

## Therm 7.8 and Window 7.8 Simulation Report

### Zero•Net UCW3500 Captured w/ 1” IGU and Fiberglass Thermal Break and Aluminum Pressure Plate

\*Thermal modeling analysis was performed on FreMarq’s UCW3500 framing system with a aluminum pressure plate (exterior) and fiberglass thermal break (interior). 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 <sup>2</sup> -F)	U-Factor Assembled (Btu/h-ft <sup>2</sup> -F)	SHGC	VT	CR
NFRC Size – Double Low E	0.191	0.247	0.319	0.595	52
5’ x 10’ Job Size - Double Low E	0.186	0.224	0.334	0.630	52
NFRC Size – Single Low E	0.243	0.289	0.326	0.601	63
5’ x 10’ Job Size – Single Low E	0.241	0.271	0.342	0.637	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<sup>2</sup>\*°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)

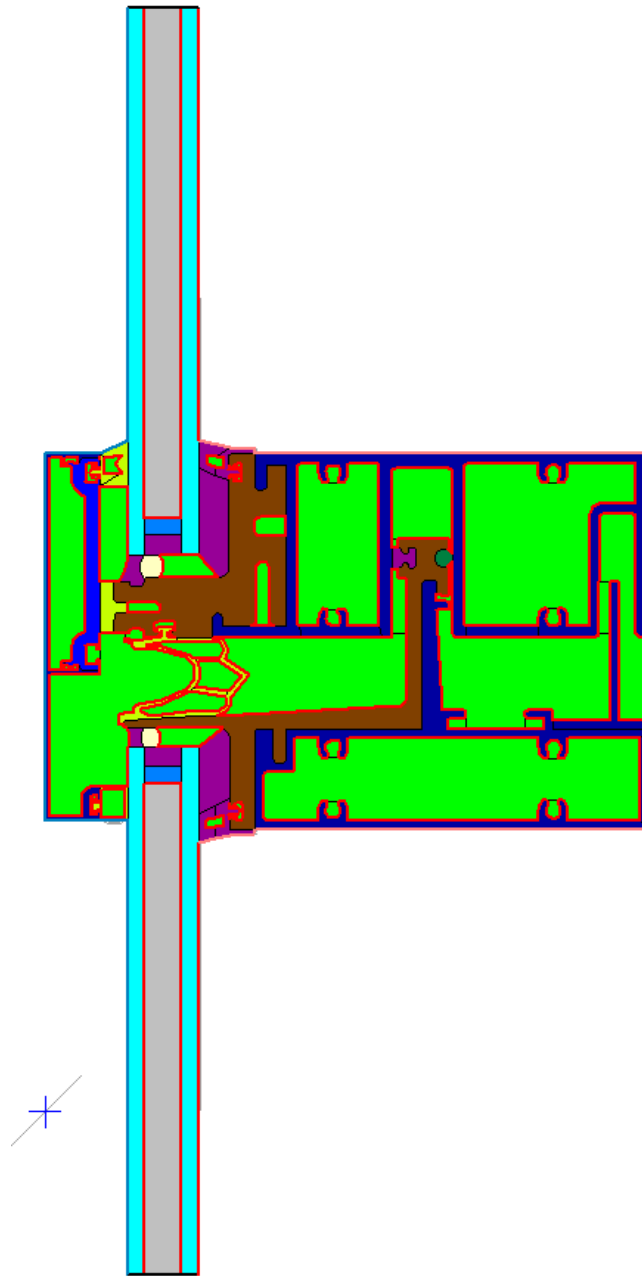
#### RD030 Glass:

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)

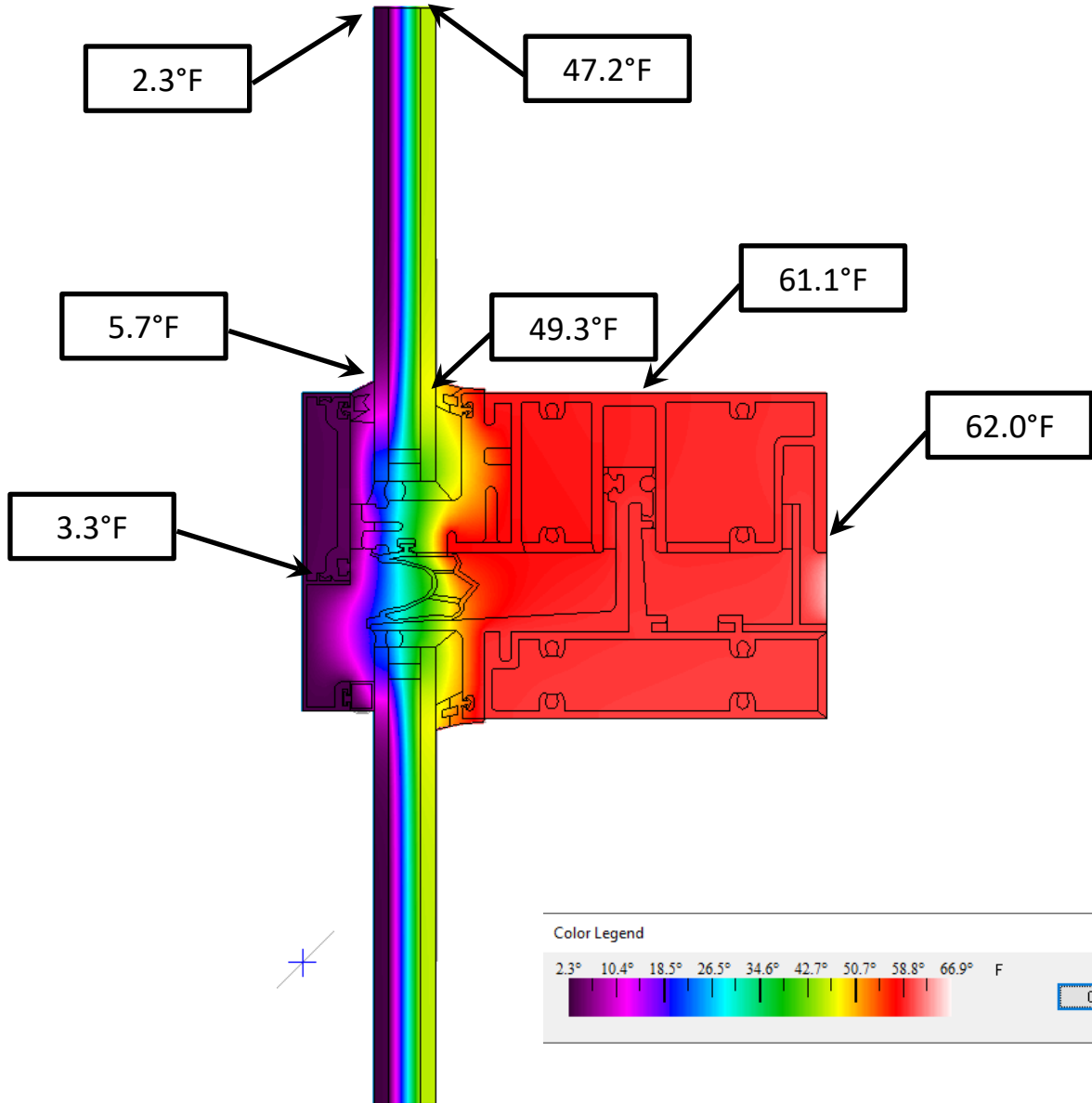
U-factor calculations were performed on standard NFRC rating size consisting of a two lite wide glazed wall system specimen with an overall size of 79" X 79". Job size model was also done at 5' x 10' on a custom single vision.

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

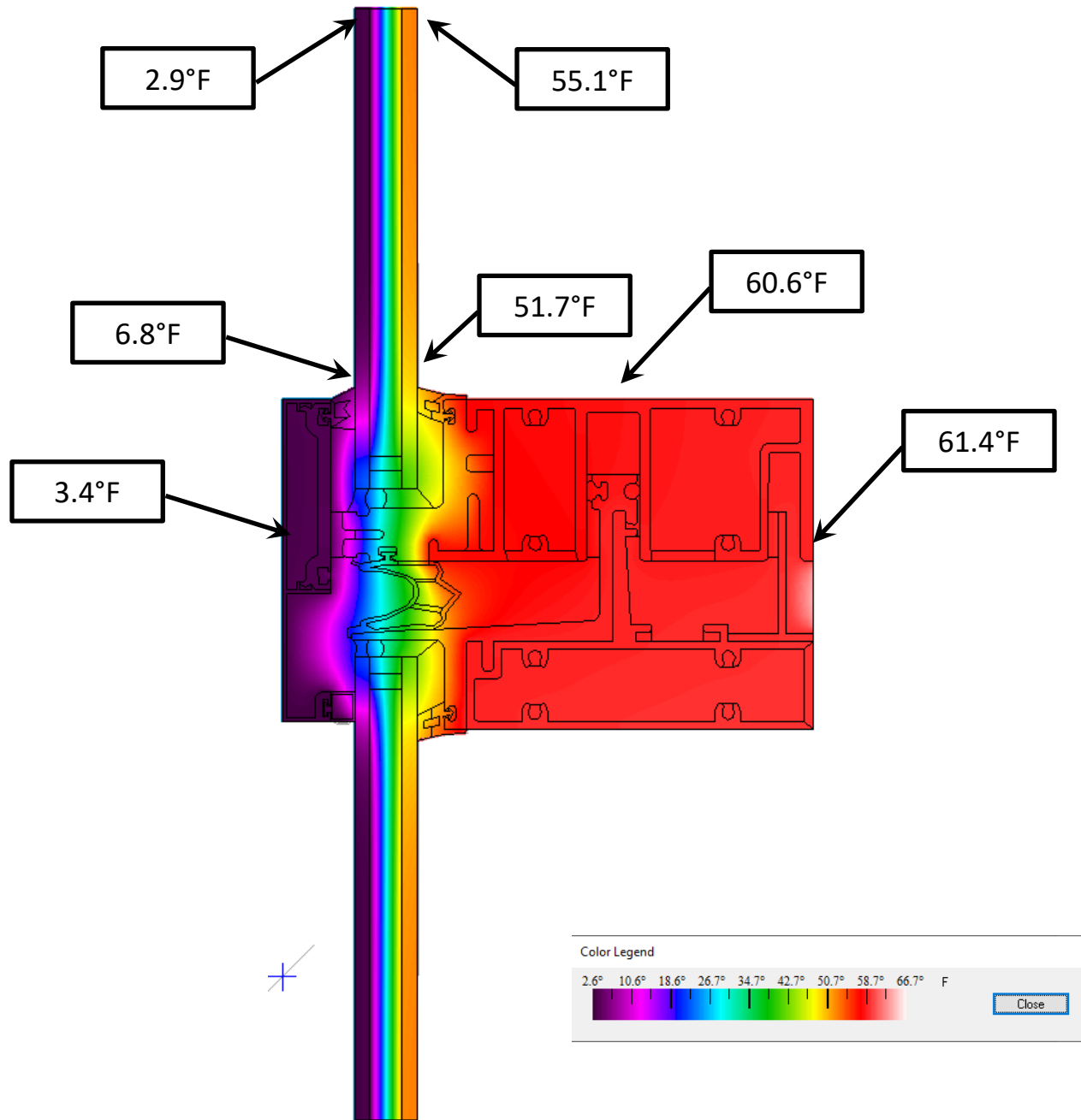
# Typical Horizontal



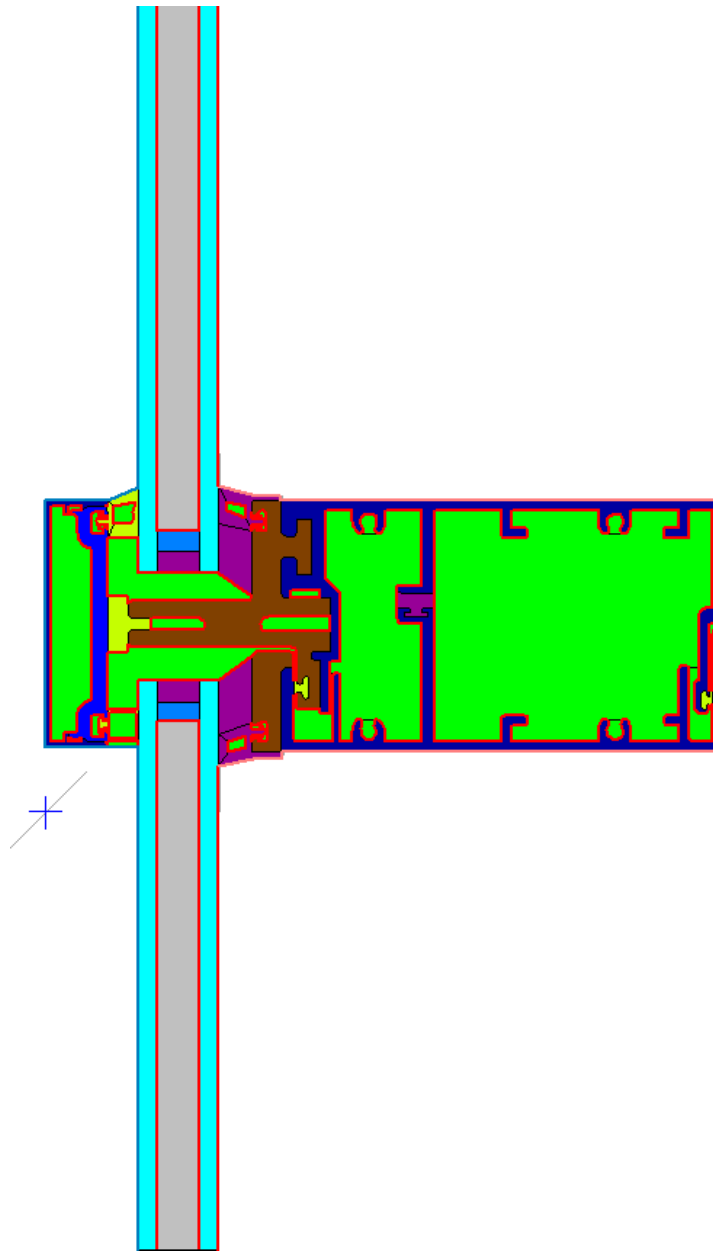
# Typical Horizontal – Double Low E



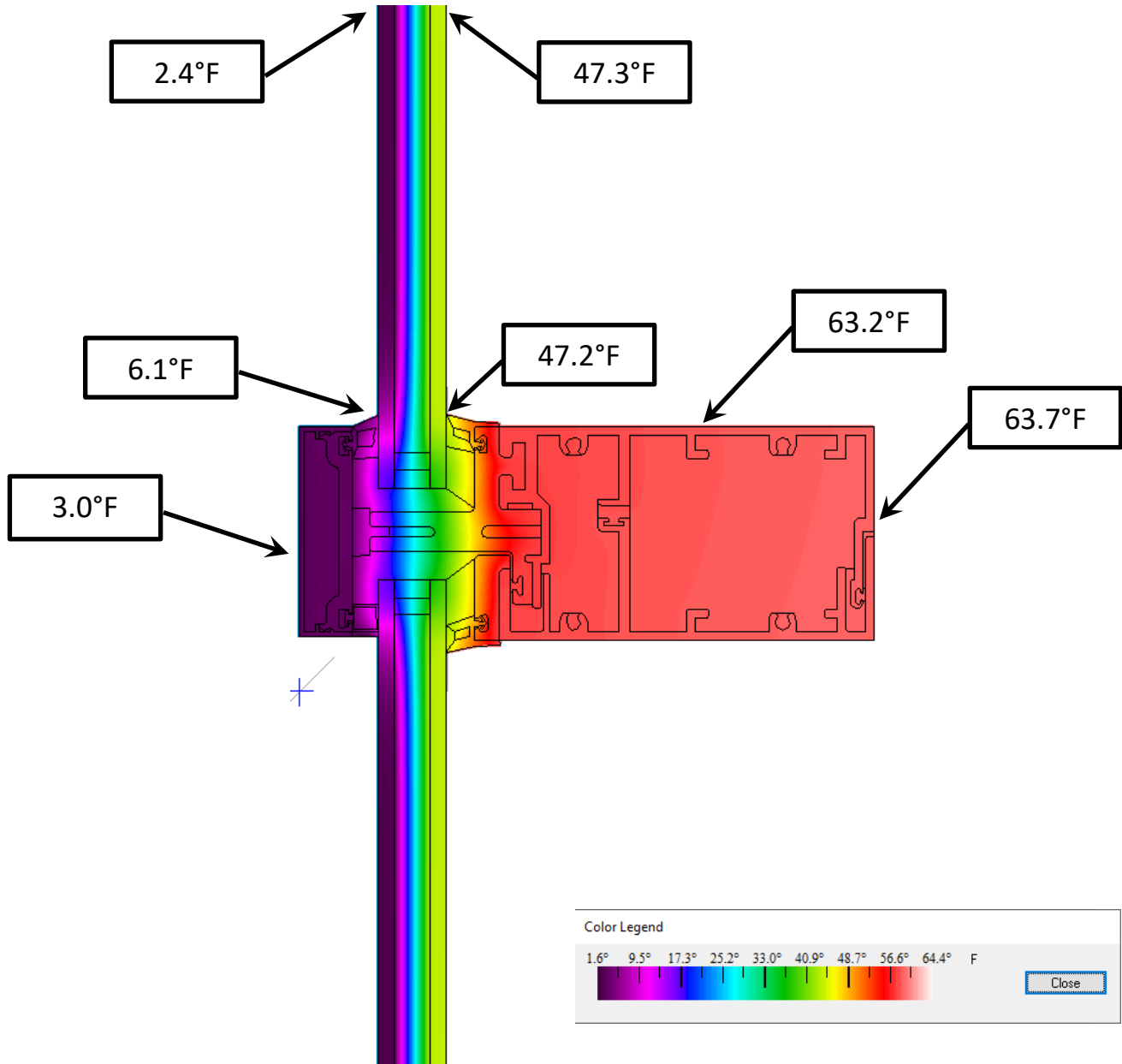
# Typical Horizontal – Single Low E



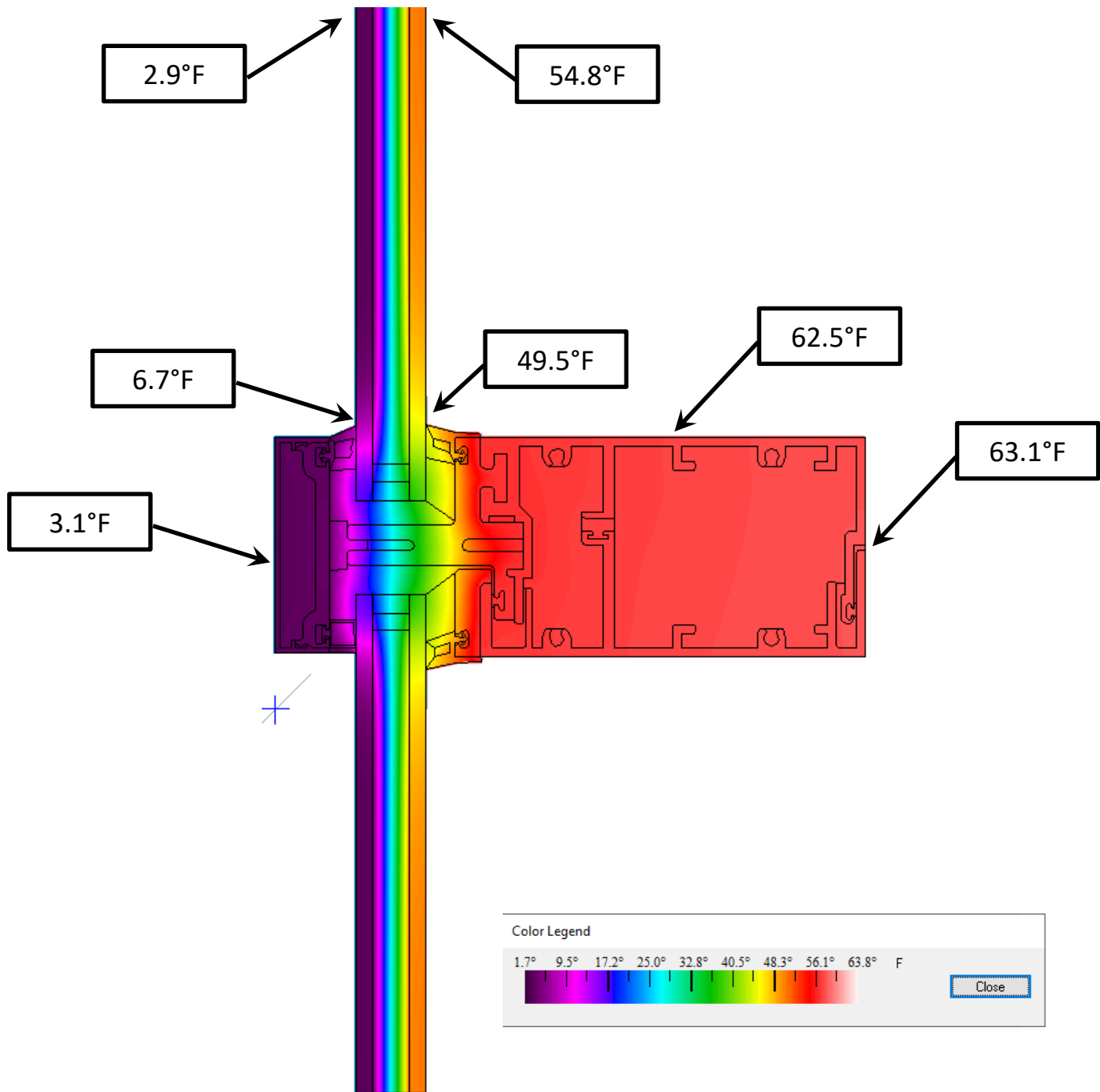
# Typical Vertical



# Typical Vertical – Double Low E



# Typical Vertical – Single Low E





ID #

Name

Mode

Type  >>

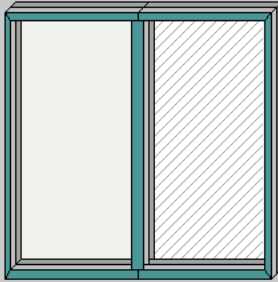
Width  inches

Height  inches

Area  ft2

Tilt

Environmental Conditions



**Total Window Results - Normal Incidence**

Ufactor  Btu/h-ft2-F

SHGC

VT

CR

Click on a component to display characteristics below

**Glazing System**

Name  >>

ID <input type="text" value="100"/>	Ucenter <input type="text" value="0.19137"/> Btu/h-ft2-F
Nlayers <input type="text" value="2"/>	SC <input type="text" value="0.42136"/>
Area <input type="text" value="14.69497"/> ft2	SHGC <input type="text" value="0.36658"/>
Edge area <input type="text" value="3.62217"/> ft2	Vtc <input type="text" value="0.69953"/>

ID #

Name

Mode

Type  >>

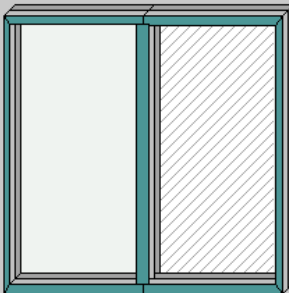
Width  inches

Height  inches

Area  ft2

Tilt

Environmental Conditions



**Total Window Results - Normal Incidence**

Ufactor  Btu/h-ft2-F

SHGC

VT

CR

Click on a component to display characteristics below

**Glazing System**

Name  >>

ID <input type="text" value="101"/>	Ucenter <input type="text" value="0.24321"/> Btu/h-ft2-F
Nlayers <input type="text" value="2"/>	SC <input type="text" value="0.43155"/>
Area <input type="text" value="14.67074"/> ft2	SHGC <input type="text" value="0.37545"/>
Edge area <input type="text" value="3.61826"/> ft2	Vtc <input type="text" value="0.70742"/>

ID #

Name

Mode

Type  >>

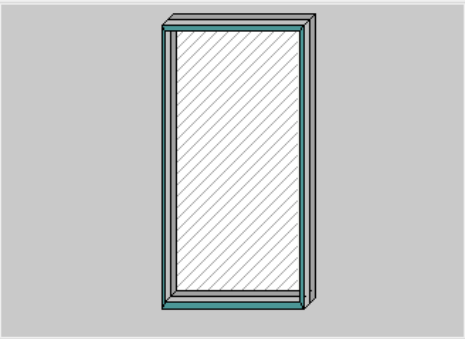
Width  inches

Height  inches

Area  ft<sup>2</sup>

Tilt

Environmental Conditions



**Total Window Results - Normal Incidence**

U-factor  Btu/h-ft<sup>2</sup>-F

SHGC

VT

CR

Click on a component to display characteristics below

**Glazing System**

Name  >>

ID	<input type="text" value="100"/>	Ucenter	<input type="text" value="0.18603"/> Btu/h-ft <sup>2</sup> -F
Nlayers	<input type="text" value="2"/>	SC	<input type="text" value="0.42034"/>
Area	<input type="text" value="39.27035"/> ft <sup>2</sup>	SHGC	<input type="text" value="0.36570"/>
Edge area	<input type="text" value="5.77118"/> ft <sup>2</sup>	Vtc	<input type="text" value="0.69953"/>

ID #

Name

Mode

Type  >>

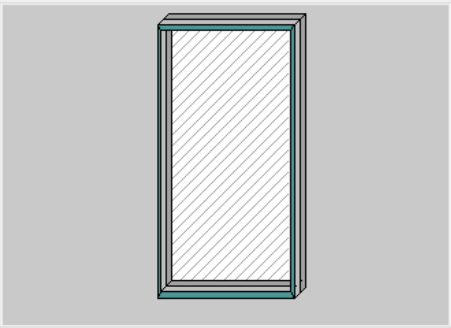
Width  inches

Height  inches

Area  ft<sup>2</sup>

Tilt

Environmental Conditions



**Total Window Results - Normal Incidence**

U-factor  Btu/h-ft<sup>2</sup>-F

SHGC

VT

CR

Click on a component to display characteristics below

**Glazing System**

Name  >>

ID	<input type="text" value="101"/>	Ucenter	<input type="text" value="0.24135"/> Btu/h-ft <sup>2</sup> -F
Nlayers	<input type="text" value="2"/>	SC	<input type="text" value="0.43129"/>
Area	<input type="text" value="39.27035"/> ft <sup>2</sup>	SHGC	<input type="text" value="0.37522"/>
Edge area	<input type="text" value="5.77118"/> ft <sup>2</sup>	Vtc	<input type="text" value="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	<input type="checkbox"/>	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%)		0.500												
▼ Glass 2 ▶▶	6025	RoomsideLE.vir	#	0.236	<input type="checkbox"/>	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	<input type="checkbox"/>	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%)		0.500												
▼ Glass 2 ▶▶	2004	Clr-6.CIG	#	0.236	<input type="checkbox"/>	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