Therm 7.8 and Window 7.8 Simulation Report

Zero•Net PW2500 SSG w/ 1” IGU and FortMax™ 2200 Thermal Break

*Thermal modeling analysis was performed on FreMarq’s PW2500 framing system with a FortMax 2200 fiberglass thermal break. Analysis of the system was performed using the Therm 7.8 and Window 7.8 computer software developed by Lawrence Berkeley Laboratory.

	U-Factor Center of Glass (Btu/h-ft^2-F)	U-Factor Assembled (Btu/h-ft^2-F)	SHGC	VT	CR
NFRC Size – Double Low E	0.191	0.241	0.338	0.627	53
5’ x 10’ Job Size - Double Low E	0.186	0.219	0.347	0.651	53
NFRC Size – Single Low E	0.243	0.284	0.345	0.634	62
5’ x 10’ Job Size – Single Low E	0.241	0.268	0.355	0.659	63

THERM 7.8 calculates heat loss through frame and edge-of-glazing components using finite element analysis. The program solves for temperature and heat flow distribution throughout the cross section. The temperature distribution can then be used to determine overall heat loss, total and component U-factors, and local temperatures at points of interest.

WINDOW 7.8 calculates U-factor and temperatures for the center-of-glazing using a two-dimensional heat flow analysis.

Standards:

NFRC 100-2014: *Procedure for Determining Fenestration Product U-Factors.*

NFRC 200-2014: *Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.*

NFRC 500-2014: *Procedure for Determining Fenestration Product Condensation Resistance Values.*

Standard NFRC environmental conditions were used to analyze the system, which are -0.4°F exterior ambient temperature with a 12.3 mph wind acting perpendicular to the wall. An exterior film coefficient of 4.579 BTU/hr*ft^2*°F was used to represent the exterior wind. Interior conditions were modeled as 69.8°F ambient temperature with natural convection only.

Two insulating glass systems were used in this analysis. The systems consisted of:

RD006 Glass:

1/4” VE-12M on Clear (#2)	(IGDB # 6046)
1/2” VTS Spacer with 90% Argon - 10% Air	(IGDB # 0009)
1/4” Room side Low E (#4)	(IGDB # 6025)

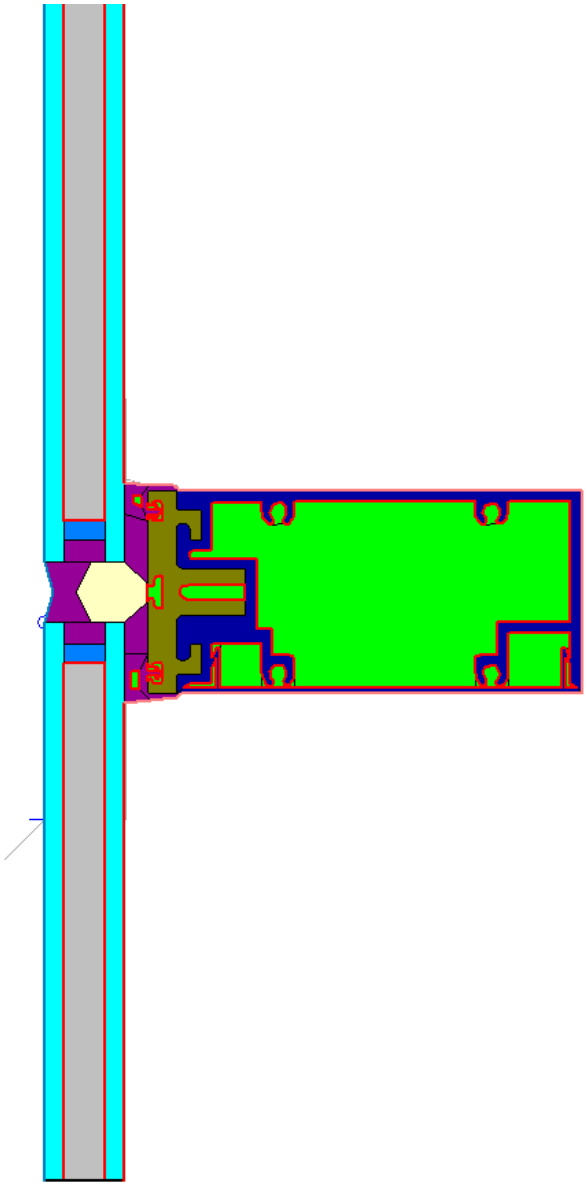
RD030 Glass:

1/4” VE-12M on Clear (#2)	(IGDB # 6046)
1/2” VTS Spacer with 90% Argon - 10% Air	(IGDB # 0009)
1/4” Clear	(IGDB # 2004)

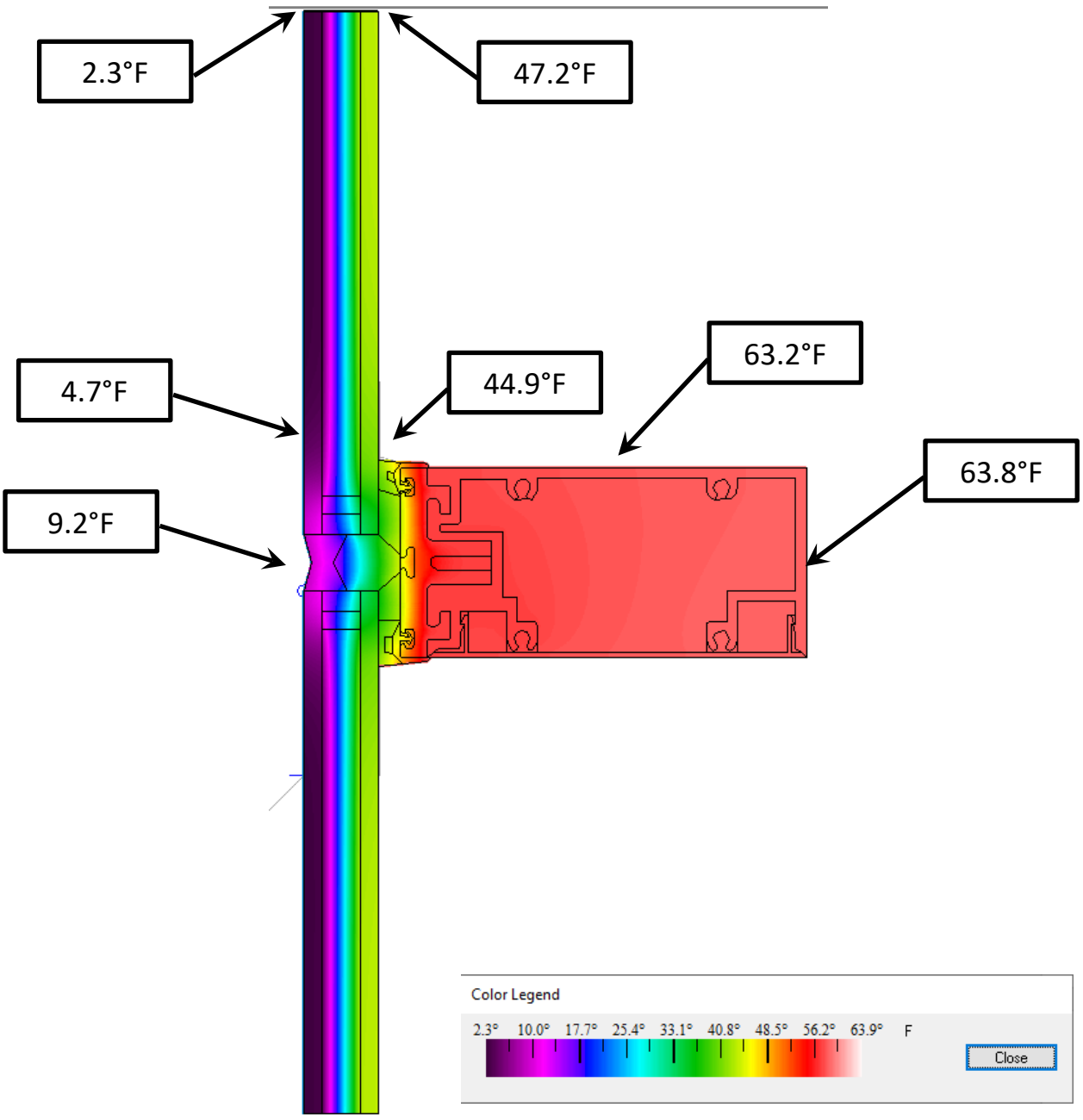
U-factor calculations were performed on standard NFRC rating size consisting of a two lite wide glazed wall system specimen with an overall size of 79” X 79”. Job size model was also done at 5’ x 10’ on a custom single vision.

Thermal model graphical outputs with frame surface temperature identification can be found below.

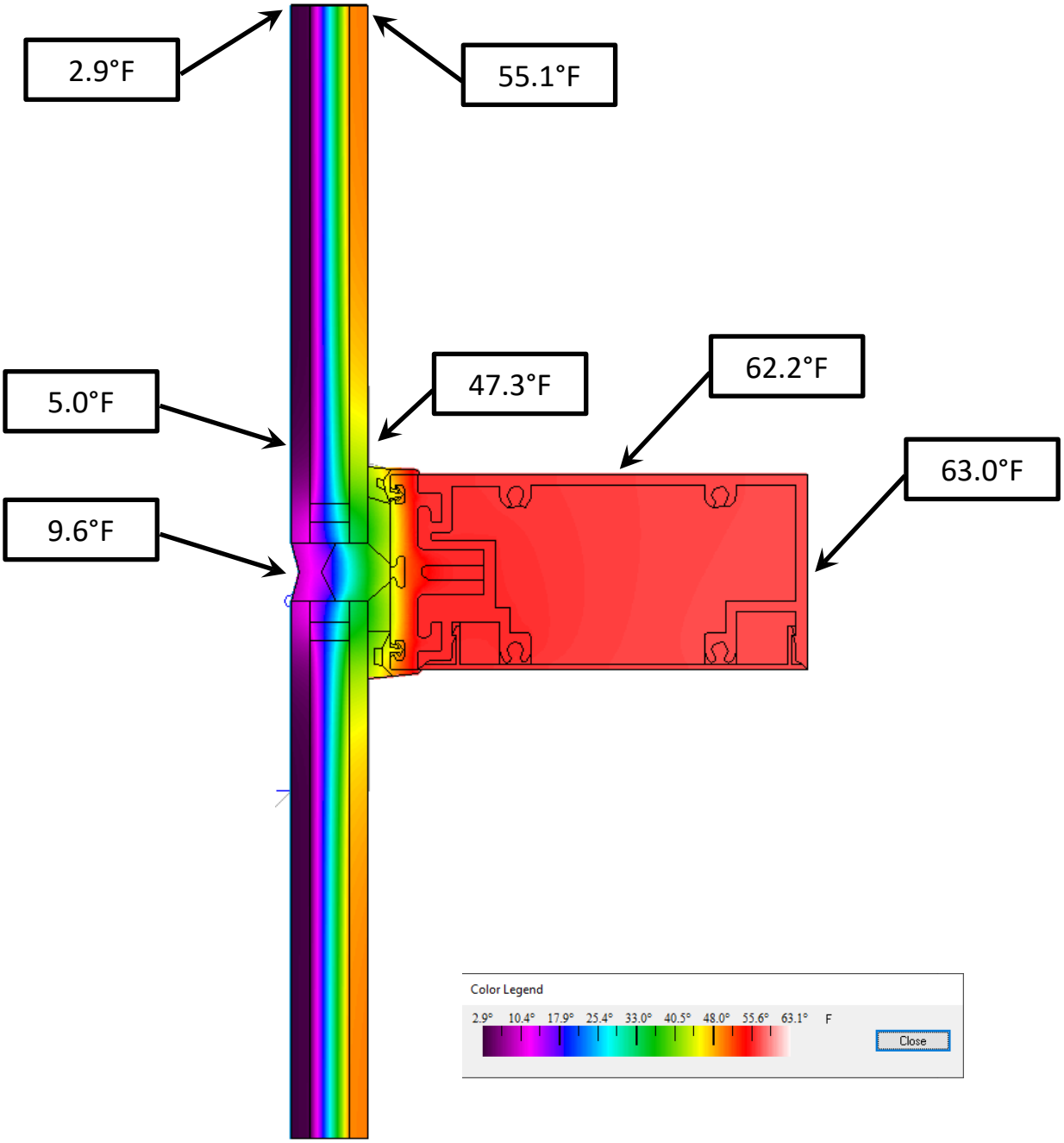
Typical Horizontal



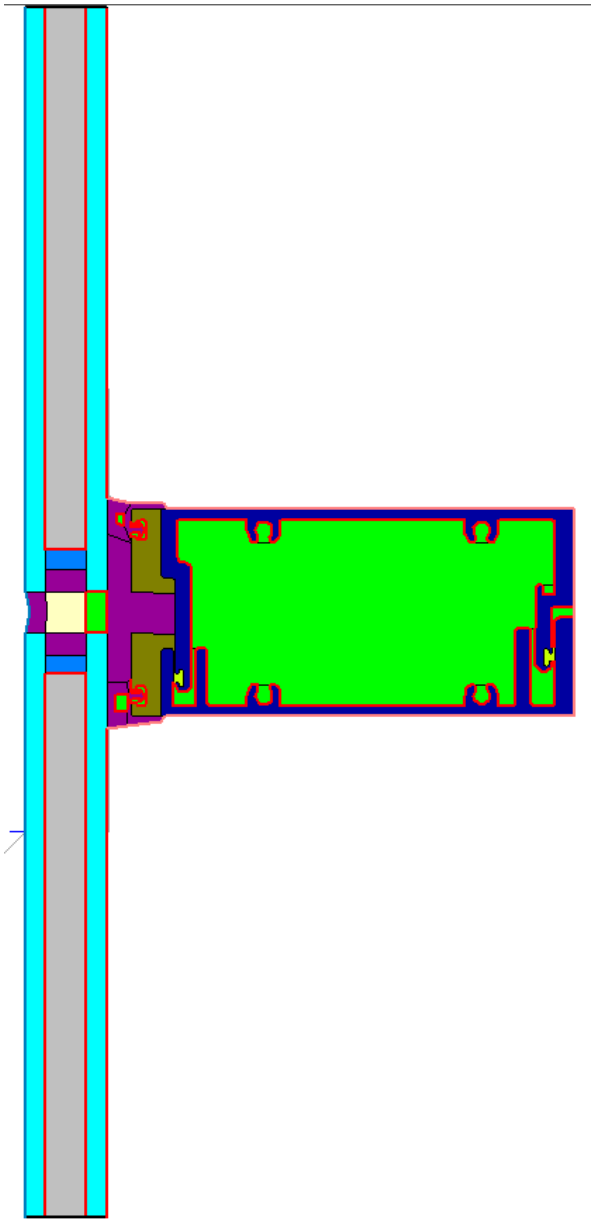
Typical Horizontal – Double Low E



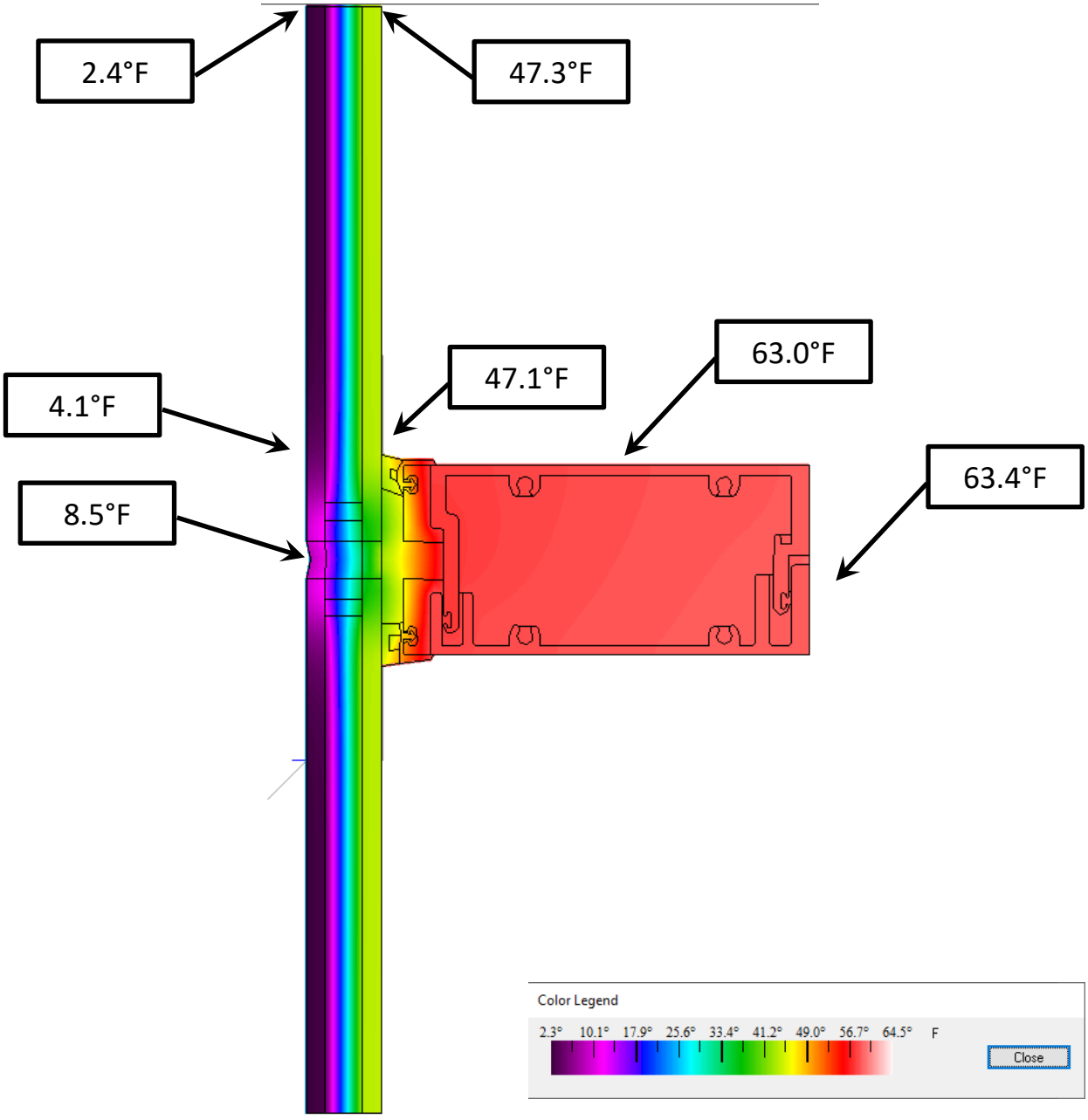
Typical Horizontal – Single Low E



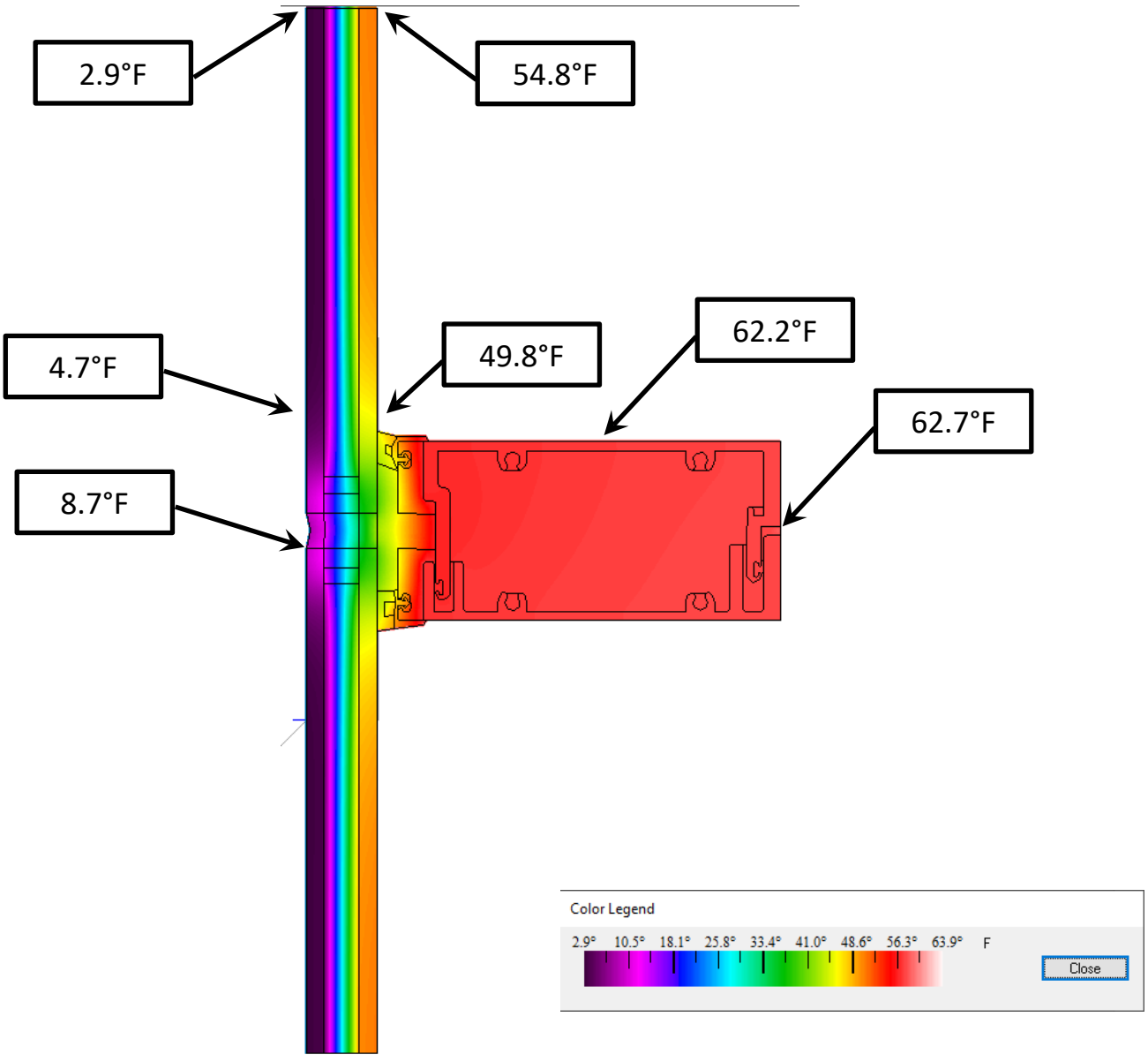
Typical Vertical



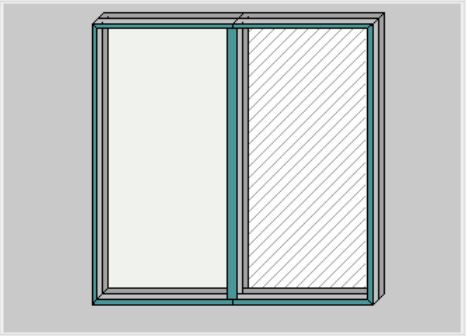
Typical Vertical – Double Low E



Typical Vertical – Single Low E



ID # 28
Name 02_102723_ssg PW2500 1in I(
Mode NFRC
Type Glazed Wall System >>
Width 78.740 inches
Height 78.740 inches
Area 43.06 ft2
Tilt 90
Environmental Conditions
NFRC 100-2010



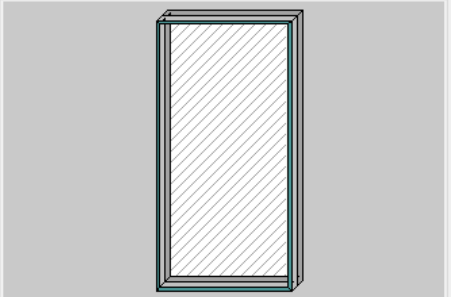
Total Window Results - Normal Incidence

U-factor 0.24110 Btu/h-ft2-F
SHGC 0.33817
VT 0.62747
CR 53

Click on a component to display characteristics below

Glazing System
Name RD006 Glass >>
ID 100
Nlayers 2
Area 15.56958 ft2
Edge area 3.73556 ft2
Ucenter 0.19137 Btu/h-ft2-F
SC 0.42136
SHGC 0.36658
Vtc 0.69953

ID # 29
Name 02_102723_ssg PW2500 1in I(
Mode NFRC
Type Custom Single Vision >>
Width 60.000 inches
Height 120.000 inches
Area 50.00 ft2
Tilt 90
Environmental Conditions
NFRC 100-2010

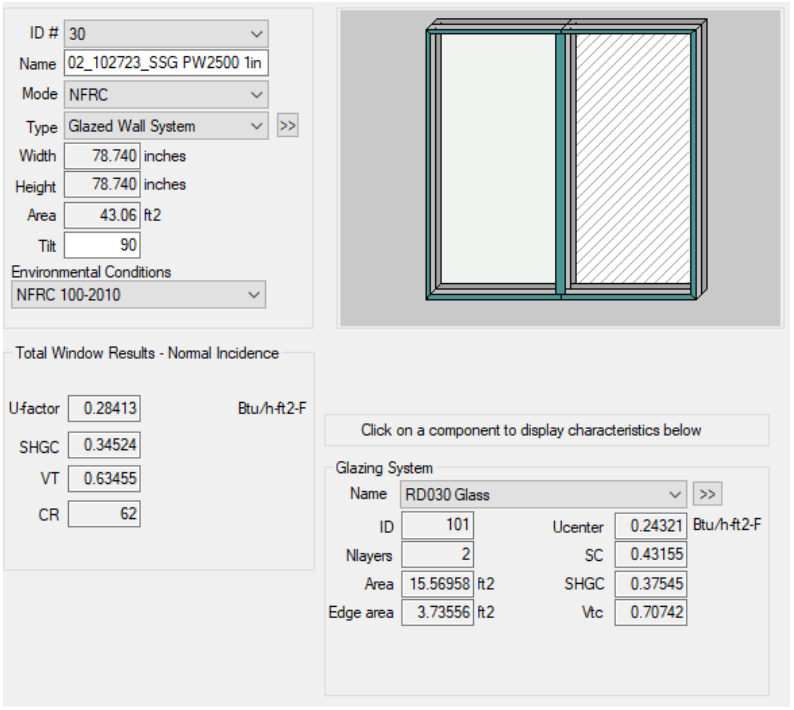


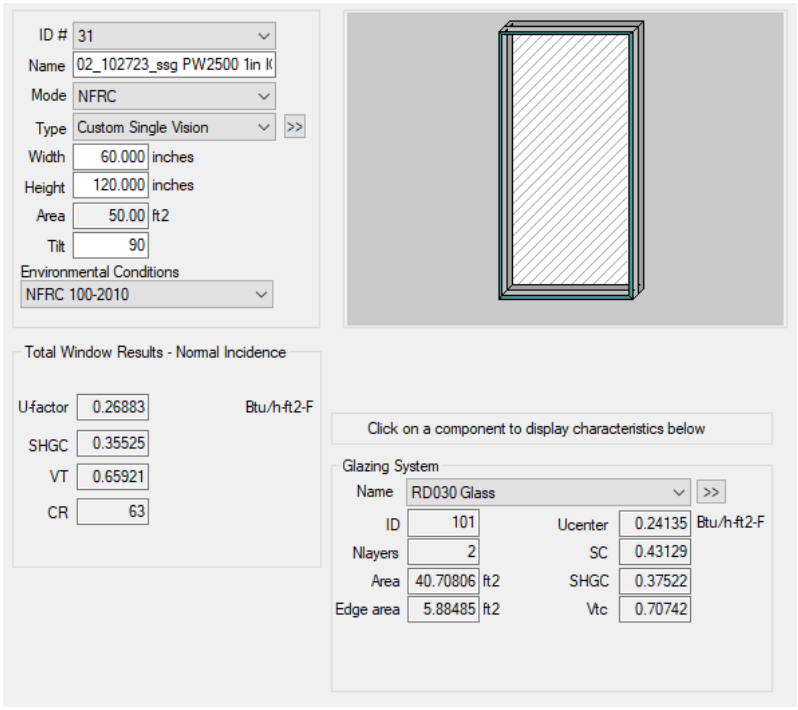
Total Window Results - Normal Incidence

U-factor 0.21994 Btu/h-ft2-F
SHGC 0.34696
VT 0.65186
CR 53

Click on a component to display characteristics below

Glazing System
Name RD006 Glass >>
ID 100
Nlayers 2
Area 40.70806 ft2
Edge area 5.88485 ft2
Ucenter 0.18603 Btu/h-ft2-F
SC 0.42034
SHGC 0.36570
Vtc 0.69953


ID # 30
Name 02_102723_SSG PW2500 1in
Mode NFRC
Type Glazed Wall System
Width 78.740 inches
Height 78.740 inches
Area 43.06 ft2
Tilt 90
Environmental Conditions
NFRC 100-2010
Total Window Results - Normal Incidence
U-factor 0.28413 Btu/h-ft2-F
SHGC 0.34524
VT 0.63455
CR 62
Click on a component to display characteristics below
Glazing System
Name RD030 Glass
ID 101
Nlayers 2
Area 15.56958 ft2
Edge area 3.73556 ft2
Ucenter 0.24321 Btu/h-ft2-F
SC 0.43155
SHGC 0.37545
Vtc 0.70742


ID # 31
Name 02_102723_ssg PW2500 1in I
Mode NFRC
Type Custom Single Vision
Width 60.000 inches
Height 120.000 inches
Area 50.00 ft2
Tilt 90
Environmental Conditions
NFRC 100-2010
Total Window Results - Normal Incidence
U-factor 0.26883 Btu/h-ft2-F
SHGC 0.35525
VT 0.65921
CR 63
Click on a component to display characteristics below
Glazing System
Name RD030 Glass
ID 101
Nlayers 2
Area 40.70806 ft2
Edge area 5.88485 ft2
Ucenter 0.24135 Btu/h-ft2-F
SC 0.43129
SHGC 0.37522
Vtc 0.70742

Window Data

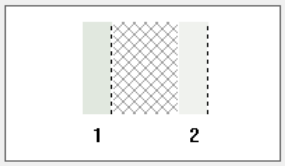
ID #: 100 Name: RD006 Glass

2 Tilt: 90 ° IG Height: 39.37 inches

Environmental Conditions: NFRC 100-2010 IG Width: 39.37 inches

Comment: Viracon Double Low E Glass

Overall thickness: 0.972 inches Mode: #



	ID	Name	Mode	Thick	Flip	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tir	E1	E2	Cond	Comment
Glass 1	6046	VE12M.VIR	#	0.236	☐	0.383	0.286	0.449	0.792	0.060	0.047	0.000	0.840	0.040	0.578	
Gap 1	9	Air (10%) / Argon (90%) I		0.500												
Glass 2	6025	RoomsideLE.vir	#	0.236	☐	0.706	0.111	0.112	0.880	0.074	0.072	0.000	0.840	0.160	0.578	

Center of Glass Results | Temperature Data | Optical Data | Angular Data | Color Properties | Radiance Results

Ufactor	SC	SHGC	Rel. Ht. Gain	Tvis	Keff	Layer 1 Keff	Gap 1 Keff	Layer 2 Keff
Btu/h-ft2-F			Btu/h-ft2		Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F
0.200	0.423	0.368	87.1	0.700	0.0252	0.5778	0.0132	0.5778

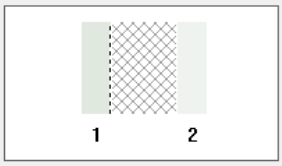
ID #: 101 Name: RD030 Glass

2 Tilt: 90 ° IG Height: 39.37 inches

Environmental Conditions: NFRC 100-2010 IG Width: 39.37 inches

Comment: Viracon Single Low E Glass

Overall thickness: 0.972 inches Mode: #



	ID	Name	Mode	Thick	Flip	Tsol	Rsol1	Rsol2	Tvis	Rvis1	Rvis2	Tir	E1	E2	Cond	Comment
Glass 1	6046	VE12M.VIR	#	0.236	☐	0.383	0.286	0.449	0.792	0.060	0.047	0.000	0.840	0.040	0.578	
Gap 1	9	Air (10%) / Argon (90%) I		0.500												
Glass 2	2004	Clr-6.CIG	#	0.236	☐	0.793	0.073	0.073	0.889	0.080	0.080	0.000	0.840	0.840	0.578	

Center of Glass Results | Temperature Data | Optical Data | Angular Data | Color Properties | Radiance Results

Ufactor	SC	SHGC	Rel. Ht. Gain	Tvis	Keff	Layer 1 Keff	Gap 1 Keff	Layer 2 Keff
Btu/h-ft2-F			Btu/h-ft2		Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F	Btu/h-ft-F
0.246	0.432	0.376	89.5	0.707	0.0265	0.5778	0.0139	0.5778

Glass Data