

**NFRC U-FACTOR, SHGC, VT, &
CONDENSATION RESISTANCE
COMPUTER SIMULATION REPORT**

**Rendered to:
TUBELITE, INC**

**SERIES/MODEL:
IS System**

Report Number: 84508.03-116-45
Report Date: 06/08/11
Expiration Date: 06/09/12

**NFRC U-FACTOR, SHGC, VT, & CONDENSATION RESISTANCE
COMPUTER SIMULATION REPORT**

Rendered to:
TUBELITE, INC
3056 Walker Ridge Drive
Walker, Michigan 49544

Report Number: 84508.03-116-45
Simulation Date: 06/09/08
Report Date: 06/08/11
Expiration Date: 06/09/12

Project Summary:

Architectural Testing, Inc. was contracted to perform U-Factor, Solar Heat Gain Coefficient, Visible Transmittance, and Condensation Resistance* computer simulations in accordance with the National Fenestration Rating Council (NFRC). The products were evaluated in full compliance with NFRC requirements to the standards listed below.

**NFRC's Condensation Resistance rating is NOT equivalent to a Condensation Resistance Factor (CRF) determined in accordance with AAMA 1503.*

Standards:

NFRC 100-2004: Procedure for Determining Fenestration Product U-Factors
NFRC 200-2004: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
NFRC 500-2004: Procedure for Determining Fenestration Product Condensation Resistance Values

Software:

Frame and Edge Modeling: THERM 5.2.14
Center-of-Glass Modeling: WINDOW 5.2.17
Total Product Calculations: WINDOW 5.2.17
Spectral Data Library: 18.1

Simulations Specimen Description:

Series/Model: IS System
Type: Glazed Wall System , Curtain Wall
Frame Material: AT Aluminum w/ Thermal Breaks - All Members
Sash Material: NA Not Applicable
Standard Size: 2000mm x 2000mm

Technical Interpretations:

None

Modeling Assumptions:

- 1) To prevent air infiltration, tape was applied to all interior sash crack locations.

Specialty Products Table:

The specialty products method allow the manufacturer to determine the overall product SHGC and VT for any glazing option. The center of glass SHGC and/or VT must be determined using WINDOW 5.2. The method gives overall product SHGC and VT indexed on center of glass properties. All values used in the calculations are truncated to six decimal place precision.

	No Dividers	Dividers < 1	Dividers > 1
SHGC0	0.006854	0.010316	0.013564
SHGC1	0.917833	0.815456	0.719396
VT0	0.000000	0.000000	0.000000
VT1	0.910979	0.805140	0.705832

$$SHGC = SHGC0 + SHGCc (SHGC1 - SHGC0)$$

$$VT = VT0 + VTc (VT1 - VT0)$$

Validation Matrix:

The following products are part of a validation matrix. Only one is required for validation testing.

<i>Product Line</i>	<i>Report Number</i>
None	-

Spacer Option Description

<i>Spacer Type</i>	<i>Sealant</i>		<i>Desiccant</i>
	<i>Primary</i>	<i>Secondary</i>	
Aluminum Spacer	Butyl Rubber	Butyl Rubber	Yes

Grid Option Description

<i>Grid Size</i>	<i>Grid Type</i>	<i>Grid Pattern</i>
None	-	-

Reinforcement Option Description

<i>Location</i>	<i>Material</i>
None	-

Gas Filling Technique Description

<i>Fill Type</i>	<i>Method</i>
84.5% Xenon	Two-probe with concentration sensor
76.0% Argon	Two-probe with concentration sensor
85.7% Argon	Two-probe with concentration sensor
83.0% Argon	Two-probe with concentration sensor
88.6% Argon	Two-probe with concentration sensor
73.8% Argon	Two-probe with concentration sensor
65.0% Argon	Two-probe with concentration sensor
74.6% Argon	Two-probe with concentration sensor
67.0% Argon	Two-probe with concentration sensor
62.5% Argon	Two-probe with concentration sensor
86.0% Argon	Two-probe with concentration sensor
90.6% Krypton	Evacuated Chamber
94.6% Xenon	Evacuated Chamber

Edge-of-Glass Construction

<i>Interior Condition</i>	EPDM glazing gasket
<i>Exterior Condition</i>	EPDM glazing gasket

Weatherstripping

<i>Type</i>	<i>Quantity</i>	<i>Location</i>
None	-	-

Frame/Sash Materials Finish

<i>Interior</i>	Painted Aluminum
<i>Exterior</i>	Painted Aluminum

NFRC 100/200/500 Summary Sheet
IS System

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)				Visible Transmittance (VT) Grids (None / <1 / >=1)			Condensation Resistance	
1	Center of Glass=0.4400											
	0.222	0.500	0.225					XEN84.5		CL	A1-D	N
	U-Factor 0.49			SHGC (N) 0.63				VT (N) 0.67			CR 43	
2	Center of Glass=0.4200											
	0.222	0.500	0.225					ARG76	0.652(#2)	GY	A1-D	N
	U-Factor 0.47			SHGC (N) 0.24				VT (N) 0.22			CR 43	
3	Center of Glass=0.4000											
	0.220	0.500	0.225					ARG85.7	0.566(#2)	GY	A1-D	N
	U-Factor 0.46			SHGC (N) 0.24				VT (N) 0.18			CR 44	
4	Center of Glass=0.3800											
	0.226	0.500	0.225					ARG83	0.471(#2)	AZ	A1-D	N
	U-Factor 0.44			SHGC (N) 0.17				VT (N) 0.14			CR 44	
5	Center of Glass=0.3600											
	0.220	0.500	0.225					ARG88.6	0.395(#2)	GY	A1-D	N
	U-Factor 0.42			SHGC (N) 0.13				VT (N) 0.07			CR 45	
6	Center of Glass=0.3400											
	0.230	0.500	0.225					ARG73.8	0.298(#2)	CL	A1-D	N
	U-Factor 0.41			SHGC (N) 0.47				VT (N) 0.55			CR 46	
7	Center of Glass=0.3200											
	0.223	0.500	0.225					ARG65	0.215(#2)	CL	A1-D	N
	U-Factor 0.39			SHGC (N) 0.57				VT (N) 0.67			CR 47	
8	Center of Glass=0.3000											
	0.233	0.500	0.225					ARG74.6	0.166(#2)	CL	A1-D	N
	U-Factor 0.37			SHGC (N) 0.41				VT (N) 0.49			CR 48	
9	Center of Glass=0.2800											
	0.223	0.500	0.225					ARG67	0.096(#2)	CL	A1-D	N
	U-Factor 0.36			SHGC (N) 0.48				VT (N) 0.66			CR 49	
10	Center of Glass=0.2600											
	0.223	0.500	0.225					ARG62.5	0.035(#2)	CL	A1-D	N
	U-Factor 0.34			SHGC (N) 0.35				VT (N) 0.64			CR 49	

NFRC 100/200/500 Summary Sheet
IS System

ID	Pane Thickness 1	Gap Width 1	Pane Thickness 2	Gap Width 2	Pane Thickness 3	Gap Width 3	Pane Thickness 4	Gap Fill	Low-e (Surface#)	Tint	Spacer	Grid Type
	U-Factor			Solar Heat Gain Coefficient (SHGC) Grids (None / <1 / >=1)				Visible Transmittance (VT) Grids (None / <1 / >=1)			Condensation Resistance	
11	Center of Glass=0.2400											
	0.223	0.500	0.223					ARG86	0.035(#2) / 0.035(#3)	CL	A1-D	N
	U-Factor 0.32			SHGC (N) 0.33				VT (N) 0.57			CR 51	
12	Center of Glass=0.2200											
	0.223	0.500	0.223					KRY90.6	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor 0.31			SHGC (N) 0.24				VT (N) 0.47			CR 52	
13	Center of Glass=0.2000											
	0.223	0.500	0.223					XEN94.6	0.018(#2) / 0.018(#3)	CL	A1-D	N
	U-Factor 0.29			SHGC (N) 0.24				VT (N) 0.47			CR 52	

The Condensation Resistance results obtained from this procedure are for controlled laboratory conditions and do not include the effects of air movement through the specimen, solar radiation, and the thermal bridging that may occur due to the specific design and construction of the fenestration system opening.

Ratings values included in this report are for submittals to an NFRC-licensed IA and are not meant to be used directly for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) by an NFRC accredited Inspection Agency (IA) are to be used for labeling purposes. The ratings values were rounded in accordance to NFRC 601, NFRC Unit and Measurement Policy.

Architectural Testing, Inc. is an NFRC accredited simulation laboratory and all simulations were conducted in full compliance with NFRC approved procedures and specifications. The NFRC procedure requires that the computational results be verified through actual test results.

Detailed drawings, simulation data files, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period, such materials shall be discarded without notice and the service life of this report will expire. Results obtained are simulated values and were secured by 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 product simulated. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

SIMULATED BY:

REVIEWED BY:

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Simulator-In-Responsible-Charge

KSL:ksl
84508.03-116-45

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A: Drawings and Bills of Material (2)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
.03 R0	6/8/2011	All	Original Report Issue



All drawings and Bills of Material used to simulate this product are enclosed in this Appendix

Appendix A

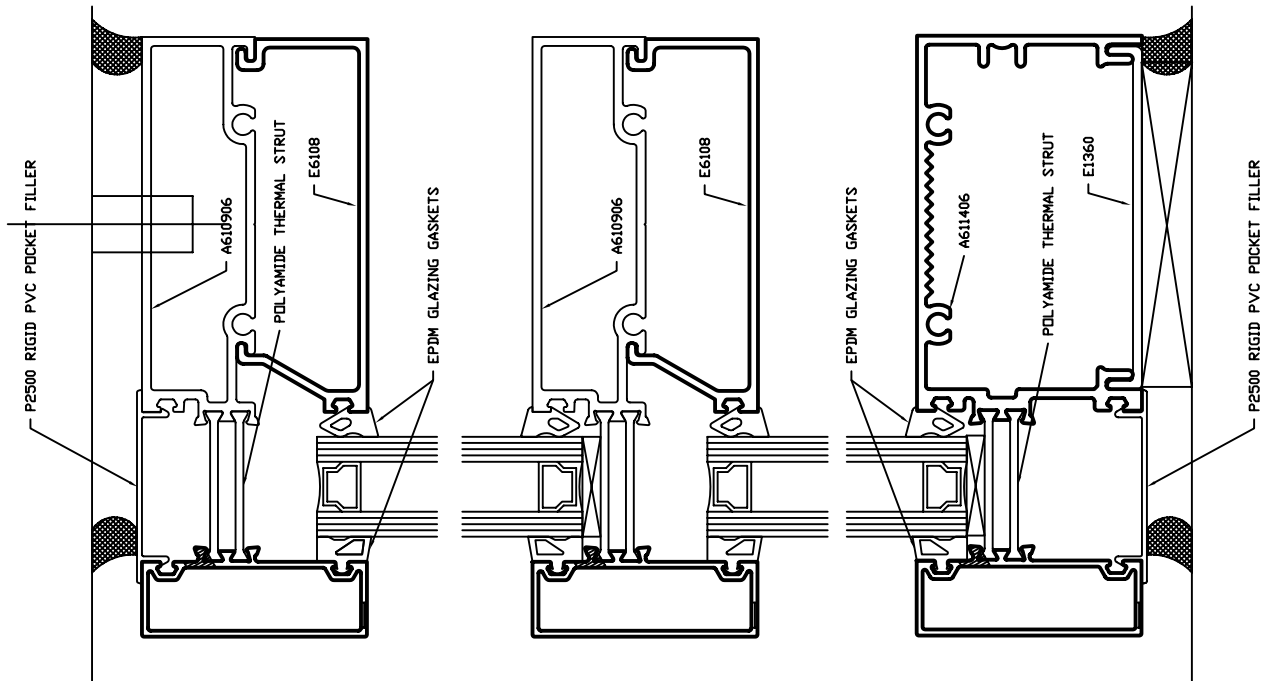
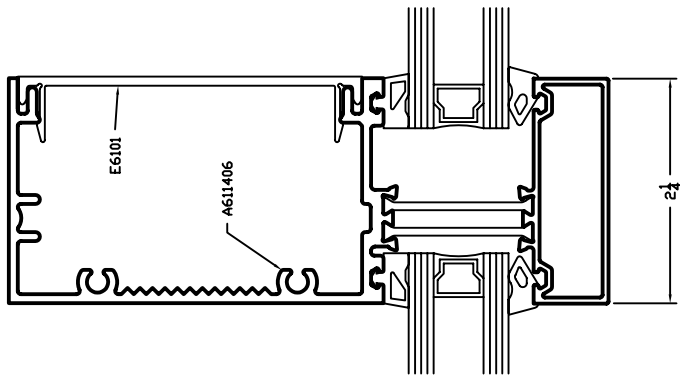
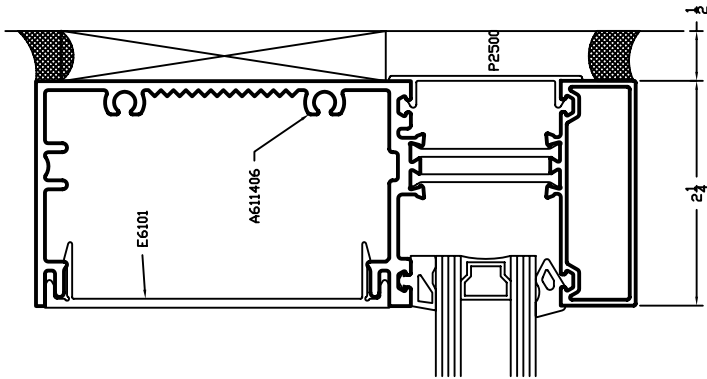
84508.03-116-45

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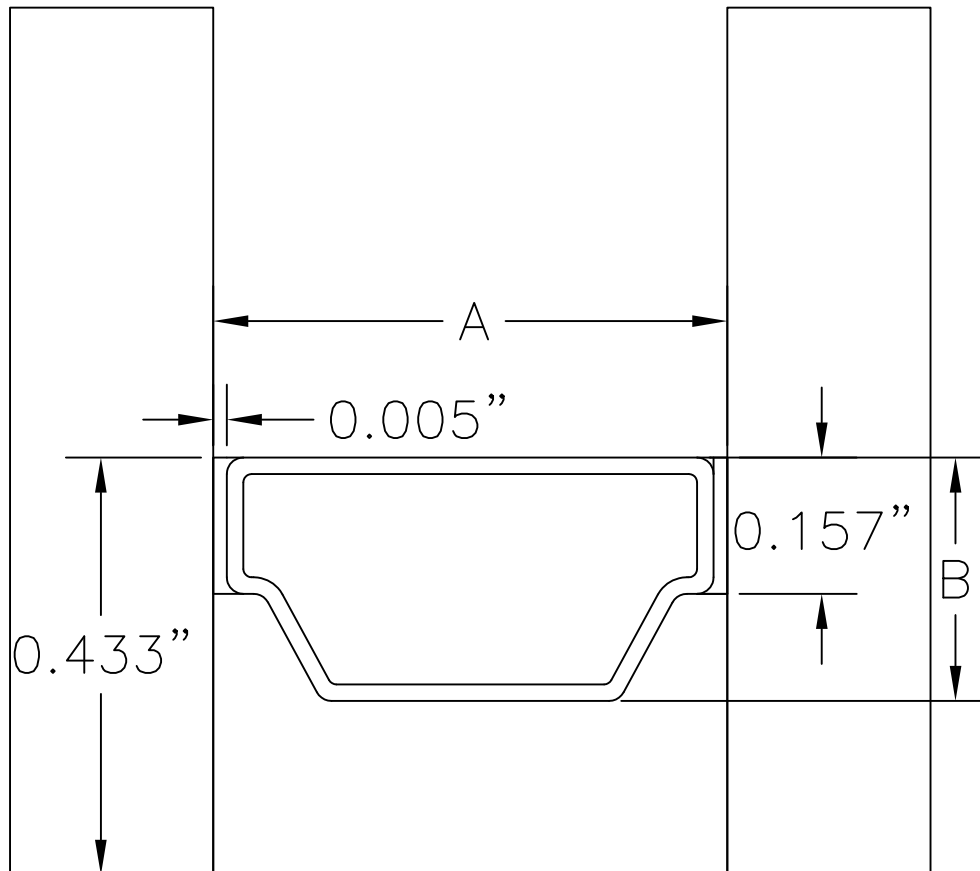
Report # 84508

Date 6/9/08

Simulator *Ken Lamb*



Aluminum Spacer



Offset: None
Primary Sealant: Butyl Rubber
Secondary Sealant: Butyl Rubber
Material: Anodized Aluminum
Width (A): 0.500
Height (B): 0.295
Wall Thickness: 0.016

ATI
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