Test Report

Classification Tests on Innovative Energy, Inc. AstroShield I, MPET/B/MPET, (Low E)

Prepared For:

Mr. Eric Baker
Innovative Energy, Inc.
10653 W 181st Avenue
Lowell, IN 46356

R & D Services, Inc.
P.O. Box 2400
Cookeville, Tennessee 38502-2400

Report: RD09332

Reviewed by: Ronald S. Graves
Vice President

June 5, 2009

The test results in this report apply only to the specimens tested. This report shall not be reproduced, except in full, without written approval of R & D Services, Inc. This report must not be used by the Client to claim product endorsement by R & D Services, Inc., NVLAP or any agency of the U.S. Government.

P.O. Box 2400
Cookeville, Tennessee 38502-2400
Phone: 931-372-8871
Fax: 931-525-3896

Bleeding and Delamination Test Report

Test Number: RD091361BD

Date of Test: January 29, 2009

Specimen Number: 1021090109-7

Date of Manufacture: Unknown

Report Prepared For: Innovative Energy, Inc. / Eric Baker

Project: Adhesive Performance (Bleeding and Delamination) of AstroShield I MPET/B/MPET (Low E).

Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy and received by R&D Services, Inc. on January 9, 2009 for classification testing. Testing was completed on January 29, 2009. The test was performed in accordance with the following test method.

ASTM C 1224-03, "Specification for Reflective Insulation for Building Applications" - Section 9.5.1, Bleeding and Delamination.

Specimen Preparation

Three (3) 3 by 6 in samples were cut from separate locations on the insulation roll of product.

Specimen Conditioning

The specimens were vertically suspended in an oven at conditions of 180°F ± 5°F and 50 % relative humidity a minimum of 5 hours prior to evaluation.

Observations

The AstroShield I MPET/B/MPET (Low E) was observed to have no bleeding or delamination under 5x magnification, thus, meeting the acceptance criteria of Section 9.5.1.4.

Ronald L Beaty

Reviewed By:

06-05-09

Date:

The results in this report apply only to the specimen tested

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Pliability Test Report

Test Number: RD091362PL

Date of Test: January 28-29, 2009

Specimen Number: 1021090109-7

Date of Manufacture: Unknown

Report Prepared For: Innovative Energy, Inc. / Eric Baker

Project: Adhesive Performance (Pliability) of Innovative Energy; AstroShield I MPET/B/MPET (Low E).

Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy and received by R&D Services, Inc. on January 9, 2009 for classification testing. Testing was completed on January 29, 2009. The test was performed in accordance with the following test method.

ASTM C1224-03, "Specification for Reflective Insulation for Building Applications" - Section 9.5.2, Pliability

Specimen Preparation

One (1) roll of AstroShield I MPET/B/MPET (Low E) was supplied to R&D Services, Inc. Two (2) sets of three (3) 3 by 6 in samples were cut from separate locations on the roll of product. One sample in each set contained a factory produced edge.

Specimen Conditioning

One set of specimens was conditioned at 70F ± 2°F with 50 ± 5% relative humidity and the second set at 32F ± 2°F with 50 ± 5% relative humidity a minimum of 24 hours prior to testing.

Observations

The specimens were folded in accordance with Section 9.5.2.4 and TAPPI Standard T512om-86. The AstroShield I MPET/B/MPET (Low E) was observed to have no cracking or delamination when folded to an 180° bend, thus, meeting the acceptance criteria of Section 9.5.2.4.

Ronald L. Shrader
Reviewed by:

06-05-09
Date:

The results in this report apply only to the specimen tested

R&D Services

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Thermal Resistance Test Report

Date of Test: January 20, 2009

Date of Manufacture: Unknown

HFM File Number: 09-8187

Specimen Number: 1021090109-7

Test Number: RD091363TR

Description of Test Specimen: Innovative Energy; AstroShield I MPET/B/MPET (Low E).

Test Method: ASTM C 518-04, "Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus."

Report Prepared For: Innovative Energy, Inc. / Eric Baker

The results in this report were obtained with a heat-flow meter built and operated in accordance with ASTM C 518-04.

Heat flow meter:	12 by 12	in. x in.
Specimen thickness:	0.189	inches
Specimen density:	2.33	lb/ft^3
Cold plate temperature:	55.04	°F
Hot plate temperature:	95.04	°F
Average specimen temperature:	75.04	°F
Apparent thermal conductivity:	0.2360	$Btu \cdot in./ft^2 \cdot hr \cdot °F$
Thermal resistance of specimen:	0.80	$ft^2 \cdot hr \cdot °F/Btu$

Notes: Calibration factor used for manual calculation? NA EMF NA
Edge guards or cabinet temperature satisfactory? Yes
Excessive moisture on cold plate? No
Length of time for test (hours)? 3.9
The precision of this test is estimated to be 2.5% (Section 10.8, ASTM C 518-04)

Reviewed By: Ronald L. Graves

Date: 06-05-09

The results in this report apply only to the specimen tested. This test conforms to ASTM Test Method C 518-04 except for the report requirements. The report includes summary data but a full complement of data is available upon request.

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Water Vapor Transmission Test Report

Test Number: RD091942WV

Date of Test: February 18 – March 13, 2009

Specimen Number: 1021090109-7

Date of Manufacture: Unknown

Report Prepared For: Innovative Energy / Eric Baker

This report contains the results of a water vapor transmission test done in accordance with ASTM Test Method E 96-05. Results were obtained using the desiccant method described in Section 11 of the Standard. The "perm" being reported was calculated using the method outlined in Section 13 of the Standard. The specimen was tested with a round pan holding the desiccant. The edges of the specimen were sealed space around the top ledge of the pan with microcrystalline wax (60 %) mixed with refined crystalline paraffin wax (40 %).

Description of the Test Specimen: Innovative Energy; AstroShield I MPET/B/MPET (Low E).

Test Conditions:	Temperature(°F)	68.5
	Relative Humidity (%)	49.0
	Test Duration (hr)	624

		No. 1	No.2	No.3
Test Results:	Weight Gain (g)	0.3833	0.7068	0.0360
	Specimen Area (ft^2)	0.1503	0.1503	0.1503
	Water Vapor Transmission ($gr/h \cdot ft^2$)	0.0631	0.1163	0.0059
	Saturation Pressure (in. Hg)	0.702	0.702	0.702
	Pressure Difference (in. Hg)	0.344	0.344	0.344
	Permeance (perm, $gr/ft^2 \cdot h \cdot$(in. Hg))	0.183	0.338	0.017
	Permeability (perm·in.)	-	-	-
	Figures showing data are attached	yes	yes	yes

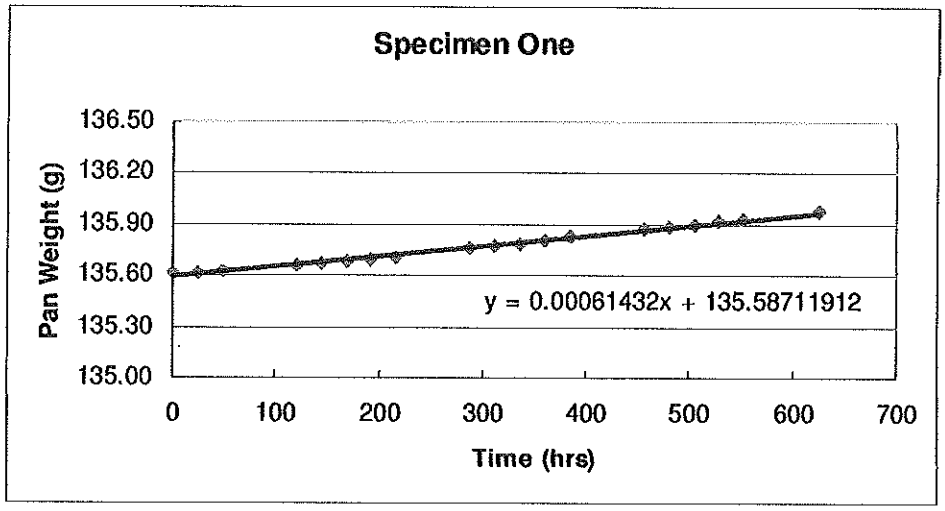
Result

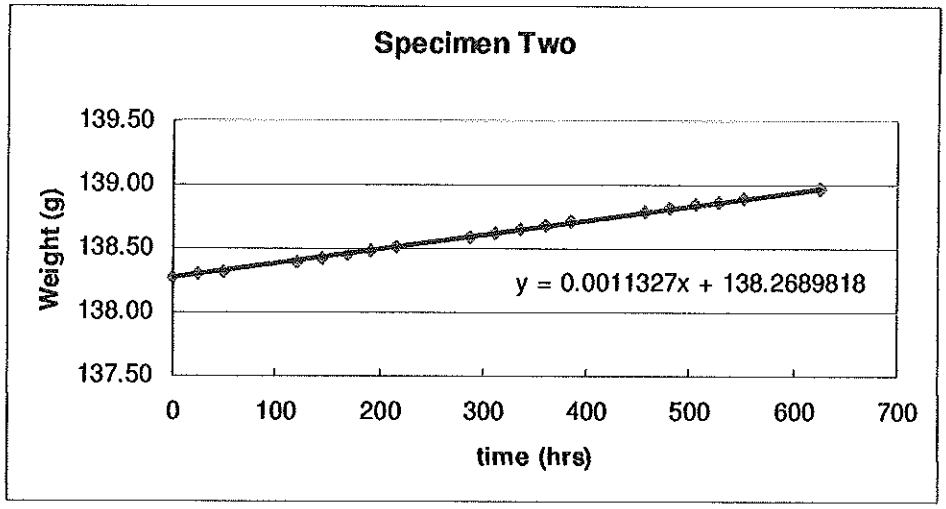
The measured average permeance for the AstroShield I MPET/B/MPET (Low E) was 0.180 perms under the conditions of the test.

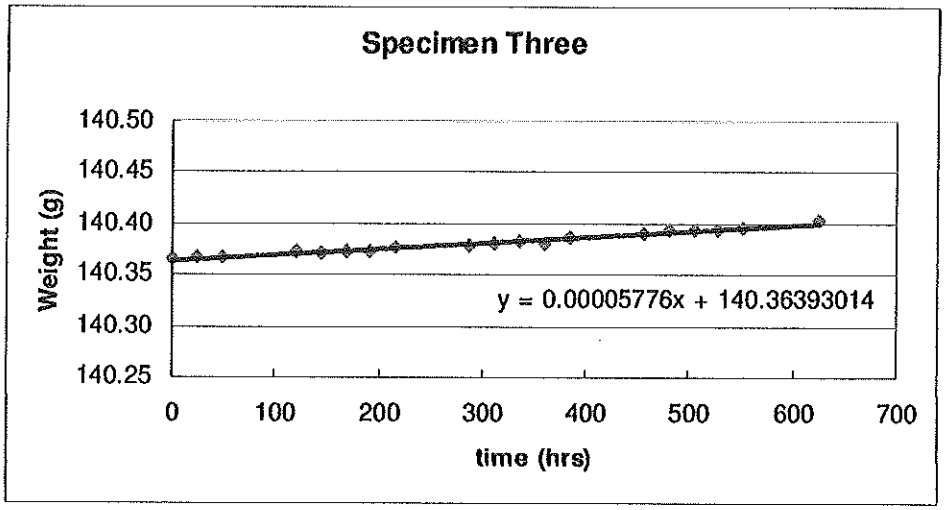
Ronald L Shrader
Reviewed By:

06-05-09
Date:

The results in this report apply only to the specimens tested.


Specimen One
Pan Weight (g)
136.50
136.20
135.90
135.60
135.30
135.00
y = 0.00061432x + 135.58711912
0
100
200
300
400
500
600
700
Time (hrs)


Specimen Two
Weight (g)
139.50
139.00
138.50
138.00
137.50
y = 0.0011327x + 138.2689818
0
100
200
300
400
500
600
700
time (hrs)


Specimen Three
Weight (g)
140.50
140.45
140.40
140.35
140.30
140.25
y = 0.00005776x + 140.36393014
0
100
200
300
400
500
600
700
time (hrs)

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Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation

Test Number: RD091943HR Test Period: January 28-February 25, 2009

Specimen Number: 1021090109-7

Product Identification: AstroShield I MPET/B/MPET (Low E),

Manufacturer: Innovative Energy Date of Manufacture: Unknown

Manufacturer's Lot Number: _____

Report Prepared For: Innovative Energy / Eric Baker

Test Description: ASTM C 1258 "Standard Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation" is contained in Vol. 04.06 of the *Annual Book of ASTM Standards.*

Exposure Conditions

Hours of exposure: 672

Exposure temperature: 49±1°C

Relative humidity: 95% ±2

Observations

Evidence of delamination: None

Evidence of corrosion: None

Loss of metallization: Small pinholes of translucency in specimens and control

Measured Values

Specimen	1	2	3	4
Water Vapor Permeance: (Perms)	0.027	0.016	0.026	0.030

Average Permeance: 0.025 (Perms)

Water Vapor Transmission Test Number: RD091947WV Date: 2009

Ronald S Shader

Report Prepared by:

06-05-09

Date:

The results in this report are limited to the material tested. No statement is made about either precision or bias of the results.

R&D Services

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Water Vapor Transmission Test Report

Test Number: RD091947WV

Date of Test: March 18 – April 15, 2009

Specimen Number: 1021090109-7

Date of Manufacture: Unknown

Report Prepared For: Innovative Energy / Eric Baker

This report contains the results of a water vapor transmission test done in accordance with ASTM Test Method E 96-05. Results were obtained using the desiccant method described in Section 11 of the Standard. The "perm" being reported was calculated using the method outlined in Section 13 of the Standard. The specimen was tested with a round pan holding the desiccant. The edges of the specimen were sealed space around the top ledge of the pan with microcrystalline wax (60 %) mixed with refined crystalline paraffin wax (40 %).

Description of the Test Specimen: Innovative Energy; AstroShield I MPET/B/MPET (Low E) After C1258.

Test Conditions:	Temperature(°F)	70.9			
	Relative Humidity (%)	49.6			
	Test Duration (hr)	672			
		No. 1	No.2	No.3	No.4
Test Results:	Weight Gain (g)	0.0663	0.0401	0.0631	0.0740
	Specimen Area (ft^2)	0.1503	0.1503	0.1503	0.1503
	Water Vapor Transmission ($gr/h \cdot ft^2$)	0.0101	0.0061	0.0096	0.0113
	Saturation Pressure (in. Hg)	0.761	0.761	0.761	0.761
	Pressure Difference (in. Hg)	0.378	0.378	0.378	0.378
	Permeance (perm, $gr/ft^2 \cdot h \cdot$(in. Hg))	0.027	0.016	0.026	0.030
	Permeability (perm·in.)	-	-	-	-
	Figures showing data are attached	yes	yes	yes	yes

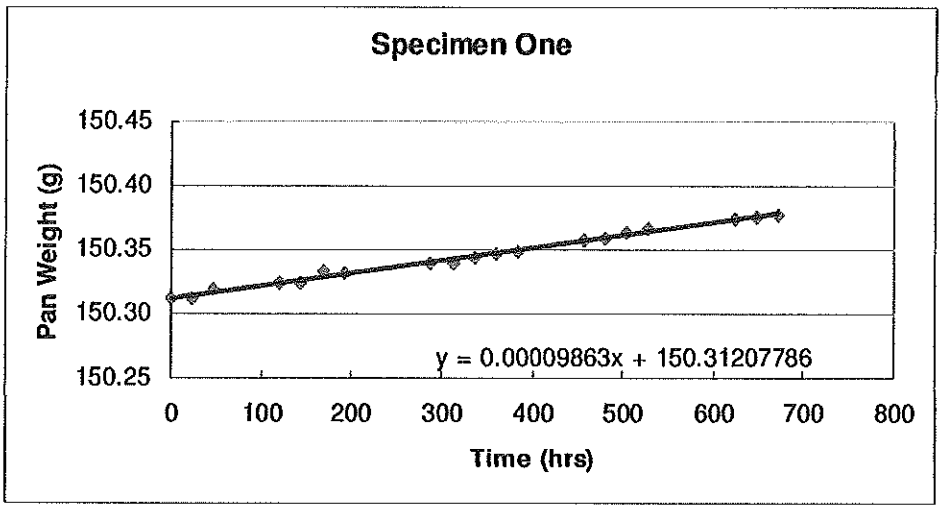
Result

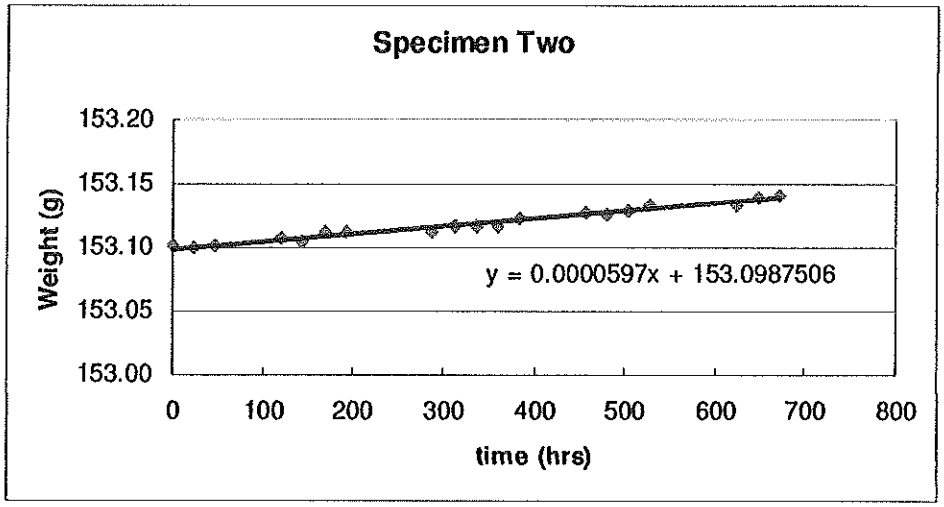
The measured average permeance for the AstroShield I MPET/B/MPET (Low E) after C1258 was 0.025 perms under the conditions of the test.

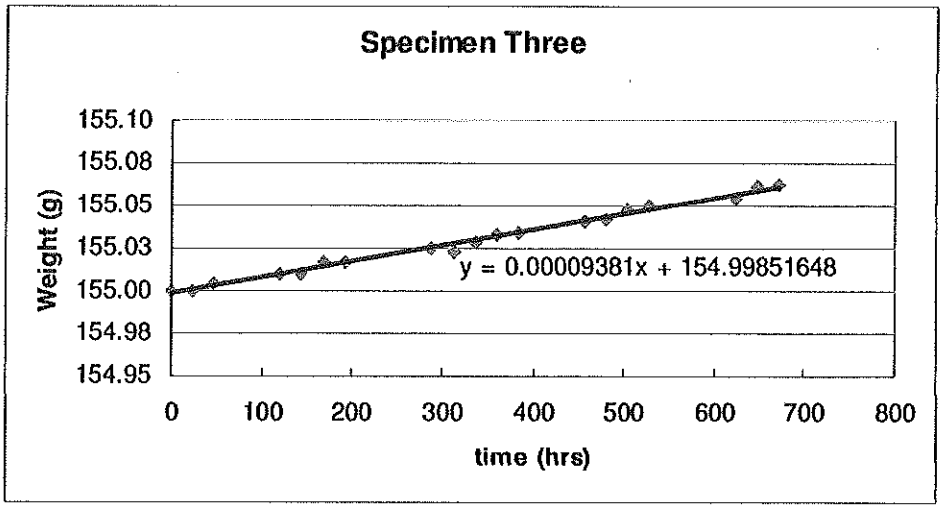
Reviewed By:

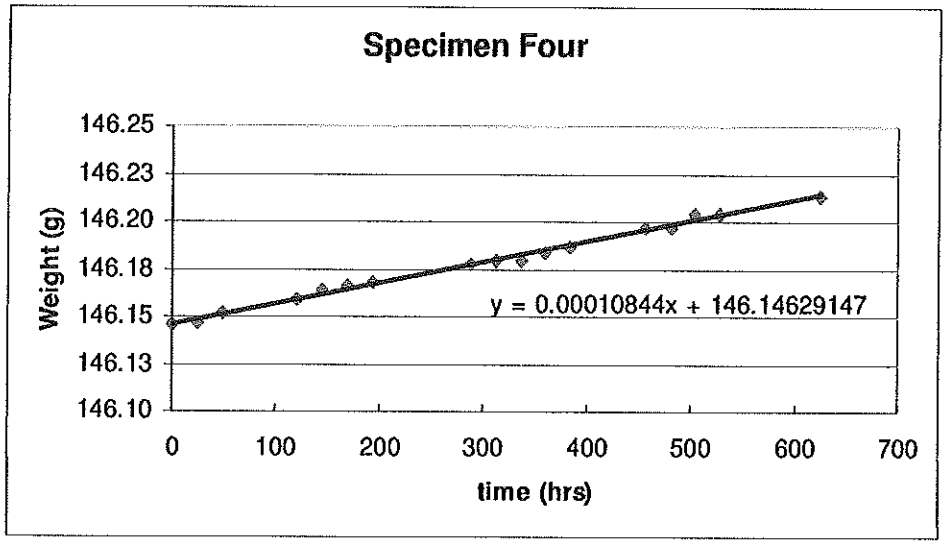
06-05-09
Date:

The results in this report apply only to the specimens tested.


Specimen One
Pan Weight (g)
150.45
150.40
150.35
150.30
150.25
y = 0.00009863x + 150.31207786
0
100
200
300
400
500
600
700
800
Time (hrs)


Specimen Two
Weight (g)
153.20
153.15
153.10
153.05
153.00
y = 0.0000597x + 153.0987506
0
100
200
300
400
500
600
700
800
time (hrs)


Specimen Three
Weight (g)
155.10
155.08
155.05
155.03
155.00
154.98
154.95
y = 0.00009381x + 154.99851648
0
100
200
300
400
500
600
700
800
time (hrs)


Specimen Four
146.25
146.23
146.20
146.18
146.15
146.13
146.10
Weight (g)
y = 0.00010844x + 146.14629147
0
100
200
300
400
500
600
700
time (hrs)

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Penetration Resistance

Test Number: RD091360PT

Date of Manufacture: Unknown

Specimen Number: 1021090109-7

Date of Test: January 21, 2009

Description of Test Specimen: Innovative Energy; AstroShield I MPET/B/MPET (Low E).

Test Method: ASTM F 1306, "Standard Test Method for Slow Rate Penetration Resistance of Flexible Barrier Films and Lammates".

Report Prepared For: Innovative Energy, Inc. / Eric Baker

The observed maximum load for penetration of the film is recorded below under penetration
load. The stress in lb_f/in^2 at the penetration force is shown as stress at penetration. The stress at penetration is based on the probe area of 0.0123 $in.^2$.

Specimen Penetration	Load at Film Penetration (lb_f)	Stress at Film (lb_f/in^2)
1	7.329	596
2	9.020	733
3	7.866	640
4	9.101	740
5	8.537	694
6	7.812	635
7	7.517	611
8	8.510	692
9	7.463	607
10	7.785	633
Average	8.094	658
Std Dev.	0.648	52.6

Reviewed By:

06-05-09
Date:

The results in this report apply only to the Specimens tested

R&D Services

Test Report for Resistance to the Growth of Fungi

Report Summary

Manufacturer: Innovative Energy, Inc.
Material Description: AstroShield I, MPET/B/MPET, (Low E) Foil Side.
ASTM Test Method: C 1338-08
Project Number: 1021
Specimen Number: 1021090109-6
Report Number: RD09-1353FR
Date of Report: February 20, 2009
Period of Test: January 19-February 16, 2009
Test Result: Pass
Number of Specimens Observed: 3
Comparative Material: Southern Yellow Pine
Fungi Checked for Viability: Yes
Regular or Extended Test: Regular

Background

The ASTM Standard Specification for many thermal insulations requires a test for the resistance of the insulation to the growth of fungi. Section 10 of C 1497, ASTM C 1338-08, Section 6.6 of ASTM C 1149, or Section 11 of ASTM C 739-08 are commonly used in the case of building materials. Evaluations for fungi growth are based on visual examinations at 40X magnification. The examinations at 40X magnification compare fungal growth on the material being evaluated with the fungal growth on an untreated comparative material that is exposed to the same environment as the test specimens. Both the material being tested and the comparative material are inoculated with a mixed spore suspension containing five specific fungal species to start the test. Since most fungi thrive in a relatively narrow range of temperature and humidity, inoculated specimens and comparative materials are maintained within temperature and relative

humidity ranges specified in the test method for the 28-day growth period. The purpose of the test is to provide an evaluation of the potential for fungal growth present in the insulation material relative to common types of wood used in building construction. The fungal species used in the tests for thermal insulation are listed below.

Aspergillus niger	*ATCC 9642*
Aspergillus flavus	*ATCC 9643*
Aspergillus versicolor	*ATCC 11730*
Penicillium funiculosum	*ATCC 11797*
Chaetomium globosum	*ATCC 6205*

A mixed spore suspension is produced from the above five species in accordance with the test method being followed. The viability of each of the five species is verified with each test as required by the test method being used. The ASTM test methods for resistance to fungal growth require a 40X visual comparison of test material and comparative materials 28 days after inoculation. The criteria for a pass/fail result at the end of the 28-day test period depends on the test method being followed.

Test using ASTM C 1338-08

Each of the replicate test specimens shall be determined to have either no fungal growth, fungal growth no greater than the comparative material, or fungal growth greater than the comparative material.

Results	Specimen	Fungal Growth Comparison
	1	No growth.
	2	No growth.
	3	No growth.

The pass/fail result: Pass
Basis for the pass/fail result: Three of three specimens passed.

This R&D Services, Inc. test report and the evaluation contained in the report are limited to the material tested. The extent to which the material tested is representative of the product being manufactured is the sole responsibility of the manufacturer. The test results are not purported to predict the performance of the material in a building or installation.

Evaluation: 06-05-09 Date:

Review: 06-05-09 Date:

References:

ASTM C 1338-08, "Standard test Method for Determining Fungi Resistance of Insulation Materials and Facings", Annual Book of ASTM Standards, Vol. 04.06.

ASTM C 1497, "Standard Specification for Cellulosic Fiber Stabilized Thermal Insulation", 2002 Annual Book of ASTM Standards, Vol. 04.06, pp. 849-852.

MIL-STD-810E, Method 508.4, "Fungus", 14 July 1989.

ASTRO - SHIELD I MPET/B/MPET w/SLIT Nov. 4/08 ⑤

ASTM E84-08

Client: R & D SERVICES, INC

Date: 11-4-2008

Project Number: 3165949SAT-007

Test Number: 5

Operator: TA/AM

Specimen ID: "INNOVATIVE ENERGY; LOWELL, IL. REFLECTIVE INSULATION; ASTRO SHIELD I MPET/SB/MPET; BOTH SIDES ARE THE SAME. SLIT ALONG CENTERLINE ON ONE SIDE TO REMOVE METALIZED. NOMINAL 3/16 INCH THICK." THE SPECIMEN WAS SELF-SUPPORTING. THE SPECIMEN WAS MOUNTED ACCORDING TO ASTM E2599-08. THE TEST WAS WITNESSED BY RON GRAVES FROM R & D SERVICES, INC.

TEST RESULTS

FLAMESPREAD INDEX: 0

SMOKE DEVELOPED INDEX: 20

SPECIMEN DATA . . .

Time to Ignition (sec): 7
Time to Max FS (sec): 0
Maximum FS (feet): 0.0
Time to 980 F (sec): Never Reached
Time to End of Tunnel (sec): Never Reached
Max Temperature (F): 484
Time to Max Temperature (sec): 597
Total Fuel Burned (cubic feet): 50.41

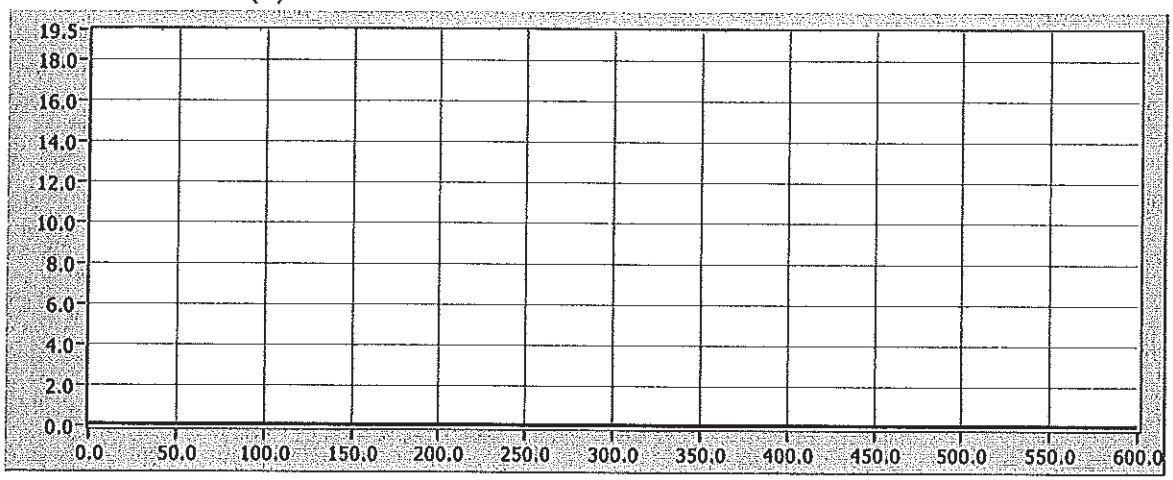
FS*Time Area (ft*min): 0.8
Smoke Area (%A*min): 20.1
Unrounded FSI: 0.4

CALIBRATION DATA . . .

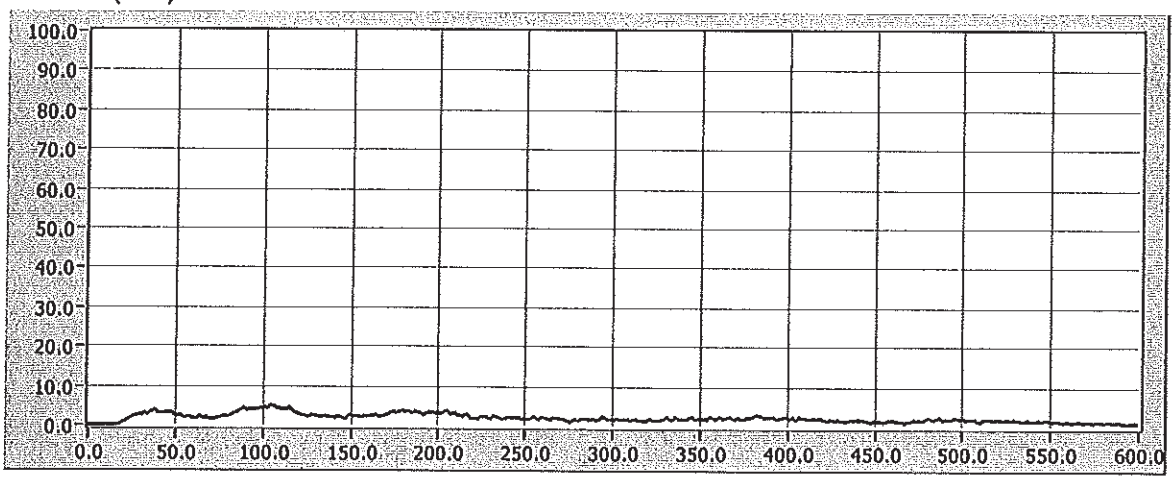
Time to Ignition of Last Red Oak (Sec): 34.0
Red Oak Smoke Area (%A*min): 94.0

Project No: 3165949SAT-007

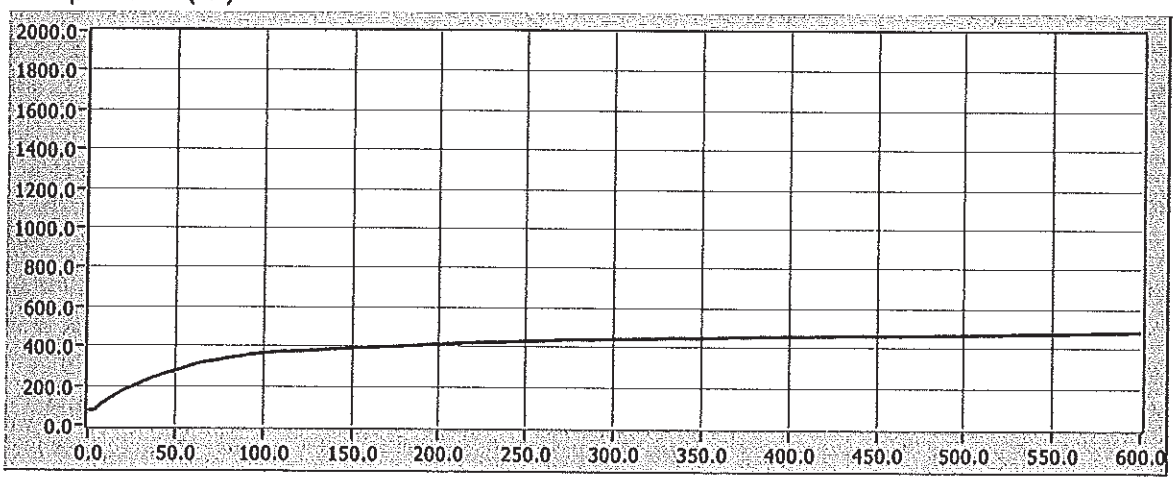
FLAME SPREAD (ft)



Smoke (%A)



Temperature (°F)



Time (sec)

600

ASTRO - SHIELD I Nov. 4/08 ①
MPET/B/MPET

ASTM E84-08

Client: R & D SERVICES, INC.

Date: 11-4-2008

Project Number: 3165949SAT-006

Test Number: 4

Operator: TA/AM

Specimen ID: "INNOVATIVE ENERGY; LOWELL, IN., REFLECTIVE INSULATION; ASTRO SHIELD I MPET/SB/MPET; BOTH SIDES ARE THE SAME. NOMINAL 3/16 INCH. THE SPECIMEN WAS MOUNTED ACCORDING TO ASTM E2599-08. THE SPECIMEN WAS SELF-SUPPORTING. THE TEST WAS WITNESSED BY RON GRAVES FROM R & D SERVICES.

TEST RESULTS

FLAMESPREAD INDEX: 0

SMOKE DEVELOPED INDEX: 15

SPECIMEN DATA . . .

Time to Ignition (sec): 9
Time to Max FS (sec): 0
Maximum FS (feet): 0.0
Time to 980 F (sec): Never Reached
Time to End of Tunnel (sec): Never Reached
Max Temperature (F): 479
Time to Max Temperature (sec): 597
Total Fuel Burned (cubic feet): 50.61

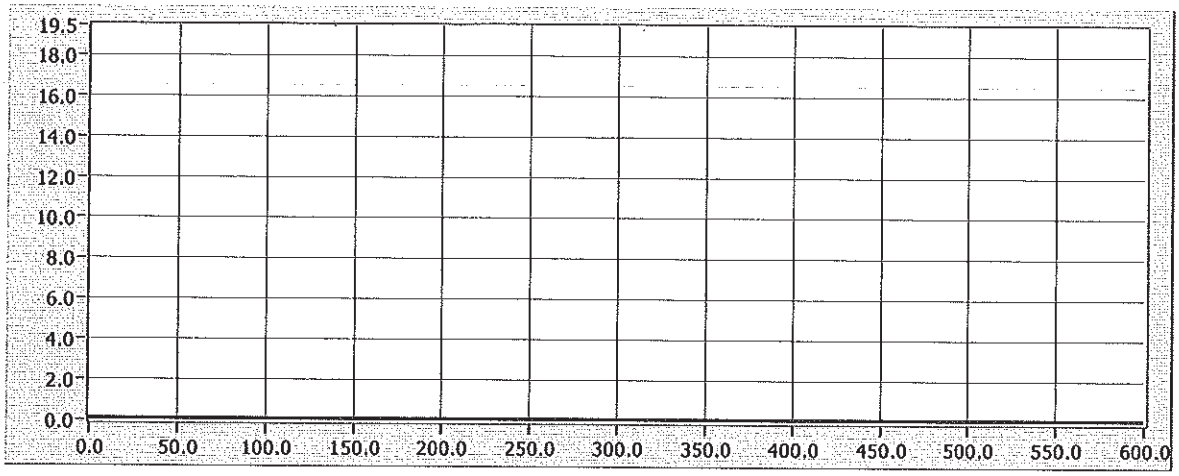
FS*Time Area (ft*min): 0.9
Smoke Area (%A*min): 16.3
Unrounded FSI: 0.5

CALIBRATION DATA . . .

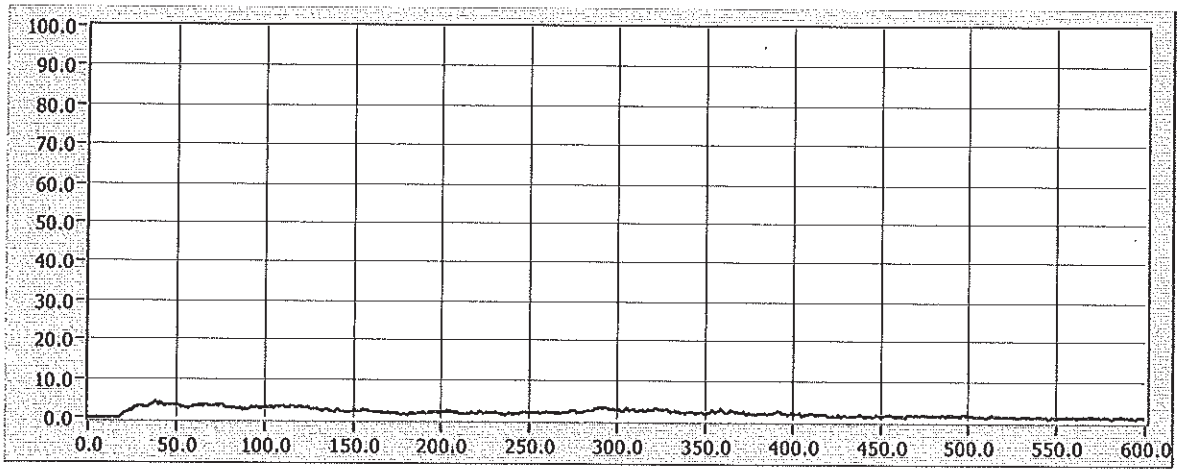
Time to Ignition of Last Red Oak (Sec): 34.0
Red Oak Smoke Area (%A*min): 94.0

Project No: 3165949SAT-006

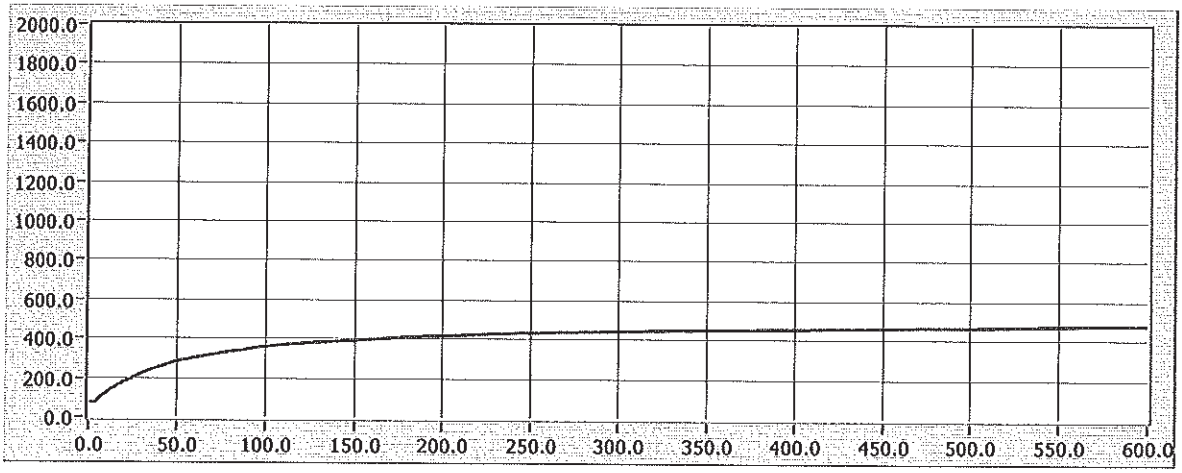
FLAME SPREAD (ft)



Smoke (%A)



Temperature (°F)



Time (sec)

600