



## Test Report

### Classification Tests on AstroShield II Samples Supplied by Innovative Energy, Inc.

Prepared For:

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

Report: RD08421

Reviewed by: *Ronald S. Graves*

Ronald S. Graves  
Vice President

August 27, 2008

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**Puncture Test**

Test Number: RD082366PT

Date of Manufacture: 2008

Specimen Number: 1021080606-7

Date of Test: August 18, 2008

Description of Test Specimen: Innovative Energy; Polyethylene Bubble Pack with Metallized Film Facers (AstroShield II).

Test Method: ASTM F 1306

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

The observed maximum load for puncture of the film is recorded below under puncture load. The stress in  $lb_f/in^2$  at the puncture force is shown as stress at puncture. The stress at penetration is based on the probe area of  $0.0123 in^2$ . The maximum force observed is shown in the fourth column. The specimens continued to resist complete puncture after penetration for the facer because of the elasticity of the bubble pack core.

Specimen	Load at Film Puncture ( $lb_f$ )	Stress at Film Puncture ( $lb_f/in^2$ )	Maximum Observed Load ( $lb_f$ )
1	10.20	829	10.23
2	7.60	618	10.30
3	10.51	854	10.60
4	11.90	967	12.35
5	7.20	585	9.24
6	10.40	846	10.47
7	10.53	856	11.76
8	12.05	980	12.05
9	8.75	711	10.12
10	7.55	614	10.72
Average	<u>9.67</u>	<u>786</u>	
Std. Dev.	<u>1.78</u>	<u>145</u>	

Ronald S Swain  
Reviewed By:

08-27-08  
Date:

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

## Test Report for Resistance to the Growth of Fungi

### Report Summary

Manufacturer: Innovative Energy

Material Description: Bubble Pack with Metallized Film Facer (AstroShield II)

ASTM Test Method: C 1338-08

Project Number: 1021

Specimen Number: 1021080606-7

Report Number: RD082396FR

Date of Report: August 21, 2008

Period of Test: June 12, 2008 – July 10, 2008

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 739-05b 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.

<i>Aspergillus niger</i>	ATCC 9642
<i>Aspergillus flavus</i>	ATCC 9643
<i>Aspergillus versicolor</i>	ATCC 11730
<i>Penicillium funiculosum</i>	ATCC 11797
<i>Chaetomium globosum</i>	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.

<u>Results</u>	<u>Specimen</u>	<u>Fungal Growth Comparison</u>
	1	<u>No growth.</u>
	2	<u>No growth.</u>
	3	<u>No growth.</u>

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.

*Karen McElroy*

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Evaluation:

08-27-08

Date:

*Ronald S. Swader*

\_\_\_\_\_  
Review:

08-27-08

Date:

References:

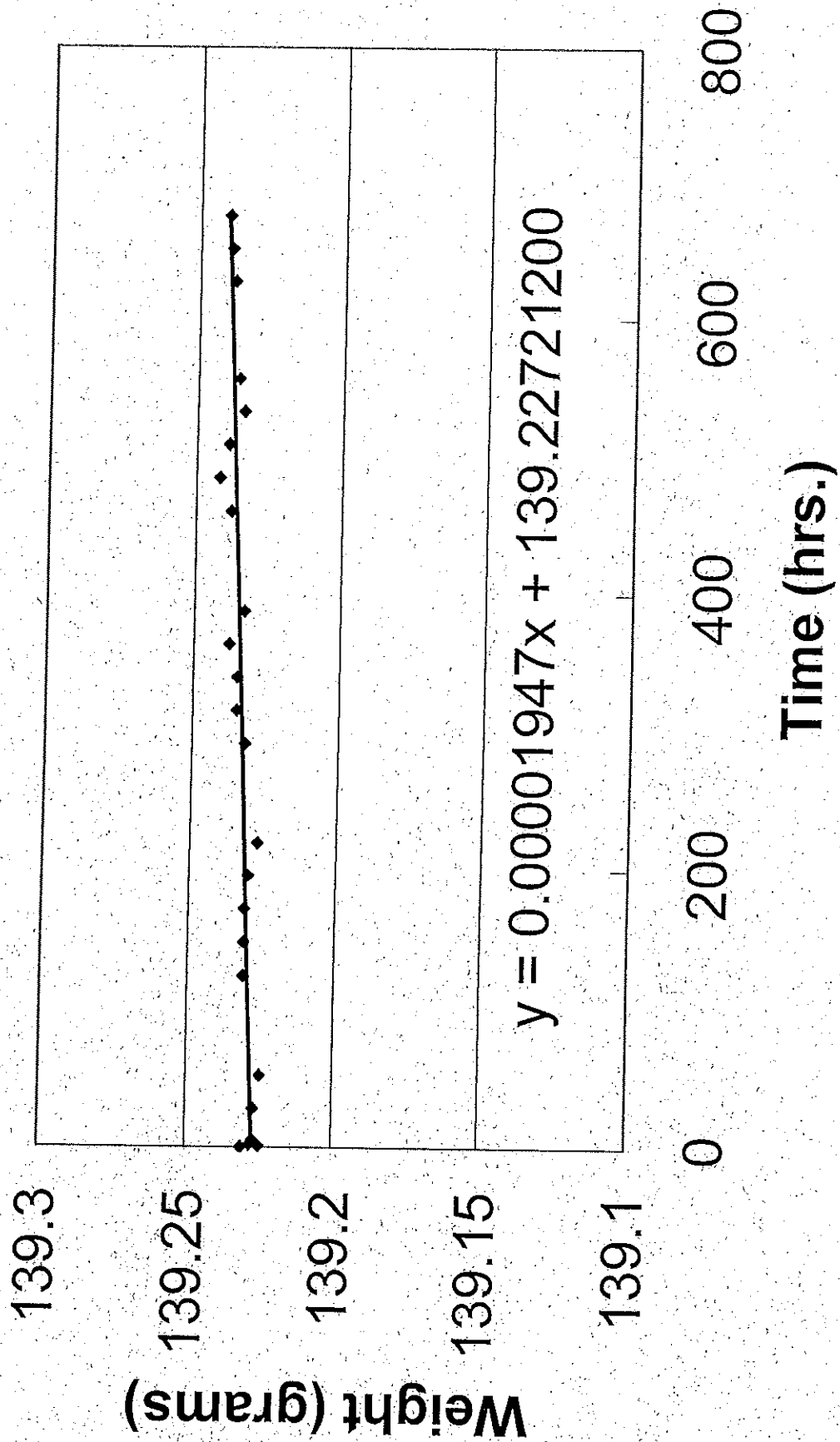
ASTM C 1338-08, "Standard test Method for Determining Fungi Resistance of Insulation Materials and Facings", Annual Book of ASTM Standards, Vol. 04.06.

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

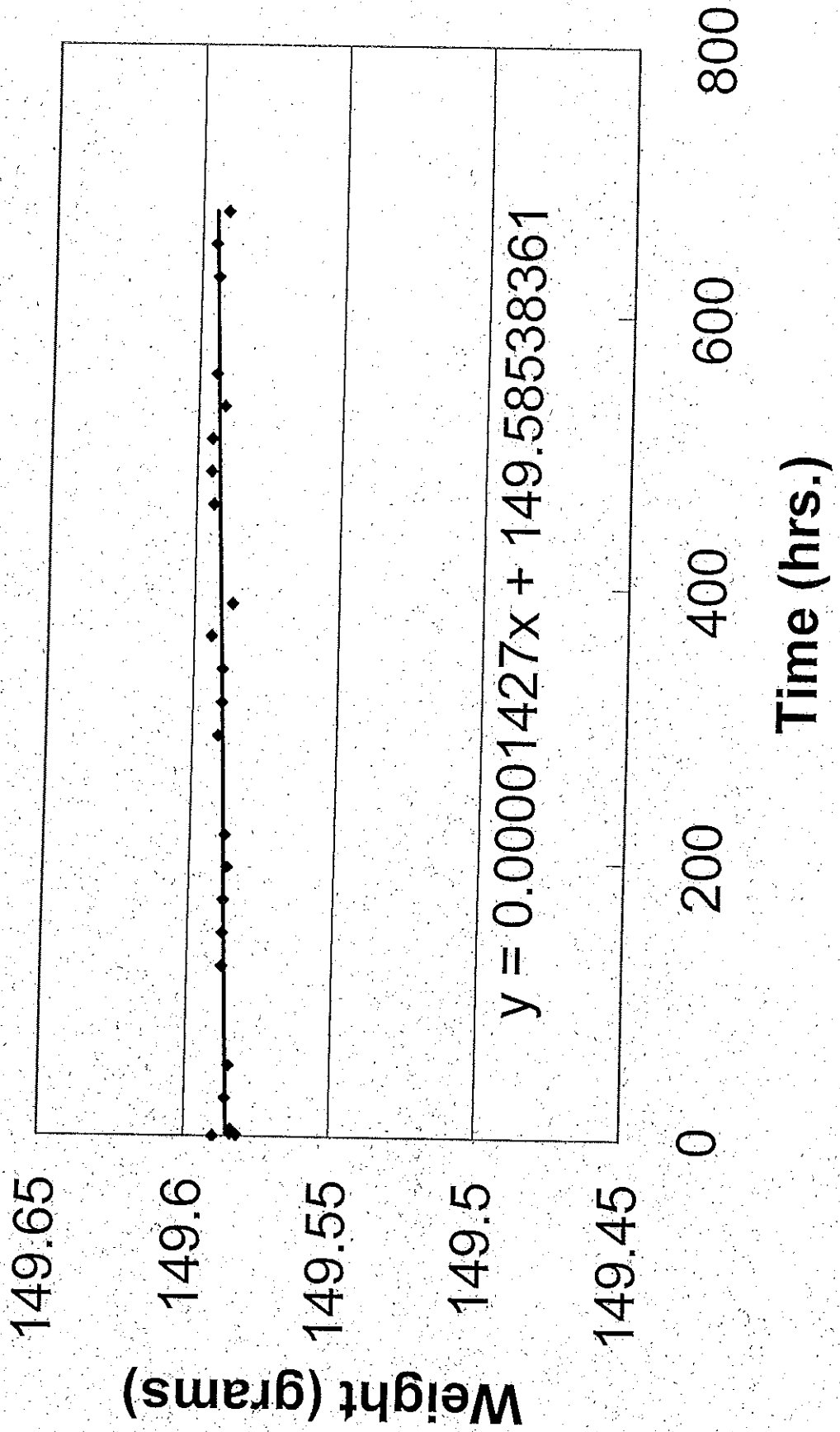
MIL-STD-810E, Method 508.4, "Fungus", 14 July 1989.



# IE Specimen One

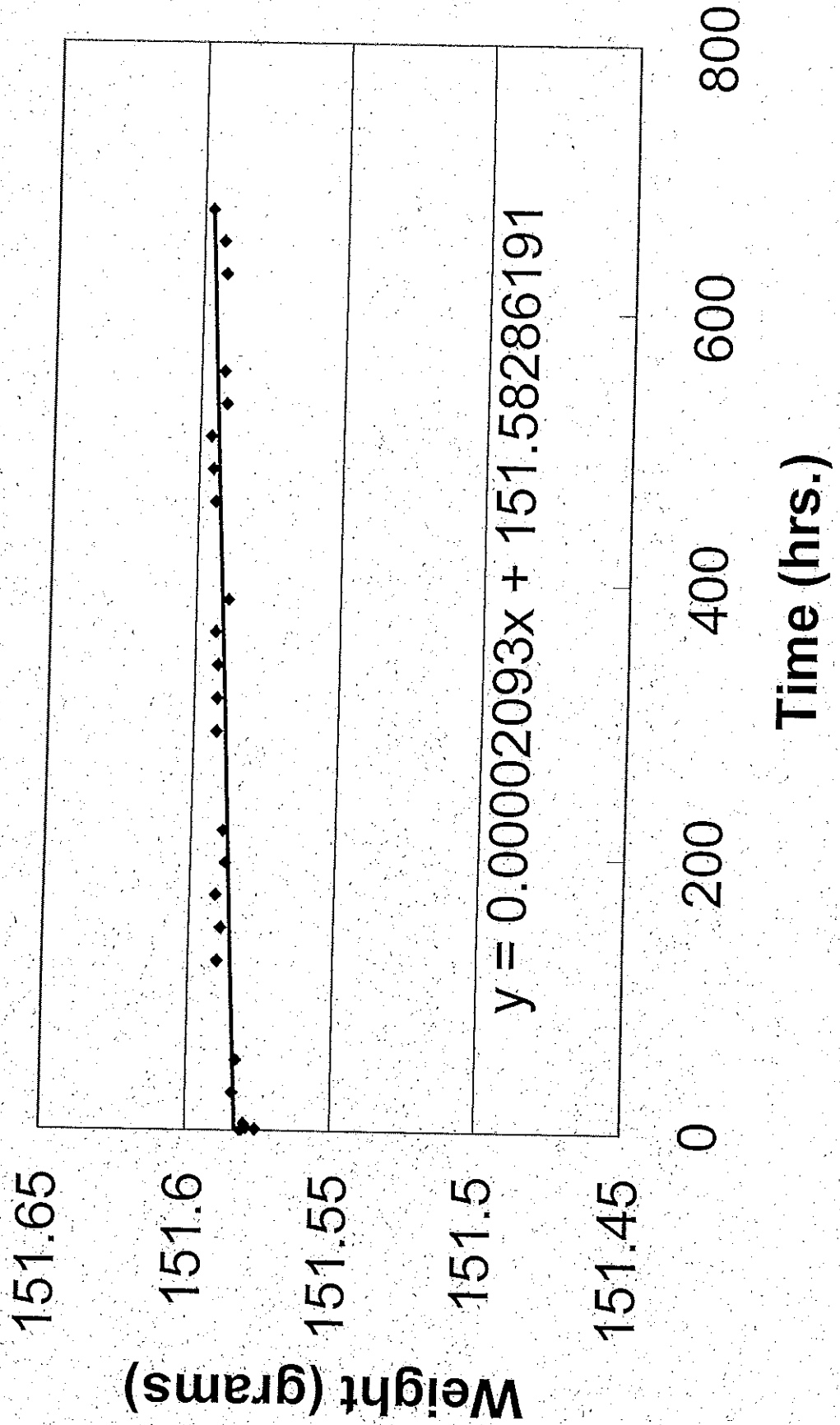


# IE Specimen Two





# IE Specimen Three





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## Water Vapor Transmission Test Report

Test Number: RD082393WV

Date of Test: July 16 – August 3, 2008

Specimen Number: 1021080606-7

Date of Manufacture: 2008

Report Prepared For: Innovative Energy, Inc. / 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: AstroShield II – Aged Values

Manufactured By: Innovative Energy, Inc.

Test Conditions:	Temperature(°F)	68.7
	Relative Humidity (%)	51.3
	Test Duration (hr)	675.5

Test Results:		No. 1	No.2	No.3
Weight Gain (g)		0.0111	0.0149	0.0113
Specimen Area (ft <sup>2</sup> )		0.1503	0.1503	0.1503
Water Vapor Transmission (gr/h·ft <sup>2</sup> )		0.0017	0.0023	0.0017
Saturation Pressure (in. Hg)		0.707	0.707	0.707
Pressure Difference (in. Hg)		0.344	0.344	0.344
Permeance (perm, gr/ft <sup>2</sup> ·h·(in. Hg))		0.0049	0.0067	0.0049
Permeability (perm·in.)		n/a	n/a	n/a
Figures showing data are attached		yes	yes	yes

### Result

The measured average permeance for the material was 0.006 perms under the conditions of the test.

Ronald S. Swain

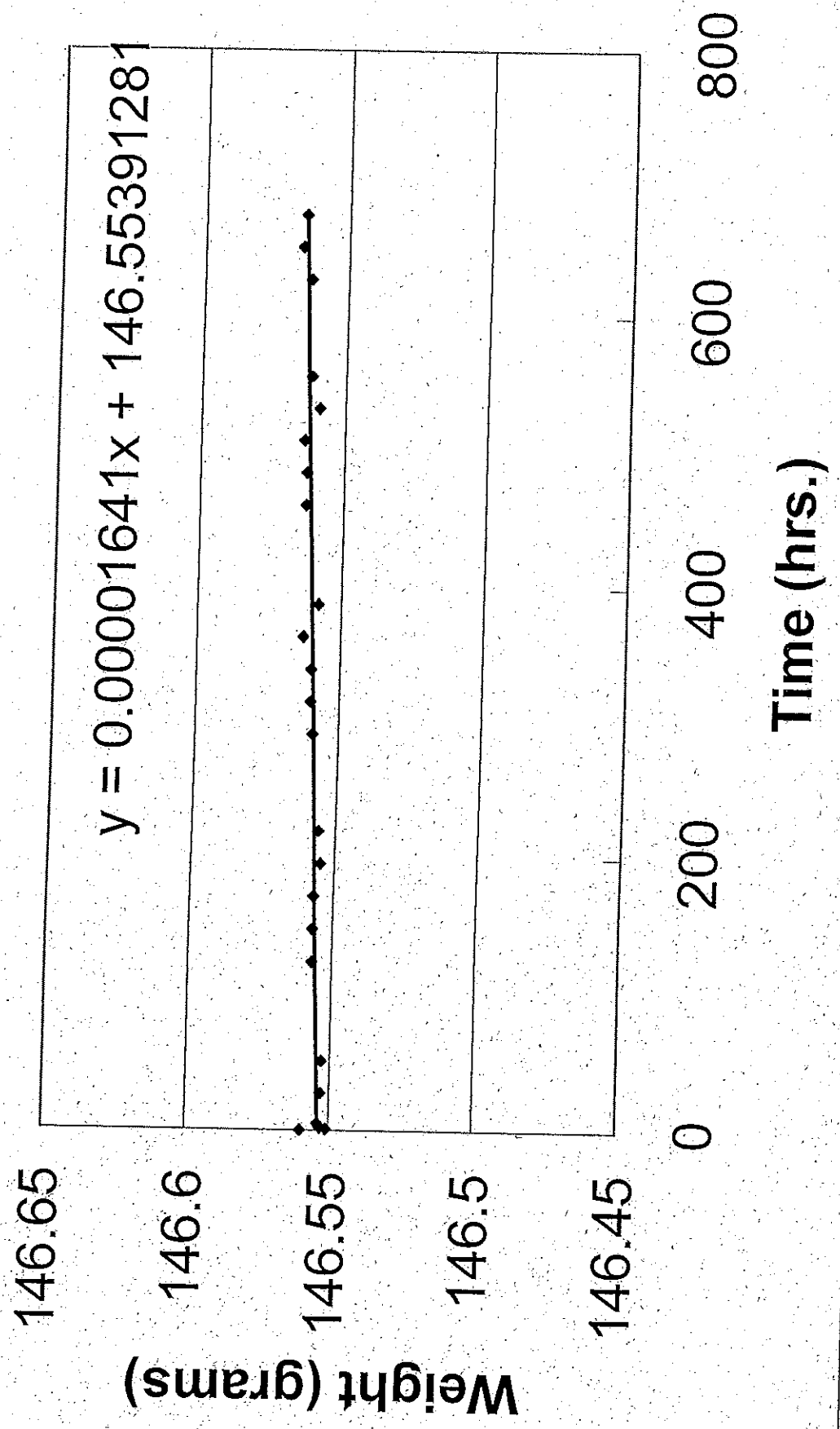
Reviewed By:

08-27-08

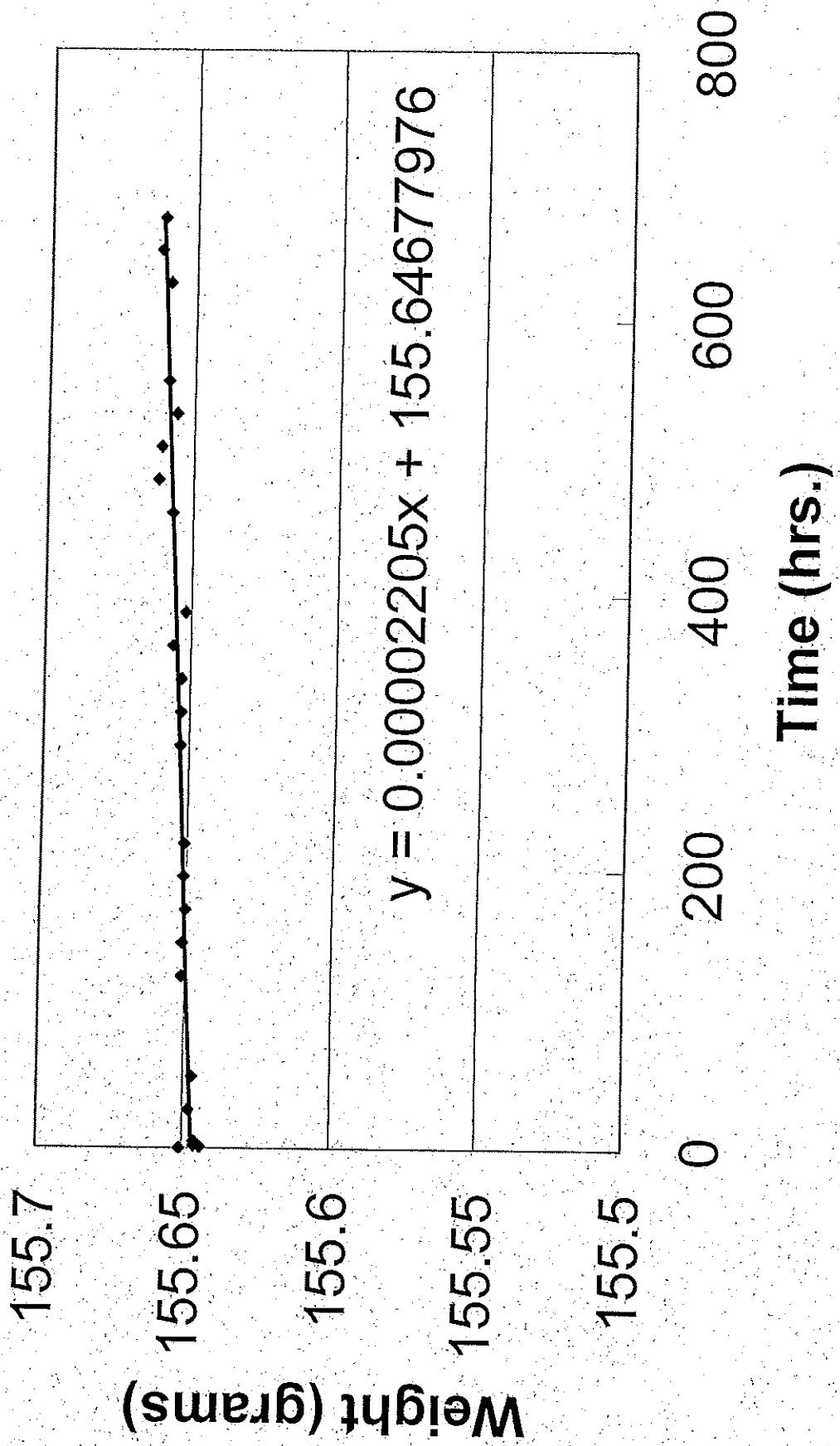
Date:

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

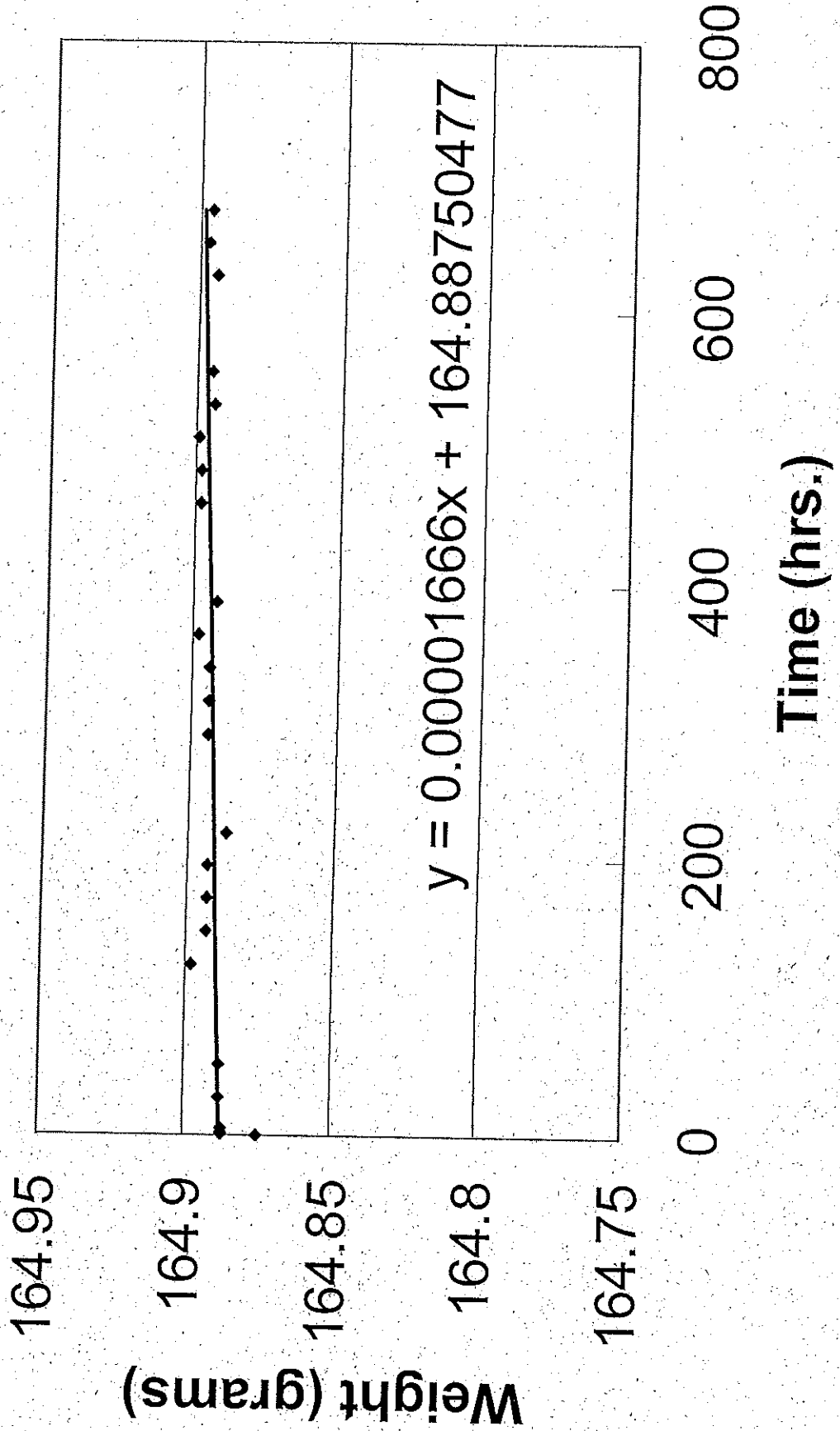
# Aged IE Specimen One



# Aged IE Specimen Two



# Aged IE Specimen Three





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## Thermal Resistance Test Report

Date of Test: June 10, 2008

Date of Manufacture: 2008

HFM File Number: 08-8009

Specimen Number: 1021080606-7

Test Number: RD082398TR

Description of Test Specimen: Innovative Energy; Bubble Pack with Metallized Film Facer (AstroShield II)

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 / 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: _____	<u>12 by 12</u>	in. x in.
Specimen thickness: _____	<u>0.313</u>	inches
Specimen density: _____	<u>2.42</u>	lb/ft <sup>3</sup>
Cold plate temperature: _____	<u>55.04</u>	°F
Hot plate temperature: _____	<u>95.04</u>	°F
Average specimen temperature: _____	<u>75.04</u>	°F
Apparent thermal conductivity: _____	<u>0.2580</u>	Btu-in./ft <sup>2</sup> -hr-°F
Thermal resistivity ( R-per-inch): _____	<u>3.876</u>	ft <sup>2</sup> -hr-°F/Btu.in
Thermal resistance of specimen: _____	<u>1.21</u>	ft <sup>2</sup> -hr-°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)? 2.2

The precision of this test is estimated to be 2.5% (Section 10.8, ASTM C 518-04)

Ronald S. Swader

Reviewed By:

08-27-08

Date:

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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## Bleeding and Delamination Test Report

Test Number: RD082399BD

Date of Test: June 11, 2008

Specimen Number: 1021080606-7

Date of Manufacture: 2008

Report Prepared For: Innovative Energy / Eric Baker

Project: Adhesive Performance (Bleeding and Delamination) of Innovative Energy Facer Attached to Bubble Pack Reflective Insulation.

### Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy and received by R&D Services, Inc. on June 6, 2008 for classification testing. Testing was completed on June 11, 2008. 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  $180^{\circ}\text{F} \pm 5^{\circ}\text{F}$  and 50 % relative humidity a minimum of 5 hours prior to evaluation.

### Observations

The Innovative Energy facer attached to bubble pack reflective insulation was observed to have no bleeding or delamination under 5x magnification, thus, meeting the acceptance criteria of Section 9.5.1.4.

*Ronald S. Swader*

08-27-08

Reviewed By:

Date:

The results in this report apply only to the specimen tested



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## Pliability Test Report

Test Number: RD082400PL

Date of Test: June 11-12, 2008

Specimen Number: 1021080606-7

Date of Manufacture: 2008

Report Prepared For: Innovative Energy / Eric Baker

Project: Adhesive Performance (Pliability) of Bubble Pack with Metallized Film Facer (AstroShield II)

### Procedure

This report presents the results of physical tests conducted on material manufactured by Innovative Energy and received by R&D Services, Inc. on June 6, 2008 for classification testing. Testing was completed on June 12, 2008. 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 bubble pack with metallized film facer (AstroShield II) 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  $70^{\circ}\text{F} \pm 2^{\circ}\text{F}$  with  $50\% \pm 5\%$  relative humidity and the second set at  $32^{\circ}\text{F} \pm 2^{\circ}\text{F}$  with  $50\% \pm 5\%$  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 Innovative Energy bubble pack with metallized film facer (AstroShield II) was observed to have no cracking or delamination when folded to an  $180^{\circ}$  bend, thus, meeting the acceptance criteria of Section 9.5.2.4.

Ronald S. Swader

Reviewed by:

08-27-08

Date:

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The results in this report apply only to the specimen tested



Client: R AND D SERVICES, INC

Date: 4-2-2008

Project Number: 3148357SAT-001

Test Number: 1

Operator: TA/AM

Specimen ID: "INNOVATIVE ENERGY, LOWELL, IN / ASTRO SHIELD II (LOW E): MPET/B/  
B/MPET". THE TEST WAS WITNESSED BY RON GRAVES FROM R & D  
SERVICES, INC. THE SPECIMEN WAS SUPPORTED BY ALUMINUM  
FRAMES.

## TEST RESULTS

FLAMESPREAD 0

SMOKE DEVELOPED INDEX: 15

## SPECIMEN DATA . . .

Time to Ignition (sec): 11

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): 588

Time to Max Temperature (sec): 548

Total Fuel Burned (cubic feet): 50.11

FS\*Time Area (ft\*min): 0.0

Smoke Area (%A\*min): 20.5

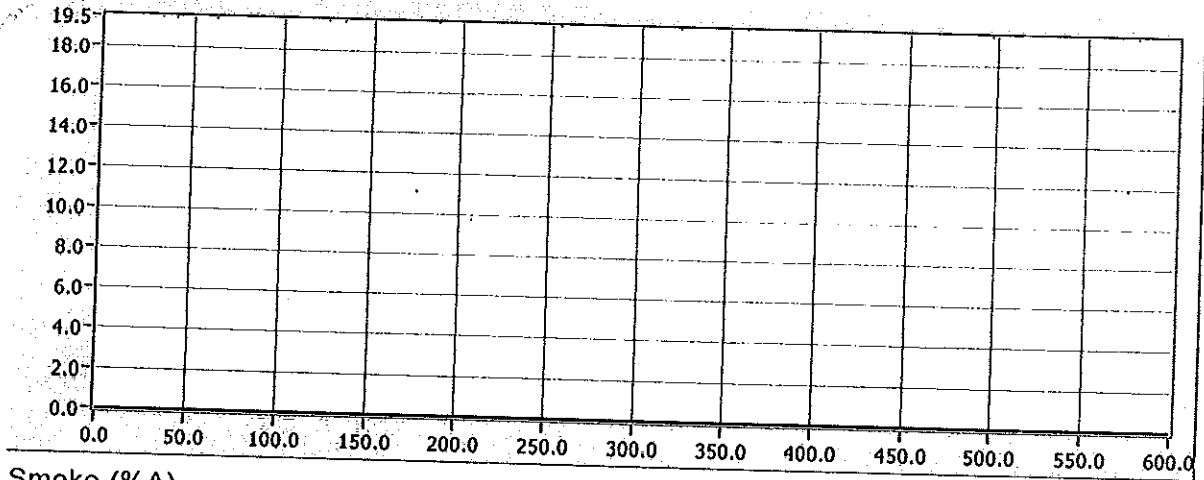
Unrounded FSI: 0.0

## CALIBRATION DATA . . .

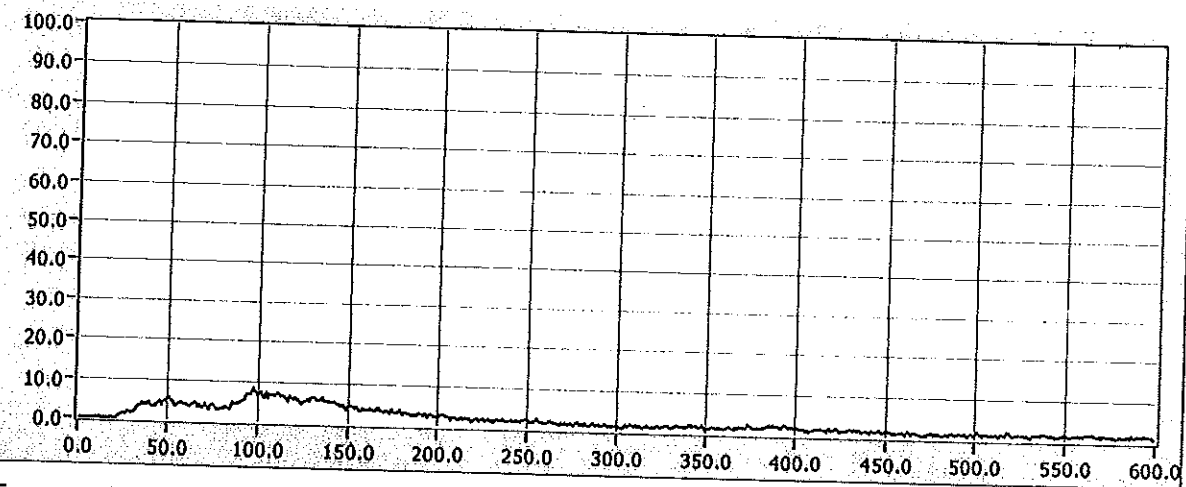
Time to Ignition of Last Red Oak (Sec): 33.0

Red Oak Smoke Area (%A\*min): 121.4

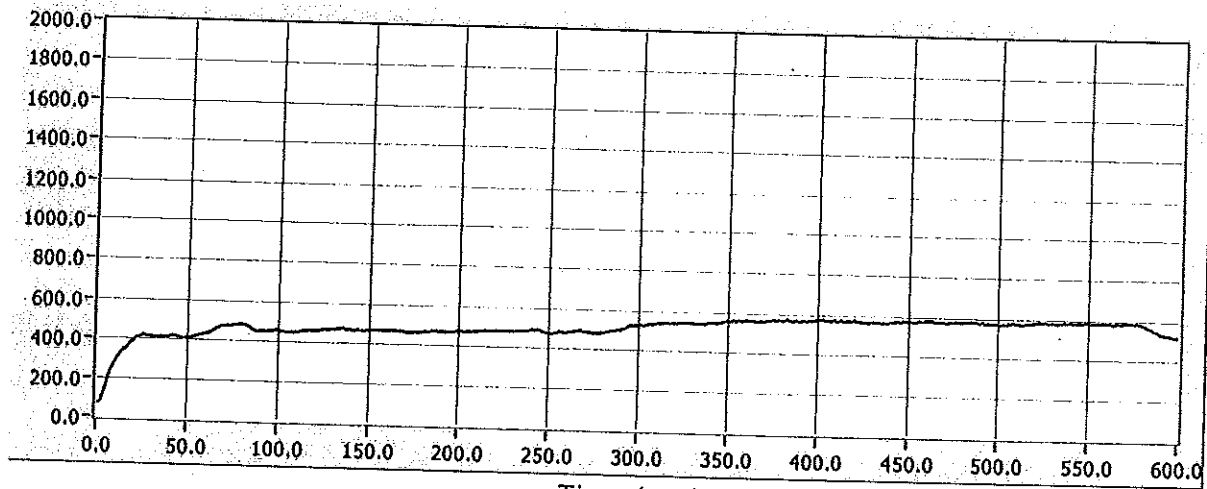
### FLAME SPREAD (ft)



### Smoke (%A)



### Temperature (°F)



Time (sec)

600

Client: R & D SERVICES, INC.

Date: 11/5/08

Project Number: 3165949SAT-009

Test Number: 1

Operator: TA MP

Specimen ID: "INNOVATIVE ENERGY; LOWELL, IL. REFLECTIVE INSULATION; ASTRO SHIELD II MPET/DB/MPET; BOTH SIDES ARE THE SAME. SLIT ALONE CENTERLINE ON ONE SIDE TO REMOVE METALIZED. NOMINAL 5/16 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): 10

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): 487

Time to Max Temperature (sec): 595

Total Fuel Burned (cubic feet): 51.51

FS\*Time Area (ft\*min): 0.9

Smoke Area (%A\*min): 17.9

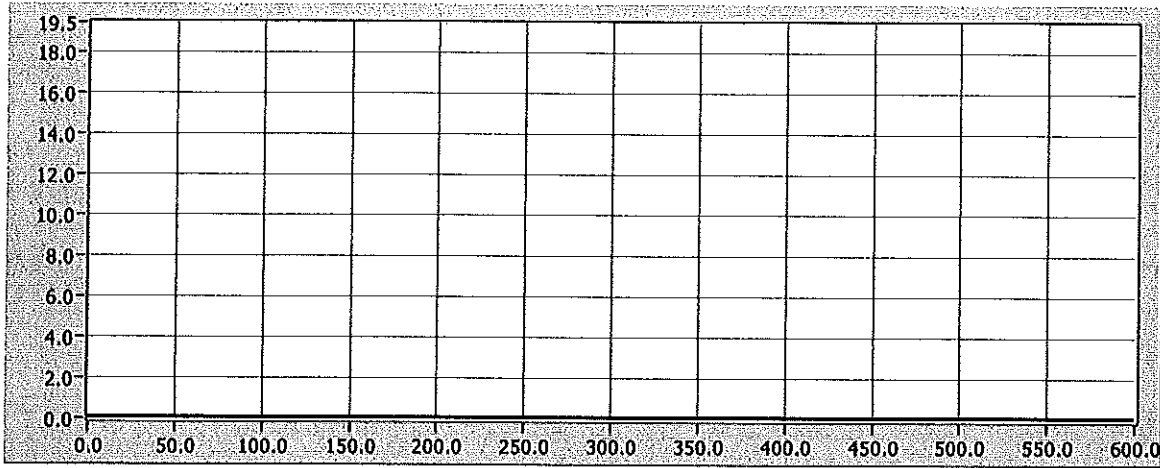
Unrounded FSI: 0.4

## CALIBRATION DATA . . .

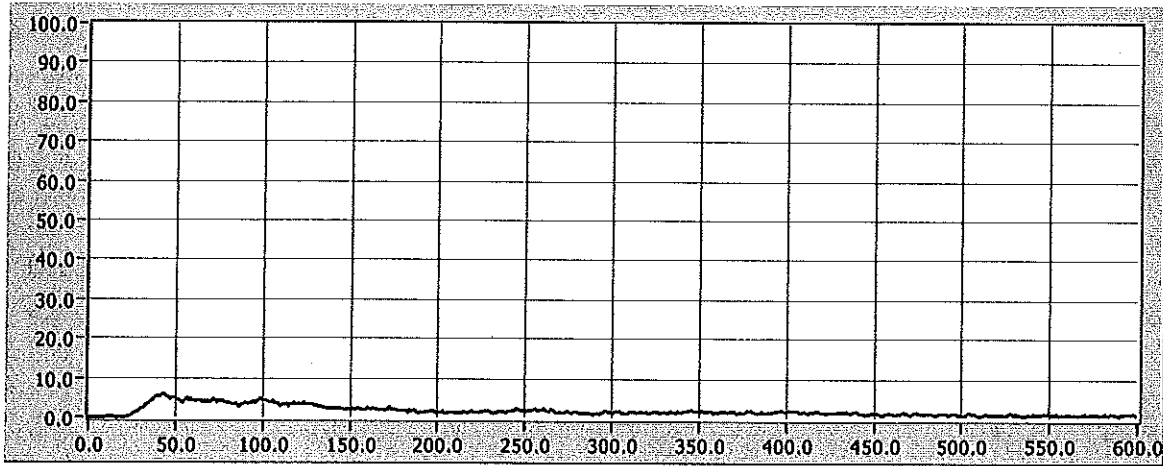
Time to Ignition of Last Red Oak (Sec): 34.0

Red Oak Smoke Area (%A\*min): 94.0

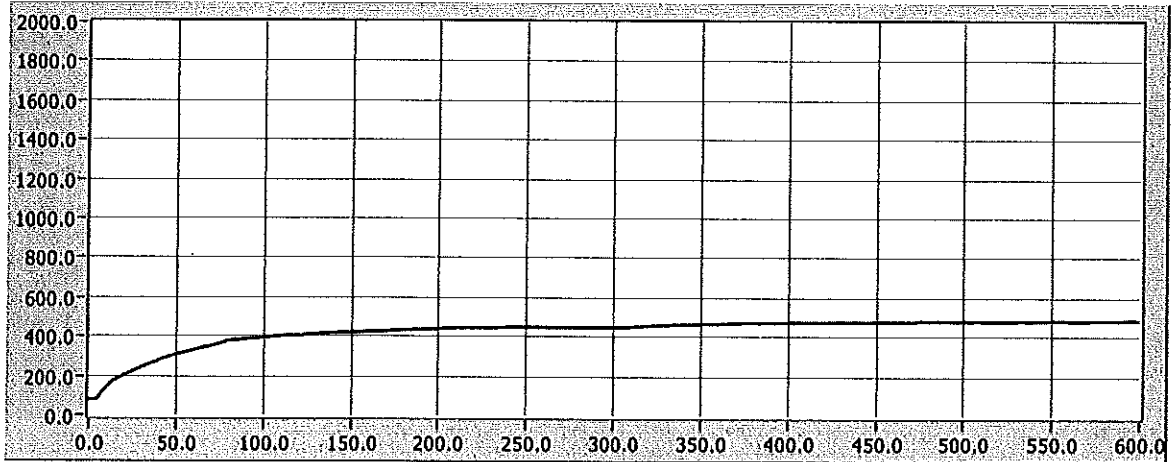
### FLAME SPREAD (ft)



### Smoke (%A)



### Temperature (°F)



Time (sec)

600