



Test Report

Selected Measurements on RB-1 Radiant Barrier Supplied by Q-LAM LLC

Prepared For:

Mr. Mohamed Fahmy
Q-LAM LLC
603 Mar Vista Drive
Monterey, CA 93940

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

Report: RD18625-R1

A handwritten signature in black ink, appearing to read 'Stuart Ruis', written over a horizontal line.

Stuart Ruis
President

September 14, 2018

The test results in this report apply only to the specimens tested. The tests conform to the respective test methods except for the report requirements. The report includes summary data but a full complement of data is available upon request. 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., IAS or any other organization.



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September 14, 2018

Mr. Mohamed Fahmy
 Q-LAM LLC
 603 Mar Vista Drive
 Monterey, CA 93940

Dear Mr. Fahmy,

R & D Services, Inc. has completed classification tests on the RB-1 Radiant Barrier product supplied from Q-LAM LLC in Monterey, California. R & D Services, Inc. received one roll of RB-1 Radiant Barrier on August 2, 2018. Tests have been completed to verify that the products comply with ASTM C1313 requirements. The test results are summarized in the following table.

RB-1 Radiant Barrier Classification Tests	TEST RESULT
Emittance (ASTM C1371)	0.054
Corrosiveness (ASTM D3310)	PASS
Fungi resistance (ASTM C1338)	PASS
Water Vapor Transmission (ASTM E96) (perm)	6.67
Bleeding and Delamination (ASTM C1313)	PASS
Pliability (ASTM C1313)	PASS
Tearing Strength (ASTM D2261) (lb _f)	
• Cross Machine Direction	14.5
• Machine Direction	10.6
Surface Burning Characteristics (ASTM E84)	
• Flame Spread Index	0
• Smoke Developed Index	5

Classification results on the Q-LAM LLC RB-1 Radiant Barrier show that the product meets the requirements of ASTM C1313.

We appreciate your business.

Stuart Ruis

R&D Services, Inc.

P.O. Box 2400, Cookeville, Tennessee, 38502-2400

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Total Hemispherical Emittance Test Report

Test Number: RD182099HE

Date of Test: August 13, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier

Test Method: ASTM C1371-15, "Test Method for Determination of Emittance of Materials near Room Temperature Using Portable Emisometers".

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

This report presents the results of the test specimen identified above using a Model AE emissometer manufactured by Devices and Services Company of Dallas, Texas. The emissometer is powered to provide warm-up prior to use. A warm-up time of one hour in a conditioned laboratory has been found to be acceptable. Calibration at high (0.89) and low (0.05) emittance is performed after the warm-up period using calibration disks supplied by Devices and Services Company. Test specimens are placed in good contact with the thermal sink that is part of the apparatus. The measurement head of the emissometer is placed on the test specimen and held in place at least 60 seconds for each measurement. The emissometer was calibrated prior to use and calibration was verified at the end of testing. The average emittance reported below is based on three measurements.

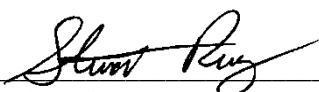
Results:

Specimen Thickness 0.11 mm (As Received)
 0.11 mm (As Tested)
 Test Temperature: 69 °F
 Test Humidity: 50 %RH

R&D Services Identification	Specimen Description	Thermal Emittance	Standard Deviation
2022180802-1	RB-1 Radiant Barrier	0.054	0.003

Uncertainty

The 95 % reproducibility as stated in Section 10 of ASTM C1371-15 is 0.019 units.


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Corrosiveness Test Report

Test Number: RD182093CO

Date of Test: August 14 - 21, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier

Test Method: ASTM D3310-00 (2014) "Test Method for Determining of Corrosivity of Adhesive Materials."

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

A sample of film product was placed in a screw cap jar with an inert cap liner. The cap was tightened and the jar placed in a forced draft circulating oven at $71 \pm 2^\circ\text{C}$. The sample was used as a control. A second sample was placed in a similar jar with a small open jar half filled with distilled water. The second jar was also tightly closed and placed in the oven. The samples were removed and examined after intervals of 1, 3, 5, and 7 days in the oven.

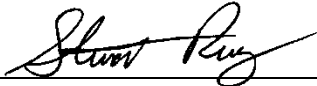
Results

Exposure Time	Test Specimen Rating
1 day	2
3 days	2
5 days	2
7 days	3

Rating Scale

- 1 Exposed sample – less tarnished than control
- 2 Exposed sample – same as control
- 3 Exposed sample – slightly worse than control
- 4 Exposed sample – significantly worse than control
- 5 Exposed sample – badly corroded

After exposure to high temperature and high humidity for seven days the sample showed no metallization loss of specimen surface area. When observed over light source the sample showed small areas of increased translucency. The control sample showed no changes.


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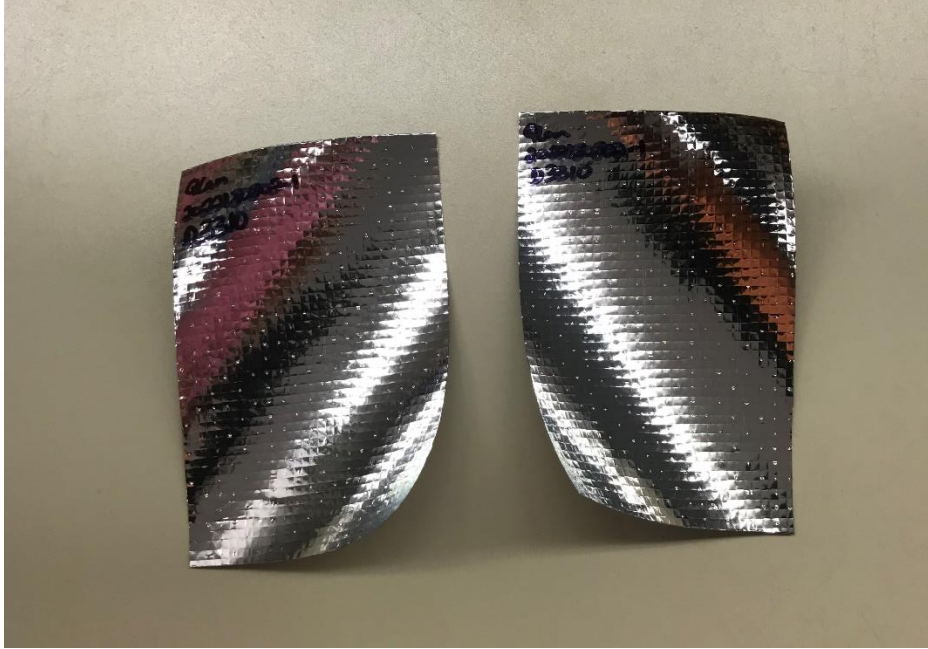


Figure 1: Specimen Before Testing

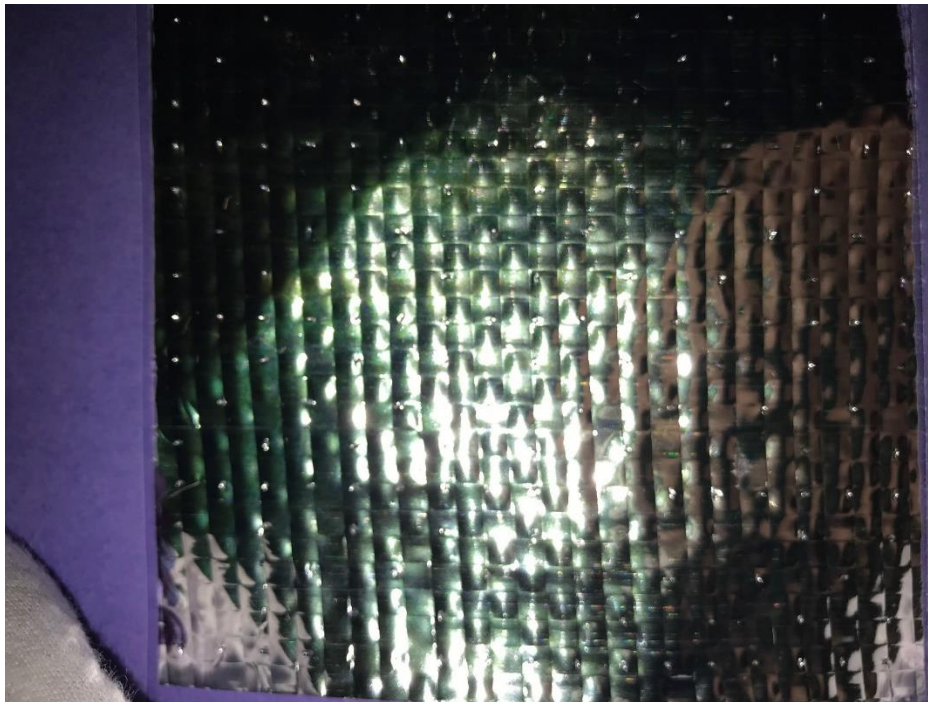


Figure 2: Specimen After Testing



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Fungi Resistance Test Report

Test Number: RD182186FR Date of Test: August 14 – September 11, 2018

Specimen Number: 2022180802-1 Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier

Test Method: ASTM C1313-13, "Specification for Sheet Radiant Barriers for Building Construction Applications and ASTM C1338-14, "Standard Test Method for Determining Fungi Resistance of Insulating Materials and Facings.

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

This test method is used to determine the relative ability of an insulation and its facing to resist fungal growth under conditions favorable for their development.

This test method uses a comparative material to determine the relative ability of a material to resist fungal growth. In some specialized product areas, it is required that no growth take place. In such cases, the use of the comparative material is omitted, and the pass/fail criterion is based upon growth.

Viability specimens are used to determine the viability of the spore suspension during incubation. A comparative material of either white birch or southern yellow pine is used as a control specimen to determine comparative growth on test specimens.

Test specimens and comparative material are exposed to a 28-day inoculation period. After the inoculation period, the specimens are removed from test chamber and evaluated under 40X magnification. Each of the test specimens are determined to have no fungal growth, fungal growth no greater than the comparative material, or fungal growth greater than the comparative material. Specimens are evaluated at seven-day intervals for fungal growth. The viability and control specimens are determined to have growth or no growth.

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



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Results:

	Date	Viability	Control	Specimen 1	Specimen 2	Specimen 3
Day 7 Observation	8/21/18	2	2	1	1	1
Day 14 Observation	8/28/18	2	2	1	1	1
Day 21 Observation	9/4/18	2	2	1	1	1
Day 28 Observation	9/13/18	2	2	1	2	1

Observation Scale: 1. No growth 2. Growth 3. Specimen has less growth than the Comparative Material 4. Specimen has more growth than the Comparative Material

Comparative Material: Birch

The pass/fail result: Pass

Basis for the pass/fail result: Test specimens showed no growth beyond inoculating area.

Carla King
 Evaluation:

9/14/18
 Date:

Steve King
 Review:

9/14/18
 Date:

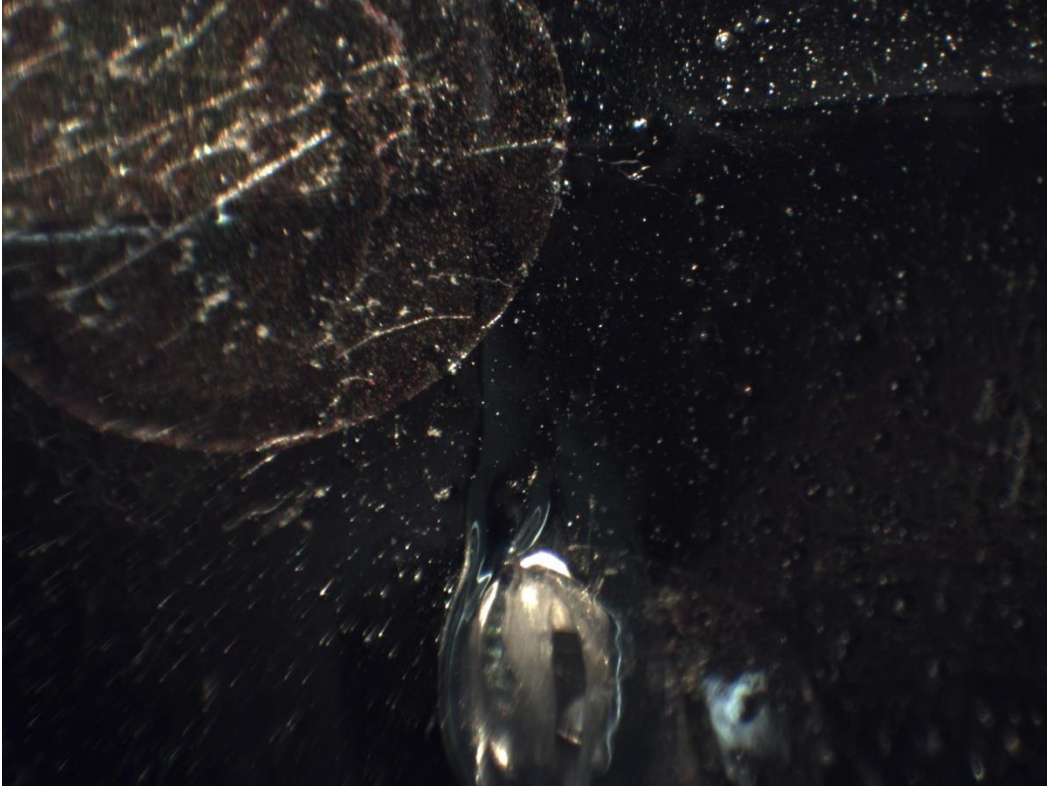


Figure 3: Sample After Testing



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Water Vapor Transmission Test Report

Test Number: RD182096WV Date of Test: August 8 – 13, 2018
 Specimen Number: 2022180802-1 Date of Manufacture: Unknown
 Description of Test Specimen: RB-1 Radiant Barrier; Specimen was the same on both sides
 Test Method: ASTM Test Method E96/E96M – 16, “Standard Test Methods for Water Vapor Transmission of Materials”.
 Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Results were obtained using the desiccant method described in Section 11 of ASTM E96. 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 around the top ledge of the pan with microcrystalline wax (60 %) mixed with refined crystalline paraffin wax (40 %).

Test Conditions:	Temperature (°F)	73.4
	Relative Humidity (%)	50.0
	Test Duration (hr)	266

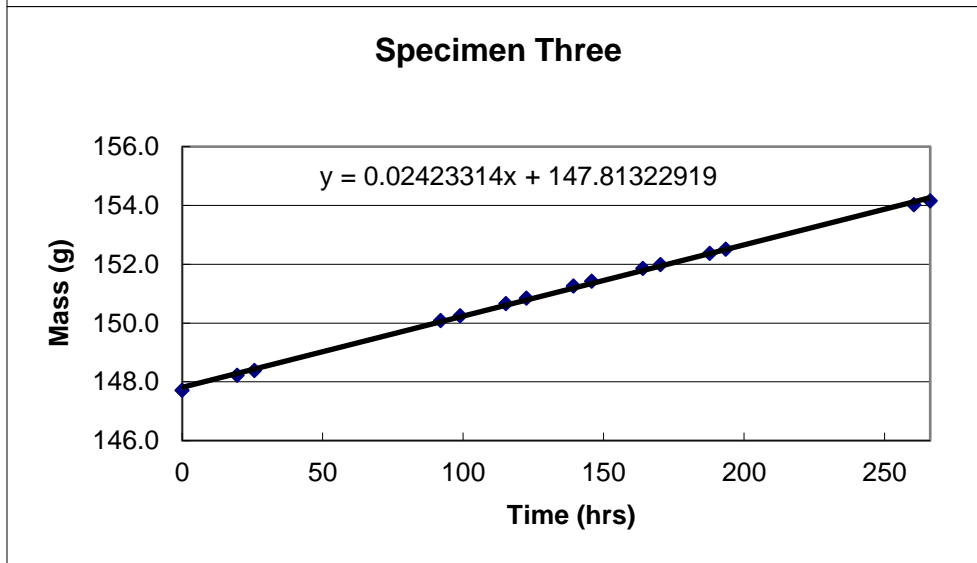
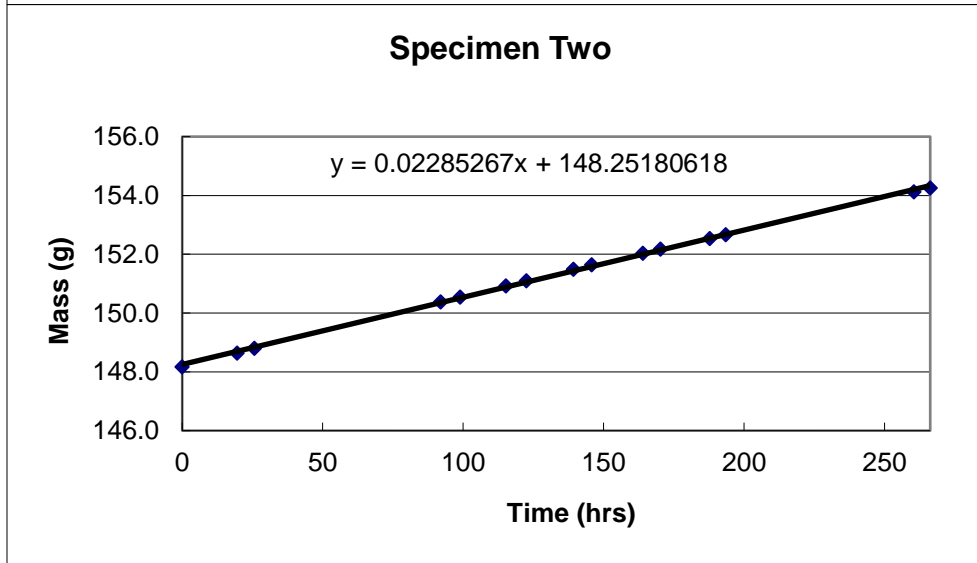
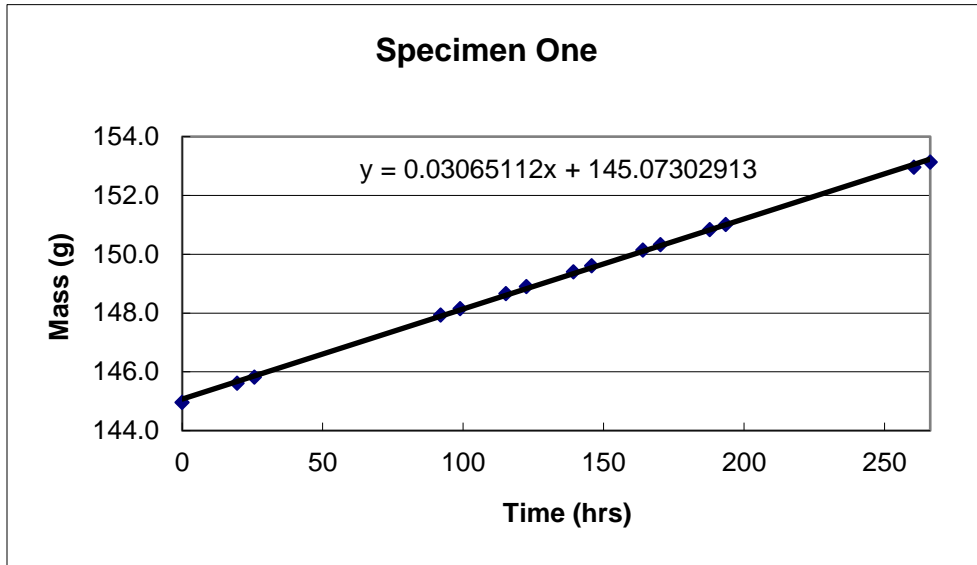
Test Results:		Specimen	Specimen	Specimen
		1	2	3
	Mass Gain (g)	8.16	6.08	6.45
	Specimen Area (ft ²)	0.145	0.145	0.145
	Water Vapor Transmission (gr/h·ft ²)	3.27	2.44	2.59
	Saturation Pressure (in. Hg)	0.829	0.829	0.829
	Pressure Difference (in. Hg)	0.415	0.415	0.415
	Permeance (perm, gr/ft ² ·h·(in. Hg))	7.89	5.88	6.24
	Thickness (in.)	n/a	n/a	n/a
	Permeability (perm·in.)	n/a	n/a	n/a
	Figure showing data is attached	yes	yes	yes

Result:

The measured average permeance for the material was 6.67 perm under the conditions of the test.


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Bleeding and Delamination Test Report

Test Number: RD182097BD

Date of Test: August 18, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier

Test Method: ASTM C1313-13, "Specification for Sheet Radiant Barriers for Building Construction Applications."

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

This report presents the results of physical tests conducted on material manufactured by Q-LAM LLC and received by R&D Services, Inc. on August 2, 2018. Testing was completed on August 18, 2018.

Specimen Preparation

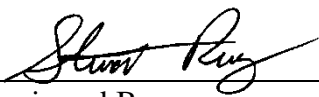
Three (3) 3 by 6 inch specimens were cut from separate locations on the roll of product.

Specimen Conditioning

The specimens were vertically suspended in an oven at conditions of $180 \pm 5^{\circ}\text{F}$ a minimum of 5 hours prior to evaluation.

Observations

The RB-1 Radiant Barrier was observed to have no bleeding or delamination under 5x magnification, thus, meeting the acceptance criteria of Section 9.5.1.4.



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Pliability Test Report

Test Number: RD182098PL

Date of Test: August 10 – 14, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier

Test Method: ASTM C1313-13, "Specification for Sheet Radiant Barriers for Building Construction Applications."

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

This report presents the results of physical tests conducted on material manufactured by Q-LAM LLC and received by R&D Services, Inc. on August 2, 2018. Testing was completed on August 14, 2018.

Specimen Preparation

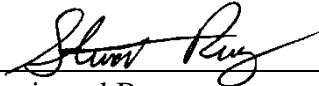
One (1) roll of radiant barrier was supplied to R&D Services, Inc. Two (2) sets of three (3) 3 by 6 inch specimens were cut from separate locations on the roll of product. One specimen in each set contained a factory produced edge.

Specimen Conditioning

One set of specimens was conditioned at $70 \pm 2^\circ\text{F}$ with $50 \pm 5\%$ relative humidity and the second set at $32 \pm 2^\circ\text{F}$ 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 RB-1 Radiant Barrier 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.


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Test Report for Tearing Strength

Test Number: RD182094TS

Date of Test: August 16, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier; Tested in cross-machine direction

Test Method: ASTM D2261-13 "Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine).

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

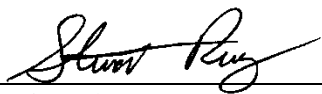
Five (5) 8 by 2 inch specimens were cut from the material with a 3 inch cut into the center of the specimen. The specimens were fastened to mechanical vise grips and subjected to a constant rate of separation using until rupture of the material occurred. The samples were conditioned at 70 ± 3°F and 50 ± 5% relative humidity for a minimum of 24 hours prior to testing. The test was conducted under the same environmental conditions.

An initial grip separation of 3.0 inches was used, and the tensile load was applied at the rate of 2.0 inch per minute until failure occurred. These values were reported in accordance with ASTM D2261-13. Calculation option 2 was used. The test was conducted using an INSTRON Universal Testing Instrument, Model Number 4400R, equipped with an electronic load cell and data acquisition system.

Results

Specimen	Width (in)	Thickness (in)	Tearing Force (lb _f)
1	1.99	0.0052	10.36
2	1.98	0.0052	11.36
3	1.99	0.0052	16.48
4	1.98	0.0053	18.04
5	2.00	0.0052	16.46

AVERAGE Tearing Force	
lb _f	Std Dev
14.54	3.44


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Test Report for Tearing Strength

Test Number: RD182095TS

Date of Test: August 16, 2018

Specimen Number: 2022180802-1

Date of Manufacture: Unknown

Description of Test Specimen: RB-1 Radiant Barrier; Tested in machine direction

Test Method: ASTM D2261-13 "Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine).

Report Prepared For: Q-LAM LLC / Mr. Mohamed Fahmy

Procedure

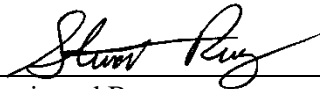
Five (5) 8 by 2 inch specimens were cut from the material with a 3 inch cut into the center of the specimen. The specimens were fastened to mechanical vise grips and subjected to a constant rate of separation using until rupture of the material occurred. The samples were conditioned at 70 ± 3°F and 50 ± 5% relative humidity for a minimum of 24 hours prior to testing. The test was conducted under the same environmental conditions.

An initial grip separation of 3.0 inches was used, and the tensile load was applied at the rate of 2.0 inch per minute until failure occurred. These values were reported in accordance with ASTM D2261-13. Calculation option 2 was used. The test was conducted using an INSTRON Universal Testing Instrument, Model Number 4400R, equipped with an electronic load cell and data acquisition system.

Results

Specimen	Width (in)	Thickness (in)	Tearing Force (lbf)
1	2.00	0.0055	14.98
2	2.00	0.0050	10.42
3	1.99	0.0050	9.15
4	1.99	0.0057	8.97
5	2.00	0.0053	9.29

AVERAGE Tearing Force	
lbf	Std Dev
10.56	2.53


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