PERFORMANCE TEST REPORT

Rendered to:

VELUX AMERICA, INC.

PRODUCT: SUN TUNNEL Domes
TYPES: Acrylic and Polycarbonate

Report No.: E3490.01-106-31
Report Date: 07/13/15
Test Record Retention Date: 06/18/19
Revision 2: 08/04/15

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PERFORMANCE TEST REPORT

Rendered to:

VELUX AMERICA, INC.
P.O. Box 5001
1418 Evans Pond Road
Greenwood, South Carolina 29648-5001

Report No.:	E3490.01-106-31
Test Start Date:	01/27/15
Test Completion Date:	06/18/15
Report Date:	07/13/15
Test Record Retention Date:	06/18/19
Revision 2:	08/04/15

Product: SUN TUNNEL Domes

Types: Acrylic and Polycarbonate

Project Summary: Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by VELUX America, Inc. to evaluate the weatherability, light transmittance, charpy impact resistance, and tensile properties of their SUN TUNNEL Acrylic and Polycarbonate Domes per the requirements of AAMA/WDMA/CSA 101/I.S.2/A440-NAFS 2011, Section 10.2.5. Average test results are listed in the tables below.

AAMA/WDMA/CSA 101/I.S.2/A440- NAFS 2011 section 10.2.5			
ASTM Method	**Specimen Type**	**Requirement**	**Test Result**
D 1003 Light Transmittance	Acrylic	**maximum 10 % transmittance loss**	**0.22 %**
	Polycarbonate		**18.01 %**
D 638 Tensile Properties	Acrylic	**maximum 10 % decrease in yield tensile strength**	**3.2 %**
	Polycarbonate		**-0.9 %**
D 6110 Charpy Impact Resistance	Acrylic	**maximum 25 % reduction in impact strength**	**-17.27 %**
	Polycarbonate		**-2.05 %**

Product Descriptions: Twenty (20) low-profile SUN TUNNEL Domes were shipped directly to Intertek-ATI on January 14, 2015. Ten (10) Acrylic and ten (10) Polycarbonate domes were received. All test specimens were machined by Intertek-ATI staff.

Test Methods: The test specimens were evaluated in accordance with the following methods.

ASTM G 155-13, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*

ASTM D 1003-13, *Standard Test Method for Haze and Luminance Transmittance of Transparent Plastics*

ASTM D 6110-10, *Standard Test Method for Determining the Charpy Impact Resistance of Notched Specimens of Plastics*

ASTM 638-10, *Standard Test Method for Tensile Properties of Plastics*

Test Procedures and Results: Test procedures and results are reported below.

ASTM G 155 - Accelerated Weathering

Test specimens were mounted to racks and placed in an Atlas Ci5000 WeatherOmeter with the designated sun side towards the light source. The accelerated weathering was performed at an irradiance level of 0.35 W/m^2 at 340 nm wavelength, and the black panel thermometer was set to 63ºC. Relative humidity was maintained at 50%. The specimens were exposed for 3000 hours to a repeating cycle that consisted of 102 minutes of light at the 63ºC black panel temperature then 18 minutes of light and water spray in which the air temperature was not controlled.

Test Procedures and Results: (Continued)

ASTM D 1003 - Luminous Transmittance

Eight specimens of each product were machined to nominally 2 in. squares. Each set of specimens was placed in a Gretag Macbeth Color i5 Spectrophotometer (ICN: 004725) for measurement with the sun side surface (the side exposed to the accelerated weathering light source) facing the light source. Illuminant C with a 2º observer was utilized in accordance with ASTM D 1003. Readings on cleaned specimens were taken before and after 3000 hours of weathering. AAMA/WDMA/CSA 101/I.S.2/A440- NAFS 2011, Section 10.2.5.2 specifies that the plastic glazing material shall not change more than 10% of its original light transmittance value when tested in accordance with ASTM D1003-13.

Acrylic			
Specimen No.	**Control % - A**	**Weathered % - B**	**Change (A-B)**
1	87.20	87.56	-0.36
2	88.09	88.22	-0.13
3	87.87	85.65	+2.22
4	88.31	87.67	+0.64
5	88.68	88.95	-0.27
6	88.41	88.27	+0.14
7	88.67	88.35	-0.32
8	86.98	87.82	+0.84
Mean	**88.03**	**87.81**	**-0.22**

Polycarbonate			
Specimen No.	**Control %**	**Weathered %**	**Change**
1	83.69	70.30	+13.39
2	82.33	56.06	+26.27
3	82.98	54.48	+28.50
4	83.03	73.14	+9.89
5	84.23	65.09	+19.14
6	83.54	68.27	+15.27
7	83.35	60.02	+23.33
8	83.08	74.77	+8.31
Mean	**83.28**	**65.27**	**+18.01**

Test Procedure and Results: (Continued)

ASTM D 6110 - Method B, Charpy Impact Resistance

The pre- and post-weathered unnotched specimens were cut to 5" long by 1/2" wide by the thickness of the material. Windage corrections were determined for use in the final results. A SATEC BLI Impact Tester (ICN: Y002778) equipped with a 16 ft·lb Charpy pendulum was utilized to determine the breaking energy for the Polycarbonate, and the 8 ft·lb Charpy pendulum was utilized to determine the breaking energy for the Acrylic specimens. The pendulum, with a 13" radius to the striker had a 24" drop height from 60º above horizontal. Each specimen was supported horizontally across a span of 4" while the ends were against two rigid anvils. Test specimens were tested with the exposed surface in tension. A single swing of the pendulum struck each specimen on the surface attempting to break the test specimen. AAMA/WDMA/CSA 101/I.S.2/A440- NAFS 2011, Section 10.2.5.4.2 specifies that "the average of the [five] specimens shall not result in more than 25% reduction in impact strength (as measured by the unnotched charpy test) as a result of the weathering."

Acrylic Control Specimens

Specimen No.	Width at Notch (in)	Depth at Notch (in)	Impact Reading (ft·lb)	Impact Resistance (ft·lb/in)
1	0.1505	0.5010	0.635	16.044
2	0.1475	0.5035	0.760	19.770
3	0.1525	0.5000	0.765	19.253
4	0.1475	0.5020	0.955	25.073
5	0.1585	0.5030	0.875	21.308
6	0.1640	0.5050	0.815	19.126
7	0.1450	0.5015	0.640	16.791
8	0.1465	0.5010	0.695	18.125
9	0.1535	0.5020	0.955	24.093
10	0.1435	0.5015	0.695	18.504
Average	**0.1510**	**0.5020**	**0.779**	**19.809**

Test Procedure and Results: (Continued)

ASTM D 6110 - Method B, Charpy Impact Resistance
(Continued)

Acrylic Weathered Specimens

Specimen No.	Width at Notch (in)	Depth at Notch (in)	Impact Reading (ft·lb)	Impact Resistance (ft·lb/in)
1	0.162	0.502	0.885	21.161
2	0.164	0.502	0.670	15.627
3	0.166	0.503	0.775	17.929
4	0.151	0.503	0.335	8.019
5	0.158	0.502	0.745	18.075
6	0.152	0.503	0.345	8.231
7	0.147	0.502	0.625	16.208
8	0.153	0.504	0.815	20.569
9	0.149	0.504	0.835	21.590
10	0.149	0.500	0.645	16.475
Average	**0.155**	**0.502**	**0.667**	**16.389**

Note: *These results represent a 17.27% reduction in impact strength after weathering.*

Polycarbonate Control Specimens

Specimen No.	Width at Notch (in)	Depth at Notch (in)	Impact Reading (ft·lb)	Impact Resistance (ft·lb/in)
1	0.144	0.505	0.610	32.272
2	0.141	0.500	0.600	32.390
3	0.145	0.501	0.406	20.849
4	0.131	0.501	0.375	21.183
5	0.141	0.502	0.540	29.084
6	0.146	0.502	0.630	32.927
7	0.138	0.501	0.560	30.772
8	0.133	0.504	0.410	22.893
9	0.134	0.502	0.535	30.309
10	0.147	0.511	0.580	30.080
Average	**0.140**	**0.503**	**0.525**	**28.276**

Test Procedure and Results: (Continued)

ASTM D 6110 - Method B, Charpy Impact Resistance
(Continued)

Polycarbonate Weathered Specimens

Specimen No.	Width at Notch (in)	Depth at Notch (in)	Impact Reading (ft·lb)	Impact Resistance (ft·lb/in)
1	0.140	0.503	0.570	30.996
2	0.130	0.503	0.445	25.777
3	0.144	0.502	0.510	26.891
4	0.144	0.503	0.415	21.587
5	0.141	0.501	0.495	26.610
6	0.147	0.514	0.670	34.969
7	0.139	0.503	0.455	24.592
8	0.139	0.505	0.430	23.151
9	0.134	0.502	0.565	32.205
10	0.135	0.504	0.535	30.179
Average	**0.139**	**0.504**	**0.509**	**27.696**

Note: *These results represent an 2.05% reduction in impact strength after weathering.*

ASTM D 638 - Tensile Tests

Test specimens were cut by Intertek-ATI to the dimensions designated for a Type I specimen. Ten control specimens were tested at room temperature and ten specimens were weathered in accordance with ASTM G 155-13 for 3000 hours then tested. Tensile properties were determined by utilizing an Instron Model 3369 Universal Test Machine (ICN: 005740) operating at a cross head speed of 0.2 in/min. AAMA/WDMA/CSA 101/I.S.2/A440- NAFS 2011, Section 10.2.5.4.3 specifies “that the average of the specimens shall not result in more than 10% decrease in yield tensile strength as a result of weathering."

Test Procedure and Results: (Continued)

ASTM D 638 - Tensile Tests
(Continued)

Acrylic - Control Specimens				
Specimen No.	**Width (in)**	**Thickness (in)**	**Maximum Load (lbf)**	**Tensile Yield Strength (psi)**
1	0.498	0.172	627.9	4,170
2	0.503	0.157	559.4	3,980
3	0.498	0.140	504.6	4,260
4	0.500	0.166	604.9	4,380
5	0.499	0.158	575.2	4,210
6	0.499	0.156	560.9	4,330
7	0.500	0.135	492.2	4,250
8	0.498	0.172	637.6	4,290
9	0.500	0.149	538.4	4,380
10	0.496	0.168	568.7	3,940
		Average	567.0	**4,220**

Acrylic - Weathered Specimens				
Specimen No.	**Width (in)**	**Thickness (in)**	**Maximum Load (lbf)**	**Tensile Yield Strength (psi)**
1	0.498	0.173	522.8	4,440
2	0.500	0.149	563.1	4,190
3	0.500	0.165	633.2	4,310
4	0.501	0.138	523.9	4,480
5	0.498	0.175	652.0	4,420
6	0.499	0.170	647.2	4,270
7	0.500	0.162	607.6	4,380
8	0.498	0.156	554.0	4,470
9	0.497	0.173	650.1	4,500
10	0.499	0.173	609.3	4,120
		Average	596.3	**4,360**

Note: *These results represent a 3.2% increase in tensile yield strength after weathering.*

Test Procedure and Results: (Continued)

ASTM D 638 - Tensile Tests
(Continued)

Polycarbonate - Control Specimens				
Specimen No.	**Width (in)**	**Thickness (in)**	**Maximum Load (lbf)**	**Tensile Yield Strength (psi)**
1	0.507	0.139	611.4	5,110
2	0.497	0.142	348.6	4,930
3	0.500	0.140	641.4	5,400
4	0.498	0.143	661.0	5,120
5	0.500	0.142	650.0	5,260
6	0.500	0.136	620.4	5,380
7	0.500	0.133	337.9	5,070
8	0.500	0.132	609.8	5,460
9	0.504	0.132	593.1	5,530
10	0.500	0.130	572.9	5,440
		Average	564.7	**5,270**

Polycarbonate - Weathered Specimens				
Specimen No.	**Width (in)**	**Thickness (in)**	**Maximum Load (lbf)**	**Tensile Yield Strength (psi)**
1	0.499	0.145	665.5	5,100
2	0.500	0.131	417.4	5,310
3	0.499	0.137	633.3	5,050
4	0.498	0.142	648.5	5,280
5	0.500	0.143	652.8	5,310
6	0.500	0.132	603.5	5,390
7	0.498	0.144	657.7	5,250
8	0.498	0.154	644.6	4,900
9	0.500	0.134	478.1	5,350
10	0.502	0.142	599.4	5,270
		Average	600.1	**5,220**

Note: *These results represent a 0.9% decrease in tensile yield strength after weathering.*

Intertek-ATI will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:

Digitally Signed by: James Hammons

J. Rich Hammons
Technician II
Components / Materials Testing

Digitally Signed by: Joseph M. Brickner

Joseph M. Brickner
Laboratory Supervisor
Components / Materials Testing

JRH:jmb/kf

Attachments (pages) This report is complete only when all attachments listed are included.
Appendix A - Photographs (7)
Appendix B - Datasheets (16)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	07/13/15	N/A	Original report issue
1	07/22/15	Appendix B	Tensile Datasheets corrected.
2	07/24/15	1, 7, 8	Summary Table corrected. % of tensile yield strength corrected.
2	07/30/15	3, 4, 6	Test Procedures corrected. Results Table corrected.
2	08/04/15	1, 3, 4	Summary Table header corrected, Test Procedures corrected, Results Table corrected

APPENDIX A

Photographs

Photo No. 1
Acrylic Dome Represented for Skylight Specimens

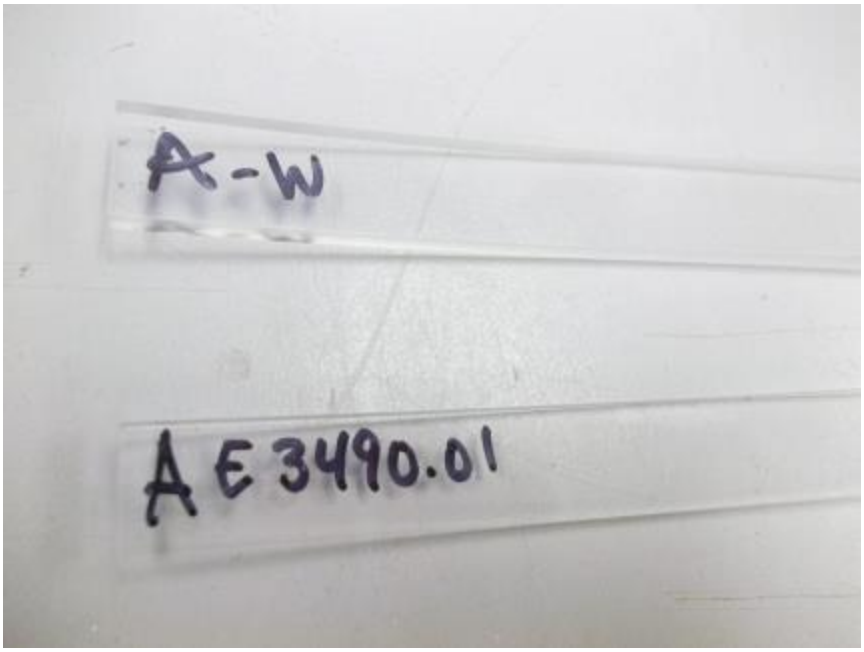


Photo No. 2
Arcylic Specimens Weathered (Top) and Control (Bottom)

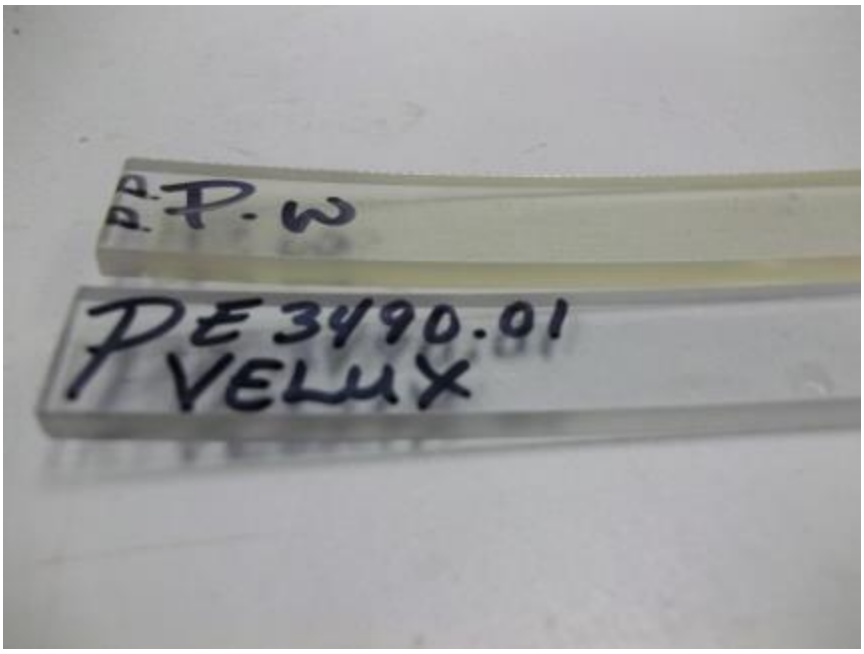


Photo No. 3
Polycarbonate Specimens Weathered (Top) and Control (Bottom)

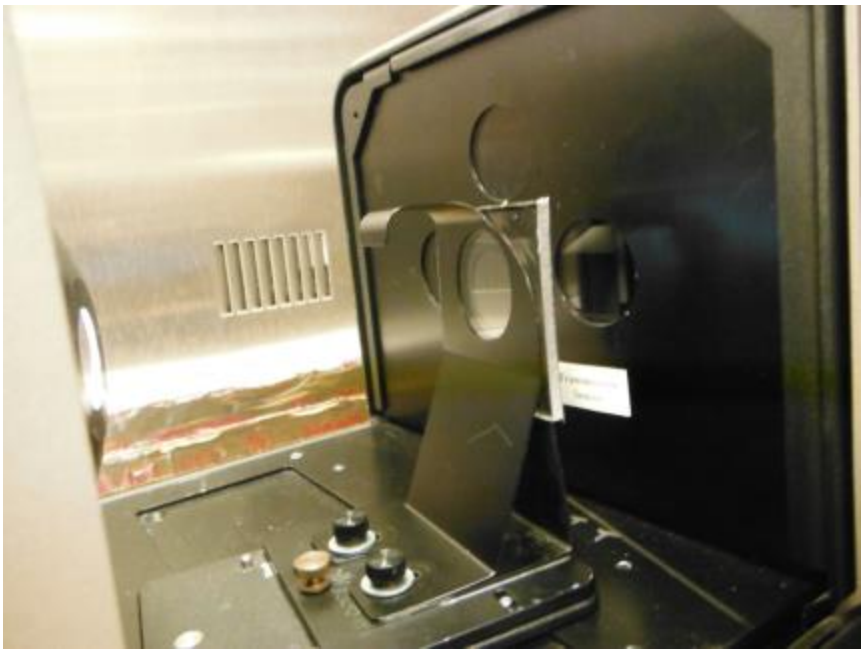


Photo No. 4
Luminance Transmittance Evaluation on Test Specimen

Photo No. 5
Acrylic Control Tensile Samples Result

Photo No. 6
Acrylic Weathered Tensile Result

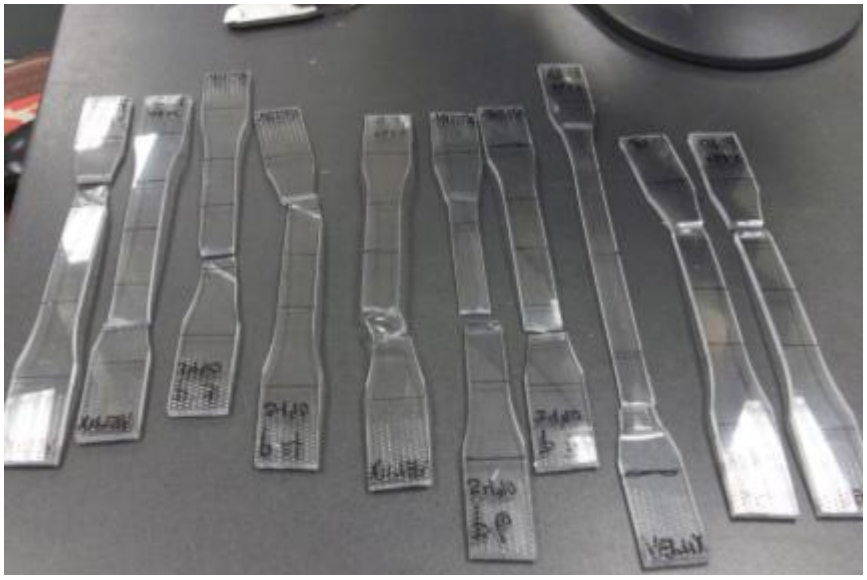


Photo No. 7
Polycarbonate Control Tensile Result

Photo No. 8
Polycarbonate Weathered Tensile Result

Photo No. 9
Charpy Specimen Loaded for Testing

Photo No. 10
Typical Result for Acrylic Control Charpy Impact Specimens

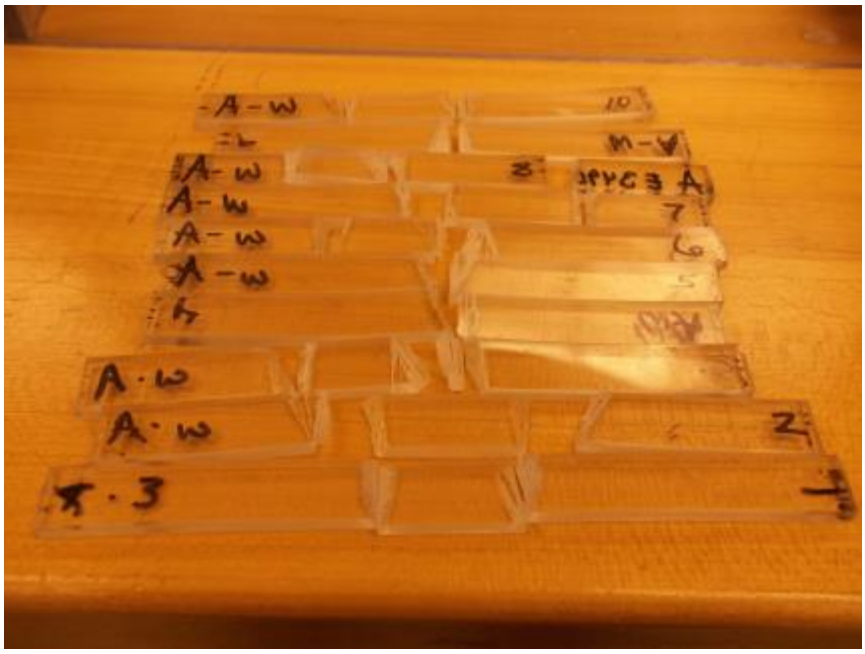


Photo No. 11
Charpy Impact Results for Weathered Acrylic Specimens

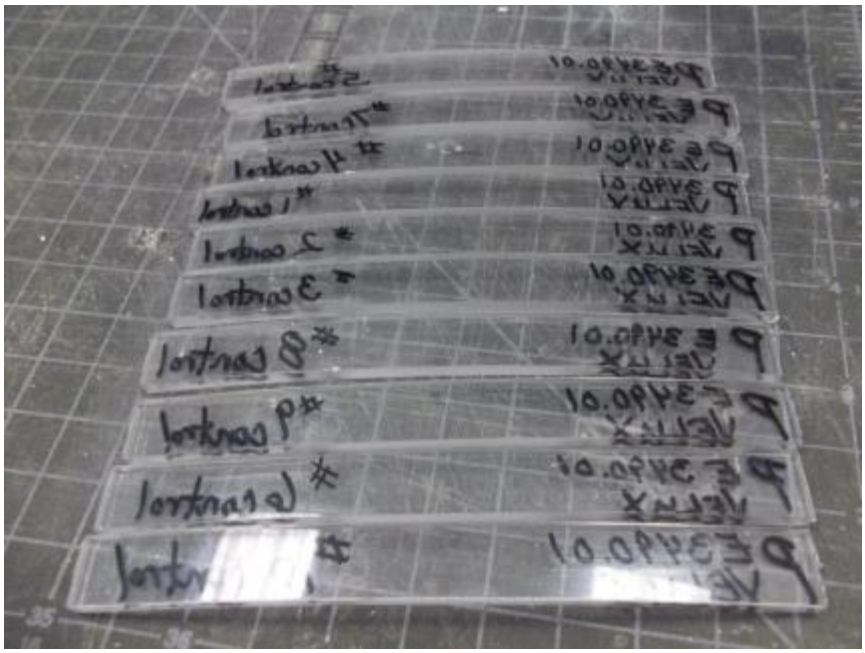


Photo No. 12
Charpy Impact Results for Polycarbonate Control Specimens

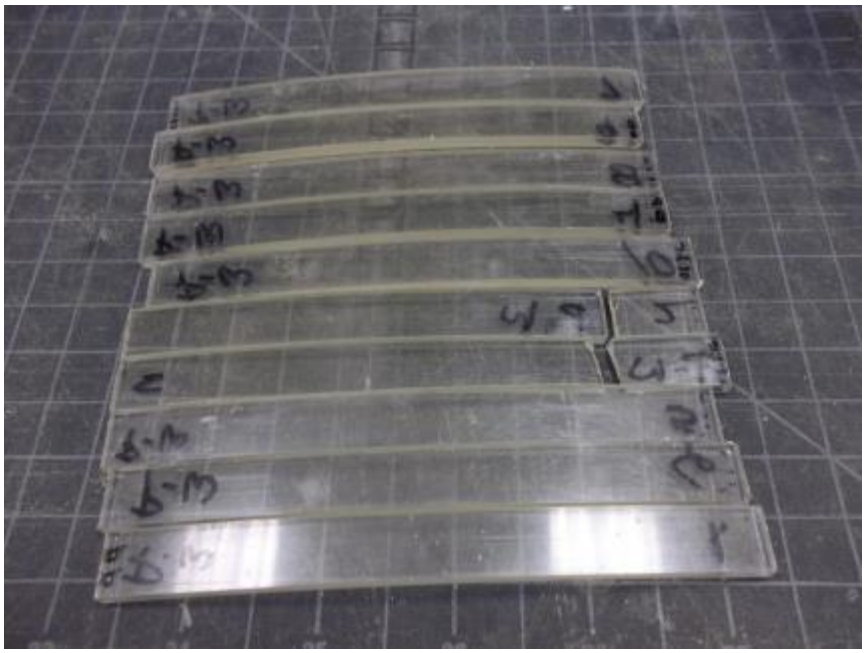


Photo No. 13
Charpy Impact Results for Polycarbonate Weather Specimens

APPENDIX B

Datasheets

ASTM D6110-06 - Charpy Impact

Client: Velux America, Inc.
ATI #: E3490.01-106-31
Equipment Name and S/N: Satec BLI Series Impact Testing Machine, ATI S/N: Y002778
Sample Description: **Acrylic Dome - control samples**

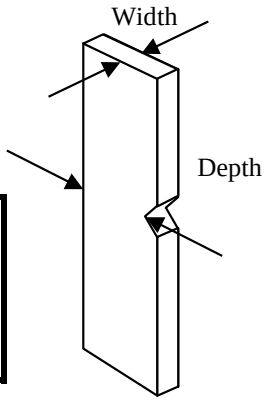
Sample Measurement Data

70	Conditioning Temp (ºF) (21.1ºC)		
50	Conditioning Humidity (%RH)		
6-8-15	Conditioning Start Date	6-15-15	Conditioning End Date
JRH	Tech	JRH	Tech

Sample Dimensions at notch (nearest 0.001")

1	0.151	width	0.501	depth	6-15-15	Date
2	0.148	width	0.504	depth	JRH	Tech
3	0.153	width	0.500	depth		
4	0.148	width	0.502	depth		
5	0.159	width	0.503	depth		
6	0.164	width	0.505	depth		
7	0.145	width	0.502	depth		
8	0.147	width	0.501	depth		
9	0.154	width	0.502	depth		
10	0.144	width	0.502	depth		

Note that the sample depth at notch must be from 0.398" to 0.402".



Test Data

Arm Capacity[1]: 8 ft-lbs

Windage Correction:

Initial Swing with Pointer set at 2.0 (Instrument Reading)
Additional swings without resetting pointer (instrument Reading)

Trial 1	Trial 2	Trial 3	Average			
0.035	0.035	0.030	0.033	Initial	6-15-15	Date
0.020	0.020	0.020	0.020	Additional	JRH	Tech

Test Conditions:

70.0	Lab Temp (ºF) (21.1ºC)	6-15-15	Date
52.8	Lab Humidity (%RH)	JRH	Tech

Specimen	Direct Instrument Reading (Initial Impact)
1	0.635
2	0.760
3	0.765
4	0.955
5	0.875
6	0.815
7	0.640
8	0.695
9	0.955
10	0.695

Legend of Footnotes:

1 - See Section 10.2 for determination of proper Arm Capacity.

Client:	Velux America, Inc.
Job No.:	E3490.01-106-31
Test Date:	6-15-15
Material:	Acrylic Dome - control samples
Weight Set Factor:	4

LEGEND	
Variable/Constant	**Definition**
β_M=	Maximum angle for one free swing - **calculated (degrees)**
β=	Angle traveled by pendulum for tested specimen - **calculated (degrees)**
h_M=	Maximum height (center of gravity) at start - **constant (2.000 ft)**
L=	Length of arm (fulcrum to center of gravity) - **constant (1.0833 ft)**
E_M=	Full-scale energy reading - **constant (2.00 ft-lb)** (Note that Full-scale energy reading can be increased from 2 ft-lb to 4, 8, or 16 ft-lbs by adding two 0.5 lb, two 1.5 lb, or two 3.5 lb weight sets to pendulum arm)
E_A=	Scale A (Dial) energy reading - first free swing - **variable (approx. 0.049 ft-lb)**
E_B=	Scale B (Dial) energy reading - after three swings - **variable (approx. 0.024 ft-lb)**
E_S=	Scale C (Dial) specimen break energy reading - **variable (_____ ft-lb)**
E_{TC}=	Total correction energy for **E_S - calculated (_____ft-lb)**
t=	Width (thickness) of specimen at notch - **variable (_____in.)**
I_S=	Impact Resistance for specimen - **calculated (_____ft-lb/in)**

Formulas	
#1	$\beta_M = \cos^{-1}\{1-[(h_M/L)(1-E_A/E_M)]\}$
#2	$\beta = \cos^{-1}\{1-[(h_M/L)(1-E_S/E_M)]\}$
#3	$E_{TC} = [E_A-(E_B/2)](\beta/\beta_M)+(E_B/2)$
#4	$I_s = (E_S-E_{TC})/t$

Constants	
Π=	3.141592653589790
Max Height h_M (feet)=	2.0000
Pendulum Arm Length L (feet)=	1.0833
Full Scale Energy=	8.0000

Specimen No.	**Input Variables**			
	Scale C Energy E_S (ft·lb)	**Scale A Energy E_A (ft·lb)**	**Scale B Energy E_B (ft·lb)**	**Width at Notch t (in.)**
1	0.635	0.033	0.020	0.151
2	0.760	0.033	0.020	0.148
3	0.765	0.033	0.020	0.153
4	0.955	0.033	0.020	0.148
5	0.875	0.033	0.020	0.159
6	0.815	0.033	0.020	0.164
7	0.640	0.033	0.020	0.145
8	0.695	0.033	0.020	0.147
9	0.955	0.033	0.020	0.154
10	0.695	0.033	0.020	0.144
Average	**0.779**	**0.033**	**0.020**	**0.151**
Standard Deviation	**0.119**	**0.000**	**0.000**	**0.006**

Calculated Values					
Specimen No.	**Maximum Angle β_M (degrees)**	**Test Angle β (degrees)**	**Correction Energy E_{TC} (ft·lb)**	**Impact Resistance I_S (ft·lb/in.)**	**J/m**
1	146.984	134.400	0.031	16.044	856.407
2	146.984	132.130	0.031	19.770	1055.289
3	146.984	132.041	0.031	19.253	1027.709
4	146.984	128.742	0.030	25.073	1338.336
5	146.984	130.112	0.031	21.308	1137.396
6	146.984	131.157	0.031	19.126	1020.922
7	146.984	134.308	0.031	16.791	896.275
8	146.984	133.300	0.031	18.125	967.489
9	146.984	128.742	0.030	24.093	1286.024
10	146.984	133.300	0.031	18.504	987.716
Average	**146.984**	**131.823**	**0.031**	**19.809**	**1057.356**
Standard Deviation	**0.000**	**2.100**	**0.000**	**2.923**	**156.030**

ASTM D6110-06 - Charpy Impact

Client: Velux America, Inc.
ATI #: E3490.01-106-31
Equipment Name and S/N: Satec BLI Series Impact Testing Machine, ATI S/N: Y002778
Sample Description: **Acrylic Dome - weathered samples (3000 Hours)**

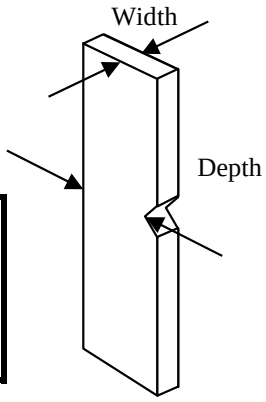
Sample Measurement Data

70	Conditioning Temp (ºF) (21.1ºC)			
50	Conditioning Humidity (%RH)			
6-8-15	Conditioning Start Date	6-15-15	Conditioning End Date	
JRH	Tech	JRH	Tech	

Sample Dimensions at notch (nearest 0.001")

1	0.162	width	0.502	depth	6-15-15	Date
2	0.164	width	0.502	depth	JRH	Tech
3	0.166	width	0.503	depth		
4	0.151	width	0.503	depth		
5	0.158	width	0.502	depth		
6	0.152	width	0.503	depth		
7	0.147	width	0.502	depth		
8	0.153	width	0.504	depth		
9	0.149	width	0.504	depth		
10	0.149	width	0.500	depth		

Note that the sample depth at notch must be from 0.398" to 0.402".



Test Data

Arm Capacity[1]: 8 ft-lbs

Windage Correction:

Initial Swing with Pointer set at 2.0 (Instrument Reading)
Additional swings without resetting pointer (instrument Reading)

Trial 1	Trial 2	Trial 3	Average			
0.030	0.035	0.035	0.033	Initial	6-15-15	Date
0.020	0.020	0.020	0.020	Additional	JRH	Tech

Test Conditions:

70.0	Lab Temp (ºF) (21.1ºC)	6-15-15	Date
52.8	Lab Humidity (%RH)	JRH	Tech

Specimen	Direct Instrument Reading (Initial Impact)
1	0.885
2	0.670
3	0.775
4	0.335
5	0.745
6	0.345
7	0.625
8	0.815
9	0.835
10	0.645

Legend of Footnotes:

1 - See Section 10.2 for determination of proper Arm Capacity.

Client:	Velux America, Inc.
Job No.:	E3490.01-106-31
Test Date:	6-15-15
Material:	Acrylic Dome - weathered samples (3000 Hours)
Weight Set Factor:	4

LEGEND	
Variable/Constant	**Definition**
β_M=	Maximum angle for one free swing - **calculated (degrees)**
β=	Angle traveled by pendulum for tested specimen - **calculated (degrees)**
h_M=	Maximum height (center of gravity) at start - **constant (2.000 ft)**
L=	Length of arm (fulcrum to center of gravity) - **constant (1.0833 ft)**
E_M=	Full-scale energy reading - **constant (2.00 ft-lb)**
	(Note that Full-scale energy reading can be increased from 2 ft-lb to 4, 8, or 16 ft-lbs by adding two 0.5 lb, two 1.5 lb, or two 3.5 lb weight sets to pendulum arm)
E_A=	Scale A (Dial) energy reading - first free swing - **variable (approx. 0.049 ft-lb)**
E_B=	Scale B (Dial) energy reading - after three swings - **variable (approx. 0.024 ft-lb)**
E_S=	Scale C (Dial) specimen break energy reading - **variable (_____ ft-lb)**
E_{TC}=	Total correction energy for **E_S - calculated (_____ft-lb)**
t=	Width (thickness) of specimen at notch - **variable (_____in.)**
I_S=	Impact Resistance for specimen - **calculated (_____ft-lb/in)**

Formulas	
#1	$\beta_M = \cos^{-1}\{1-[(h_M/L)(1-E_A/E_M)]\}$
#2	$\beta = \cos^{-1}\{1-[(h_M/L)(1-E_S/E_M)]\}$
#3	$E_{TC} = [E_A-(E_B/2)](\beta/\beta_M)+(E_B/2)$
#4	$I_s = (E_S-E_{TC})/t$

Constants	
Π=	3.141592653589790
Max Height h_M (feet)=	2.0000
Pendulum Arm Length L (feet)=	1.0833
Full Scale Energy=	8.0000

Specimen No.	**Input Variables**			
	Scale C Energy E_S (ft·lb)	**Scale A Energy E_A (ft·lb)**	**Scale B Energy E_B (ft·lb)**	**Width at Notch t (in.)**
1	0.885	0.033	0.020	0.162
2	0.670	0.033	0.020	0.164
3	0.775	0.033	0.020	0.166
4	0.335	0.033	0.020	0.151
5	0.745	0.033	0.020	0.158
6	0.345	0.033	0.020	0.152
7	0.625	0.033	0.020	0.147
8	0.815	0.033	0.020	0.153
9	0.835	0.033	0.020	0.149
10	0.645	0.033	0.020	0.149
Average	**0.668**	**0.033**	**0.020**	**0.155**
Standard Deviation	**0.192**	**0.000**	**0.000**	**0.007**

Calculated Values					
Specimen No.	**Maximum Angle β_M (degrees)**	**Test Angle β (degrees)**	**Correction Energy E_{TC} (ft·lb)**	**Impact Resistance I_S (ft·lb/in.)**	**J/m**
1	146.984	129.939	0.031	21.161	1129.525
2	146.984	133.756	0.031	15.627	834.153
3	146.984	131.864	0.031	17.929	957.029
4	146.984	140.255	0.032	8.019	428.062
5	146.984	132.398	0.031	18.075	964.831
6	146.984	140.049	0.032	8.231	439.338
7	146.984	134.586	0.031	16.208	865.173
8	146.984	131.157	0.031	20.569	1097.909
9	146.984	130.807	0.031	21.590	1152.438
10	146.984	134.216	0.031	16.475	879.400
Average	**146.984**	**133.903**	**0.031**	**16.389**	**874.786**
Standard Deviation	**0.000**	**3.620**	**0.001**	**4.827**	**257.678**

ASTM D6110-06 - Charpy Impact

Client: Velux America, Inc.
ATI #: E3490.01-106-31
Equipment Name and S/N: Satec BLI Series Impact Testing Machine, ATI S/N: Y002778
Sample Description: **Polycarbonate Dome - Control samples**

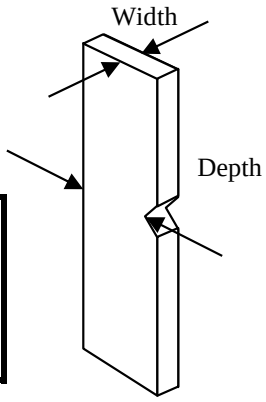
Sample Measurement Data

70	Conditioning Temp (ºF) (21.1ºC)			
50	Conditioning Humidity (%RH)			
6-8-15	Conditioning Start Date	6-15-15	Conditioning End Date	
JRH	Tech	JRH	Tech	

Sample Dimensions at notch (nearest 0.001")

1	0.144	width	0.505	depth	6-15-15	Date
2	0.141	width	0.500	depth	JRH	Tech
3	0.145	width	0.501	depth		
4	0.131	width	0.501	depth		
5	0.141	width	0.502	depth		
6	0.146	width	0.502	depth		
7	0.138	width	0.501	depth		
8	0.133	width	0.504	depth		
9	0.134	width	0.502	depth		
10	0.147	width	0.511	depth		

Note that the sample depth at notch must be from 0.398" to 0.402".



Test Data

Arm Capacity[1]: 16 ft-lbs

Windage Correction:

Initial Swing with Pointer set at 2.0 (Instrument Reading)
Additional swings without resetting pointer (instrument Reading)

Trial 1	Trial 2	Trial 3	Average			
0.030	0.030	0.030	0.030	Initial	6-15-15	Date
0.020	0.020	0.020	0.020	Additional	JRH	Tech

Test Conditions:

70.0	Lab Temp (ºF) (21.1ºC)	6-15-15	Date
52.8	Lab Humidity (%RH)	JRH	Tech

Specimen	Direct Instrument Reading (Initial Impact)
1	0.610
2	0.600
3	0.406
4	0.375
5	0.540
6	0.630
7	0.560
8	0.410
9	0.535
10	0.580

Legend of Footnotes:

1 - See Section 10.2 for determination of proper Arm Capacity.

Client:	Velux America, Inc.
Job No.:	E3490.01-106-31
Test Date:	6-15-15
Material:	Polycarbonate Dome - Control samples
Weight Set Factor:	8

LEGEND	
Variable/Constant	**Definition**
β_M=	Maximum angle for one free swing - **calculated (degrees)**
β=	Angle traveled by pendulum for tested specimen - **calculated (degrees)**
h_M=	Maximum height (center of gravity) at start - **constant (2.000 ft)**
L=	Length of arm (fulcrum to center of gravity) - **constant (1.0833 ft)**
E_M=	Full-scale energy reading - **constant (2.00 ft-lb)** (Note that Full-scale energy reading can be increased from 2 ft-lb to 4, 8, or 16 ft-lbs by adding two 0.5 lb, two 1.5 lb, or two 3.5 lb weight sets to pendulum arm)
E_A=	Scale A (Dial) energy reading - first free swing - **variable (approx. 0.049 ft-lb)**
E_B=	Scale B (Dial) energy reading - after three swings - **variable (approx. 0.024 ft-lb)**
E_S=	Scale C (Dial) specimen break energy reading - **variable (_____ ft-lb)**
E_{TC}=	Total correction energy for **E_S - calculated (_____ft-lb)**
t=	Width (thickness) of specimen at notch - **variable (_____in.)**
I_S=	Impact Resistance for specimen - **calculated (_____ft-lb/in)**

Formulas	
#1	$\beta_M = \cos^{-1}\{1-[(h_M/L)(1-E_A/E_M)]\}$
#2	$\beta = \cos^{-1}\{1-[(h_M/L)(1-E_S/E_M)]\}$
#3	$E_{TC} = [E_A-(E_B/2)](\beta/\beta_M)+(E_B/2)$
#4	$I_s = (E_S-E_{TC})/t$

Constants	
π=	3.141592653589790
Max Height h_M (feet)=	2.0000
Pendulum Arm Length L (feet)=	1.0833
Full Scale Energy=	16.0000

Specimen No.	**Input Variables**			
	Scale C Energy E_S (ft·lb)	**Scale A Energy E_A (ft·lb)**	**Scale B Energy E_B (ft·lb)**	**Width at Notch t (in.)**
1	0.610	0.030	0.020	0.144
2	0.600	0.030	0.020	0.141
3	0.406	0.030	0.020	0.145
4	0.375	0.030	0.020	0.131
5	0.540	0.030	0.020	0.141
6	0.630	0.030	0.020	0.146
7	0.560	0.030	0.020	0.138
8	0.410	0.030	0.020	0.133
9	0.535	0.030	0.020	0.134
10	0.580	0.030	0.020	0.147
Average	**0.525**	**0.030**	**0.020**	**0.140**
Standard Deviation	**0.093**	**0.000**	**0.000**	**0.006**

Calculated Values					
Specimen No.	**Maximum Angle β_M (degrees)**	**Test Angle β (degrees)**	**Correction Energy E_{TC} (ft·lb)**	**Impact Resistance I_S (ft·lb/in.)**	**J/m**
1	147.432	140.880	0.029	32.272	1722.589
2	147.432	140.985	0.029	32.390	1728.911
3	147.432	143.069	0.029	20.849	1112.895
4	147.432	143.412	0.029	21.183	1130.695
5	147.432	141.619	0.029	29.084	1552.444
6	147.432	140.671	0.029	32.927	1757.571
7	147.432	141.407	0.029	30.772	1642.544
8	147.432	143.025	0.029	22.893	1221.984
9	147.432	141.672	0.029	30.309	1617.829
10	147.432	141.195	0.029	30.080	1605.623
Average	**147.432**	**141.794**	**0.029**	**28.276**	**1509.308**
Standard Deviation	**0.000**	**1.004**	**0.000**	**4.752**	**253.653**

ASTM D6110-06 - Charpy Impact

Client: Velux America, Inc.
ATI #: E3490.01-106-31
Equipment Name and S/N: Satec BLI Series Impact Testing Machine, ATI S/N: Y002778
Sample Description: **Polycarbonate Dome - Weathered - Control samples**

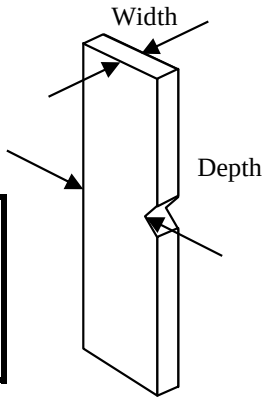
Sample Measurement Data

70	Conditioning Temp (ºF) (21.1ºC)			
50	Conditioning Humidity (%RH)			
6-8-15	Conditioning Start Date	6-15-15	Conditioning End Date	
JRH	Tech	JRH	Tech	

Sample Dimensions at notch (nearest 0.001")

1	0.140	width	0.503	depth	6-15-15	Date
2	0.130	width	0.503	depth	JRH	Tech
3	0.144	width	0.502	depth		
4	0.144	width	0.503	depth		
5	0.141	width	0.501	depth		
6	0.147	width	0.514	depth		
7	0.139	width	0.503	depth		
8	0.139	width	0.505	depth		
9	0.134	width	0.502	depth		
10	0.135	width	0.504	depth		

Note that the sample depth at notch must be from 0.398" to 0.402".



Test Data

Arm Capacity[1]: 16 ft-lbs

Windage Correction:

Initial Swing with Pointer set at 2.0 (Instrument Reading)
Additional swings without resetting pointer (instrument Reading)

Trial 1	Trial 2	Trial 3	Average			
0.025	0.030	0.030	0.028	Initial	6-15-15	Date
0.020	0.020	0.020	0.020	Additional	JRH	Tech

Test Conditions:

70.0	Lab Temp (ºF) (21.1ºC)	6-15-15	Date
52.8	Lab Humidity (%RH)	JRH	Tech

Specimen	Direct Instrument Reading (Initial Impact)
1	0.570
2	0.445
3	0.510
4	0.415
5	0.495
6	0.670
7	0.455
8	0.430
9	0.565
10	0.535

Legend of Footnotes:

1 - See Section 10.2 for determination of proper Arm Capacity.

Client:	Velux America, Inc.
Job No.:	E3490.01-106-31
Test Date:	6-15-15
Material:	Polycarbonate Dome - Weathered - Control samples
Weight Set Factor:	8

LEGEND	
Variable/Constant	**Definition**
β_M=	Maximum angle for one free swing - **calculated (degrees)**
β=	Angle traveled by pendulum for tested specimen - **calculated (degrees)**
h_M=	Maximum height (center of gravity) at start - **constant (2.000 ft)**
L=	Length of arm (fulcrum to center of gravity) - **constant (1.0833 ft)**
E_M=	Full-scale energy reading - **constant (2.00 ft-lb)**
	(Note that Full-scale energy reading can be increased from 2 ft-lb to 4, 8, or 16 ft-lbs by adding two 0.5 lb, two 1.5 lb, or two 3.5 lb weight sets to pendulum arm)
E_A=	Scale A (Dial) energy reading - first free swing - **variable (approx. 0.049 ft-lb)**
E_B=	Scale B (Dial) energy reading - after three swings - **variable (approx. 0.024 ft-lb)**
E_S=	Scale C (Dial) specimen break energy reading - **variable (_____ ft-lb)**
E_{TC}=	Total correction energy for **E_S - calculated (_____ft-lb)**
t=	Width (thickness) of specimen at notch - **variable (_____in.)**
I_S=	Impact Resistance for specimen - **calculated (_____ft-lb/in)**

Formulas	
#1	$\beta_M = \cos^{-1}\{1-[(h_M/L)(1-E_A/E_M)]\}$
#2	$\beta = \cos^{-1}\{1-[(h_M/L)(1-E_S/E_M)]\}$
#3	$E_{TC} = [E_A-(E_B/2)](\beta/\beta_M)+(E_B/2)$
#4	$I_s = (E_S-E_{TC})/t$

Constants	
Π=	3.141592653589790
Max Height h_M (feet)=	2.0000
Pendulum Arm Length L (feet)=	1.0833
Full Scale Energy=	16.0000

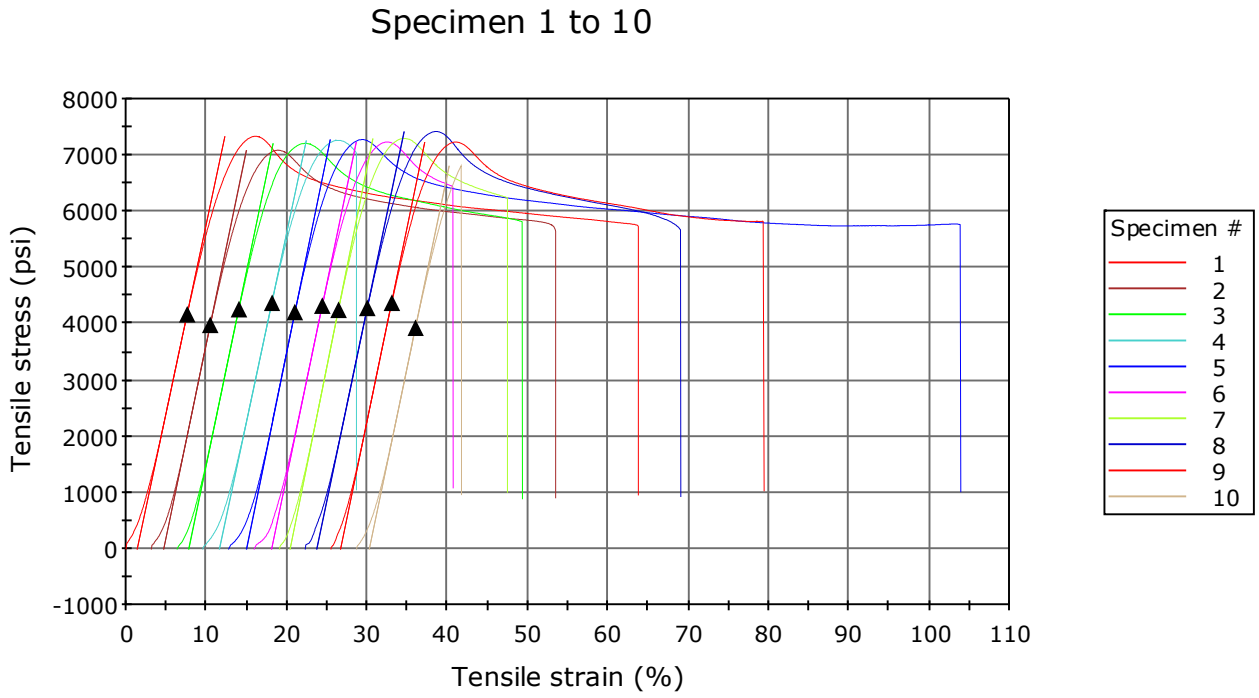
Specimen No.	**Input Variables**			
	Scale C Energy E_S (ft·lb)	**Scale A Energy E_A (ft·lb)**	**Scale B Energy E_B (ft·lb)**	**Width at Notch t (in.)**
1	0.570	0.028	0.020	0.140
2	0.445	0.028	0.020	0.130
3	0.510	0.028	0.020	0.144
4	0.415	0.028	0.020	0.144
5	0.495	0.028	0.020	0.141
6	0.670	0.028	0.020	0.147
7	0.455	0.028	0.020	0.139
8	0.430	0.028	0.020	0.139
9	0.565	0.028	0.020	0.134
10	0.535	0.028	0.020	0.135
Average	**0.509**	**0.028**	**0.020**	**0.139**
Standard Deviation	**0.079**	**0.000**	**0.000**	**0.005**

Calculated Values					
Specimen No.	**Maximum Angle β_M (degrees)**	**Test Angle β (degrees)**	**Correction Energy E_{TC} (ft·lb)**	**Impact Resistance I_S (ft·lb/in.)**	**J/m**
1	147.452	141.301	0.028	30.996	1654.504
2	147.452	142.642	0.028	25.777	1375.919
3	147.452	141.940	0.028	26.891	1435.368
4	147.452	142.970	0.028	21.587	1152.289
5	147.452	142.101	0.028	26.610	1420.366
6	147.452	140.255	0.027	34.969	1866.588
7	147.452	142.533	0.028	24.592	1312.644
8	147.452	142.806	0.028	23.151	1235.737
9	147.452	141.354	0.028	32.205	1719.046
10	147.452	141.672	0.028	30.179	1610.893
Average	**147.452**	**141.958**	**0.028**	**27.696**	**1478.335**
Standard Deviation	**0.000**	**0.839**	**0.000**	**4.261**	**227.449**

Tensile Strength of Plastics (All Types)
Last Updated by: Todd B. 08/13/14
Uses Instron Wedge Grips with appropriate wedges for materials being evaluated (between 0.04 and 0.55 inches thick)
NO EXTENSOMETER

Sample file name: E3490.01-106-31 Acrylic-Velux.is_tens

ATI Job #	E3490.01-106-31
Client Name	Velux America, Inc.
Sample Description	Acrylic
User	Rich H.
Lab Conditions	71.0ºF / 49.0% RH
Load Cell Capacity / ICN	10 kN / 005965
Load Cell Calibration Due Date	09/04/14
Frame / ICN	Instron 3369 / 005740
Frame Calibration Due Date	09/04/14



General Data

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
1	0.498	0.434	0.172	0.150	4.5	0.2	6/17/2015 9:42 AM
2	0.503	0.455	0.157	0.140	4.5	0.2	6/17/2015 10:00 AM
3	0.498	0.456	0.140	0.130	4.5	0.2	6/17/2015 10:12 AM
4	0.500	0.498	0.166	0.166	4.5	0.2	6/17/2015 10:27 AM
5	0.499	0.396	0.158	0.126	4.5	0.2	6/17/2015 10:35 AM
6	0.499	0.489	0.156	0.153	4.5	0.2	6/17/2015 10:51 AM

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
7	0.500	0.483	0.135	0.130	4.5	0.2	6/17/2015 10:57 AM
8	0.498	0.471	0.172	0.162	4.5	0.2	6/17/2015 11:09 AM
9	0.500	0.470	0.149	0.140	4.5	0.2	6/17/2015 11:25 AM
10	0.496	0.496	0.168	0.168	4.5	0.2	6/17/2015 11:41 AM
Mean	0.499	0.465	0.158	0.147	4.5		
Standard Deviation	0.002	0.032	0.013	0.015	0.000		

	End Date
1	6/17/2015 9:49 AM
2	6/17/2015 10:05 AM
3	6/17/2015 10:16 AM
4	6/17/2015 10:29 AM
5	6/17/2015 10:44 AM
6	6/17/2015 10:53 AM
7	6/17/2015 11:00 AM
8	6/17/2015 11:14 AM
9	6/17/2015 11:31 AM
10	6/17/2015 11:43 AM
Mean	
Standard Deviation	

Determined Results

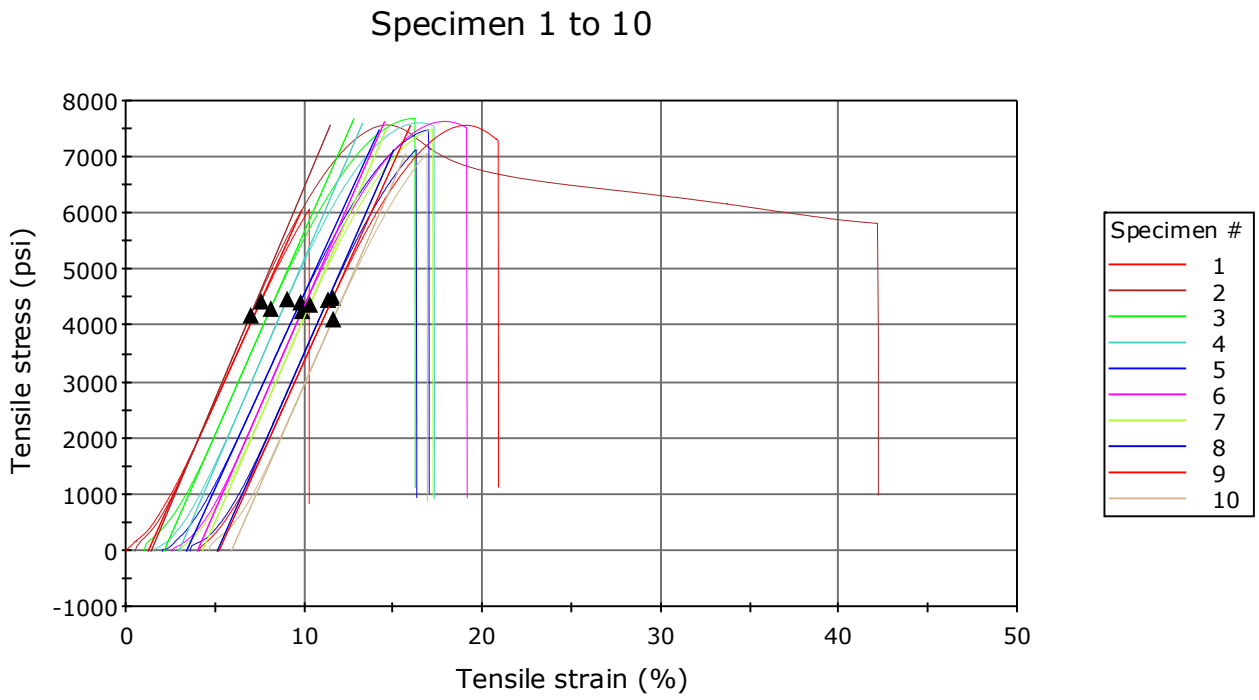
	Maximum Load (lbf)	Tensile Strength (psi)	Tensile Strength at Yield (Offset 0.02 %) (psi)	Final Gauge Length (in)	Nominal Strain (%)
1	627.9	7330	4170	2.668	7.1
2	559.4	7083	3980	2.570	7.0
3	504.6	7204	4260	2.440	7.1
4	604.9	7258	4380	2.105	7.5
5	575.2	7272	4210	3.205	7.4
6	560.9	7228	4330	2.080	7.4
7	492.2	7291	4250	2.242	6.9
8	637.6	7415	4290	2.404	7.2
9	538.4	7227	4380	2.499	6.9
10	568.7	6805	3940	2.033	5.8
Mean	567.0	7211	4220	2.425	7.0
Standard Deviation	47.844	166.539	151.423	0.350	0.485

	Modulus of Elasticity (psi)	Failure Mode
1	67298	Broke within gage marks
2	68906	Broke within gage marks
3	68598	Broke within gage marks
4	67062	Broke within gage marks
5	69671	Broke within gage marks
6	68557	Broke outside gauge marks
7	70902	Broke within gage marks
8	68326	Broke outside gauge marks
9	68909	Broke within gage marks
10	68311	Broke outside gauge marks
Mean	68654	
Standard Deviation	1096.674	

Tensile Strength of Plastics (All Types)
Last Updated by: Todd B. 08/13/14
Uses Instron Wedge Grips with appropriate wedges for materials being evaluated (between 0.04 and 0.55 inches thick)
NO EXTENSOMETER

Sample file name: E3490.01-106-31 Acrylic-Weathered-Velux.is_tens

ATI Job #	E3490.01-106-31
Client Name	Velux America, Inc.
Sample Description	Acrylic-Weathered
User	Rich H.
Lab Conditions	71.0ºF / 49.0% RH
Load Cell Capacity / ICN	10 kN / 005965
Load Cell Calibration Due Date	09/04/14
Frame / ICN	Instron 3369 / 005740
Frame Calibration Due Date	09/04/14



General Data

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
1	0.498	0.498	0.173	0.173	4.5	0.2	6/17/2015 11:56 AM
2	0.500	0.488	0.149	0.146	4.5	0.2	6/17/2015 12:02 PM
3	0.500	0.500	0.165	0.166	4.5	0.2	6/17/2015 12:17 PM
4	0.501	0.499	0.138	0.136	4.5	0.2	6/17/2015 12:26 PM
5	0.498	0.495	0.175	0.172	4.5	0.2	6/17/2015 12:36 PM
6	0.499	0.499	0.170	0.171	4.5	0.2	6/17/2015 12:45 PM

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
7	0.500	0.498	0.162	0.162	4.5	0.2	6/17/2015 12:52 PM
8	0.498	0.498	0.156	0.155	4.5	0.2	6/17/2015 12:59 PM
9	0.497	0.496	0.173	0.172	4.5	0.2	6/17/2015 1:14 PM
10	0.499	0.498	0.173	0.174	4.5	0.2	6/17/2015 1:20 PM
Mean	0.499	0.497	0.163	0.163	4.5		
Standard Deviation	0.001	0.003	0.012	0.013	0.000		

	End Date
1	6/17/2015 11:57 AM
2	6/17/2015 12:06 PM
3	6/17/2015 12:19 PM
4	6/17/2015 12:28 PM
5	6/17/2015 12:37 PM
6	6/17/2015 12:46 PM
7	6/17/2015 12:54 PM
8	6/17/2015 1:00 PM
9	6/17/2015 1:15 PM
10	6/17/2015 1:21 PM
Mean	
Standard Deviation	

Determined Results

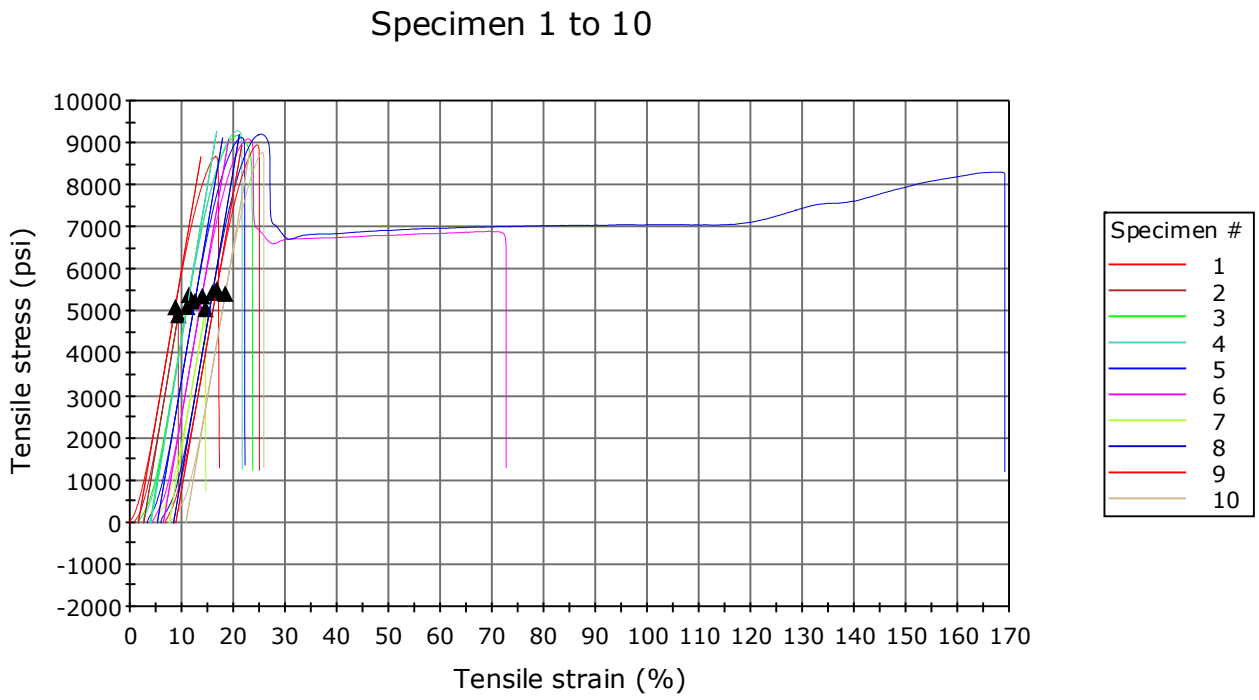
	Maximum Load (lbf)	Tensile Strength (psi)	Tensile stress at Yield (Offset 0.02 %) (psi)	Final Gauge Length (in)	Nominal Strain (%)	Modulus of Elasticity (psi)
1	522.8	6062	4440	2.016	4.6	70357
2	563.1	7566	4190	2.440	6.3	75235
3	633.2	7672	4310	2.057	6.7	72213
4	523.9	7605	4480	2.030	6.6	73882
5	652.0	7481	4420	2.014	6.6	69240
6	647.2	7629	4270	2.070	6.8	72669
7	607.6	7486	4380	2.015	6.3	72642
8	554.0	7131	4470	2.012	5.6	72074
9	650.1	7559	4500	2.076	6.7	70347
10	609.3	7057	4120	2.008	5.4	72180
Mean	596.3	7325	4360	2.074	6.2	72084
Standard Deviation	51.401	489.838	129.895	0.131	0.727	1761.831

	Failure Mode
1	Broke within gage marks
2	Broke within gage marks
3	Broke within gage marks
4	Broke within gage marks
5	Broke within gage marks
6	Broke within gage marks
7	Broke outside gauge marks
8	Broke outside gauge marks
9	Broke outside gauge marks
10	Broke outside gauge marks
Mean	
Standard Deviation	

Tensile Strength of Plastics (All Types)
Last Updated by: Todd B. 08/13/14
Uses Instron Wedge Grips with appropriate wedges for materials being evaluated (between 0.04 and 0.55 inches thick)
NO EXTENSOMETER

Sample file name: E3490.01-106-31 Polycarbonate-Velux.is_tens

ATI Job #	E3490.01-106-31
Client Name	Velux America, Inc.
Sample Description	Polycarbonate
User	Rich H.
Lab Conditions	71.0ºF / 49.0% RH
Load Cell Capacity / ICN	10 kN / 005965
Load Cell Calibration Due Date	09/04/14
Frame / ICN	Instron 3369 / 005740
Frame Calibration Due Date	09/04/14



General Data

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
1	0.507	0.430	0.139	0.116	4.5	0.2	6/17/2015 1:36 PM
2	0.497	0.497	0.142	0.142	4.5	0.2	6/17/2015 1:46 PM
3	0.500	0.453	0.140	0.128	4.5	0.2	6/17/2015 1:51 PM
4	0.498	0.464	0.143	0.122	4.5	0.2	6/17/2015 3:16 PM
5	0.500	0.453	0.142	0.122	4.5	0.2	6/17/2015 3:29 PM
6	0.500	0.420	0.136	0.092	4.5	0.2	6/17/2015 3:39 PM

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
7	0.500	0.498	0.133	0.133	4.5	0.2	6/17/2015 3:51 PM
8	0.500	0.400	0.132	0.086	4.5	0.2	6/17/2015 3:57 PM
9	0.504	0.474	0.132	0.990	4.5	0.2	6/17/2015 4:16 PM
10	0.500	0.488	0.130	0.100	4.5	0.2	6/17/2015 4:22 PM
Mean	0.501	0.458	0.137	0.203	4.5		
Standard Deviation	0.003	0.033	0.005	0.277	0.000		

	End Date
1	6/17/2015 1:38 PM
2	6/17/2015 1:47 PM
3	6/17/2015 1:53 PM
4	6/17/2015 3:18 PM
5	6/17/2015 3:31 PM
6	6/17/2015 3:46 PM
7	6/17/2015 3:52 PM
8	6/17/2015 4:13 PM
9	6/17/2015 4:18 PM
10	6/17/2015 4:24 PM
Mean	
Standard Deviation	

Determined Results

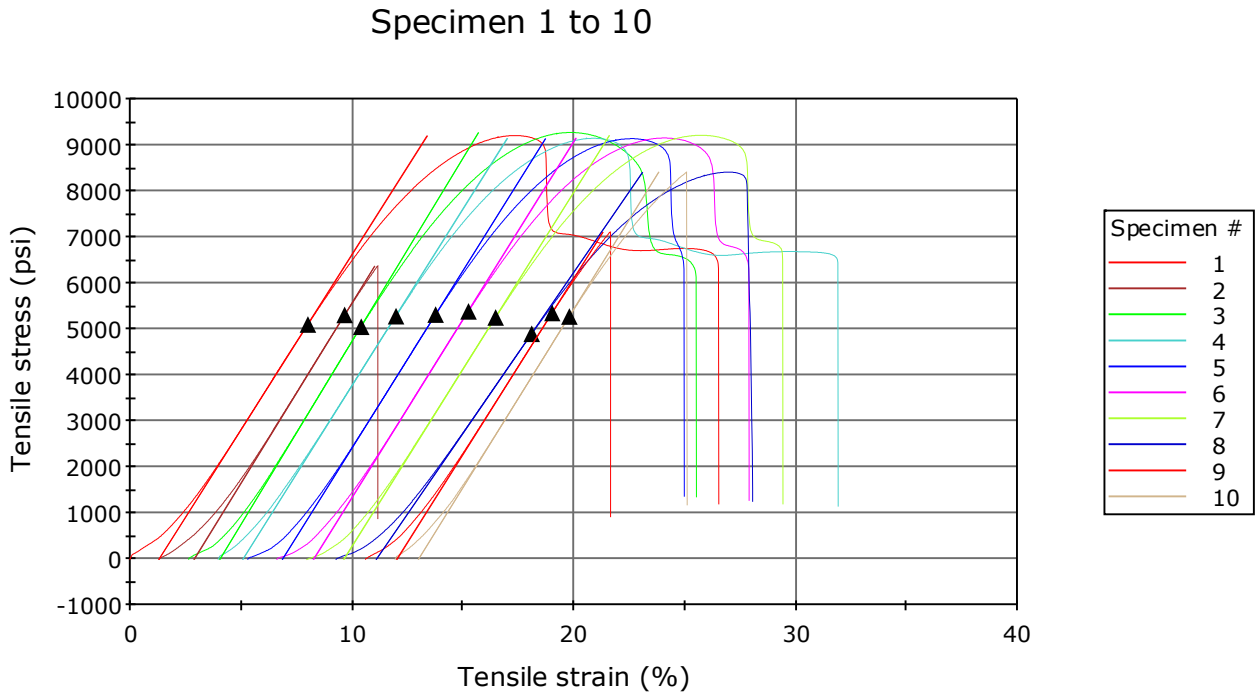
	Maximum Load (lbf)	Tensile Strength (psi)	Tensile stress at Yield (Offset 0.02 %) (psi)	Final Gauge Length (in)	Nominal Strain (%)	Modulus of Elasticity (psi)
1	611.4	8674	5110	2.020	7.4	71757
2	348.6	4939	4930	2.022	3.8	73836
3	641.4	9173	5400	2.148	8.5	72221
4	661.0	9281	5120	2.075	8.1	73151
5	650.0	9123	5260	2.024	8.0	72531
6	620.4	8954	5380	2.793	8.3	72042
7	337.9	5082	5070	2.012	4.2	72094
8	609.8	9149	5460	3.554	8.5	72459
9	593.1	8946	5530	2.023	7.9	70534
10	572.9	8776	5440	2.024	7.9	71517
Mean	564.7	8210	5270	2.270	7.3	72214
Standard Deviation	119.610	1696.556	200.481	0.511	1.752	896.493

	Failure Mode
1	Broke outside gauge marks
2	Broke outside gauge marks
3	Broke within gage marks
4	Broke outside gauge marks
5	Broke within gage marks
6	Broke within gage marks
7	Broke outside gauge marks
8	Broke outside gauge marks
9	Broke outside gauge marks
10	Broke outside gauge marks
Mean	
Standard Deviation	

Tensile Strength of Plastics (All Types)
Last Updated by: Todd B. 08/13/14
Uses Instron Wedge Grips with appropriate wedges for materials being evaluated (between 0.04 and 0.55 inches thick)
NO EXTENSOMETER

Sample file name: E3490.01-106-31 Polycarbonate-Weathered-Velux.is_tens

ATI Job #	E3490.01-106-31
Client Name	Velux America, Inc.
Sample Description	Polycarbonate-Weathered
User	Rich H.
Lab Conditions	71.0ºF / 49.0% RH
Load Cell Capacity / ICN	10 kN / 005965
Load Cell Calibration Due Date	09/04/14
Frame / ICN	Instron 3369 / 005740
Frame Calibration Due Date	09/04/14



General Data

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
1	0.499	0.466	0.145	0.108	4.5	0.2	6/17/2015 4:31 PM
2	0.500	0.500	0.131	0.128	4.5	0.2	6/17/2015 4:36 PM
3	0.499	0.435	0.137	0.105	4.5	0.2	6/17/2015 4:40 PM
4	0.498	0.414	0.142	0.104	4.5	0.2	6/17/2015 4:44 PM
5	0.500	0.453	0.143	0.115	4.5	0.2	6/17/2015 4:50 PM
6	0.500	0.443	0.132	0.109	4.5	0.2	6/17/2015 4:56 PM

	Width (in)	Final Width (in)	Thickness (in)	Final Thickness (in)	Initial Grip Separation (in.)	Test Speed	Start Date
7	0.498	0.442	0.144	0.110	4.5	0.2	6/17/2015 5:03 PM
8	0.498	0.424	0.154	0.114	4.5	0.2	6/17/2015 5:08 PM
9	0.500	0.494	0.134	0.134	4.5	0.2	6/17/2015 5:13 PM
10	0.502	0.500	0.142	0.141	4.5	0.2	6/17/2015 5:17 PM
Mean	0.499	0.457	0.140	0.117	4.5		
Standard Deviation	0.001	0.032	0.007	0.013	0.000		

	End Date
1	6/17/2015 4:33 PM
2	6/17/2015 4:37 PM
3	6/17/2015 4:42 PM
4	6/17/2015 4:47 PM
5	6/17/2015 4:52 PM
6	6/17/2015 4:58 PM
7	6/17/2015 5:05 PM
8	6/17/2015 5:10 PM
9	6/17/2015 5:14 PM
10	6/17/2015 5:18 PM
Mean	
Standard Deviation	

Determined Results

	Maximum Load (lbf)	Tensile Strength (psi)	Tensile stress at Yield (Offset 0.02 %) (psi)	Final Gauge Length (in)	Nominal Strain (%)	Modulus of Elasticity (psi)
1	665.5	9132	5100	2.270	7.7	76061
2	417.4	6372	5310	2.003	4.4	78327
3	633.3	9260	5050	2.208	7.7	79492
4	648.5	9070	5280	2.266	7.5	76688
5	652.8	9130	5310	2.067	7.7	77138
6	603.5	9113	5390	2.136	7.8	77352
7	657.7	9168	5250	2.132	7.9	76936
8	644.6	8404	4900	2.019	7.9	70053
9	478.1	7109	5350	2.039	4.9	76497
10	599.4	8409	5270	2.025	5.8	77713
Mean	600.1	8517	5220	2.116	6.9	76626
Standard Deviation	84.381	1000.010	154.106	0.102	1.356	2510.481

	Failure Mode
1	Broke within gage marks
2	Broke outside gauge marks
3	Broke within gage marks
4	Broke within gage marks
5	Broke within gage marks
6	Broke within gage marks
7	Broke within gage marks
8	Broke outside gauge marks
9	Broke outside gauge marks
10	Broke outside gauge marks
Mean	
Standard Deviation	