
<th>Unexposed Base GWB</th>
<th>Unexposed Face GWB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3’ × 10’</td>
<td>1’ × 10’</td>
<td>1’ × 10’</td>
<td>3’ × 10’</td>
</tr>
<tr>
<td></td>
<td>77.1 lbs</td>
<td>26.9 lbs</td>
<td>24.3 lbs</td>
<td>77.2 lbs</td>
</tr>
<tr>
<td>2</td>
<td>2’ × 10’</td>
<td>4’ × 10’</td>
<td>4’ × 10’</td>
<td>2’ × 10’</td>
</tr>
<tr>
<td></td>
<td>51.6 lbs</td>
<td>103.6 lbs</td>
<td>104.0 lbs</td>
<td>52.4 lbs</td>
</tr>
<tr>
<td>3</td>
<td>2’ × 10’</td>
<td>4’ × 10’</td>
<td>4’ × 10’</td>
<td>2’ × 10’</td>
</tr>
<tr>
<td></td>
<td>49.9 lbs</td>
<td>102.9 lbs</td>
<td>104.5 lbs</td>
<td>52.6 lbs</td>
</tr>
<tr>
<td>4</td>
<td>3’ × 10’</td>
<td>1’ × 10’</td>
<td>1’ × 10’</td>
<td>3’ × 10’</td>
</tr>
<tr>
<td></td>
<td>78.0 lbs</td>
<td>25.0 lbs</td>
<td>26.3 lbs</td>
<td>77.2 lbs</td>
</tr>
</tbody>
</table>

**Temperature**

To obtain representative thermal information of the samples during the tests, the two-hour wall assembly was instrumented with sample thermocouples (TC\(_s\)). One group of TC\(_s\) (1-5) was located between the GWB and metal studs on the exposed side (for finish rating) at the center and relative quarter points (according to stud location) of the assembly (Figure 2a). TC\(_s\)3 was located between the center stud and side of the CJB, which would not necessarily be
representative of the overall assembly finish rating. Additional interior TCs (6-7) were placed on the outside of the CJB for better analysis of its performance (Figure 1). The other main group of TCs (8-16) was located on the unexposed layer of GWB at the center, quarter, and midline center points of the assembly to monitor the backside temperature. TCs locations can be seen on Figure 2b. Centerline TCs (10, 13, 16) were placed 1/4” from the edge of the GWB. Averages for each group were computed to determine overall finish and test performance.

![Figure 2](image)

Figure 2. (a) Finish rating TCs on exposed side between base GWB layer and metal studs (left – north), (b) TCs on unexposed side (right – north).

**TEST RESULTS**

Testing of the wall assembly took place on February 23, 2012. The panels were fixed in place within the 10’ x 10’ sample holder and insulated on the perimeter edges with ceramic wool insulation. The furnace temperature, samples temperatures, and furnace pressure, were continuously monitored at 1 Hz until test termination. These data are presented in the figures below. Additional photographs of the samples before, during, and after each test are provided in Appendix B – Photographs.

**Test Date & Time:** 02/23/12, 08:30 AM

**Furnace:** Large-scale vertical exposure E119 furnace – 2-hr exposure with hose-stream

**Laboratory Conditions:** 16°C, 38% RH

**Witnesses:** Brad Hamilton, Jim Klein

<table>
<thead>
<tr>
<th>Test Time  (hr:mm:ss)</th>
<th>Event</th>
</tr>
</thead>
</table>

Table 2. Observations for two-hour wall test
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>Start Test</td>
</tr>
<tr>
<td>02:15</td>
<td>Darkening of patches</td>
</tr>
<tr>
<td>05:00</td>
<td>Bow near south side GWB joint, possibly cracked GWB or just flaking patch</td>
</tr>
<tr>
<td>30:30</td>
<td>Smoke/steam on outside/top sections</td>
</tr>
<tr>
<td>42:13</td>
<td>Single-point finish failure (TC(_S)3)</td>
</tr>
<tr>
<td>49:30</td>
<td>Intumescing material nearly flush with GWB layers</td>
</tr>
<tr>
<td>55:17</td>
<td>Average finish failure (TC(_S) 1-5)</td>
</tr>
<tr>
<td>01:05:00</td>
<td>Intumescing materials sticks out (\frac{1}{2})” in some places of center crack</td>
</tr>
<tr>
<td>01:09:30</td>
<td>Small flames from intumescent material</td>
</tr>
<tr>
<td>01:28:00</td>
<td>Intumescent appears to be deteriorating – growing shorter</td>
</tr>
<tr>
<td>01:34:30</td>
<td>Slight swelling on outside intumescent layer</td>
</tr>
<tr>
<td>01:38:00</td>
<td>Cracking face on GWB layer</td>
</tr>
<tr>
<td>01:57:00</td>
<td>Continued cracking</td>
</tr>
<tr>
<td>02:01:00</td>
<td>Terminate test – to hose-stream</td>
</tr>
</tbody>
</table>

The test was allowed to run an extra minute, as to ensure heating requirements were met. There was no apparent change to the unexposed side of the wall assembly. There was no passage of flame or gases hot enough to ignite cotton waste, therefore, passing this endurance requirement.

**Temperature Data**

The furnace temperature followed the standard time-temperature curve as shown in Figure 3. A comparison of the area under the time-temperature curve with the standard is also shown in Figure 4. Little variation (0.03%) is observed, well below the 7.5% recommended for a 2-hr test.

The temperature profiles for these samples are grouped as exposed (finish) and unexposed TC\(_S\) as shown in Figure 5. Additional TC\(_S\) (6-7) near the CJB is also included. An analysis of the TC\(_S\) data shows an insulative plateau (particularly TC\(_S\)6) in the 40-60 min region. TC\(_S\)3 supersedes the single-point finish temperature limit (181°C + ambient [16°C] = 197°C) at 42 min, 13 s into the test, giving an overall finish rating of 42 min, reported to the nearest integral minute. However, as discussed above, TC\(_S\)3 was placed near the CJB and is not representative of the entire wall assembly. This can also be verified by comparing the other exposed TC\(_S\) in Figure 5. Removing TC\(_S\)3, the average finish temperature (139°C + ambient [16°C] = 155°C) is superseded at 62 min, 31 s into the test, giving an overall finish rating of 63 min, reported to the nearest integral minute. The unexposed TC\(_S\) did not supersede the threshold temperatures for average temperature (155°C) or single-point temperature (197°C), therefore, passing the heat transmission requirement.
Figure 3. Furnace comparison with standard for the two-hour exposure test.

Figure 4. Area under time-temperature curve for the two-hour exposure test.
**Figure 5.** Exposed and unexposed TC's for the two-hour exposure test.

**Displacement Data**

This was a non-load-bearing wall assembly, so no vertical deflection measurements were obtained for this test. However, horizontal deflection measurements were taken every five minutes at three locations along the horizontal midline on the unexposed sample surface to monitor horizontal movement and/or buckling of the sample. It can be seen in Figure 6 that the center horizontal deflection (toward the furnace) reached up to 1 1/2” by the end of the two-hour test. The sides showed lower deflection (1”, 3/4”) as was expected.
Figure 6. Horizontal deflection of wall assembly for the two-hour test exposure.

**Hose-stream**

Directly following the two-hour exposure, the wall assembly was pulled away from the furnace and a water hose stream was applied at a pressure of 30 psi for 2 min 30 s ($2 \frac{1}{2} \text{ min/100 ft}^2$ for 2-hr resistance, ASTM E2226, *Standard Practice for Application of Hose Stream*). No opening allowed for the penetration of water from the applied hose stream beyond the unexposed surface, therefore, passing this hose-stream requirement. It appeared that little damage was done to the base layer of GWB on the unexposed side.

**CONCLUSION**

The wall assembly passed all requirements for the 2-hr fire endurance tests, according to ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*. The 2-hr wall assembly maintained structure its resistance period without the passage of flame or gases hot enough to ignite cotton waste or did not transmit heat through the wall assembly allowing the average temperature to supersede 139°C + ambient or the single-point temperature to supersede 181°C + ambient. In addition, the wall assembly was subjected to a hose-stream following heating (2 min 30 s hose stream) and did not develop an opening that permits the projection of water from the hose stream beyond the unexposed surface.
SIGNATURES

Testing performed by,

Mike White
Laboratory Manager

Reviewed and Approved by,

Brent M. Pickett, Ph.D.
Technical Director

WESTERN FIRE CENTER 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 WFCi accepts no responsibilities for any inaccuracies therein. WFCi did not select the specimen and has not verified the composition, manufacturing techniques or quality assurance procedures.

<table>
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<th>Version</th>
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<td>Original</td>
<td>March 7 2012</td>
<td>12033</td>
<td>Original report</td>
</tr>
<tr>
<td>Revision 1</td>
<td>July 28, 2017</td>
<td>12033r1</td>
<td>Changed company name from BlazeFrame to Safti-Seal. Updated appendix.</td>
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APPENDIX A – DRAWINGS

Control Joint Protection and Framing Solution

Safti-Frame™

Safti-Frame "CJB" (Control Joint Backer)

Install Before or After Cavity Obstructions
Eliminate Drywall Rips/Mineral Wool and Extra Stud
Eliminate Fire Caulking of Penetrations through Cavity Drywall Rips
Zinc or Vinyl Architectural Control Joint (optional)

![Diagram of Safti-Frame CJB installation]

<table>
<thead>
<tr>
<th>Part #</th>
<th>Intumescent Width</th>
<th>Profile Width</th>
<th>Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>CJB-18</td>
<td>1.25&quot;</td>
<td>3.25&quot;</td>
<td>.018</td>
</tr>
</tbody>
</table>

[www.saftiseal.com](http://www.saftiseal.com)
Safti-Seal Inc. - (425) 869-2811
**Control Joint Protection and Framing Solution**

**Installation:**
- Locate first flange of CJB between wall "stud" and wall sheathing
- Fasten CJB max. 8" O/C utilizing wall sheathing fasteners for attachment
- Span wall sheathing from adjacent "stud" and attach to second CJB flange
- Edges of wall sheathing align with edges of intumescent material

**Rated 1 hour - Top View CJB at Stud/Jamb (Single Side & Back to Back)**

**Rated 2 Hour - Top View CJB at Stud/Jamb (Single Side & Back to Back)**

Profiles are manufactured with 25ga galvanized steel complying with ASTM A653 having a minimum G40 coating. Profiles comply with ASTM C645 and are installed behind joints in wall sheathing where control joints (Zinc or Vinyl 093) are installed to prevent face cracking.

www.saftiseal.com
Safti-Seal Inc. - (425) 869-2811

Western Fire Center, Inc.
Kelso, WA
APPENDIX B – PHOTOGRAPHS

(a)  
(b)  
(c)  
(d)  
(e)  
(f)
Figure B.1. Two-hour wall assembly, (a-f) Construction, (g-m) Fire endurance, (n-r) Post-test hose-stream.