



WESTERN FIRE CENTER, INC.

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Fire Testing of Exterior Vents

Indicative testing conducted in accordance with the test methodology described in ASTM E2886/E2886M, Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement

Conducted For:

Vulcan Technologies, Inc.
580 Irwin Street, Suite 1
San Rafael, CA 94901

Material:

6"×14" Exterior Eave Vent (VFS 614 FF)

WFCi Report #15021r1

****The results of this report pertain only to the materials tested****

Test Date: March 20, 2015

Original Report Issued: April 9, 2015

Revision Issued: April 9, 2015

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INTRODUCTION

The report summarized the testing of exterior eave vents for Vulcan Technologies, Inc tested at Western Fire Center, Inc. (WFCi). The purpose of this test was to evaluate the fire test performance characteristics of the exterior vent products in accordance with ASTM E2886/E2886M, *Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement*. Two separate methods are defined in the standard, ember exposure to vents and direct flame impingement in multiple orientations (vertical/horizontal). Only the direct flame impingement in the horizontal orientation is treated in this report.

SUMMARY OF TEST METHOD

Ember Test

Embers are generated from a circular tumbler filled with 10 Class C brand (ASTM E108) positioned over a representative installed horizontal exterior vent and combustible target material. The brands are ignited by a 2” gas flame for a 3 min period. After the brand ignition, the tumbler is activated allowing the created embers to fall on top of the vent (upper shelf). Embers that the vent does not collect/stop can pass through and ignite a combustible cotton target (lower shelf) below the vent. Air flow is regulated by a fan downstream of the tumbler, vent, and target material at a velocity of 2 mi/hr. The test is run until all the embers have run out of the tumbler and all combustion ceased. Assembly dimensions and locations are described in Figure 1 as well as the actual installation in Figure 2.

No specific acceptance criterion is given for this standard, but observations are to be made regarding ignition of the target cotton material including smoldering and flaming ignition. To give representative temperature information, 3 thermocouples are installed 1” above the vent at center and quarter points. Three (3) replicates of this test are performed as directed by the standard.

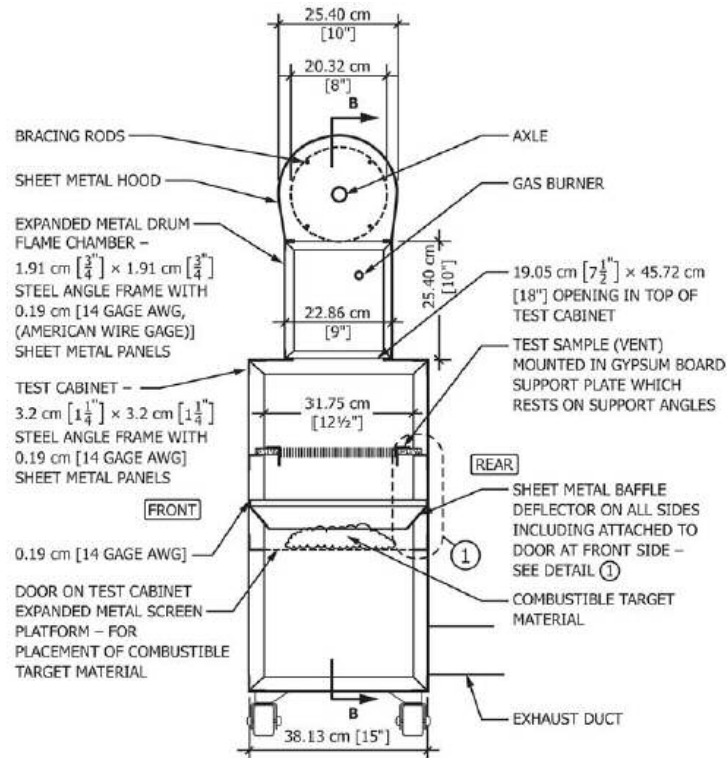


Figure 1. Ember test assembly showing tumbler, vent, and target locations.



Figure 2. Actual installation of vent in ember chamber with upper and lower shelf.

Direct Flame Test

A nominal 4'×8' table (Figure 3) was used for the direct flame exposure. The table had a 20"×20" hole cut on one side and a 16" skirt on each side except the side away from the hole. A 6³/₄"×6³/₄" sand burner was positioned 10" below the table hole. A vent sample is installed in either a horizontal or vertical configuration. For the horizontal vent (Figure 3b), a 27¹/₂"×27¹/₂" flat lid with the installed vent was used to cover the table hole. For the vertical vent (Figure 3c), a 31¹/₂"×31¹/₂"×31¹/₂" box with the installed vent on one side was used to cover the table hole. The box had four 2"×12" holes in the top to allow flames to escape. Only the horizontal configuration will be addressed in this test report.

Prior to the test, the gas flame was verified to have a heat output of 300 kW. The flat lid or box, depending on vent orientation, was slid over the table hole. The test is designed to run for 10 min. At 30 s, 5 m, and 9 m 30 s into the test, a target cotton pad was placed next to the vent for

30 s to see if the vent allows heat to transfer through the vent. No specific acceptance criterion is given for this standard, but observations are to be made regarding ignition of the target cotton material including flaming ignition, smoking, and/or darkening of the pad. No thermocouples were included in this test as they are optional in the standard. Three (3) replicates of this test (in each orientation) are performed as directed by the standard.

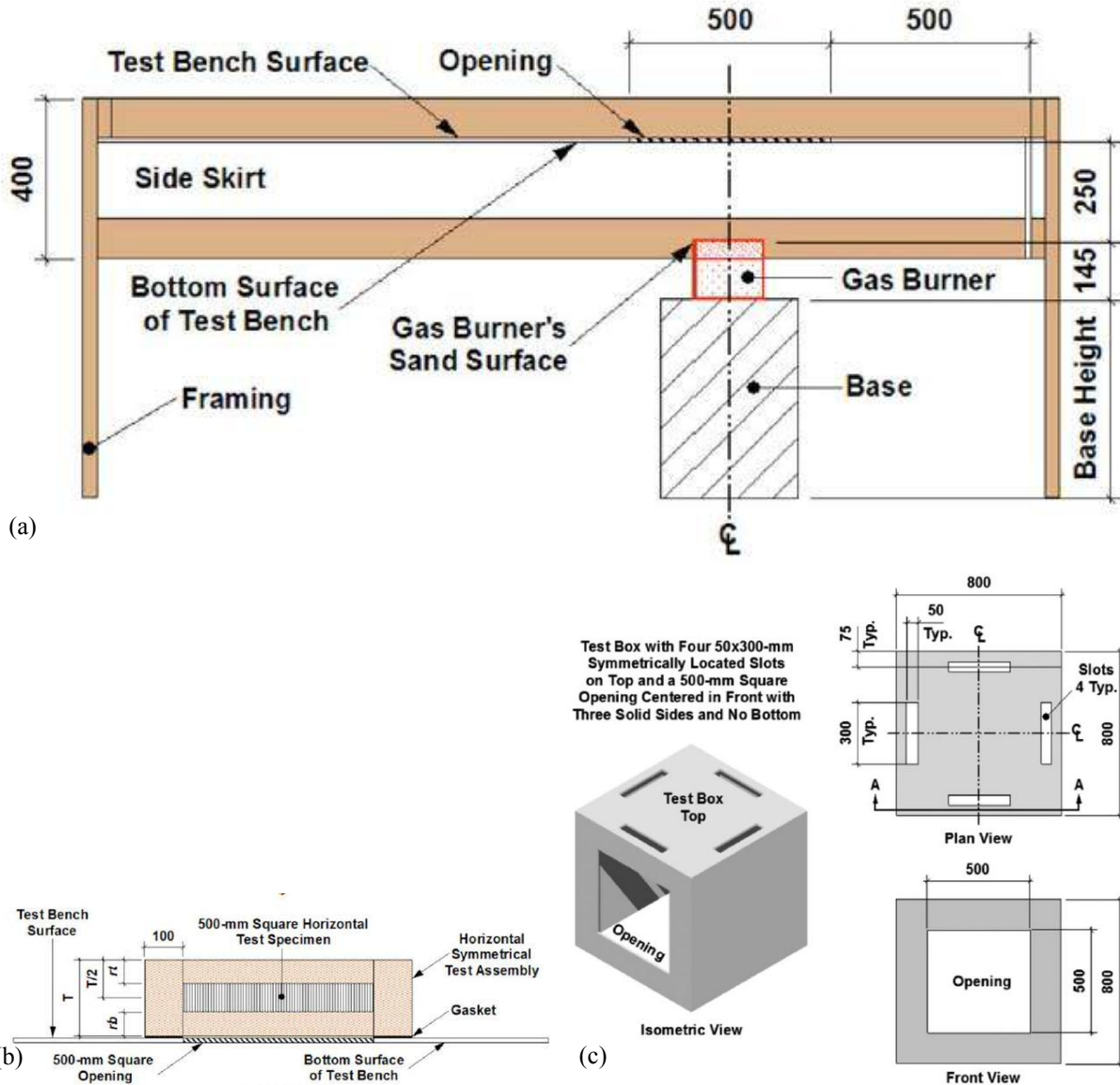


Figure 3. Direct flame apparatus showing (a) overall table, (b) horizontal lid and vent, and (c) box for vertical vents.



Figure 4. Actual flame prior to horizontal vent test.

SAMPLE DESCRIPTION

A nominal 6"×14" (7"×15" with flange, 5½"×13½" without flange) representative exterior eave vent (VFS 614 FF) produced by Vulcan Technologies, Inc was used as the test sample for all tests. The vent is a protected/coated honeycomb panel encased in metal framework. Each vent was third-part witnessed by Product Certification Consultants, LLC (APPENDIX A: INSPECTION REPORT) and identified as '2-9-15 PCC-GT, FFC, #1 through #12' (Figure 5). Each vent was weighed prior to testing. WFCi did not select the sample components and has not verified the manufacturing techniques or accuracy of the products and labeling.



Figure 5. Vent identification.

For the ember tests, the vent was installed in a layer of gypsum with a hole corresponding to its size and installed on the upper shelf of the test cabinet. The perimeter flange was covered with aluminum tape as outlined in the standard. For the direct flame tests, the vent was installed in two layers of gypsum with a hole corresponding to its size. In addition, to replicate typical construction of installation into wood joists/studs, the vent was backed OSB into which the vent was fastened with 1½" screws. Below is a summary of each vent tested:

- Test 1: Ember Test. Vent #7. Mass 420.62 g
- Test 2: Ember Test. Vent #8. Mass 416.55 g
- Test 3: Ember Test. Vent #9. Mass 420.10 g
- Test 5: Horizontal Direct Flame Test. Vent #11. Mass 432.27 g
- Test 6: Horizontal Direct Flame Test. Vent #12. Mass 424.50 g
- Test 7: Horizontal Direct Flame Test. Vent #2. Mass 418.26 g

TEST RESULTS

Testing was performed on March 20, 2015 with Larry Dumm and Chris Tatasciore as witness for Gunter Manufacturing. The heat source (300 kW) for the direct flame exposure tests were verified just before the test began. Ambient conditions on the test day ranged between 13°C and 16°C and 47% and 54% RH.

Ember Test Results

A typical test showed small ember going through the screen of the vent and landing upon the cotton target, charring the cotton (smoldering ignition), but no flaming ignition was observed. The embers began to run out around 5-6 min into the test with all signs of combustion out around 10-11 min. Individual observations are shown below.

Test 1 - Ember

VFS 614 FF Exterior Eave Vent #7

Test Date & Time: March 20, 2015 – 9:45 AM

Table 1. Observations for Test 1.

Test Time (mm:ss)	Event
-03:30	Burner applied to brands (15 s delay in flame adjustment)
-00:15	Gas off – shield/door being closed
00:00	Start test – tumbler activated
00:20	Small embers through vent – charring cotton
05:40	Reduced embers
10:10	All combustion out – terminate test

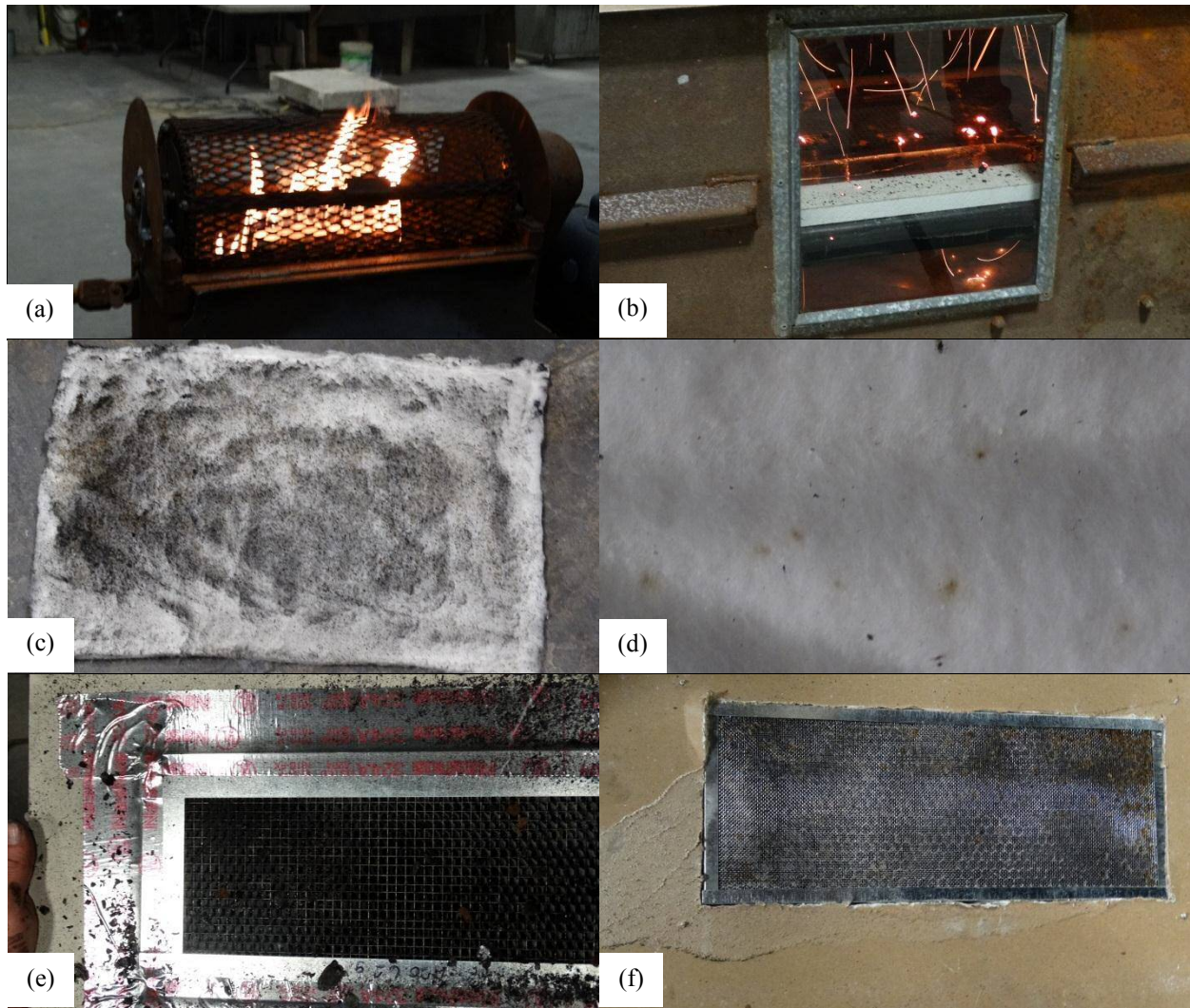


Figure 6. Test 1 showing (a) flaming brands, (b) embers through vent, (c) cotton front, (d) cotton back, (e) vent front, and (f) vent back.

The three thermocouples (Figure 7) just above the vent on the upper shelf showed an initial spike to around 60°C when the tumbler was activated which remained for approximately 3 min, then gradually decreased as the embers burned out.

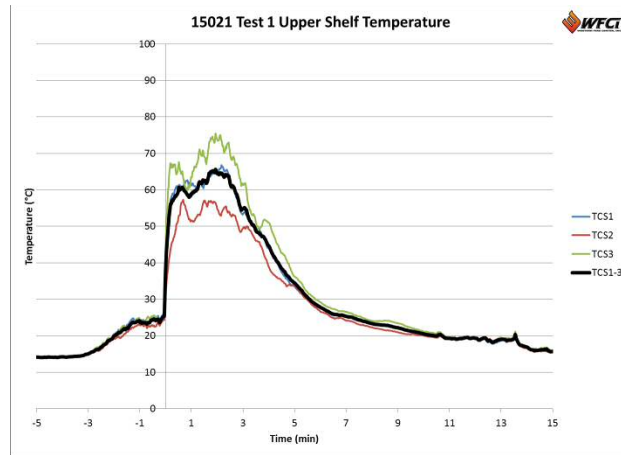


Figure 7. Test 1 temperature just above vent.

Test 2 - Ember

VFS 614 FF Exterior Eave Vent #8

Test Date & Time: March 20, 2015 – 10:15 AM

Table 2. Observations for Test 2.

Test Time (mm:ss)	Event
-03:15	Burner applied to brands
-00:15	Gas off – shield/door being closed
00:00	Start test – tumbler activated – embers through vent
01:05	Charring cotton target
05:30	Reduced embers
10:00	All combustion out – terminate test

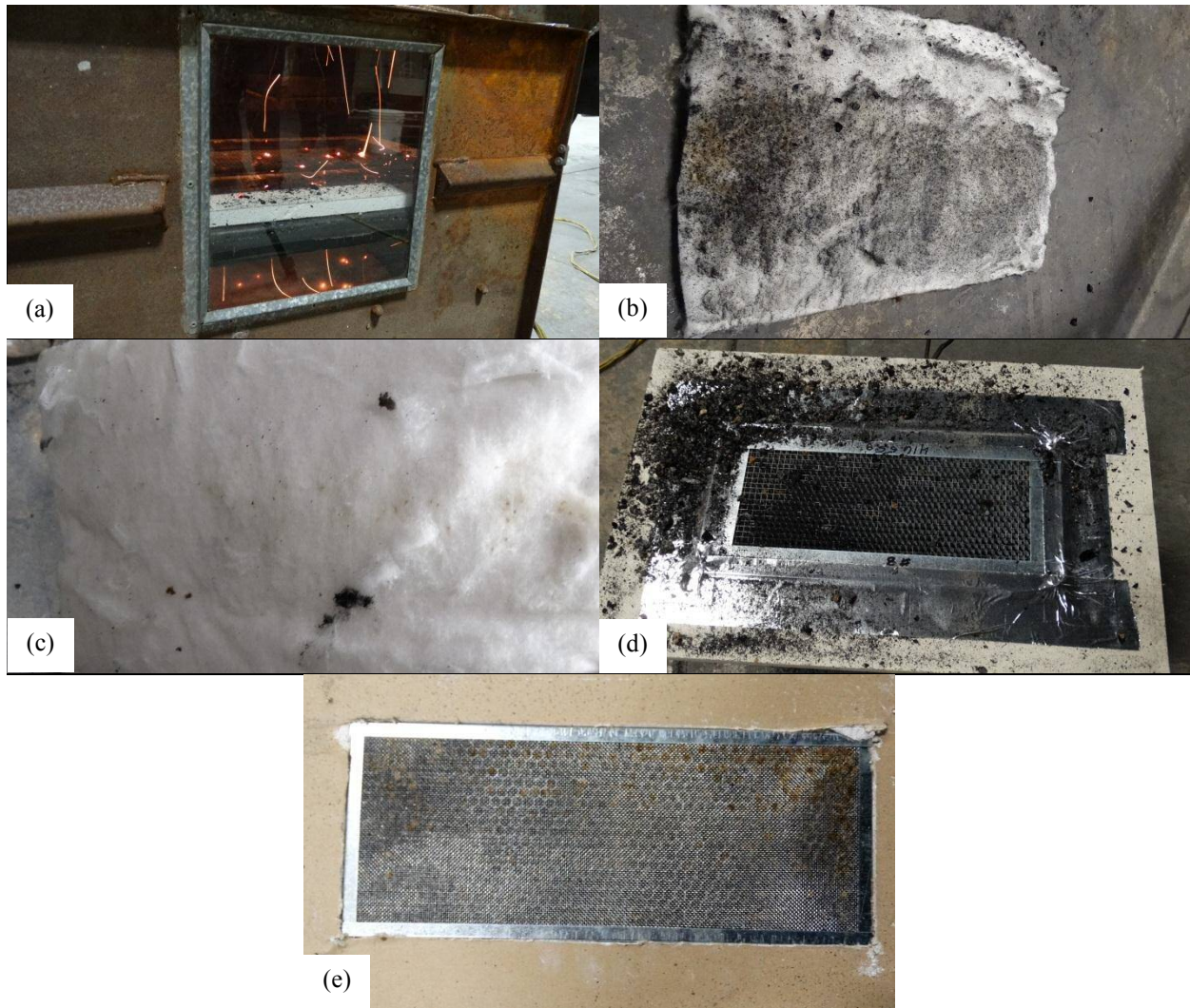


Figure 8. Test 2 showing (a) embers through vent, (b) cotton front, (c) cotton back, (d) vent front, and (e) vent back.

The three thermocouples (Figure 9) just above the vent on the upper shelf showed an initial spike to around 80°C when the tumbler was activated which remained for approximately 3 min, then gradually decreased as the embers burned out.

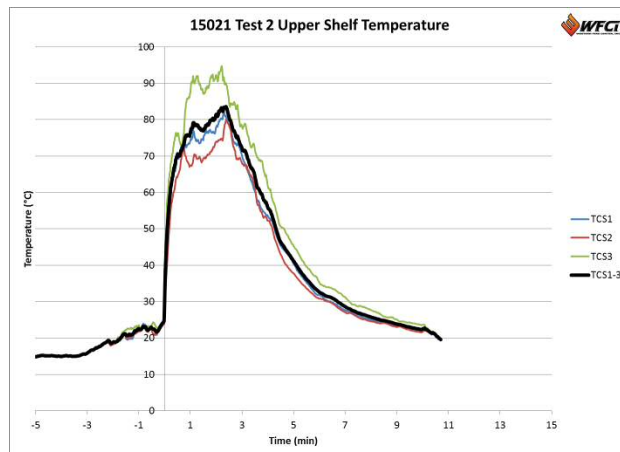


Figure 9. Test 2 temperature just above vent.

Test 3 - Ember

VFS 614 FF Exterior Eave Vent #9

Test Date & Time: March 20, 2015 – 10:45 AM

Table 3. Observations for Test 3.

Test Time (mm:ss)	Event
-03:10	Burner applied to brands
-00:10	Gas off – shield/door being closed
00:00	Start test – tumbler activated
00:10	Ember through vent
01:55	Charring cotton target
06:15	Reduced embers
07:45	No visible embers in tumbler
10:00	All combustion out – terminate test

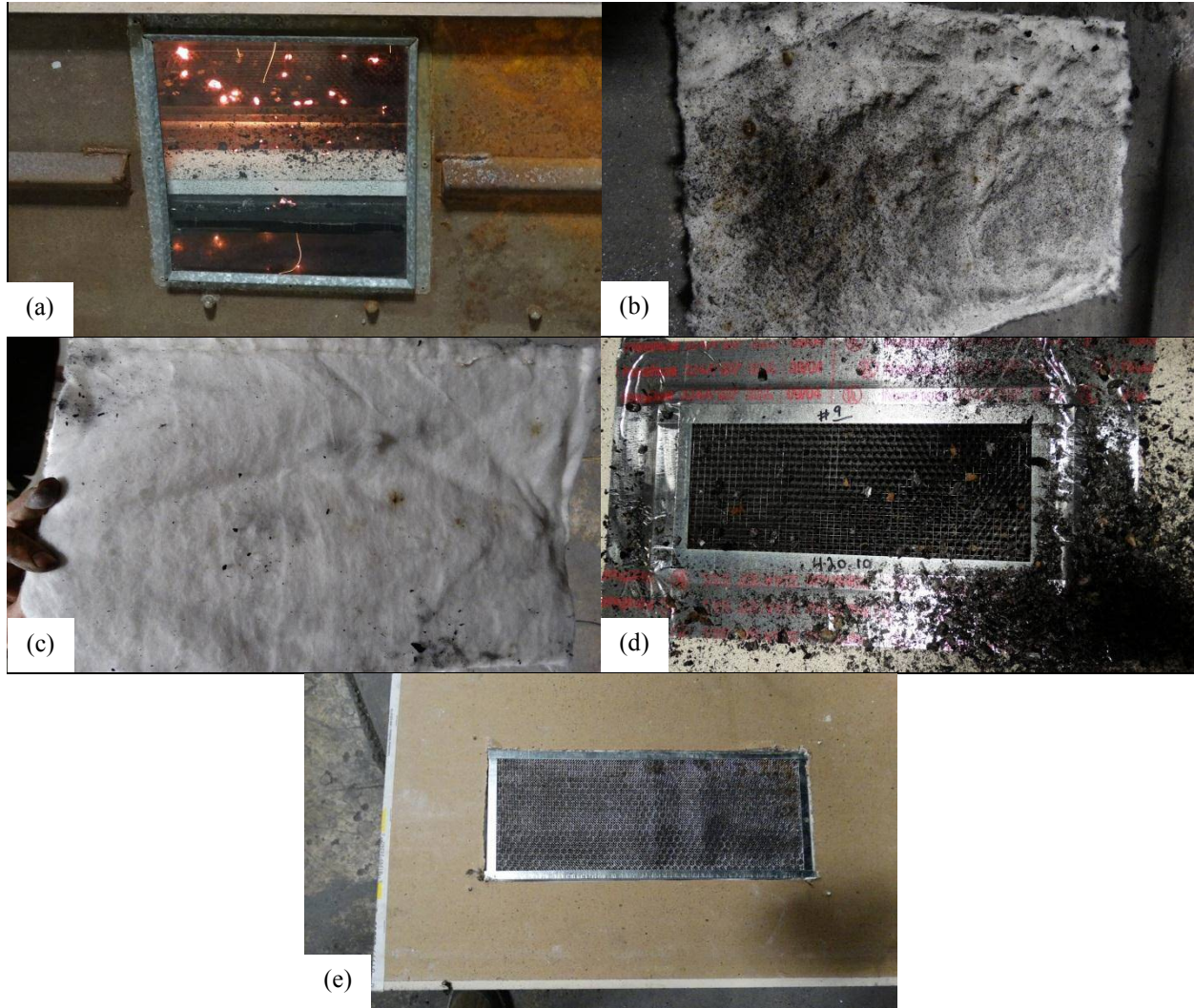


Figure 10. Test 3 showing (a) embers through vent, (b) cotton front, (c) cotton back, (d) vent front, and (e) vent back.

The three thermocouples (Figure 11) just above the vent on the upper shelf showed an initial spike to around 80°C when the tumbler was activated which remained for approximately 3 min, then gradually decreased as the embers burned out.

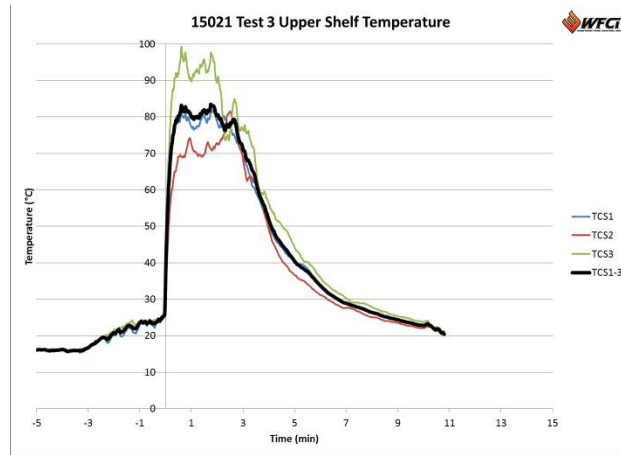


Figure 11. Test 3 temperature just above vent.

Direct Flame Test Results

The horizontal direct flame tests showed flames that initially hit the vent, but then spread across the underside of the table, eventually coming out the back end of the table (e.g., side without the skirt). It appeared that this configuration, with the burner so close to the vent, produced a fuel-rich/oxygen-lean environment under the table, possibly altering the overall flame temperature at the vent. That being said, the protective coating closed off the opening of the honeycomb mesh, prohibiting air flow through the vent. No ignition of the multiple cotton targets was observed. Individual observations for the horizontal tests are shown below.

Test 5 – Horizontal Direct Flame

VFS 614 FF Exterior Eave Vent #11

Test Date & Time: March 20, 2015 – 3:10 PM

Table 4. Observations for Test 5.

Test Time (mm:ss)	Event
00:00	Start test – vent/lid moved over burner
00:30	Cotton target 1 on vent
01:00	Cotton target 1 off vent – no ignition, no discoloration
02:20	Pulsating flames out back end between 2’ and 6’ high
05:00	Cotton target 2 on vent
05:30	Cotton target 2 off vent – no ignition, no discoloration
09:30	Cotton target 3 on vent
10:00	Cotton target 3 off vent – no ignition, no discoloration – terminate test



Figure 12. Test 5 showing (a) smoke through vent, (b) cotton 1, (c) flames under table, (d) flames out back end, (e) vent front, and (f) vent back.

Test 6 – Horizontal Direct Flame

VFS 614 FF Exterior Eave Vent #12

Test Date & Time: March 20, 2015 – 4:10 PM

Table 5. Observations for Test 6.

Test Time (mm:ss)	Event
00:00	Start test – vent/lid moved over burner
00:30	Cotton target 1 on vent – flames around perimeter skirt
01:00	Cotton target 1 off vent – no ignition, no discoloration
05:00	Cotton target 2 on vent
05:30	Cotton target 2 off vent – no ignition, no discoloration

09:30	Cotton target 3 on vent
10:00	Cotton target 3 off vent – no ignition, no discoloration – terminate test

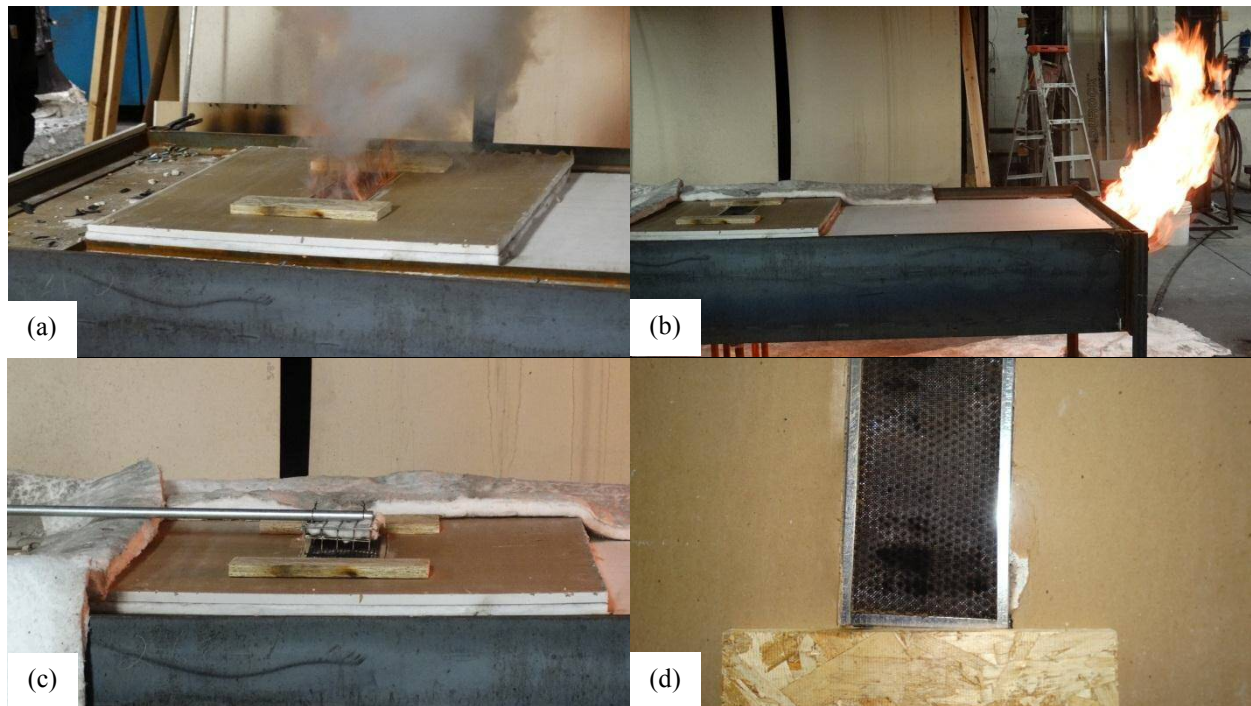


Figure 13. Test 6 showing (a) smoke through vent, (b) flames out back end, (c) cotton 3, (d) vent back.

Test 7 – Horizontal Direct Flame

VFS 614 FF Exterior Eave Vent #12

Test Date & Time: March 20, 2015 – 4:35 PM

Table 6. Observations for Test 7.

Test Time (mm:ss)	Event
00:00	Start test – vent/lid moved over burner
00:30	Cotton target 1 on vent
01:00	Cotton target 1 off vent – no ignition, no discoloration
05:00	Cotton target 2 on vent
05:30	Cotton target 2 off vent – no ignition, no discoloration
09:30	Cotton target 3 on vent
10:00	Cotton target 3 off vent – no ignition, no discoloration – terminate test

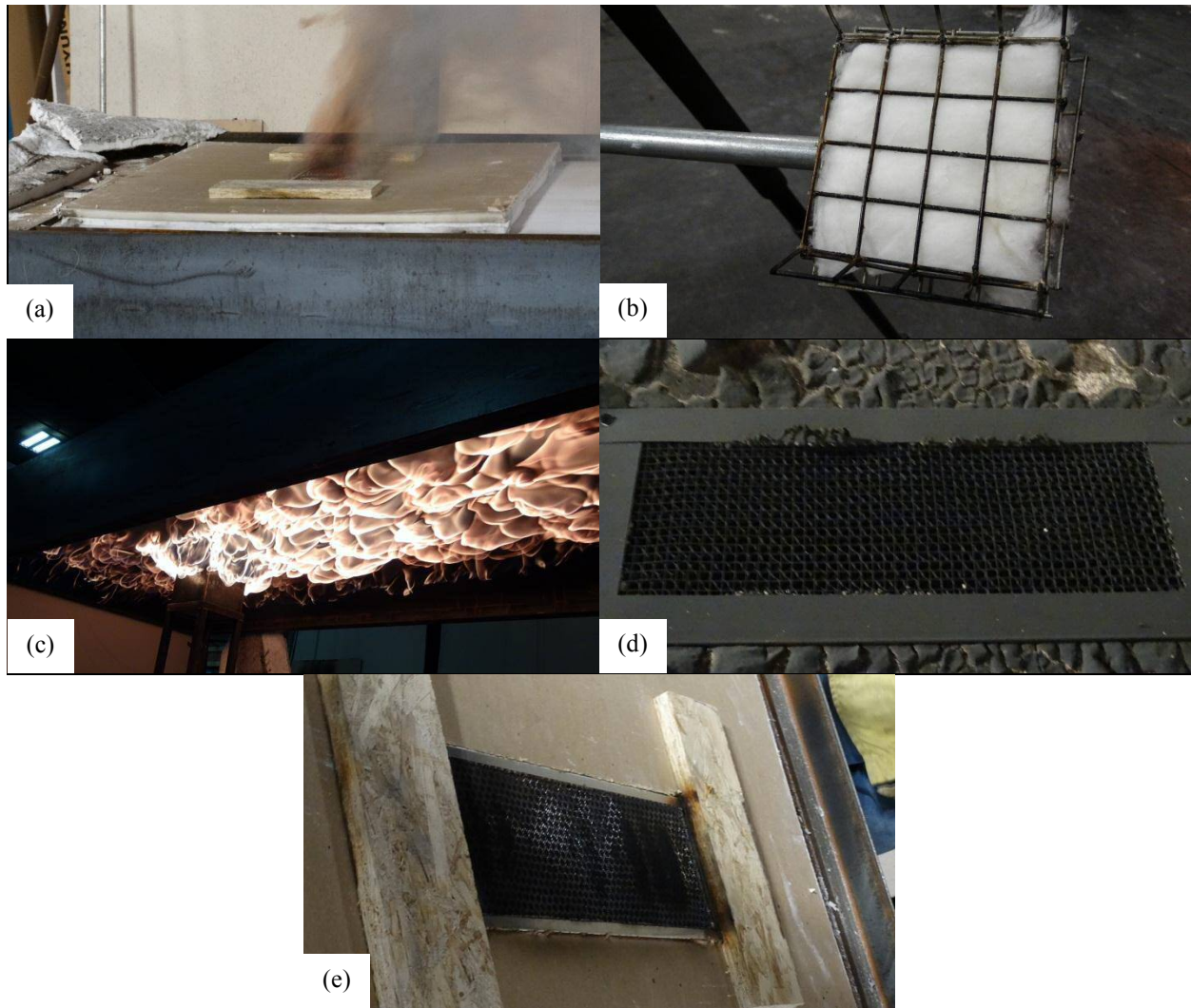


Figure 14. Test 7 showing (a) smoke through vent, (b) cotton 1 after exposure, (c) under table, (d) vent front, and (e) vent back.

CONCLUSION

Exterior vents as identified above by Vulcan Technologies, Inc. were tested according to the two methods within ASTM E2886/E2886M, embers and direct flame in the horizontal orientation. For the ember tests, the test vents did not allow embers to pass through them and ignite (flaming) the cotton target. Some smoldering of the target was observed. For the horizontally-installed direct flame tests, according to the approved standard, the vents did not allow ignition of the cotton targets. Three replicate tests were performed for the ember and horizontally-installed direct flame vent configurations.

SIGNATURES

Testing performed by,



Brent M. Pickett, Ph.D.

Technical Director

Reviewed and approved by,



Mike White

Laboratory Manager

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.

Version	Date Issued	Document Number	Changes
Original	April 9, 2015	15021	Original report
Revision 1	April 9, 2015	15021r1	Removed sections relating to vertical direct flames tests as requested by the client

APPENDIX A: INSPECTION REPORT

Product Certification Consultants LLC

Making A Difference In Your Business

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REPORT FOR

VULCAN TECHNOLOGIES, INC.
580 IRWIN STREET, SUITE 1
SAN RAFAEL, CA 94901


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INSPECTION FOR Exterior Eave

The product and information described in this Report are representative samples of the product supplied by the Applicant and submitted for this investigation by the Applicant.

Product Description: The product is designated “Exterior Eave” and is comprised of a proprietary coated honeycomb panel encased in metal framework. The nominal size is 6” x 14”.

Date of Inspection:

January 28 & 29, 2015 (Proprietary Coating Mixing and Curing)
February 3 & 9, 2015 (Coating Application and Assembly into Eave)

Location of Inspection:

January 28 & 29, 2015 at Precision Technical Coatings, Inc. Berkeley, CA
February 3 & 9, 2015 at Gunter Manufacturing, Inc. Loomis, CA

On Site Inspection Contact:

January 28 & 29, 2015-- Ed Berrios
February 3 & 9, 2015—Larry Dumm

PCC LLC Inspector: Mr. Garrett S Tom P.E.

Manufacturing Description:

January 28, 2015

Proprietary coating is designated Firefree 88 (FF 88) and is a mix of liquid and powder components. The production ticket formulation is on file with the inspection agency. After mixing, the coating rests overnight. FF 88 is also listed with Factory Mutual (FM) and is under third party inspection.

January 29, 2015

After resting overnight, the coating was poured into buckets for transport to Gunter Manufacturing. QC tests witnessed included viscosity, weight per gallon, PH and opacity.

Thirteen (13) buckets were identified with the following information.
1-29-15, PCC-GT, FF88, #1 thru #13

The coating buckets were transported to Gunter Manufacturing.

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February 3, 2015

The marked buckets were confirmed and the contents were poured into the coating equipment where the coating of the aluminum honeycomb core, nominal 5/8" thick with 1/4" cells with 1-2 mil cell walls. The core sheets need to be dried prior to cutting to size and final assembly.

Three (3) core sheets were identified with the following information.
2-3-15, PCC-GT, Coated Sheet #1, #2, #3

February 9, 2015

Coated sheet #3 was cut to size (5-1/4" x 13-1/4") and assembled into the four (4)-- 28 gauge galvanized steel frame components. Core protected with 1/4" hardware cloth on one side and a 16 mesh fine screen on the other.

Twelve (12) finished "Exterior Eave" were identified with the following information.
2-9-15, PCC-GT, FFC, #1 thru #12

SCOPE OF INVESTIGATION

The investigation as specified in this Report has been conducted to provide a chain of custody inspection for the product. The product is to be shipped to Western Fire Center, Inc. in Kelso, WA for fire testing.

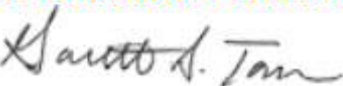
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FINISHED PRODUCT

Sample #	Nominal Width, In.	Nominal Length, In.	Weight grams
1	7-1/8	15	405
2	7-1/8	15	417
3	7-1/8	15	416
4	7-1/8	15	417
5	7-1/8	15	423
6	7-1/8	15	427
7	7-1/8	15	419
8	7-1/8	15	416
9	7-1/8	15	420
10	7-1/8	15	418
11	7-1/8	15	433
12	7-1/8	15	425

Report By

Product Certification Consultants LLC

By: 

Garrett S. Tom, LLC Manager

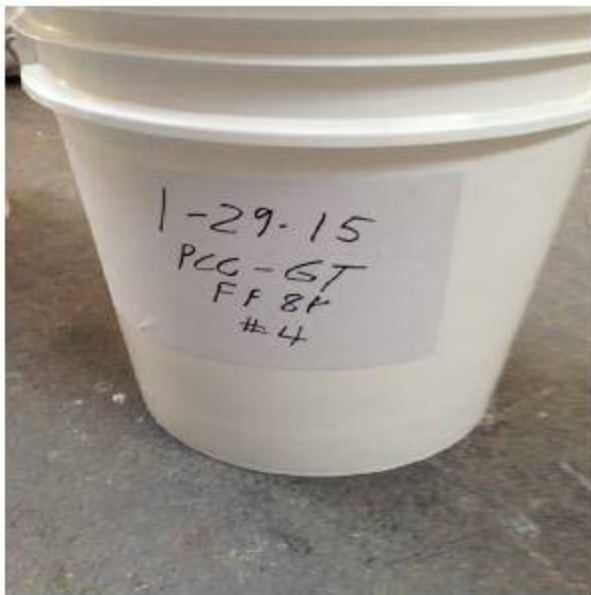
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INSPECTION PHOTOS

Photo 1—FF 88 Coating Mixing (1.28.15)



Photo 2—Coating Bucket ID (1.29.15)



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INSPECTION PHOTOS

Photo 3—Coating Loading into Spray Equipment (2-3-15)



Photo 4—Core Coated Sheets ID (2-3-15)



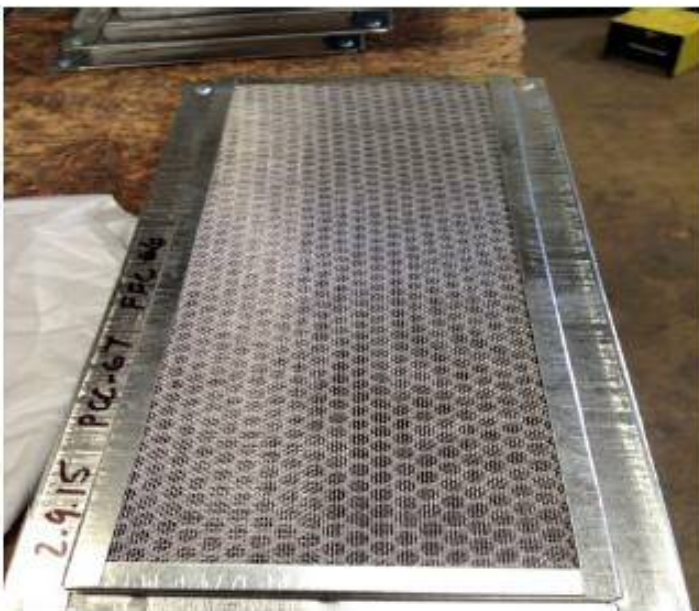
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INSPECTION PHOTOS

Photo 5—Cores Cut to Size (2-9-15)



Photo 6—Finished Exterior Eave Product (2-9-15)



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INSPECTION PHOTOS

Photo 7—Finished Exterior Eave ID #1-#6 (2-9-15)



Photo 8—Finished Exterior Eave #7-#12 (2-9-15)

