Architectural Testing

**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**

Architectural Testing

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.

Product Line	Report Number
None	-

Spacer Option Description

| Spacer Type | Sealant | | Desiccant |
	Primary	Secondary	
Aluminum Spacer	Butyl Rubber	Butyl Rubber	Yes

Grid Option Description

Grid Size	Grid Type	Grid Pattern
None	-	-

Reinforcement Option Description

Location	Material
None	-

Gas Filling Technique Description

Fill Type	Method
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

Interior Condition	EPDM glazing gasket
Exterior Condition	EPDM glazing gasket

Weatherstripping

Type	Quantity	Location
None	-	-

Frame/Sash Materials Finish

Interior	Painted Aluminum
Exterior	Painted Aluminum

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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

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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:

Digitally Signed by: Kevin Louder   Digitally Signed by: Kristen L. Livelsberger

Kevin S. Louder   Kristen L. Livelsberger
Project Engineer   Senior Simulation Technician
                                                         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)

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Revision Log

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

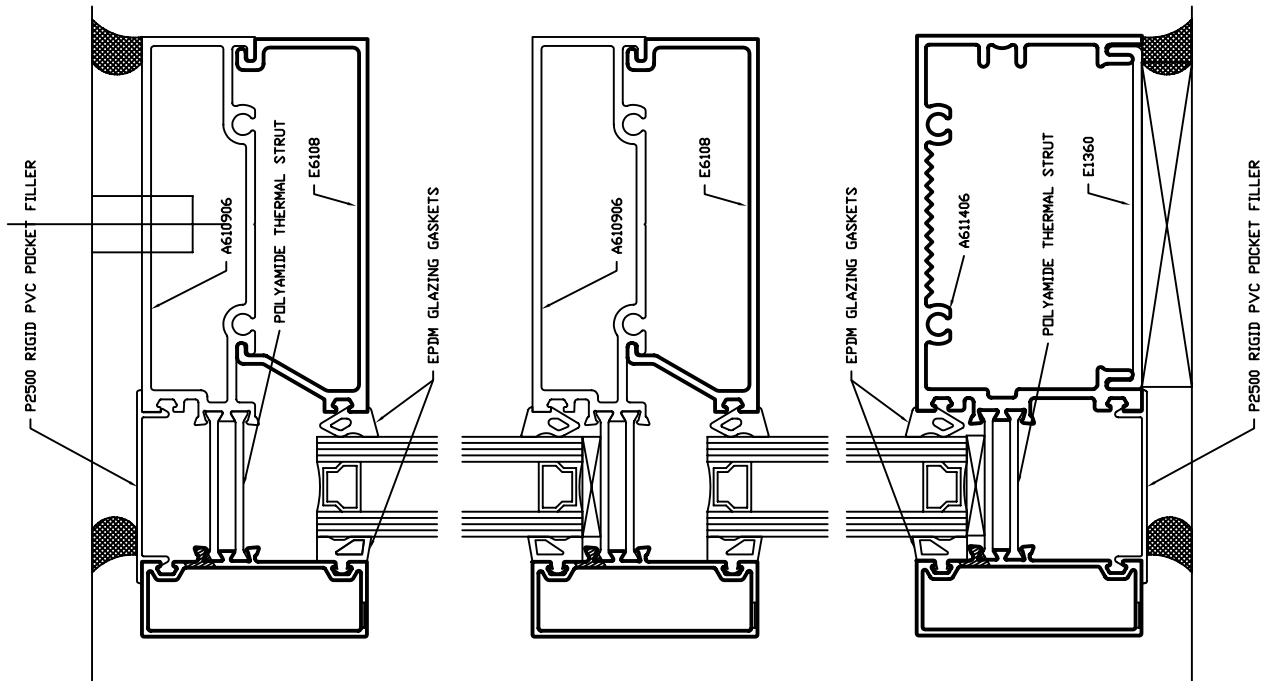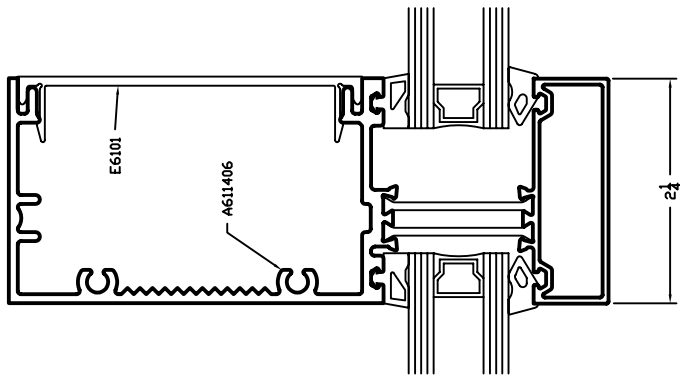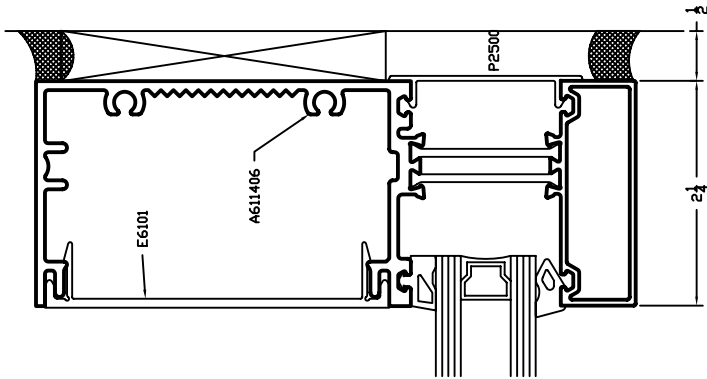All drawings and Bills of Material used to simulate this product are enclosed in this Appendix

P2500

A611406

E6101

2¼

E6101

A611406

2¼

P2500 RIGID PVC POCKET FILLER

A610906

POLYAMIDE THERMAL STRUT

E6108

EPDM GLAZING GASKETS

A610906

E6108

EPDM GLAZING GASKETS

A611406

POLYAMIDE THERMAL STRUT

E1360

P2500 RIGID PVC POCKET FILLER

Aluminum Spacer

A

0.005"

0.157"

B

0.433"
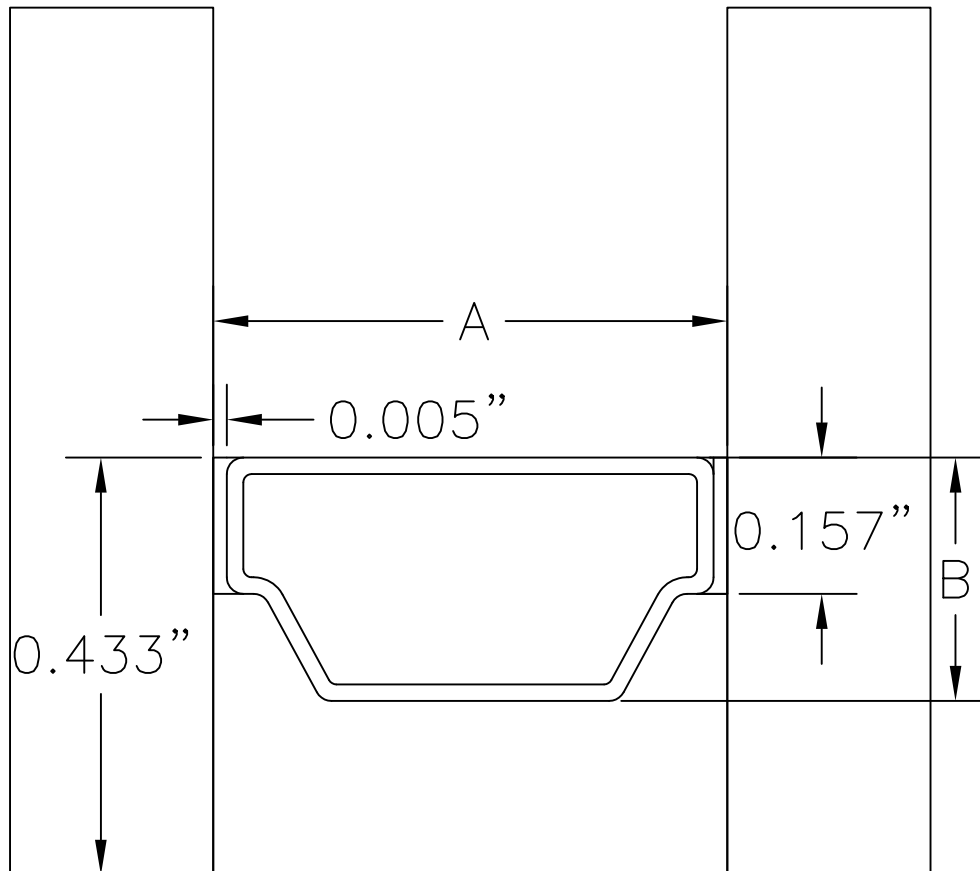
Offset: _____None_____

Primary Sealant: _____Butyl Rubber_____

Secondary Sealant: _____Butyl Rubber_____

Material: _____Anodized Aluminum_____

Width (A): _____0.500_____

Height (B): _____0.295_____

Wall Thickness: _____0.016_____