TESSERACT DRAFTING & DESIGN INC.

THERMAL SIMULATION REPORT: ALPINE 35, ALPINE 35+

Disclaimer

Please note that the fenestration system details were modeled and assessed for thermal heat transmittance only. The details were not evaluated with respect to other building enclosure functions such as moisture control, air leakage, or durability as part of this report. TESSERACT DRAFTING + DESIGN and its employees neither endorse nor warrant the suitability of the simulated products. The scope of work is to determine U-factors for the system as it was provided to TESSERACT DRAFTING + DESIGN. Furthermore, the effective U-factors provided in this report are for the fenestration product only, in general conformance with the requirements of NFRC 100. The effective U-factors do not account for thermal bridging of attachment anchors, floors slabs, and other installation realities.

Thermal simulation is not a guarantee of exact performance. The effective U-values presented in this report are not intended to certify the modeled products, or to be used for labeling purposes. The results are the exclusive property of Siber Facade for use on the identified building and may not be reproduced except in full, without the written approval of TESSERACT DRAFTING + DESIGN. Commercially reasonable business efforts were made to accurately model the thermal performance of the fenestration products documented in this report, but because of the large amount of input data and analyses, it is possible that non-material errors or omissions could remain.

Product Description

Tested product is a punch out type window with options for full size operable vent or an operable vent insert. Mullions, head sill and intermediate extrusions are thermally broken by a thermal break and rolled.

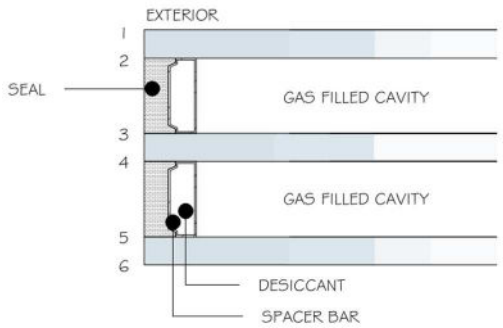
A + Series feature additional phenolic foam inserts.

Glass Types

The system was modeled with triple glazed IGUs per Siber Façade provided make ups.
Typical unit make up consists of 5mm Clear lite, 12mm Argon Filled Spacer Cavity, 5mm Clear Lite, 12mm Argon Filled Spacer Cavity, 5mm Clear Lite. Four different Low E coating configurations were simulated. As summarized in the table below.

TAG	MAKE UP	U_{cog}(W/m2-K)	U_{cog}(Btu/hft2-F)
Alpine 01	5mm CLR PDE67A #2 12mm Ar 95% Air 5% 5mm CLR PLE88A #4 12mm Ar 95% Air 5% 5mm CLR	0.757	0.133
Alpine 02	5mm CLR PDE80A #2 12mm Ar 95% Air 5% 5mm CLR 12mm Ar 95% Air 5% 5mm CLR PDE 80A #5	0.643	0.113
Alpine 03	5mm CLR GY70 #2 12mm Ar 95% Air 5% 5mm CLR GY70#4 12mm Ar 95% Air 5% 5mm CLR	0.695	0.122
Alpine 04	5mm CLR PDE80A #2 12mm Ar 95% Air 5% 5mm CLR 12mm Ar 95% Air 5% 5mm CLR	0.954	0.168

Typical Sealed Unit



Results

Fixed Window Alpine 35 (W/m2-K)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Window Head Alpine 01	2.628818	1.128473	49.690mm
Window Head Alpine 02	2.917970	0.931873	49.690mm
Window Head Alpine 03	2.630802	1.076004	49.690mm
Window Head Alpine 04	2.616360	1.402599	49.690mm
Window Jamb Alpine 01	2.795188	1.150349	49.690mm
Window Jamb Alpine 02	3.081762	0.946310	49.690mm
Window Jamb Alpine 03	2.797548	1.097923	49.690mm
Window Jamb Alpine 04	2.780461	1.424165	49.690mm
Window Sill Alpine 01	2.627962	1.128209	49.690mm
Window Sill Alpine 02	2.917092	0.931741	49.690mm
Window Sill Alpine 03	2.629941	1.075736	49.690mm
Window Sill Alpine 04	2.615527	1.402387	49.690mm

Fixed Window Alpine 35 (Btu/hft2-F)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Window Head Alpine 01	0.462962	0.198736	1.956291in
Window Head Alpine 02	0.513884	0.164112	1.956291in
Window Head Alpine 03	0.463311	0.189495	1.956291in
Window Head Alpine 04	0.460768	0.247012	1.956291in
Window Jamb Alpine 01	0.492261	0.202588	1.956291in
Window Jamb Alpine 02	0.542730	0.166655	1.956291in
Window Jamb Alpine 03	0.489668	0.250810	1.956291in
Window Jamb Alpine 04	0.489668	0.250810	1.956291in
Window Sill Alpine 01	0.462811	0.198689	1.956291in
Window Sill Alpine 02	0.513730	0.164089	1.956291in
Window Sill Alpine 03	0.463159	0.189448	1.956291in
Window Sill Alpine 04	0.460621	0.246975	1.956291in

System U-Value

Type: Picture, 1200mm x 1500mm

Name	U-Value (W/m2-K)	U-Value (Btu/hft2-F)
Alpine 01	1.094	0.193
Alpine 02	1.065	0.188
Alpine 03	1.043	0.184
Alpine 04	1.328	0.234

Fixed Window Alpine 35+ (W/m2-K)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Window Head Alpine 01	2.322172	1.090032	49.690mm
Window Head Alpine 02	2.615592	0.906479	49.690mm
Window Head Alpine 03	2.323550	1.037427	49.690mm
Window Head Alpine 04	2.313576	1.365125	49.690mm
Window Jamb Alpine 01	2.333775	1.092453	49.690mm
Window Jamb Alpine 02	2.627322	0.908180	49.690mm
Window Jamb Alpine 03	2.335163	1.039818	49.690mm
Window Jamb Alpine 04	2.325110	1.367932	49.690mm
Window Sill Alpine 01	2.320912	1.089705	49.690mm
Window Sill Alpine 02	2.614317	0.906347	49.690mm
Window Sill Alpine 03	2.322284	1.037142	49.690mm
Window Sill Alpine 04	2.312348	1.364912	49.690mm

Fixed Window Alpine 35+ (Btu/hft2-F)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Window Head Alpine 01	0.408958	0.191966	1.956291in
Window Head Alpine 02	0.460632	0.159640	1.956291in
Window Head Alpine 03	0.409201	0.182702	1.956291in
Window Head Alpine 04	0.407444	0.240412	1.956291in
Window Jamb Alpine 01	0.411002	0.192392	1.956291in
Window Jamb Alpine 02	0.462698	0.159940	1.956291in
Window Jamb Alpine 03	0.411246	0.183123	1.956291in
Window Jamb Alpine 04	0.409475	0.240907	1.956291in
Window Sill Alpine 01	0.408736	0.191908	1.956291in
Window Sill Alpine 02	0.460408	0.159617	1.956291in
Window Sill Alpine 03	0.408978	0.182651	1.956291in
Window Sill Alpine 04	0.407228	0.240375	1.956291in

System U-Value

Type: Picture, 1200mm x 1500mm

Name	U-Value (W/m2-K)	U-Value (Btu/hft2-F)
Alpine 01	1.030	0.181
Alpine 02	1.004	0.177
Alpine 03	0.978	0.172
Alpine 04	1.264	0.223

Operable Window Alpine 35 (W/m2-K)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Operable Head Alpine 01	2.527454	1.068969	82.133mm
Operable Head Alpine 02	2.529428	1.023849	82.133mm
Operable Head Alpine 03	2.528723	1.017115	82.133mm
Operable Head Alpine 04	2.516613	1.338623	82.133mm
Operable Jamb Alpine 01	2.637295	1.081639	82.133mm
Operable Jamb Alpine 02	2.639300	1.036409	82.133mm
Operable Jamb Alpine 03	2.638633	1.029666	82.133mm
Operable Jamb Alpine 04	2.625982	1.352033	82.133mm
Operable Sill Alpine 01	2.527635	1.069054	82.133mm
Operable Sill Alpine 02	2.707434	0.897762	82.133mm
Operable Sill Alpine 03	2.529359	1.017331	82.133mm
Operable Sill Alpine 04	2.517199	1.338834	82.133mm

Operable Operable Alpine 35 (Btu/hft2-F)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Operable Head Alpine 01	0.44513	0.18827	3.579626in
Operable Head Alpine 02	0.44548	0.18032	3.579626in
Operable Head Alpine 03	0.44535	0.17913	3.579626in
Operable Head Alpine 04	0.44322	0.23576	3.579626in
Operable Jamb Alpine 01	0.46448	0.19050	3.579626in
Operable Jamb Alpine 02	0.46483	0.18253	3.579626in
Operable Jamb Alpine 03	0.46471	0.18134	3.579626in
Operable Jamb Alpine 04	0.46248	0.23812	3.579626in
Operable Sill Alpine 01	0.44516	0.18828	3.579626in
Operable Sill Alpine 02	0.47683	0.15811	3.579626in
Operable Sill Alpine 03	0.44547	0.17917	3.579626in
Operable Sill Alpine 04	0.44332	0.23579	3.579626in

System U-Value

Type: Casement, 600mm x 1500mm (23.622in x 59.055in)
Type: Dual Action, 1200 x 1500 (23.622in x 59.055in)

	Casement		Dual Action	
Name	U-Value (W/m2-K)	U-Value (Btu/hft2-F)	U-Value (W/m2-K)	U-Value (Btu/hft2-F)
Alpine 01	1.485	0.261	1.230	0.217
Alpine 02	1.433	0.252	1.159	0.204
Alpine 03	1.447	0.255	1.184	0.209
Alpine 04	1.624	0.286	1.389	0.245

Operable Window Alpine 35+ (W/m2-K)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Operable Head Alpine 01	2.334823	1.050386	82.133mm
Operable Head Alpine 02	2.514839	0.884327	82.133mm
Operable Head Alpine 03	2.335909	0.998536	82.133mm
Operable Head Alpine 04	2.324688	1.320094	82.133mm
Operable Jamb Alpine 01	2.334646	1.050331	82.133mm
Operable Jamb Alpine 02	2.514632	0.884281	82.133mm
Operable Jamb Alpine 03	2.335706	0.998481	82.133mm
Operable Jamb Alpine 04	2.324481	1.320094	82.133mm
Operable Sill Alpine 01	2.334914	1.050462	82.133mm
Operable Sill Alpine 02	2.515416	0.884458	82.133mm
Operable Sill Alpine 03	2.336482	0.998743	82.133mm
Operable Sill Alpine 04	2.325236	1.320390	82.133mm

Operable Operable Alpine 35+ (Btu/hft2-F)

Name	U_{frame}	U_{edge}	Projected Frame Dimension
Operable Head Alpine 01	0.41121	0.18499	3.579626in
Operable Head Alpine 02	0.44291	0.15575	3.579626in
Operable Head Alpine 03	0.41140	0.17586	3.579626in
Operable Head Alpine 04	0.40942	0.23249	3.579626in
Operable Jamb Alpine 01	0.41117	0.18498	3.579626in
Operable Jamb Alpine 02	0.44287	0.15574	3.579626in
Operable Jamb Alpine 03	0.41136	0.17585	3.579626in
Operable Jamb Alpine 04	0.40938	0.23249	3.579626in
Operable Sill Alpine 01	0.41122	0.18501	3.579626in
Operable Sill Alpine 02	0.44301	0.15577	3.579626in
Operable Sill Alpine 03	0.41150	0.17590	3.579626in
Operable Sill Alpine 04	0.40952	0.23254	3.579626in

System U-Value

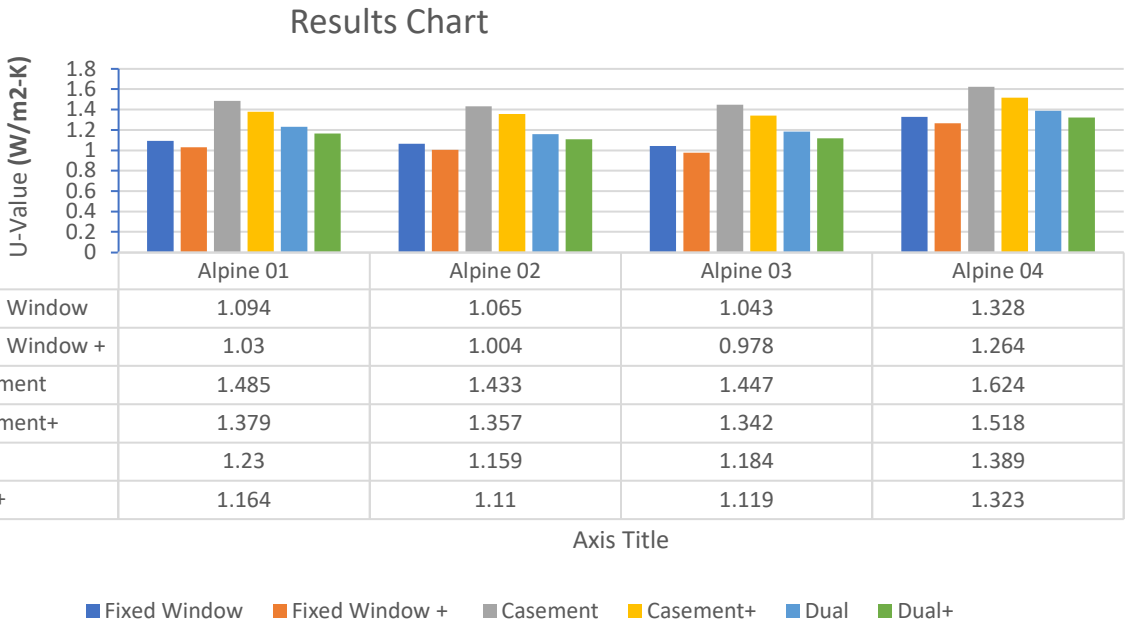
Type: Casement, 600mm x 1500mm (23.622in x 59.055in)
Type: Dual Action, 1200 x 1500 (23.622in x 59.055in)

	Casement		Dual Action	
Name	U-Value (W/m2-K)	U-Value (Btu/hft2-F)	U-Value (W/m2-K)	U-Value (Btu/hft2-F)
Alpine 01	1.379	0.243	1.164	0.205
Alpine 02	1.357	0.239	1.110	0.196
Alpine 03	1.342	0.236	1.119	0.197
Alpine 04	1.518	0.267	1.323	0.233

Acronyms and Symbols

U_{frame}	**Frame** U-Value
U_{edge}	**Edge** of Glass U-Value
U_{cog}	Center of Glass U-Value

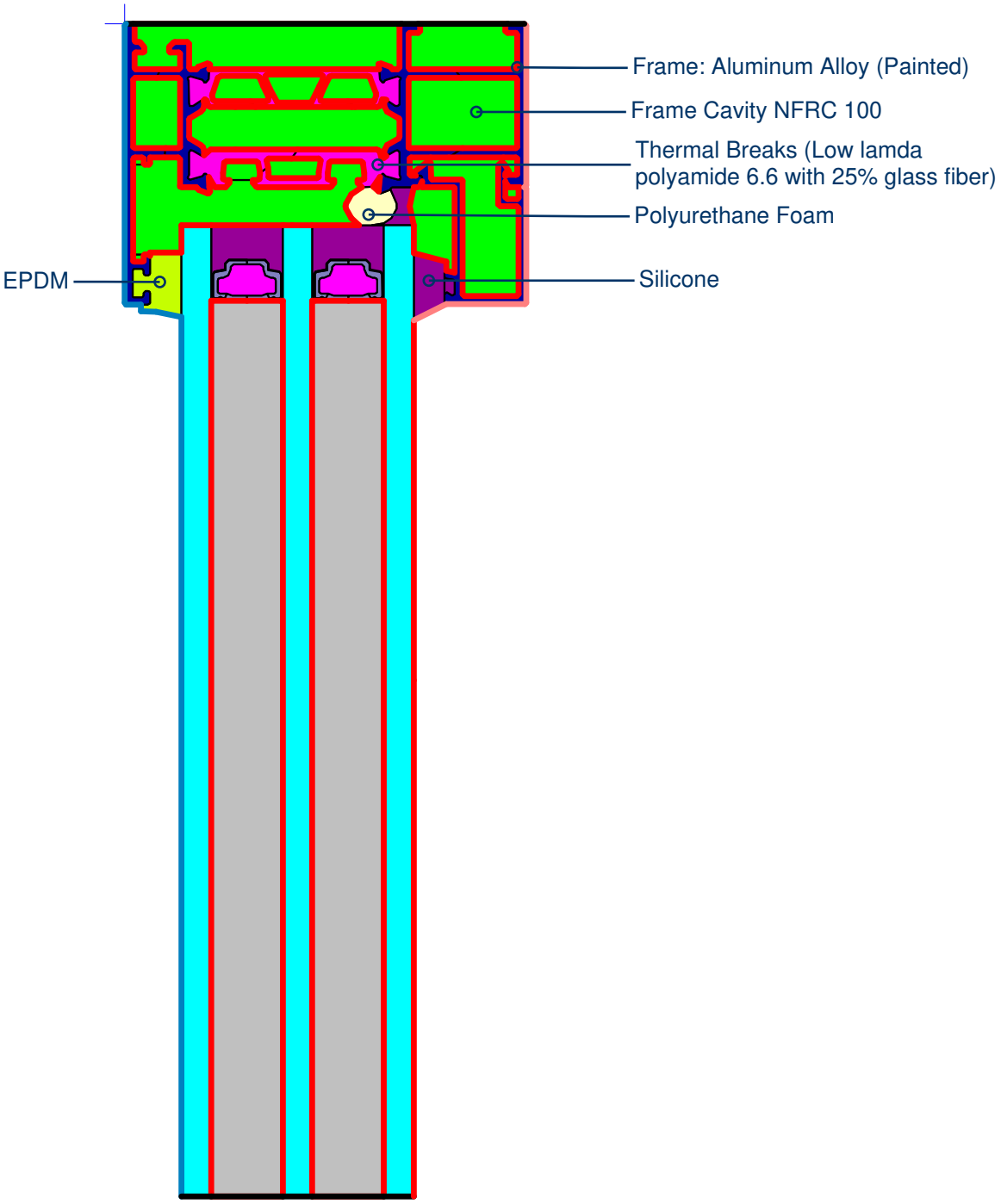
Data Comparison

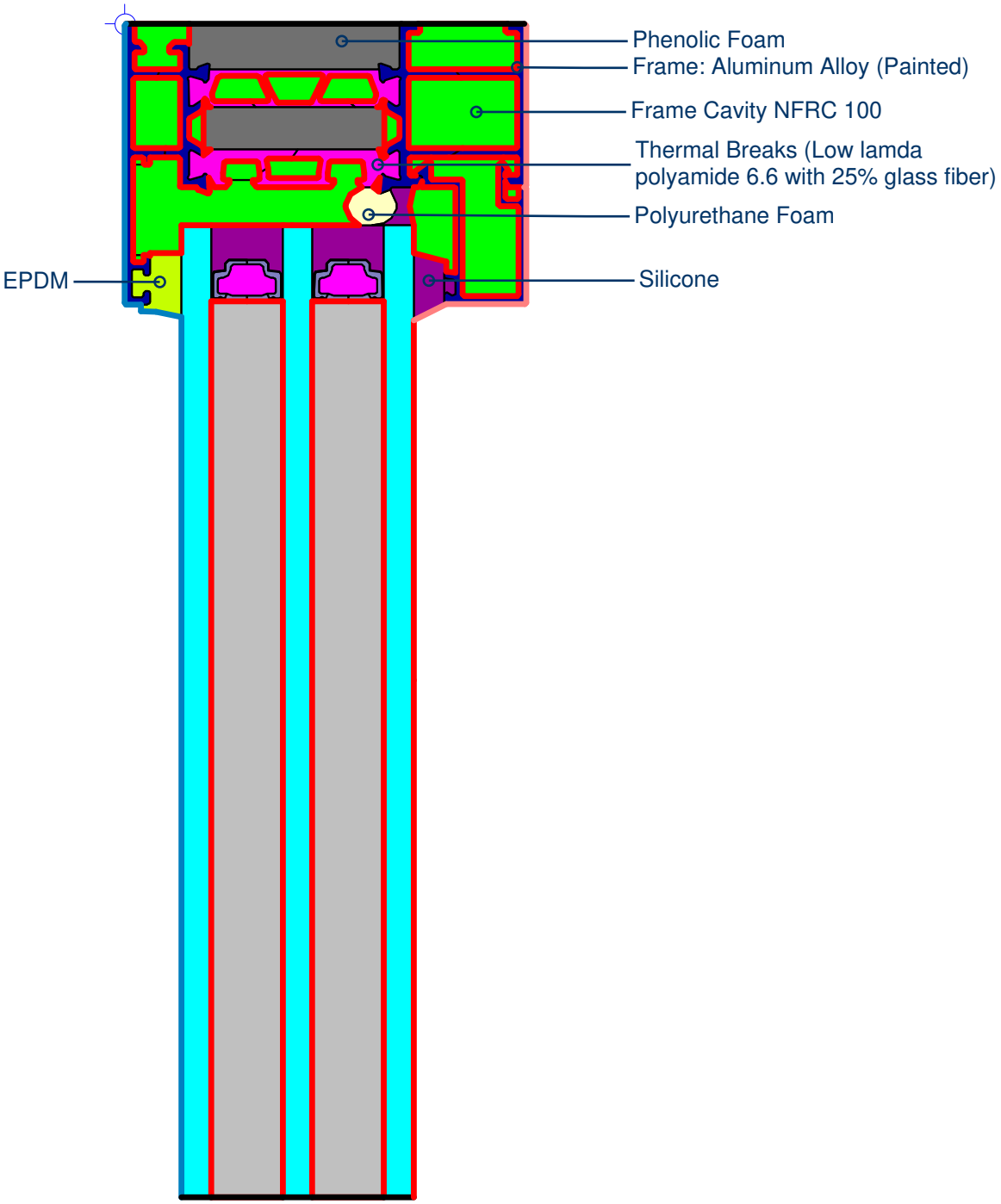


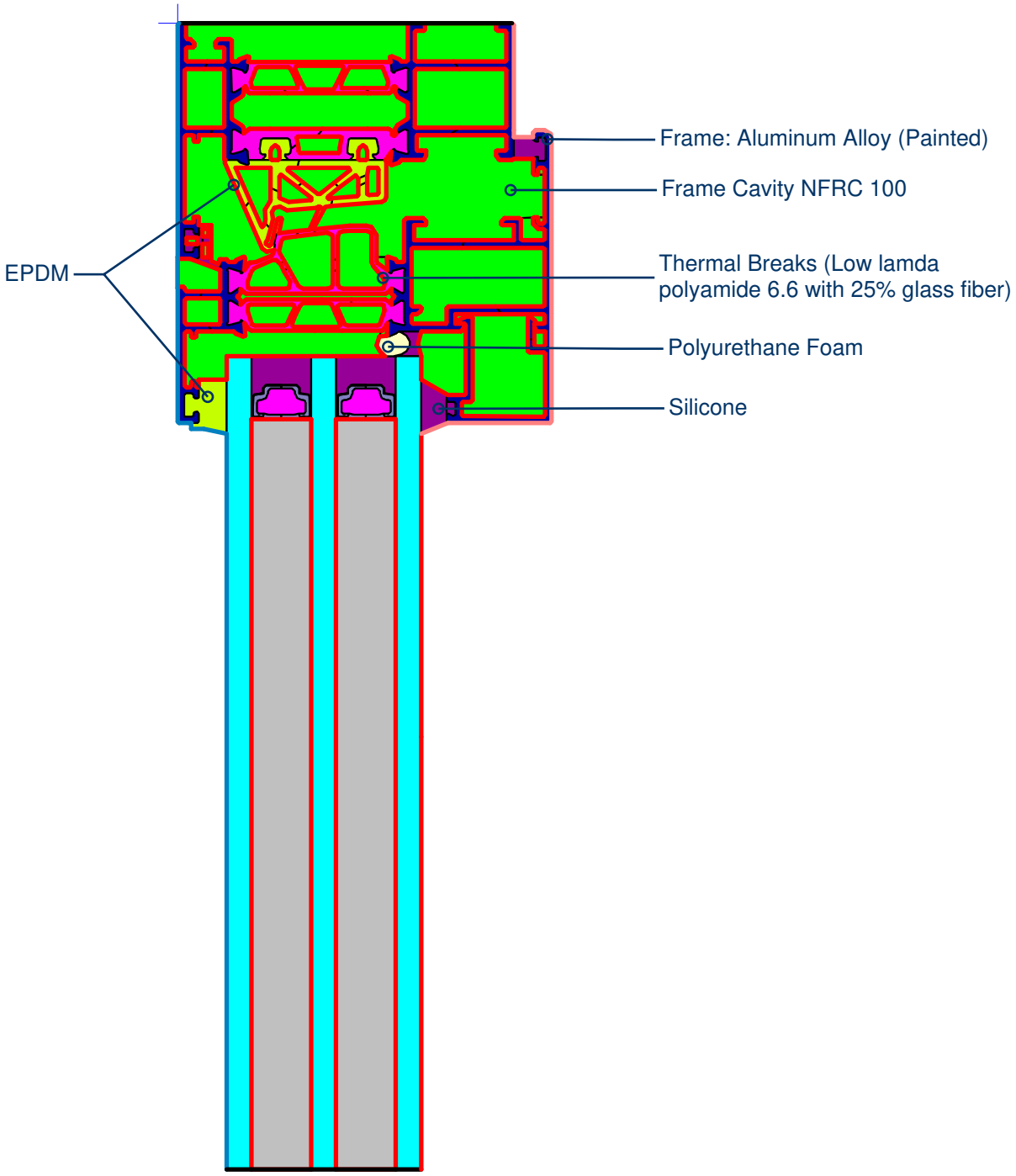
	Alpine 01	Alpine 02	Alpine 03	Alpine 04
Fixed Window	1.094	1.065	1.043	1.328
Fixed Window +	1.03	1.004	0.978	1.264
Casement	1.485	1.433	1.447	1.624
Casement+	1.379	1.357	1.342	1.518
Dual	1.23	1.159	1.184	1.389
Dual+	1.164	1.11	1.119	1.323

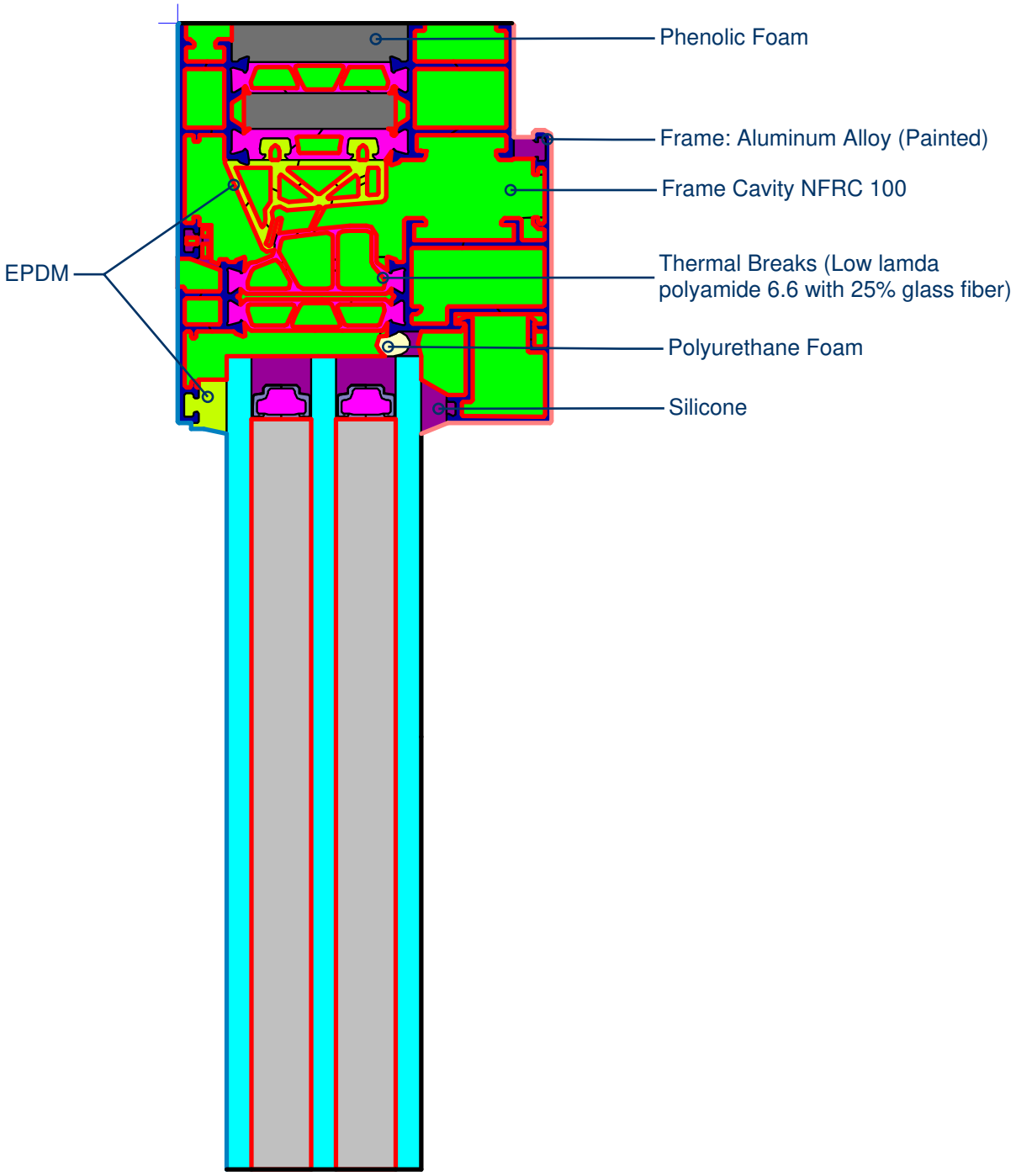
Simulation Materials

	Name	Conductivity (W/m2-K)	Conductivity (Btu/hft2-F)
	Frame Cavity NFRC 100		
	Polyamide 6.6 25% Glass Fiber	0.1980	0.114
	Aluminum (Painted)	160	92.4463
	Silicone	0.35	0.202
	EPDM	0.2500	0.1444
	Polyurethane Foam	0.0500	0.0289
	Phenolic Foam	0.0230	0.0133


Frame: Aluminum Alloy (Painted)
Frame Cavity NFRC 100
Thermal Breaks (Low lamda polyamide 6.6 with 25% glass fiber)
Polyurethane Foam
EPDM
Silicone


Phenolic Foam
Frame: Aluminum Alloy (Painted)
Frame Cavity NFRC 100
Thermal Breaks (Low lamda polyamide 6.6 with 25% glass fiber)
Polyurethane Foam
EPDM
Silicone


Frame: Aluminum Alloy (Painted)
Frame Cavity NFRC 100
EPDM
Thermal Breaks (Low lamda polyamide 6.6 with 25% glass fiber)
Polyurethane Foam
Silicone


Phenolic Foam
Frame: Aluminum Alloy (Painted)
Frame Cavity NFRC 100
EPDM
Thermal Breaks (Low lamda polyamide 6.6 with 25% glass fiber)
Polyurethane Foam
Silicone