

**CLIENT:** **ICYNENE INC.**  
6747 Campobello Rd.  
Mississauga, ON  
Canada L5N 2L7

**Test Report No: T849-49**

**Date: June 30<sup>th</sup>, 2016**

**SAMPLE ID:** Various types of fiberglass insulation.

**SAMPLING DETAIL:** Test samples were submitted directly to QAI Toronto by client.

**DATE OF RECEIPT:** The samples were received at QAI Laboratories on May 20<sup>th</sup>, 2016 and May 24<sup>th</sup>, 2016 in good condition.

**TESTING PERIOD:** May 31<sup>st</sup> to June 6<sup>th</sup>, 2016.

**AUTHORIZATION:** QAI Proposal Number 16NT051602 dated May 16<sup>th</sup>, 2016, signed by John Evans May 16<sup>th</sup>, 2016.

**TEST(S) REQUESTED:** **ASTM C518** – *Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.*  
**ASTM C167-15** – *Standard Test Method for Thickness and Density of Blanket or Batt Thermal Insulations.*

**TEST RESULTS:** The various insulations were tested to ASTM C518 and ASTM C167 with a summary of results available on Page 2 of this report.

**Prepared By**

Robert Giona  
Senior Technologist

**Signed for and on behalf of  
QAI Laboratories Ltd.**

Matt Lansdowne  
Business Manager



## SUMMARY OF TEST RESULTS

Sample	Measured Thickness (in)	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lbs/ft <sup>3</sup> )	Thermal Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> ·F/BTU)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
Company A R-38 Batt	9.8	0.544	0.664	8.00	25.61	3.202
Company B R-21 Roll	5.9	0.382	0.779	5.50	19.24	3.499
Company B R-19 Wall Roll	6.4	0.280	0.523	5.50	16.56	3.010
Company A R-30 Batt	9.8	0.413	0.505	8.00	24.86	3.107
Company B R-15 Roll	4.0	0.360	1.073	3.50	13.95	3.985
Company B R-30 Attic Batt	9.7	0.428	0.528	8.00	25.73	3.217
Company B R-19 Wall Batt	6.3	0.218	0.416	5.50	16.51	3.013



**1.0 THICKNESS AND DENSITY AS PER ASTM C167-15**

**Test Procedure**

Various types, sizes, and manufactured products of insulation were used for testing. Each type of insulation has their own requirements for selecting specimens for testing which are listed below:

Bundles – All bundles of insulation contained either seven (7) or nine (9) batts per bundle. Seven-batt bundles were subjected to the three-batt sample selection where the center batt and the second batt in from each end were chosen. Nine-batt bundles were subjected to five-batt sample selection where the center batt, second-from-center batts, and the first two batts from one end were chosen.

Rolls – Five batts, each measuring 48” in length were cut from the roll. One batt from the center of the roll, two batts from the ends of the roll, and two batts from the quarter points along the length were cut from the roll for testing.

After selection and cutting of the samples, they were ready to be subjected to the expansion procedure. Each sample, in turn, was grasped along the long edge and raised 18 inches above a hard, flat surface. The sample was released and allowed to strike the surface. The sample was raised to 18 inches again and allowed to strike the surface for a second time. The same sample was then grasped along the other edge, dropped twice as noted, and then allowed to rest for a minimum of 5 minutes before thickness measurements were taken.

After a minimum 5 minute rest period, the samples were placed face down onto a hard, flat surface. A pin gauge with sliding depth disk was inserted into each specimen, either in 5 locations for 24in x 48in or 15in x 48in samples, or 10 locations for roll samples as required by the standard.

Based on the measurements taken, mass per unit area and densities were calculated.

**Test Requirements**

As this is a client request for Research and Development purposes, no test requirements were given.

**Test Results**

Sample:	Company A - R38 Kraft Paper Batt																			
	Thickness (mm)										Mass	Specimen Dimensions (inches)		Specimen Area		Volume	Mass per Unit Area	Density		
Specimen	1	2	3	4	5	6	7	8	9	10	Average (inches)	(lbs)	Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )	(in <sup>3</sup> )	(lbs/ft <sup>2</sup> )	(lb/ft <sup>3</sup> )	
1	243	237	257	260	260						251	9.9	2.8	16	48	768	5.33	7601.39	0.525000	0.637
2	261	227	257	266	253						253	10.0	2.8	16	48	768	5.33	7643.72	0.525000	0.633
3	257	237	267	267	266						259	10.2	3.0	16	48	768	5.33	7825.13	0.562500	0.662
END	230	229	242	238	240						236	9.3	3.0	16	48	768	5.33	7129.70	0.562500	0.727
Average	248	233	256	258	255						250	9.8	2.9	16	48	768	5.33	7549.98	0.543750	0.664
Date Code	11/07/13																			



**Test Results continued**

Sample:	Company B - 1/2 Roll - R21																			
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	150	148	146	136	155	135	159	153	158	150	149	5.9	3.8	15	93	1395	9.69	8183.27	0.392258	0.802
2	150	159	146	153	148	140	156	164	164	161	154	6.1	4.0	15	93	1395	9.69	8463.37	0.412903	0.817
3	151	149	149	154	160	136	151	150	150	147	150	5.9	3.8	15	93	1395	9.69	8221.71	0.392258	0.799
END	129	158	149	152	136	132	137	143	160	156	145	5.7	3.2	15	93	1395	9.69	7974.57	0.330323	0.693
Average	145	154	148	149	150	136	151	153	158	154	150	5.9	3.7	15	93	1395	9.69	8210.73	0.381935	0.779
Date Code	10/29/15																			

Sample:	Company B - 2x6 Wall Roll - R19																			
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	166	155	146	145	155	156	148	161	158	137	153	6.0	1.4	15	48	720	5.00	4328.50	0.280000	0.559
2	159	143	143	158	162	171	180	190	193	176	168	6.6	1.4	15	48	720	5.00	4748.03	0.280000	0.510
3	176	174	186	185	184	170	183	175	172	162	177	7.0	1.4	15	48	720	5.00	5008.82	0.280000	0.483
4	150	152	151	144	163	180	168	172	169	155	160	6.3	1.4	15	48	720	5.00	4546.77	0.280000	0.532
5	162	157	166	168	163	157	155	167	150	146	159	6.3	1.4	15	48	720	5.00	4509.92	0.280000	0.536
Average	163	156	158	160	165	167	167	173	168	155	163	6.4	1.4	15	48	720	5.00	4628.41	0.280000	0.523
Date Code	01 13 16 05																			

Sample:	Company A - R30 Kraft Paper Batts																			
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	245	247	246	251	246						247	9.7	2.2	16	48	768	5.33	7468.35	0.412500	0.509
2	255	247	252	245	241						248	9.8	2.2	16	48	768	5.33	7498.58	0.412500	0.507
3	262	256	265	245	245						255	10.0	2.2	16	48	768	5.33	7698.14	0.412500	0.494
4	247	246	222	249	232						239	9.4	2.2	16	48	768	5.33	7232.50	0.412500	0.526
5	252	258	251	254	260						255	10.0	2.2	16	48	768	5.33	7710.24	0.412500	0.493
Average	252	251	247	249	245						249	9.8	2.2	16	48	768	5.33	7521.56	0.412500	0.505
Date Code	4/19/16																			



**Test Results continued**

Sample:		Company B - R-15 - Wall Roll																		
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	99	95	91	92	88						93	3.7	1.2	15	48	720	5.00	2636.22	0.240000	0.787
2	107	109	105	98	106						105	4.1	1.8	15	48	720	5.00	2976.38	0.360000	1.045
3	110	105	105	106	100						105	4.1	2.0	15	48	720	5.00	2982.05	0.400000	1.159
4	109	110	106	108	101						107	4.2	2.0	15	48	720	5.00	3027.40	0.400000	1.142
5	100	98	105	102	102						101	4.0	2.0	15	48	720	5.00	2874.33	0.400000	1.202
Average	105	103	102	101	99						102	4.0	1.8	15	48	720	5.00	2899.28	0.360000	1.073
Date Code	04 08 16 05																			

Sample:		Company B - R-30 Attic Batt																		
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	238	238	253	240	252						244	9.6	2.2	16	48	768	5.33	7383.69	0.412500	0.515
2	245	255	243	235	247						245	9.6	2.2	16	48	768	5.33	7407.87	0.412500	0.513
3	260	252	268	225	225						246	9.7	2.3	16	48	768	5.33	7438.11	0.431250	0.534
4	246	254	255	258	248						252	9.9	2.4	16	48	768	5.33	7625.57	0.450000	0.544
5	245	250	234	252	250						246	9.7	2.3	16	48	768	5.33	7444.16	0.431250	0.534
Average	247	250	251	242	244						247	9.7	2.3	16	48	768	5.33	7459.88	0.427500	0.528
Date Code	12 11 15 03																			

Sample:		Company B - R-19 Wall Batt																		
Specimen	Thickness (mm)										Average (inches)	Mass (lbs)	Specimen Dimensions (inches)		Specimen Area		Volume (in <sup>3</sup> )	Mass per Unit Area (lbs/ft <sup>2</sup> )	Density (lb/ft <sup>3</sup> )	
	1	2	3	4	5	6	7	8	9	10			Width	Length	(inch <sup>2</sup> )	(ft <sup>2</sup> )				
1	145	149	160	146	161	164	180	178	160	160	160	6.3	2.2	16	94	1504	10.44	9491.78	0.210638	0.401
2	189	187	157	150	175	150	175	179	176	156	169	6.7	2.6	16	94	1504	10.44	10030.61	0.248936	0.448
3	173	165	166	165	164	144	135	142	136	134	152	6.0	2.2	16	94	1504	10.44	9024.00	0.210638	0.421
4	155	159	147	174	160	155	146	152	152	134	153	6.0	2.2	16	94	1504	10.44	9083.21	0.210638	0.419
5	162	165	149	170	172	175	168	159	161	170	165	6.5	2.2	16	94	1504	10.44	9776.00	0.210638	0.389
Average	165	165	156	161	166	158	161	162	157	151	160	6.3	2.3	16	94	1504	10.44	9481.12	0.218298	0.416
Date Code	11 15 16 0																			

**Conclusion**

As this is a client request for Research and Development purposes, conclusions are to be made by the client.



**2.0 THERMAL RESISTANCE TESTING AS PER ASTM C518-15**

**Test Procedure**

Three specimens from each of the sampled product were subjected to thermal testing. Where applicable, 24in x 24in specimens were cut from the sample material. Where 24in wide pieces were not practical, a 15in x 15in piece was cut and additional insulation was placed surrounding the specimen. Specimens were cut from the left, center and right sides of insulation batts and were allowed to condition for a minimum of 40 hours at 23°C ± 2°C and 50% ± 5% relative humidity prior to testing.

**Test Requirements**

As specified by the client, each sample was to be tested at the “end-use” thickness. For example, insulation batt manufactured for 2x4 wall construction was tested at 3.5 inches. Insulation batts that measured over 8 inches in thickness were compressed and tested at 8 inches as this is the maximum height allowed by the heat flow meter.

**Test Results**

Company A - R38 Kraft Paper Batts	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Left	8.00	27.72	0.2886	3.465
Center	8.00	25.29	0.3163	3.161	
Right	8.00	23.83	0.3357	2.979	
<b>Average</b>	<b>8.00</b>	<b>25.61</b>	<b>0.3135</b>	<b>3.202</b>	

  

Company B - 1/2 Roll - R21	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Left	5.50	20.23	0.2719	3.678
Center	5.50	18.72	0.2938	3.404	
Right	5.50	18.77	0.2930	3.414	
<b>Average</b>	<b>5.50</b>	<b>19.24</b>	<b>0.2862</b>	<b>3.499</b>	



**Test Results continued**

	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Company B - 2x6 Wall Roll - R19	Left	5.50	16.60	0.3313
	Center	5.50	16.31	0.3372	2.966
	Right	5.50	16.76	0.3282	3.047
	<b>Average</b>	<b>5.50</b>	<b>16.56</b>	<b>0.3322</b>	<b>3.010</b>
	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Company A - R30 Kraft Paper Batts	Left	8.00	24.91	0.3211
	Center	8.00	25.02	0.3197	3.128
	Right	8.00	24.64	0.3246	3.080
	<b>Average</b>	<b>8.00</b>	<b>24.86</b>	<b>0.3218</b>	<b>3.107</b>
	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Company B - R-15 - Wall Roll	Left	3.50	13.72	0.2550
	Center	3.50	14.12	0.2480	4.033
	Right	3.50	14.01	0.2499	4.002
	<b>Average</b>	<b>3.50</b>	<b>13.95</b>	<b>0.2510</b>	<b>3.985</b>
	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Company B - R-30 Attic Batt	Left	8.00	25.93	0.3085
	Center	8.00	25.20	0.3174	3.150
	Right	8.00	26.07	0.3069	3.258
	<b>Average</b>	<b>8.00</b>	<b>25.73</b>	<b>0.3109</b>	<b>3.217</b>

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**Test Results continued**

	Thermal Testing Results				
	Specimen Location from Batt	Test Thickness (inches)	Thermal Resistance (hr·ft <sup>2</sup> F/BTU)	Thermal Conductivity (BTU·in/hr·ft <sup>2</sup> ·°F)	Thermal Resistivity (hr·ft <sup>2</sup> ·°F/BTU·in)
	Company B - R-19 Wall Batt	Left	5.50	16.47	0.3339
	Center	5.50	16.31	0.3372	2.996
	Right	5.50	16.76	0.3282	3.047
	<b>Average</b>	<b>5.50</b>	<b>16.51</b>	<b>0.3331</b>	<b>3.013</b>

**Conclusion**

As this is a client request for Research and Development purposes, conclusions are to be made by the client.

\*\*\*\*End of Report\*\*\*\*