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Heat & Moisture Dissipation Characteristics of Foam Sweating Hot Plate Method

Ghostbed, Inc.
Marc Werner
7143 W. Broward Blvd
Fort Lauderdale, FL 33317

Tested & Reported by:
Brent L. Larson

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Sample ID: GBSolidfoam

Size: ~50" x 20" x 5"

Report Number: ESP042739P.1.R0

August 16, 2024

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EAR-CONTROLLED DATA



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TEST RESULTS SUMMARY:

R-dry
1.1252 m ² k/w

R-wet
586.91 m ² pa/w

Evaporative Capacity
10.92 g.m ² /hr

"Qmax"
158.70 w/m ²

Testing was conducted August 13, 2024.

Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"

TEST METHOD:

Testing was conducted with a "sweating guarded hot plate" (SGHP) using ANSI/RESNA SS-1 2019 Section 4 as a procedural guide. The sample was placed onto a support surface consisting of a metal frame mattress foundation with a corrugated plastic deck covered with heavy nonwoven fabric. Prior to testing, the sample was allowed to condition for at least 48 hours in a laboratory environment of 71 +/- 5 °F and 50 +/- 5% relative humidity. All subsequent testing was also performed in these conditions. The SGHP was weighted to produce 32 pounds of load on the sample surface and was covered with an insulating layer consisting of two cotton blankets and a mylar "space" blanket. Each test was run until steady state of the heat flow (Q) was achieved. Steady state is defined as the point at which there has been less than 5% change in Q over a 30 minute period. One evaluation was performed "dry" and one was performed with distilled water applied. The SGHP was centered on the sample. A water vapor permeable wicking material was used to evenly distribute the water.

The general idea behind this test is to simulate the thermal and moisture emittance of a human body and how the sample responds. Typically, it is desirable to have lower "R" (thermal resistance) values and higher evaporative capacity characteristics. This indicates that the sample is better able to dissipate heat and moisture.

Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"

TEST RESULTS:

R-dry	
1.1252	$\text{m}^2\text{k/w}$
2.05	% Δ
R-wet	
586.91	$\text{m}^2\text{pa/w}$
3.90	% Δ

Q-dry	
10.68	w/m^2
-3.86	% Δ
Q-wet	
18.21	w/m^2
-4.72	% Δ

Evaporative Capacity	
10.92	$\text{g.m}^2/\text{hr}$

Test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

Tested & Reported by:

Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659 – 7218

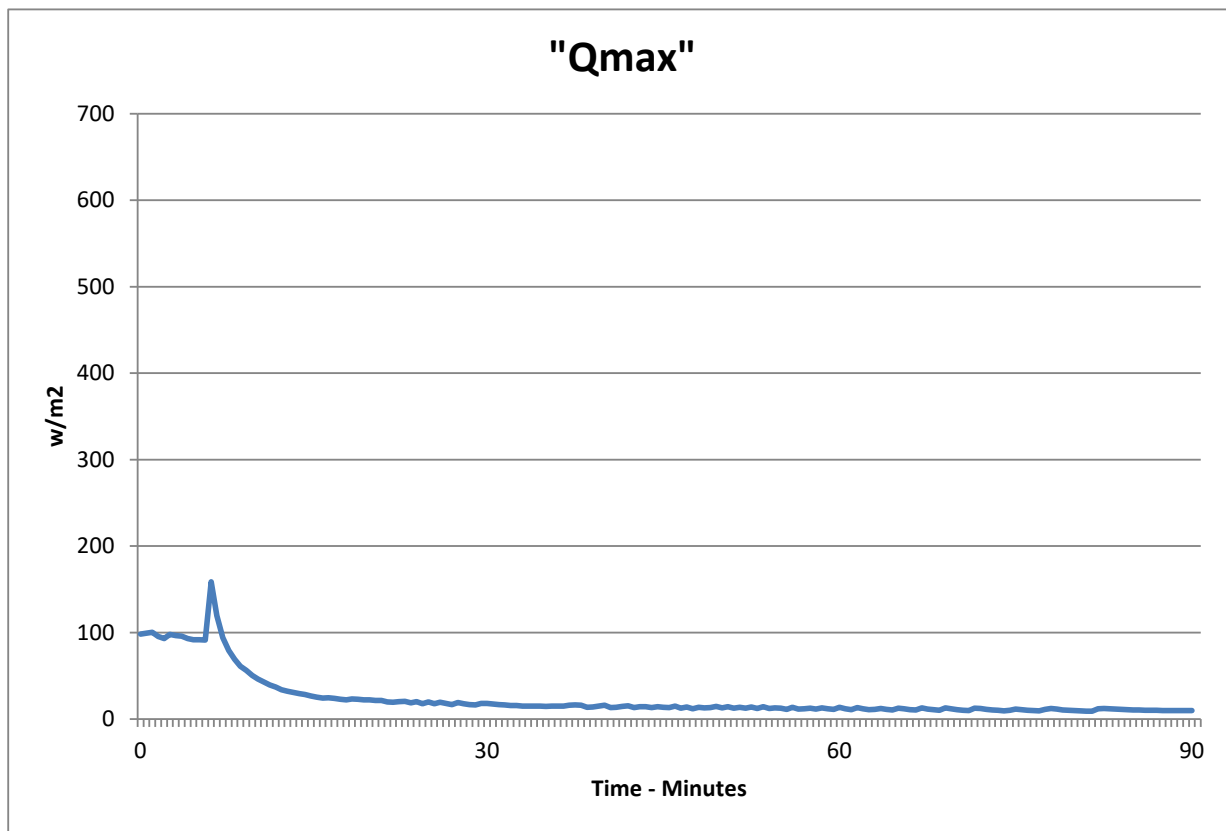
Sample ID: GBSolidfoam

Size: ~50" x 20" x 5"

ADDENDUM:

"Qmax" is the peak heat flow (Q) value registered by the hot plate device (dry test only).

"Qmax"	
158.70	W/m ²



Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"



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Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

Report Number: ESP042739P.2.R0

August 16, 2024

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TEST RESULTS SUMMARY:

R-dry
1.1542 m ² k/w

R-wet
504.52 m ² pa/w

Evaporative Capacity
12.52 g.m ² /hr

"Qmax"
303.01 w/m ²

Testing was conducted August 14, 2024.

Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

Report Number: ESP042739P.2.R0

August 16, 2024

Page 2 of 5

EAR-CONTROLLED DATA

TEST METHOD:

Testing was conducted with a "sweating guarded hot plate" (SGHP) using ANSI/RESNA SS-1 2019 Section 4 as a procedural guide. The sample was placed onto a support surface consisting of a metal frame mattress foundation with a corrugated plastic deck covered with heavy nonwoven fabric. Prior to testing, the sample was allowed to condition for at least 48 hours in a laboratory environment of 71 +/- 5 °F and 50 +/- 5% relative humidity. All subsequent testing was also performed in these conditions. The SGHP was weighted to produce 32 pounds of load on the sample surface and was covered with an insulating layer consisting of two cotton blankets and a mylar "space" blanket. Each test was run until steady state of the heat flow (Q) was achieved. Steady state is defined as the point at which there has been less than 5% change in Q over a 30 minute period. One evaluation was performed "dry" and one was performed with distilled water applied. The SGHP was centered on the sample. A water vapor permeable wicking material was used to evenly distribute the water.

The general idea behind this test is to simulate the thermal and moisture emittance of a human body and how the sample responds. Typically, it is desirable to have lower "R" (thermal resistance) values and higher evaporative capacity characteristics. This indicates that the sample is better able to dissipate heat and moisture.

Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

TEST RESULTS:

R-dry	
1.1542	$\text{m}^2\text{k/w}$
-2.08	% Δ
R-wet	
504.52	$\text{m}^2\text{pa/w}$
3.33	% Δ

Q-dry	
10.40	w/m^2
0.61	% Δ
Q-wet	
18.75	w/m^2
-4.49	% Δ

Evaporative Capacity	
12.52	$\text{g.m}^2/\text{hr}$

Test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

Tested & Reported by:

Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659 – 7218

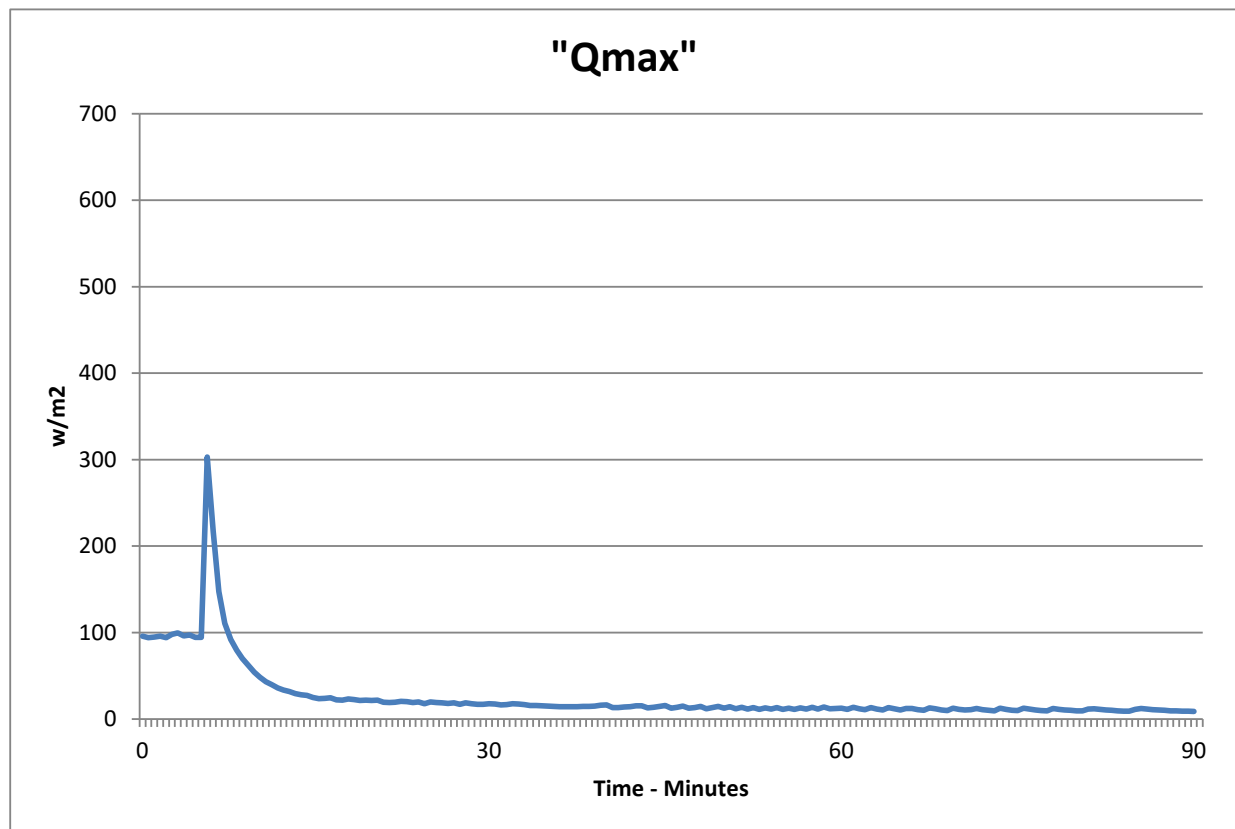
Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

ADDENDUM:

"Qmax" is the peak heat flow (Q) value registered by the hot plate device (dry test only).

"Qmax"	
303.01	w/m ²



Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"



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Heat & Moisture Dissipation Characteristics of Foam Body Analog Method

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Marc Werner
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Fort Lauderdale, FL 33317

Tested & Reported by:
Brent L. Larson

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Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"

Report Number: ESP042739P.1.R0.Body Analog

August 16, 2024

Page 1 of 5

EAR-CONTROLLED DATA

TEST RESULTS SUMMARY:

	Avg Temperature °C
60 min	35.9
120 min	36.3
180 min	36.3
MAX 0-180 min	36.3
End-Pressure Lift	33.6
MIN-After Lift	33.8
196 Minutes	36.2

Area "A" Under the Curve	
365.4	degree/minutes

	Avg Rel. Humidity %
60 min	63.7
120 min	66.1
180 min	67.2
MAX 0-180 min	67.2
End-Pressure Lift	44.5
MIN-After Lift	45.1
196 Minutes	67.0

Typically, lower temperatures and relative humidity values are more conducive to healthy tissue. In this respect, a larger "Area A" indicates the sample is better able to dissipate heat when the source is removed.

Testing was conducted August 13, 2024.

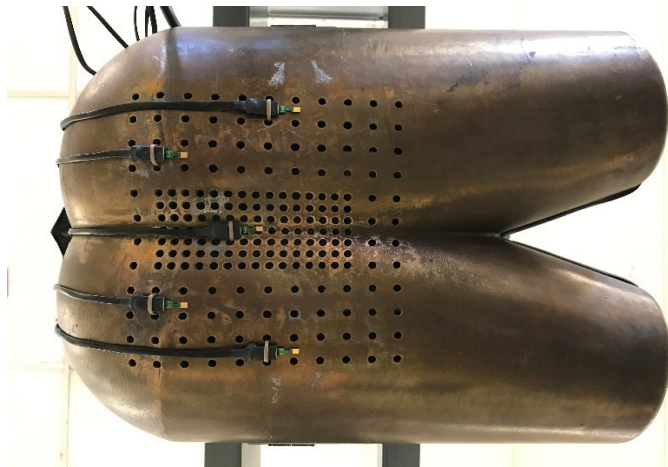
Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"

TEST METHOD:

Testing was conducted with a "body analog" fixture (see picture below) using ANSI/RESNA SS-1:2019 part 3 as a procedural guide. Prior to testing, the sample was allowed to condition for at least 12 hours in a laboratory environment of 71 +/- 5 °F and 50 +/- 5% relative humidity. All subsequent testing was also performed in these conditions. The test fixture was heated to 37 °C prior to testing. Two pairs of cooling towels were saturated with ~200 ml of distilled water and placed inside the test fixture covering all of the holes on the bottom surface. The body analog was placed onto the sample. Average temperature and relative humidity data was recorded for 180 minutes. At the 180 minute point, the fixture was raised off of the sample for approximately 45 seconds and then re-applied to the sample surface. The test was continued for an additional 15 minutes and then stopped.

"Area A" is calculated by subtracting the actual data curve from the extrapolated data curve between 180 and 196 minutes.

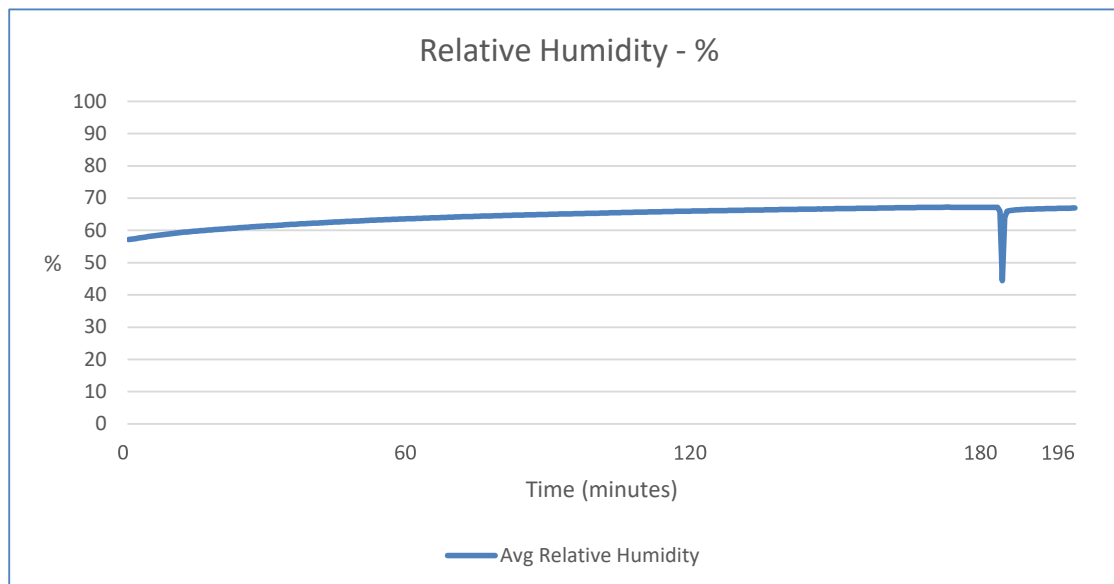
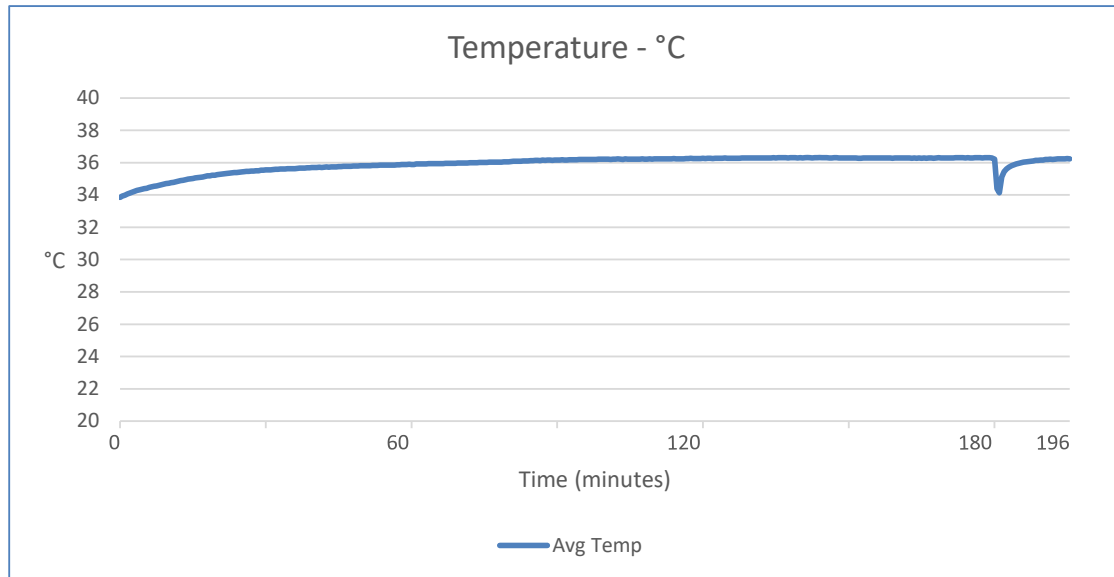
**SETUP NOTES / TEST OBSERVATIONS:**

-test location: center of sample

Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"

GRAPHS:



Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"



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Tested & Reported by:

A handwritten signature in blue ink that reads 'Brent L. Larson'.

Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659-7218

Sample ID: GBsolidfoam

Size: ~50" x 20" x 5"



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Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

Report Number: ESP042739P.2.R0.Body Analog

August 16, 2024

Page 1 of 5

EAR-CONTROLLED DATA

TEST RESULTS SUMMARY:

	Avg Temperature °C
60 min	35.8
120 min	36.1
180 min	36.1
MAX 0-180 min	36.1
End-Pressure Lift	33.5
MIN-After Lift	33.6
196 Minutes	36.1

Area "A" Under the Curve	
322.4	degree/minutes

	Avg Rel. Humidity %
60 min	62.9
120 min	65.4
180 min	66.7
MAX 0-180 min	66.7
End-Pressure Lift	45.3
MIN-After Lift	46.2
196 Minutes	66.5

Typically, lower temperatures and relative humidity values are more conducive to healthy tissue. In this respect, a larger "Area A" indicates the sample is better able to dissipate heat when the source is removed.

Testing was conducted August 14, 2024.

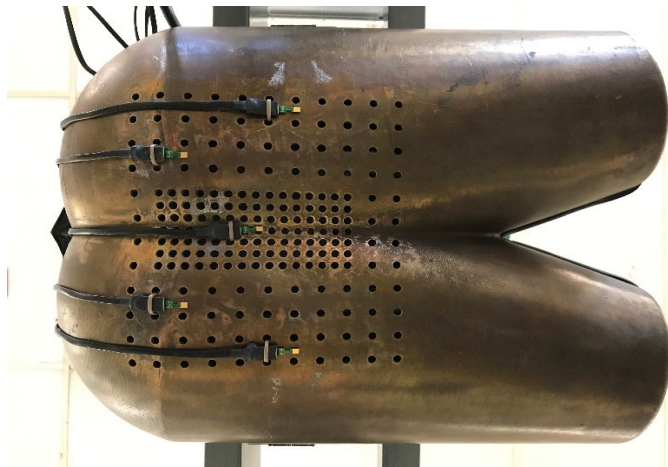
Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

TEST METHOD:

Testing was conducted with a "body analog" fixture (see picture below) using ANSI/RESNA SS-1:2019 part 3 as a procedural guide. Prior to testing, the sample was allowed to condition for at least 12 hours in a laboratory environment of 71 +/- 5 °F and 50 +/- 5% relative humidity. All subsequent testing was also performed in these conditions. The test fixture was heated to 37 °C prior to testing. Two pairs of cooling towels were saturated with ~200 ml of distilled water and placed inside the test fixture covering all of the holes on the bottom surface. The body analog was placed onto the sample. Average temperature and relative humidity data was recorded for 180 minutes. At the 180 minute point, the fixture was raised off of the sample for approximately 45 seconds and then re-applied to the sample surface. The test was continued for an additional 15 minutes and then stopped.

"Area A" is calculated by subtracting the actual data curve from the extrapolated data curve between 180 and 196 minutes.

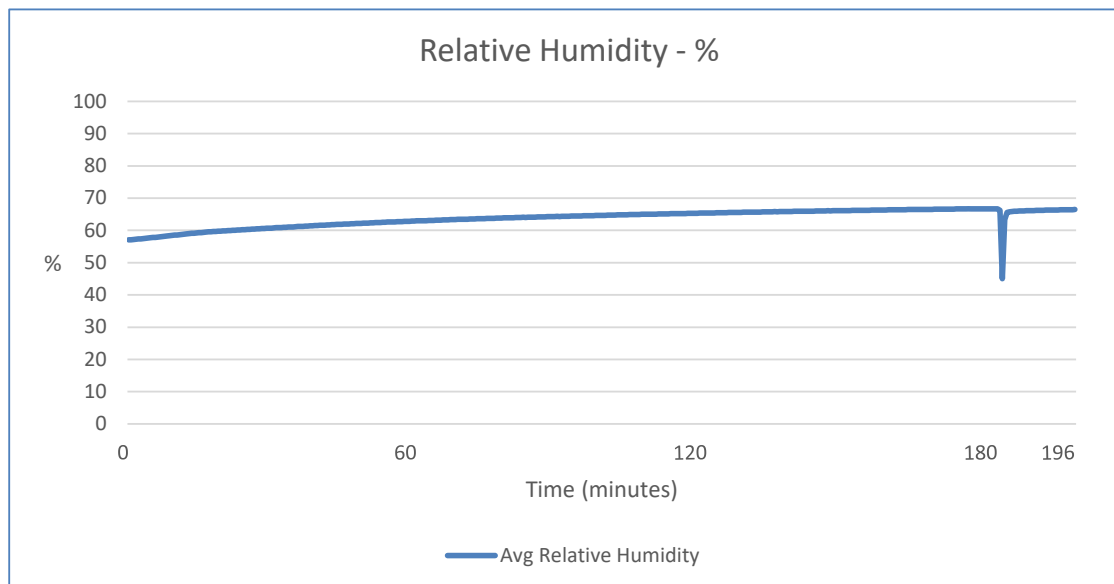
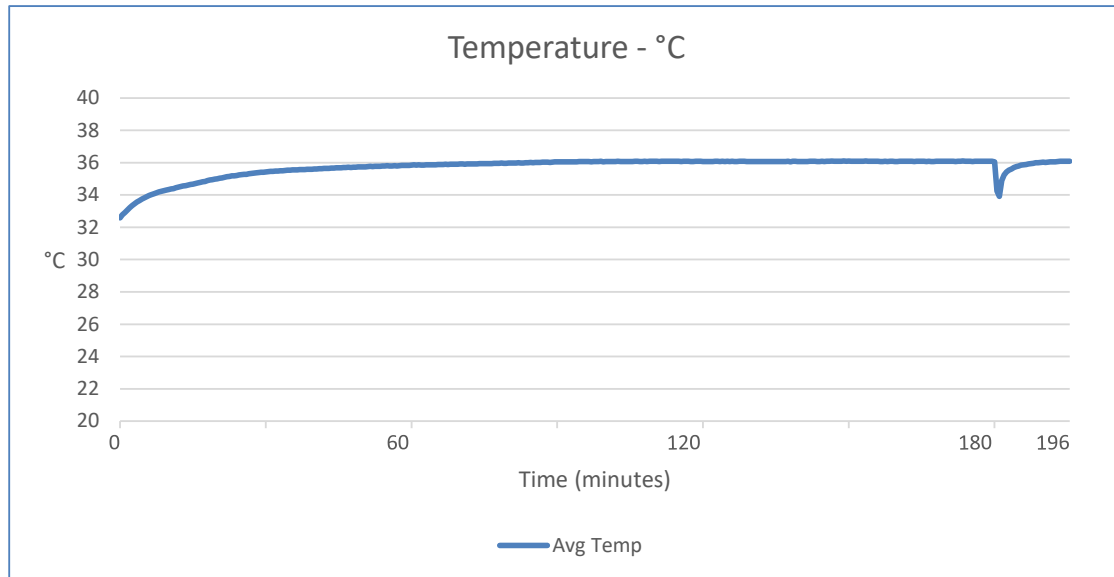
**SETUP NOTES / TEST OBSERVATIONS:**

-test location: center of sample

Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

GRAPHS:



Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

Report Number: ESP042739P.2.R0.Body Analog

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Tested & Reported by:

A handwritten signature in blue ink that reads 'Brent L. Larson'.

Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659-7218

Sample ID: GBpunchedPCM

Size: ~50" x 20" x 5"

Report Number: ESP042739P.2.R0.Body Analog

August 16, 2024

Page 5 of 5

EAR-CONTROLLED DATA

AIR FLOW ANALYSIS OF FOAM MATERIALS

Ghostbed, Inc.
Marc Werner
7143 W. Broward Blvd
Fort Lauderdale, FL 33317

Tested by:
Gavin D. Ray
Reported by:
Brent L. Larson

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AIR FLOW ANALYSIS OF FOAM MATERIALS

INTRODUCTION:

This report presents the results of air flow testing using ASTM D3574-17 Section G as a procedural guide. Testing was conducted on August 14th, 2024.

RESULTS SUMMARY: (values reported in cubic feet per minute - CFM)

GBsolidfoam			
Specimen #1	Specimen #2	Specimen #3	Average
6.57	6.15	6.51	6.41

TEST METHOD:

All samples were conditioned in an atmosphere of 72 ± 4 °F / $50 \pm 5\%$ relative humidity for at least 24 hours prior to testing.

The air flow test stand was conceptually based on ASTM D3574-17 Section G. Testing was initiated by applying a suction rate of ~0.5 inches of water to the specimens. Air flow readings were obtained after a 10 second period of relative steady state.

Specimen size: ~51 mm x 51 mm x 25mm

Tested samples will be retained for 5 days from the date of this report and then discarded unless we receive written authorization requesting otherwise.

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

Reported by:



Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659 – 7218

Tested by:



Gavin D. Ray
Engineering Technician
Sleep System Evaluation

AIR FLOW ANALYSIS OF FOAM MATERIALS

Ghostbed, Inc.
Marc Werner
7143 W. Broward Blvd
Fort Lauderdale, FL 33317

Tested by:
Gavin D. Ray
Reported by:
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AIR FLOW ANALYSIS OF FOAM MATERIALS

INTRODUCTION:

This report presents the results of air flow testing using ASTM D3574-17 Section G as a procedural guide. Testing was conducted on August 14th, 2024.

RESULTS SUMMARY: (values reported in cubic feet per minute - CFM)

GBpunchedPCM			
Specimen #1	Specimen #2	Specimen #3	Average
6.01	6.27	5.50	5.93

TEST METHOD:

All samples were conditioned in an atmosphere of 72 ± 4 °F / $50 \pm 5\%$ relative humidity for at least 24 hours prior to testing.

The air flow test stand was conceptually based on ASTM D3574-17 Section G. Testing was initiated by applying a suction rate of ~0.5 inches of water to the specimens. Air flow readings were obtained after a 10 second period of relative steady state.

Specimen size: ~51 mm x 51 mm x 25mm

Tested samples will be retained for 5 days from the date of this report and then discarded unless we receive written authorization requesting otherwise.

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

Reported by:



Brent L. Larson
Manager
Sleep System Evaluation
Phone: (651) 659 – 7218

Tested by:



Gavin D. Ray
Engineering Technician
Sleep System Evaluation