MORRISON HERSHFIELD

Foriea Thermal Clip Thermal Analysis

Presented to:

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1. INTRODUCTION

Morrison Hershfield (MH) was retained by Skyline Sheet Metal, Inc. (Skyline) to evaluate the thermal performance of the Foriea Thermal Clip system for a variety of clip spacings, insulation thicknesses, and backup walls. This report is a summary of the analysis.

The Foriea Thermal Clip is made of galvanized steel with a nylon thermal isolator. The clip is available in two sizes, 2 inch and 3.5 inches. Both horizontal and vertical girts can be attached to the Foriea Thermal Clip, as shown in Figure 1.1.

Figure 1.1: Horizontal and Vertical Girt Attachment to Foriea Thermal Clip

The Foriea Thermal Clip can be used with both continuous girts and intermittent girts. The clip spacing and girt length for the intermittent configurations is dependent on the direction of the girt and are shown below in Figure 1.2.

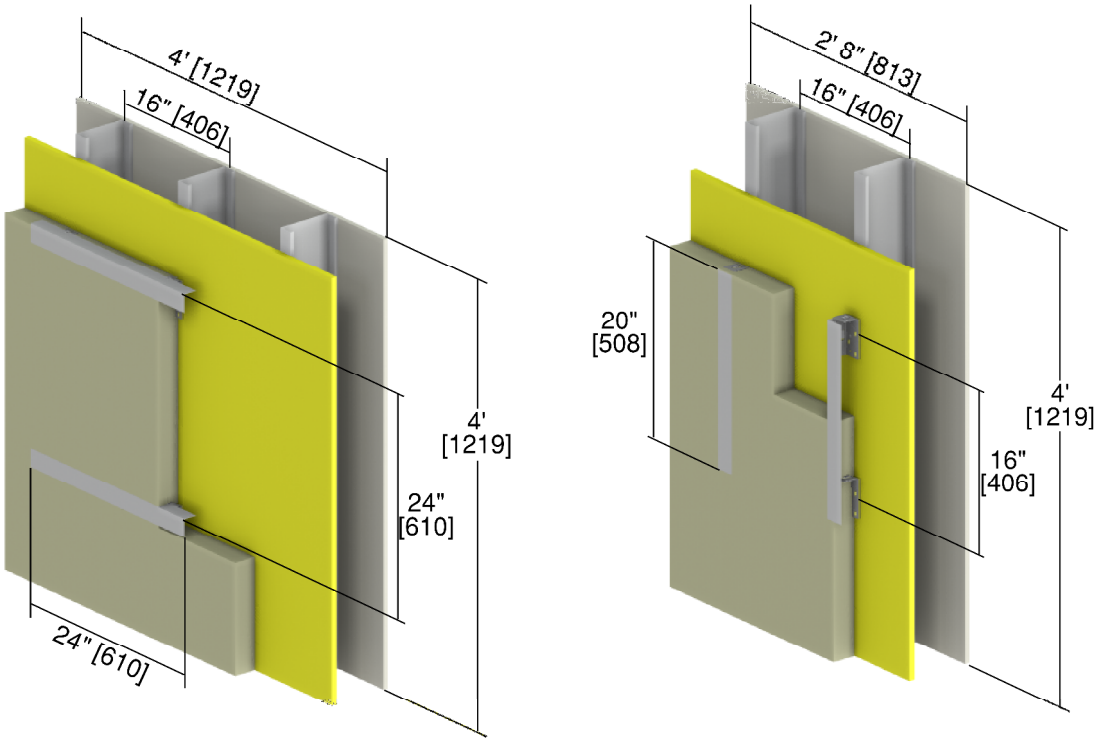


Figure 1.2: Intermittent Horizontal and Vertical Girt Clear Wall Configuration

The 2 inch and 3.5 inch Foriea Thermal Clip were evaluated to determine the clear field U-values and effective R-values for a variety of clip spacings, girt orientations and lengths, and backup wall configurations. The configurations evaluated are shown in Table 1.1 below. Figure 1.3 illustrates representative configurations for all backup wall types, and Figure 1.4 depicts the girt penetration for all insulation thicknesses. The geometry of the Foriea Thermal Clip was based on the drawings provided by Skyline dated April 22, 2020 and are provided in Appendix A.

Table 1.1: Evaluated Foriea Thermal Clip Assemblies

Backup Wall	Foriea Thermal Clip Size	Exterior Insulation Thickness[1] (inches)	Girt Configuration	Horizontal Clip Spacing (inches)	Vertical Clip Spacing (inches)
6" Steel Stud, 16" o.c., Uninsulated Cavity	2 inch	2, 2.5, 3	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
	3.5 inch	3.5, 4, 4.5, 5, 5.5, 6	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
6" Steel Stud, 16" o.c., R-19 Batt Insulation in Cavity	2 inch	2, 2.5, 3	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
	3.5 inch	3.5, 4, 4.5, 5, 5.5, 6	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
2" x 6" Wood Frame, 16" o.c, R-18 Batt Insulation in Cavity	2 inch	2, 2.5, 3	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
	3.5 inch	3.5, 4, 4.5, 5, 5.5, 6	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
CMU	2 inch	2, 2.5, 3	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16
	3.5 inch	3.5, 4, 4.5, 5, 5.5, 6	Continuous Horizontal, Continuous Vertical	16	24, 48
			Intermittent Horizontal	16	24
			Intermittent Vertical	16	16

[1]Thicknesses highlighted in red indicate interpolated values

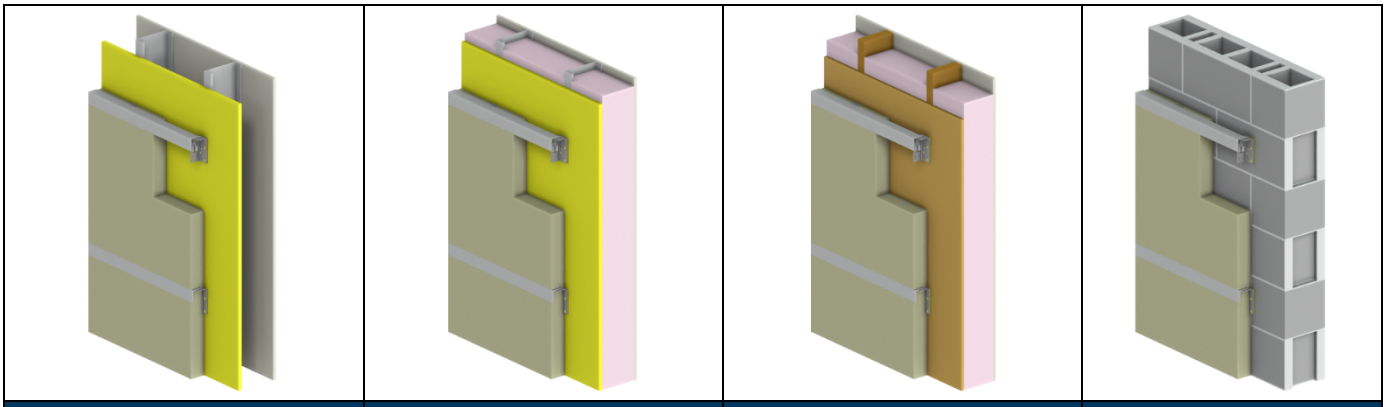
			
Exterior Insulated Steel Stud Assembly	**Split Insulated Steel Stud Assembly**	**Split Insulated Wood Frame Assembly**	**Concrete Block Wall**
• 1/2 inch gypsum • 6 inch x 1 5/8 inch steel studs in uninsulated cavity • 5/8 inch gypsum sheathing • Foriea Thermal Clip system • Exterior mineral wool insulation	• 1/2 inch gypsum • 6 inch x 1 5/8 inch steel studs in R-19 batt insulation cavity • 5/8 inch gypsum sheathing • Foriea Thermal Clip system • Exterior mineral wool insulation	• 1/2 inch gypsum • 2 inch x 6 inch wood studs with R-18 batt insulation cavity • 1/2 inch plywood sheathing • Foriea Thermal Clip system • Exterior mineral wool insulation	• 8 inch CMU • Foriea Thermal Clip system • Exterior mineral wool insulation

Figure 1.2: Schematics of Evaluated Foriea Thermal Clip Assemblies

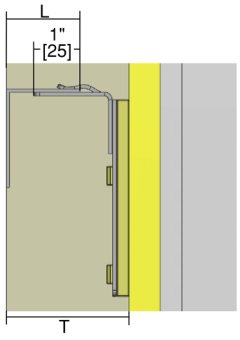
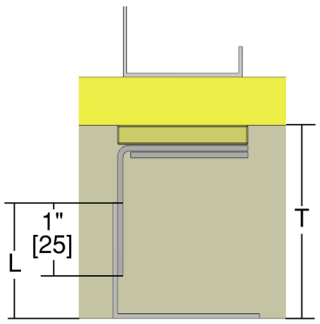
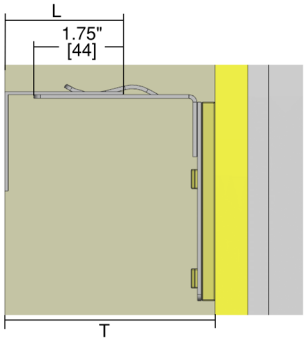
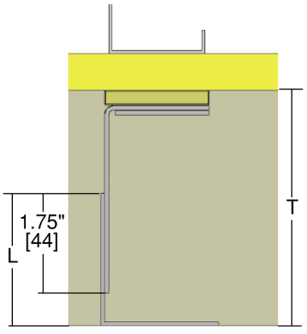
Clip Size	Horizontal Girt	Vertical Girt	T in	L in
2 inch Clip			2	1
			2.5	1.5
			3	2
3.5 inch Clip			3.5	3.5
			4	2.25
			5	3.25
			6	4.25

Figure 1.3: Girt Penetration for all Insulation Thicknesses

2. MODELLING PROCEDURES

The thermal performance of the different assembly scenarios was evaluated by 3D thermal modelling using the Nx software package from Siemens, which is a general purpose computer aided design (CAD) and finite element analysis (FEA) package. The thermal solver and modelling procedures utilized for this study were extensively calibrated and validated to within +/- 5% of hotbox testing for *ASHRAE Research Project 1365-RP Thermal Performance of Building Envelope Details for Mid- and High-Rise Construction and for the Building Envelope Thermal Bridging Guide*[1]. The thermal analysis utilized steady-state conditions, published thermal properties of materials and information provided by Skyline. Additional assumptions for the thermal analysis are listed in Appendix B. Further assembly information, including material properties, are given in Appendix C.

1 https://www.bchydro.com/thermalguide

3. THERMAL RESULTS

The U-values and effective R-values for all Foriea Thermal Clip configurations are shown below. Example temperature profiles for each configuration are provided in Appendix D.

3.1 Foriea Thermal Clip with Exterior Insulated Steel Stud Assembly

Table 3.1.1: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Horizontal Girt, Exterior Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[2] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h·ft² °F (W/m²·K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.095 (0.54)	R-10.5 (1.85)	0.090 (0.51)	R-11.1 (1.95)
	2.5	R-10.5 (1.85 RSI)	0.084 (0.48)	R-11.9 (2.10)	0.078 (0.44)	R-12.8 (2.25)
	3.0	R-12.6 (2.22 RSI)	0.076 (0.43)	R-13.2 (2.33)	0.069 (0.39)	R-14.4 (2.54)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.068 (0.39)	R-14.6 (2.58)	0.062 (0.35)	R-16.1 (2.84)
	4.0	R-16.8 (2.96 RSI)	0.063 (0.36)	R-15.8 (2.78)	0.057 (0.32)	R-17.7 (3.11)
	4.5	R-18.9 (3.33 RSI)	0.060 (0.34)*	R-16.8 (2.96)*	0.052 (0.30)*	R-19.1 (3.37)*
	5.0	R-21.0 (3.70 RSI)	0.056 (0.32)	R-17.8 (3.14)	0.049 (0.28)	R-20.6 (3.62)
	5.5	R-23.1 (4.07 RSI)	0.053 (0.30)*	R-18.7 (3.30)*	0.046 (0.26)*	R-21.9 (3.85)*
	6.0	R-25.2 (4.44 RSI)	0.051 (0.29)	R-19.6 (3.45)	0.043 (0.24)	R-23.2 (4.09)

*Denotes interpolated values

Table 3.1.2: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 24" o.c. Vertically with an Intermittent Horizontal Girt, Exterior Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[2] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m² K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.091 (0.52)	R-10.9 (1.92)
	2.5	R-10.5 (1.85 RSI)	0.079 (0.45)	R-12.6 (2.22)
	3.0	R-12.6 (2.22 RSI)	0.071 (0.40)	R-14.2 (2.50)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.064 (0.36)	R-15.7 (2.77)
	4.0	R-16.8 (2.96 RSI)	0.058 (0.33)	R-17.2 (3.03)
	4.5	R-18.9 (3.33 RSI)	0.054 (0.31)*	R-18.6 (3.27)*
	5.0	R-21.0 (3.70 RSI)	0.050 (0.28)	R-19.9 (3.51)
	5.5	R-23.1 (4.07 RSI)	0.047 (0.27)*	R-21.2 (3.73)*
	6.0	R-25.2 (4.44 RSI)	0.045 (0.25)	R-22.4 (3.95)

*Denotes interpolated values

[2] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-3.3 towards the nominal R-value of the entire assembly.

Table 3.1.3: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Vertical Girt, Exterior Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[3] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.097 (0.55)	R-10.3 (1.82)	0.092 (0.52)	R-10.8 (1.91)
	2.5	R-10.5 (1.85 RSI)	0.087 (0.49)	R-11.6 (2.04)	0.082 (0.46)	R-12.2 (2.16)
	3.0	R-12.6 (2.22 RSI)	0.079 (0.45)	R-12.7 (2.23)	0.074 (0.42)	R-13.5 (2.38)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.071 (0.40)	R-14.2 (2.50)	0.065 (0.37)	R-15.5 (2.72)
	4.0	R-16.8 (2.96 RSI)	0.066 (0.38)	R-15.1 (2.66)	0.060 (0.34)	R-16.6 (2.92)
	4.5	R-18.9 (3.33 RSI)	0.063 (0.36)*	R-16.0 (2.81)*	0.057 (0.32)*	R-17.6 (3.10)*
	5.0	R-21.0 (3.70 RSI)	0.060 (0.34)	R-16.8 (2.96)	0.054 (0.31)	R-18.6 (3.28)
	5.5	R-23.1 (4.07 RSI)	0.057 (0.32)*	R-17.5 (3.08)*	0.052 (0.29)*	R-19.4 (3.42)*
	6.0	R-25.2 (4.44 RSI)	0.055 (0.31)	R-18.2 (3.20)	0.049 (0.28)	R-20.2 (3.56)

*Denotes interpolated values

Table 3.1.4: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 16" o.c. Vertically with an Intermittent Vertical Girt, Exterior Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[3] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m² K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.095 (0.54)	R-10.5 (1.86)
	2.5	R-10.5 (1.85 RSI)	0.083 (0.47)	R-12.0 (2.12)
	3.0	R-12.6 (2.22 RSI)	0.074 (0.42)	R-13.4 (2.36)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.068 (0.38)	R-14.8 (2.61)
	4.0	R-16.8 (2.96 RSI)	0.062 (0.35)	R-16.0 (2.82)
	4.5	R-18.9 (3.33 RSI)	0.058 (0.33)*	R-17.2 (3.03)*
	5.0	R-21.0 (3.70 RSI)	0.055 (0.31)	R-18.3 (3.23)
	5.5	R-23.1 (4.07 RSI)	0.052 (0.29)*	R-19.4 (3.41)*
	6.0	R-25.2 (4.44 RSI)	0.049 (0.28)	R-20.4 (3.59)

*Denotes interpolated values

[3] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-3.3 towards the nominal R-value of the entire assembly.

3.2 Foriea Thermal Clip with Split Insulated Steel Stud Assembly

Table 3.2.1: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Horizontal Girt, Split Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[4] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.053 (0.30)	R-18.9 (3.33)	0.050 (0.29)	R-19.8 (3.49)
	2.5	R-10.5 (1.85 RSI)	0.049 (0.28)	R-20.3 (3.57)	0.046 (0.26)	R-21.5 (3.79)
	3.0	R-12.6 (2.22 RSI)	0.046 (0.26)	R-21.6 (3.80)	0.043 (0.25)	R-23.2 (4.08)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.044 (0.25)	R-22.8 (4.01)	0.040 (0.23)	R-24.8 (4.36)
	4.0	R-16.8 (2.96 RSI)	0.042 (0.24)	R-23.9 (4.21)	0.038 (0.22)	R-26.3 (4.63)
	4.5	R-18.9 (3.33 RSI)	0.040 (0.23)*	R-24.9 (4.38)*	0.036 (0.20)*	R-27.7 (4.89)*
	5.0	R-21.0 (3.70 RSI)	0.039 (0.22)	R-25.9 (4.56)	0.034 (0.19)	R-29.2 (5.14)
	5.5	R-23.1 (4.07 RSI)	0.037 (0.21)*	R-26.8 (4.71)*	0.033 (0.19)*	R-30.5 (5.37)*
	6.0	R-25.2 (4.44 RSI)	0.036 (0.21)	R-27.6 (4.87)	0.031 (0.18)	R-31.8 (5.61)

*Denotes interpolated values

Table 3.2.2: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 24" o.c. Vertically with an Intermittent Horizontal Girt, Split Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[4] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.051 (0.29)	R-19.6 (3.45)
	2.5	R-10.5 (1.85 RSI)	0.047 (0.27)	R-21.2 (3.74)
	3.0	R-12.6 (2.22 RSI)	0.044 (0.25)	R-22.8 (4.01)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.041 (0.23)	R-24.2 (4.27)
	4.0	R-16.8 (2.96 RSI)	0.039 (0.22)	R-25.7 (4.52)
	4.5	R-18.9 (3.33 RSI)	0.037 (0.21)*	R-27.0 (4.76)*
	5.0	R-21.0 (3.70 RSI)	0.035 (0.20)	R-28.4 (5.00)
	5.5	R-23.1 (4.07 RSI)	0.034 (0.19)*	R-29.6 (5.22)*
	6.0	R-25.2 (4.44 RSI)	0.032 (0.18)	R-30.8 (5.43)

*Denotes interpolated values

[4] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-21.4 towards the nominal R-value of the entire assembly.

Table 3.2.3: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Vertical Girt, Split Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[5] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.054 (0.31)	R-18.6 (3.28)	0.051 (0.29)	R-19.5 (3.43)
	2.5	R-10.5 (1.85 RSI)	0.051 (0.29)	R-19.7 (3.46)	0.048 (0.27)	R-20.7 (3.64)
	3.0	R-12.6 (2.22 RSI)	0.048 (0.27)	R-20.7 (3.64)	0.046 (0.26)	R-21.9 (3.85)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.045 (0.26)	R-22.2 (3.90)	0.042 (0.24)	R-23.9 (4.21)
	4.0	R-16.8 (2.96 RSI)	0.043 (0.25)	R-23.0 (4.05)	0.040 (0.23)	R-24.9 (4.39)
	4.5	R-18.9 (3.33 RSI)	0.042 (0.24)*	R-23.8 (4.19)*	0.039 (0.22)*	R-25.9 (4.56)*
	5.0	R-21.0 (3.70 RSI)	0.041 (0.23)	R-24.6 (4.33)	0.037 (0.21)	R-26.8 (4.73)
	5.5	R-23.1 (4.07 RSI)	0.040 (0.23)*	R-25.2 (4.44)*	0.036 (0.21)*	R-27.6 (4.86)*
	6.0	R-25.2 (4.44 RSI)	0.039 (0.22)	R-25.8 (4.55)	0.035 (0.20)	R-28.4 (4.99)

*Denotes interpolated values

Table 3.2.4: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 16" o.c. Vertically with an Intermittent Vertical Girt, Split Insulated Steel Stud Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[5] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.053 (0.30)	R-18.9 (3.33)
	2.5	R-10.5 (1.85 RSI)	0.049 (0.28)	R-20.3 (3.58)
	3.0	R-12.6 (2.22 RSI)	0.046 (0.26)	R-21.6 (3.81)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.044 (0.25)	R-22.9 (4.04)
	4.0	R-16.8 (2.96 RSI)	0.041 (0.24)	R-24.1 (4.24)
	4.5	R-18.9 (3.33 RSI)	0.040 (0.23)*	R-25.2 (4.44)*
	5.0	R-21.0 (3.70 RSI)	0.038 (0.22)	R-26.3 (4.63)
	5.5	R-23.1 (4.07 RSI)	0.037 (0.21)*	R-27.3 (4.81)*
	6.0	R-25.2 (4.44 RSI)	0.035 (0.20)	R-28.3 (4.98)

*Denotes interpolated values

[5] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-21.4 towards the nominal R-value of the entire assembly.

3.3 Foriea Thermal Clip with Wood Frame Assembly

Table 3.3.1: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Horizontal Girt, Wood Frame Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[6] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.038 (0.21)	R-26.4 (4.65)	0.037 (0.21)	R-26.9 (4.74)
	2.5	R-10.5 (1.85 RSI)	0.036 (0.20)	R-28.0 (4.93)	0.035 (0.20)	R-28.7 (5.05)
	3.0	R-12.6 (2.22 RSI)	0.034 (0.19)	R-29.4 (5.18)	0.033 (0.19)	R-30.4 (5.36)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.032 (0.18)	R-31.0 (5.47)	0.031 (0.18)	R-32.3 (5.69)
	4.0	R-16.8 (2.96 RSI)	0.031 (0.18)	R-32.3 (5.70)	0.029 (0.17)	R-34.0 (5.98)
	4.5	R-18.9 (3.33 RSI)	0.030 (0.17)*	R-33.5 (5.91)*	0.028 (0.16)*	R-35.6 (6.26)*
	5.0	R-21.0 (3.70 RSI)	0.029 (0.16)	R-34.7 (6.12)	0.027 (0.15)	R-37.2 (6.55)
	5.5	R-23.1 (4.07 RSI)	0.028 (0.16)*	R-35.8 (6.30)*	0.026 (0.15)*	R-38.6 (6.81)
	6.0	R-25.2 (4.44 RSI)	0.027 (0.15)	R-36.8 (6.48)	0.025 (0.14)	R-40.1 (7.07)

*Denotes interpolated values

Table 3.3.2: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 24" o.c. Vertically with an Intermittent Horizontal Girt, Wood Frame Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[6] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.037 (0.21)	R-26.8 (4.71)
	2.5	R-10.5 (1.85 RSI)	0.035 (0.20)	R-28.5 (5.03)
	3.0	R-12.6 (2.22 RSI)	0.033 (0.19)	R-30.2 (5.33)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.031 (0.18)	R-32.0 (5.63)
	4.0	R-16.8 (2.96 RSI)	0.030 (0.17)	R-33.6 (5.92)
	4.5	R-18.9 (3.33 RSI)	0.028 (0.16)*	R-35.1 (6.18)*
	5.0	R-21.0 (3.70 RSI)	0.027 (0.16)	R-36.6 (6.45)
	5.5	R-23.1 (4.07 RSI)	0.026 (0.15)*	R-38.0 (6.70)*
	6.0	R-25.2 (4.44 RSI)	0.025 (0.14)	R-39.4 (6.95)

*Denotes interpolated values

[6] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-20.5 towards the nominal R-value of the entire assembly.

Table 3.3.3: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Vertical Girt, Wood Frame Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[7] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.038 (0.22)	R-26.2 (4.62)	0.038 (0.21)	R-26.7 (4.69)
	2.5	R-10.5 (1.85 RSI)	0.036 (0.21)	R-27.6 (4.86)	0.036 (0.20)	R-28.1 (4.95)
	3.0	R-12.6 (2.22 RSI)	0.035 (0.20)	R-28.9 (5.08)	0.034 (0.19)	R-29.5 (5.19)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.033 (0.19)	R-30.6 (5.40)	0.032 (0.18)	R-31.6 (5.57)
	4.0	R-16.8 (2.96 RSI)	0.032 (0.18)	R-31.7 (5.59)	0.030 (0.17)	R-32.8 (5.78)
	4.5	R-18.9 (3.33 RSI)	0.031 (0.17)*	R-32.7 (5.76)*	0.029 (0.17)*	R-33.9 (5.98)*
	5.0	R-21.0 (3.70 RSI)	0.030 (0.17)	R-33.7 (5.93)	0.029 (0.16)	R-35.0 (6.17)
	5.5	R-23.1 (4.07 RSI)	0.029 (0.16)*	R-34.5 (6.07)*	0.028 (0.16)*	R-35.9 (6.33)*
	6.0	R-25.2 (4.44 RSI)	0.028 (0.16)	R-35.3 (6.21)	0.027 (0.15)	R-36.8 (6.48)

*Denotes interpolated values

Table 3.3.4: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 16" o.c. Vertically with an Intermittent Vertical Girt, Wood Frame Assembly

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[7] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m² K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.038 (0.21)	R-26.4 (4.66)
	2.5	R-10.5 (1.85 RSI)	0.036 (0.20)	R-28.1 (4.94)
	3.0	R-12.6 (2.22 RSI)	0.034 (0.19)	R-29.6 (5.22)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.032 (0.18)	R-31.2 (5.50)
	4.0	R-16.8 (2.96 RSI)	0.031 (0.17)	R-32.6 (5.74)
	4.5	R-18.9 (3.33 RSI)	0.029 (0.17)*	R-33.9 (5.98)*
	5.0	R-21.0 (3.70 RSI)	0.028 (0.16)	R-35.3 (6.21)
	5.5	R-23.1 (4.07 RSI)	0.027 (0.16)*	R-36.5 (6.43)*
	6.0	R-25.2 (4.44 RSI)	0.027 (0.15)	R-37.7 (6.64)

*Denotes interpolated values

[7] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-20.5 towards the nominal R-value of the entire assembly.

3.4 Foriea Thermal Clip with CMU

Table 3.4.1: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Horizontal Girt, CMU

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[8] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.103 (0.58)	R-9.7 (1.71)	0.097 (0.55)	R-10.3 (1.82)
	2.5	R-10.5 (1.85 RSI)	0.090 (0.51)	R-11.1 (1.95)	0.083 (0.47)	R-12.0 (2.12)
	3.0	R-12.6 (2.22 RSI)	0.081 (0.46)	R-12.3 (2.17)	0.073 (0.42)	R-13.6 (2.40)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.074 (0.42)	R-13.5 (2.38)	0.066 (0.37)	R-15.2 (2.68)
	4.0	R-16.8 (2.96 RSI)	0.069 (0.39)	R-14.6 (2.57)	0.060 (0.34)	R-16.7 (2.94)
	4.5	R-18.9 (3.33 RSI)	0.064 (0.36)*	R-15.6 (2.74)*	0.055 (0.31)*	R-18.1 (3.18)*
	5.0	R-21.0 (3.70 RSI)	0.060 (0.34)	R-16.5 (2.91)	0.051 (0.29)	R-19.5 (3.43)
	5.5	R-23.1 (4.07 RSI)	0.058 (0.33)*	R-17.4 (3.06)*	0.048 (0.27)*	R-20.7 (3.65)*
	6.0	R-25.2 (4.44 RSI)	0.055 (0.31)	R-18.2 (3.20)	0.045 (0.26)	R-22.0 (3.87)

*Denotes interpolated values

Table 3.4.2: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 24" o.c. Vertically with an Intermittent Horizontal Girt, CMU

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[8] ft² hr °F/Btu (m² °K/W)	U-Value Btu/h ft² °F (W/m² °K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.098 (0.56)	R-10.2 (1.79)
	2.5	R-10.5 (1.85 RSI)	0.085 (0.48)	R-11.8 (2.08)
	3.0	R-12.6 (2.22 RSI)	0.075 (0.43)	R-13.3 (2.35)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.068 (0.39)	R-14.7 (2.60)
	4.0	R-16.8 (2.96 RSI)	0.062 (0.35)	R-16.1 (2.84)
	4.5	R-18.9 (3.33 RSI)	0.057 (0.33)*	R-17.4 (3.07)*
	5.0	R-21.0 (3.70 RSI)	0.053 (0.30)	R-18.8 (3.30)
	5.5	R-23.1 (4.07 RSI)	0.050 (0.28)*	R-19.9 (3.51)*
	6.0	R-25.2 (4.44 RSI)	0.047 (0.27)	R-21.1 (3.72)

*Denotes interpolated values

[8] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-2.9 towards the nominal R-value of the entire assembly.

Table 3.4.3: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally with a Continuous Vertical Girt, CMU

Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[9] ft² hr °F/Btu (m²K/W)	24" Vertical Clip Spacing		48" Vertical Clip Spacing	
			U-Value Btu/h ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)	U-Value Btu/h ·ft² °F (W/m²K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.106 (0.60)	R-9.5 (1.67)	0.099 (0.56)	R-10.1 (1.77)
	2.5	R-10.5 (1.85 RSI)	0.094 (0.54)	R-10.6 (1.87)	0.088 (0.50)	R-11.4 (2.01)
	3.0	R-12.6 (2.22 RSI)	0.086 (0.49)	R-11.6 (2.05)	0.079 (0.45)	R-12.6 (2.23)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.077 (0.44)	R-13.0 (2.29)	0.069 (0.39)	R-14.5 (2.55)
	4.0	R-16.8 (2.96 RSI)	0.072 (0.41)	R-13.8 (2.44)	0.064 (0.37)	R-15.5 (2.74)
	4.5	R-18.9 (3.33 RSI)	0.068 (0.39)*	R-14.6 (2.57)*	0.061 (0.34)*	R-16.5 (2.91)*
	5.0	R-21.0 (3.70 RSI)	0.065 (0.37)	R-15.4 (2.71)	0.057 (0.33)	R-17.5 (3.08)
	5.5	R-23.1 (4.07 RSI)	0.063 (0.36)*	R-16.0 (2.82)*	0.055 (0.31)*	R-18.2 (3.21)*
	6.0	R-25.2 (4.44 RSI)	0.060 (0.34)	R-16.6 (2.93)	0.053 (0.30)	R-19.0 (3.35)

*Denotes interpolated values

Table 3.4.4: U-Values and Effective R-Values for the Foriea Thermal Clip spaced 16" o.c. Horizontally and 16" o.c. Vertically with an Intermittent Vertical Girt, Wood Frame Assembly

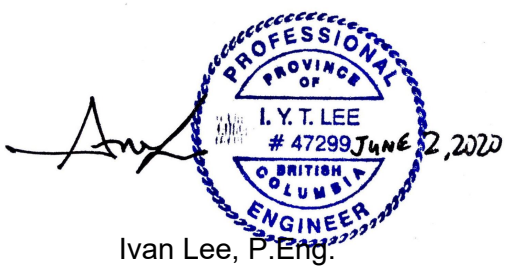
Foriea Thermal Clip Size	Exterior Insulation Thickness (in)	Exterior Insulation Nominal R-Value[9] ft² hr °F/Btu (m²K/W)	U-Value Btu/h ft² °F (W/m² K)	Effective R-Value h ft² °F/Btu (m²K/W)
2 inch	2.0	R-8.4 (1.48 RSI)	0.103 (0.58)	R-9.7 (1.71)
	2.5	R-10.5 (1.85 RSI)	0.090 (0.51)	R-11.1 (1.96)
	3.0	R-12.6 (2.22 RSI)	0.080 (0.46)	R-12.4 (2.19)
3.5 inch	3.5	R-14.7 (2.59 RSI)	0.073 (0.41)	R-13.7 (2.41)
	4.0	R-16.8 (2.96 RSI)	0.067 (0.38)	R-14.8 (2.61)
	4.5	R-18.9 (3.33 RSI)	0.063 (0.36)*	R-15.9 (2.80)*
	5.0	R-21.0 (3.70 RSI)	0.059 (0.33)	R-17.0 (2.99)
	5.5	R-23.1 (4.07 RSI)	0.056 (0.32)*	R-17.9 (3.16)*
	6.0	R-25.2 (4.44 RSI)	0.053 (0.30)	R-18.9 (3.33)

*Denotes interpolated values

[9] This value is the nominal R-value of the exterior insulation ONLY. Additional components, such as the sheathing, batt insulation, and air films all contribute an additional R-2.9 towards the nominal R-value of the entire assembly.

We believe that this report meets your objectives for evaluating the thermal performance for the Foriea Thermal Clip system assemblies. If you have any questions or comments related to the above, please do not hesitate to contact the undersigned.

Morrison Hershfield Limited

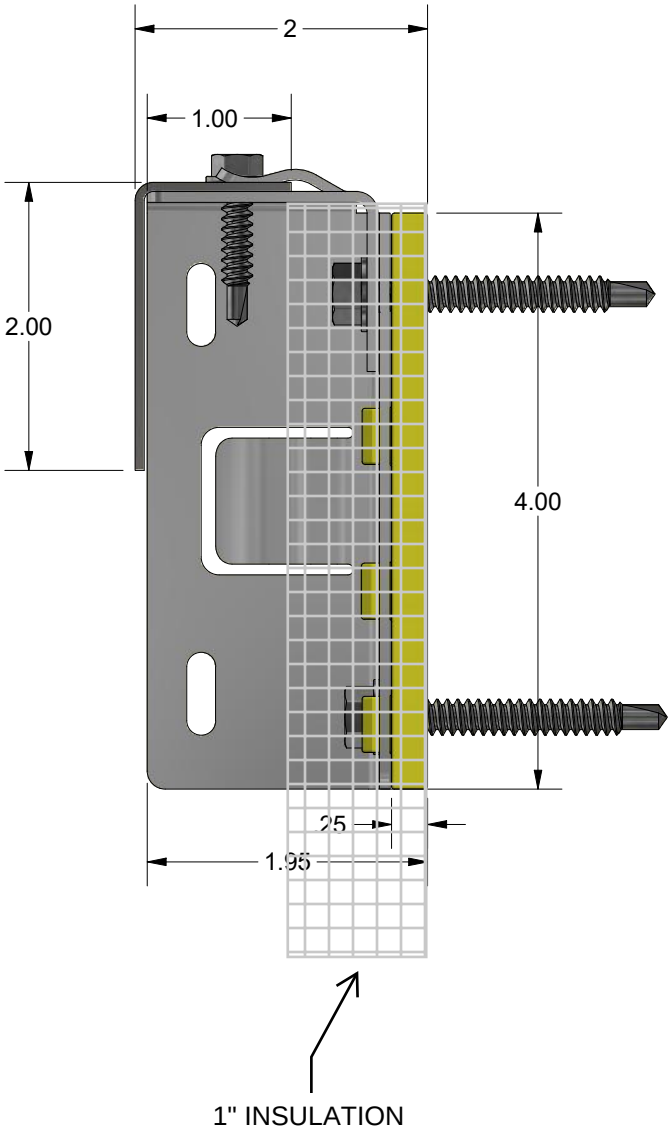


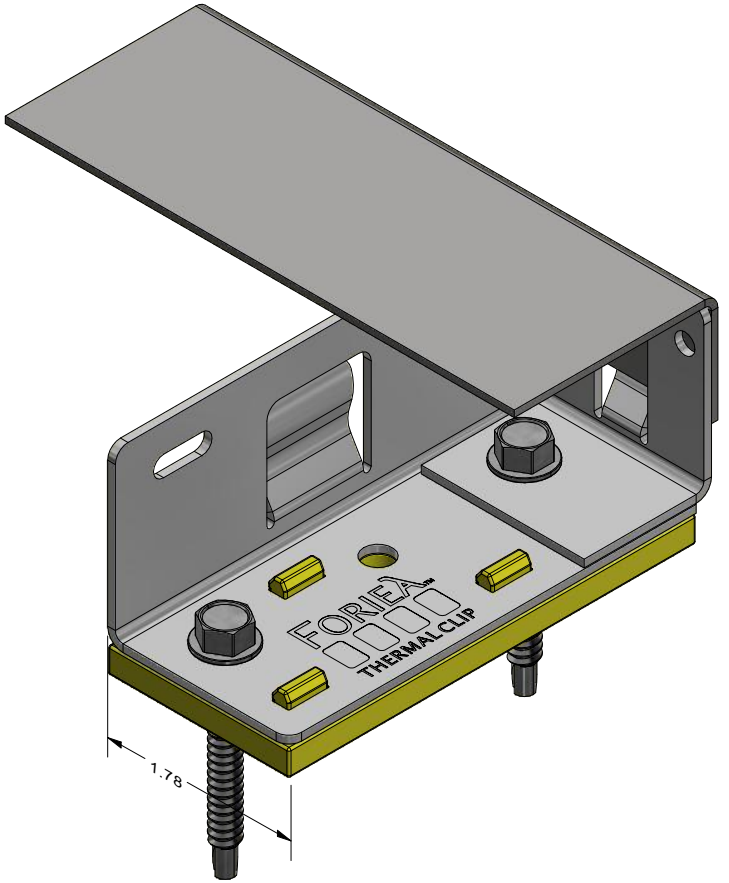
Katie Hay, P.Eng.
Building Science Consultant

Ivan Lee, P.Eng.
Building Science Consultant

APPENDIX A:
DETAIL DRAWINGS

FORIEA™
THERMAL CLIP





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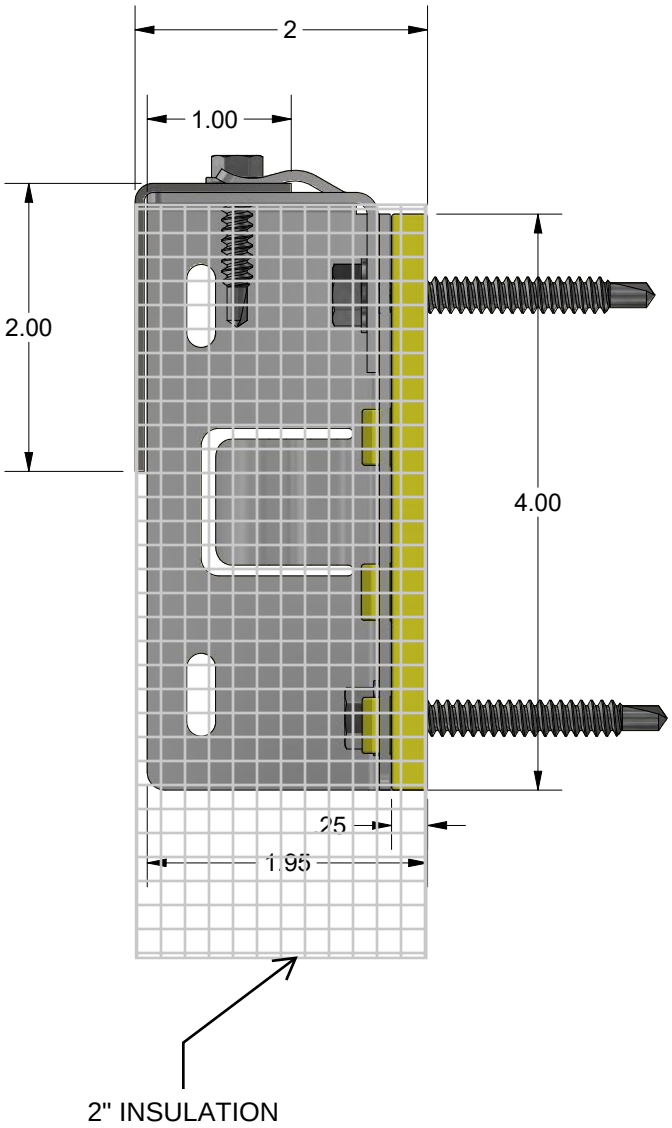
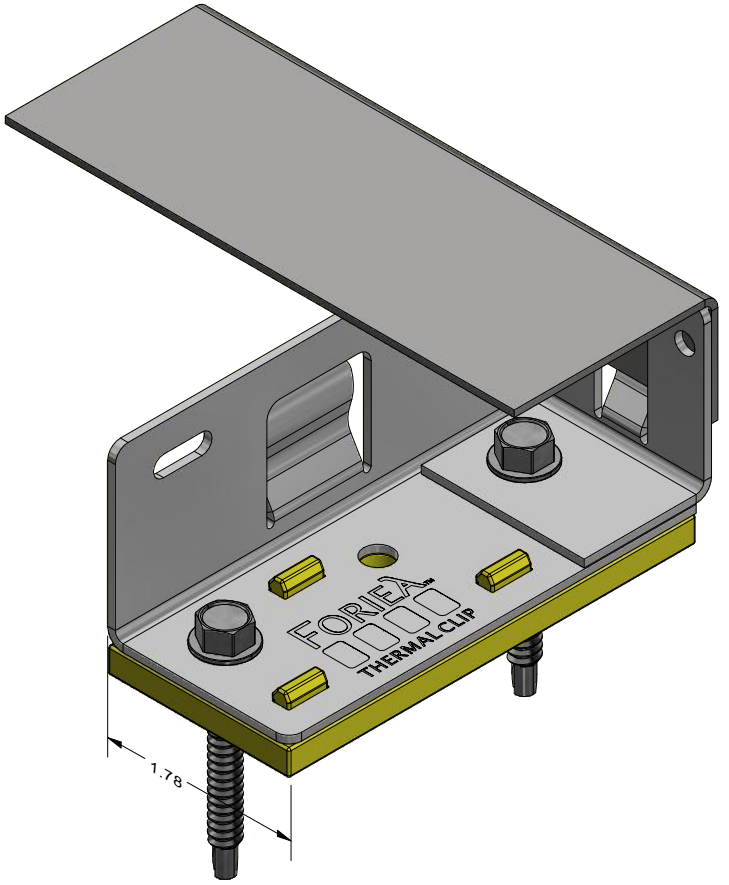
CHECKED		2" FORIEA THERMAL CLIP @ 2" DEPTH HORIZONTAL FURRING / 1" INSULATION		
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

FORIEA™
THERMAL CLIP





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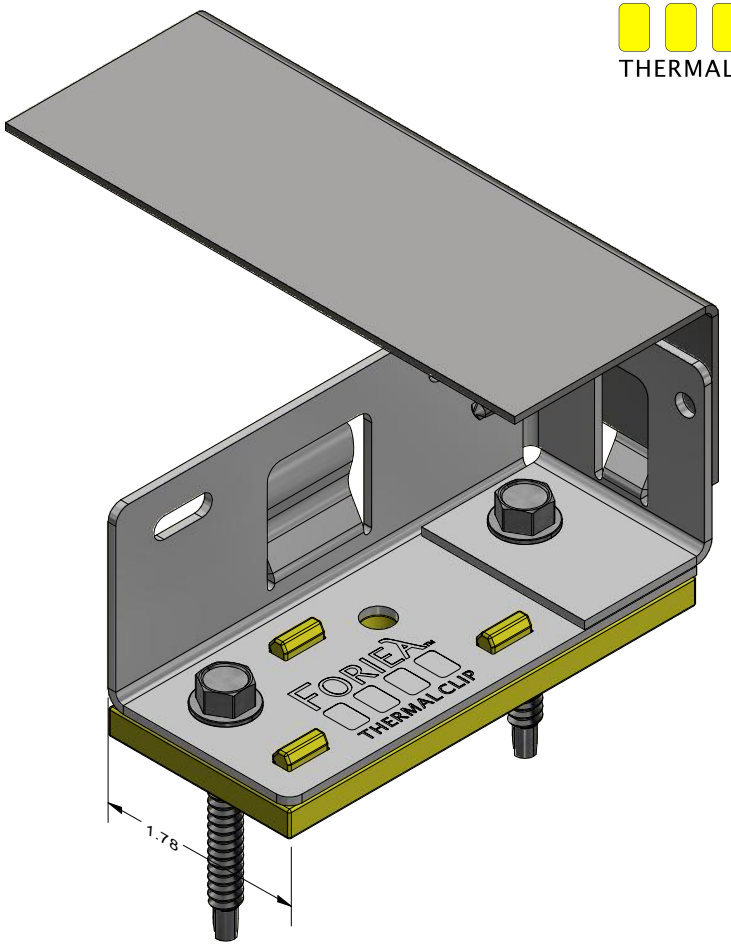
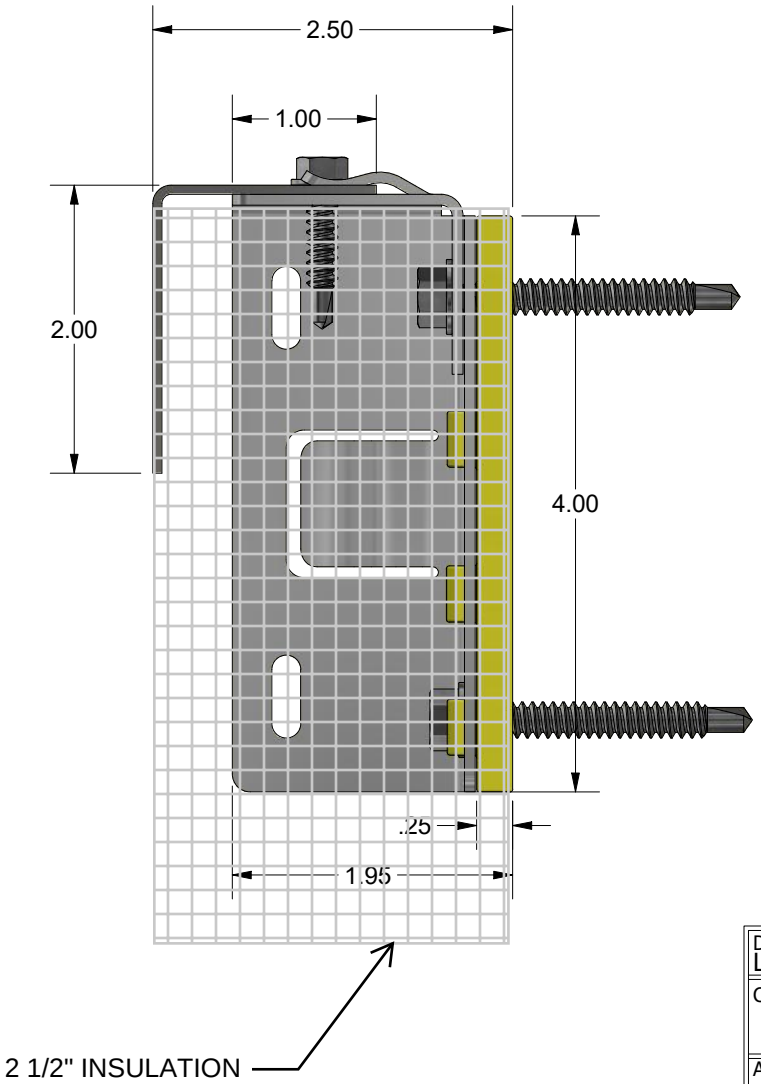
APPROVED			
		SIZE A	DWG NO / REV
	SCALE .75		

FORIEA™
THERMAL CLIP





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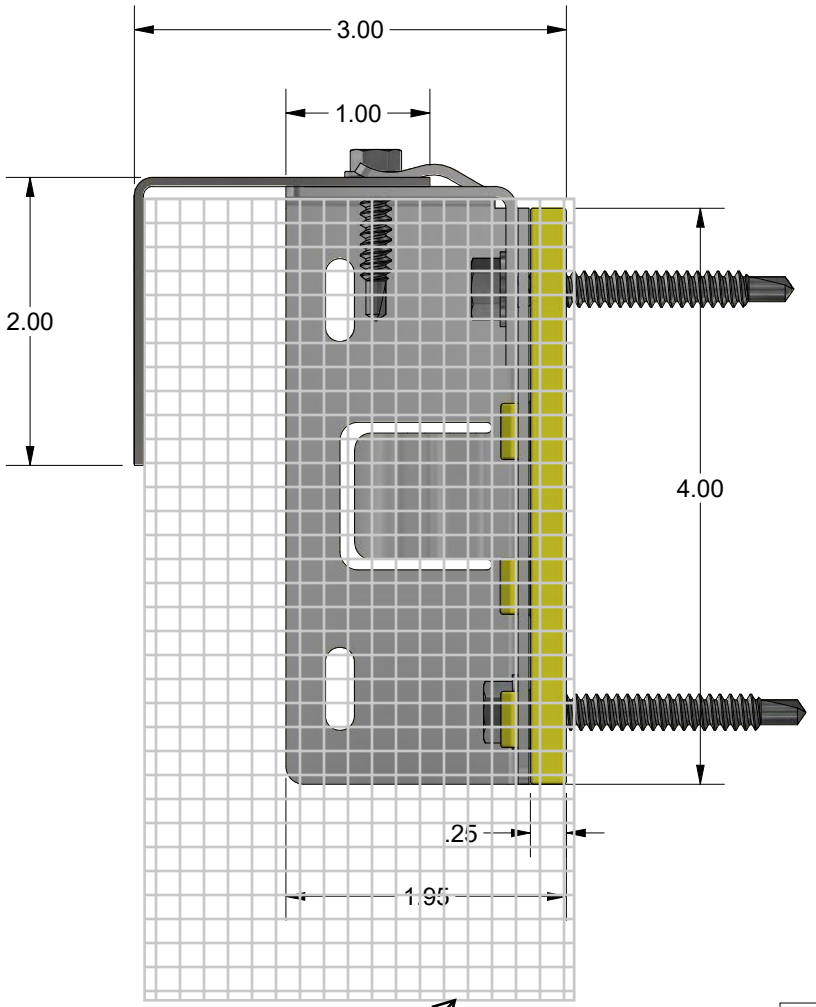
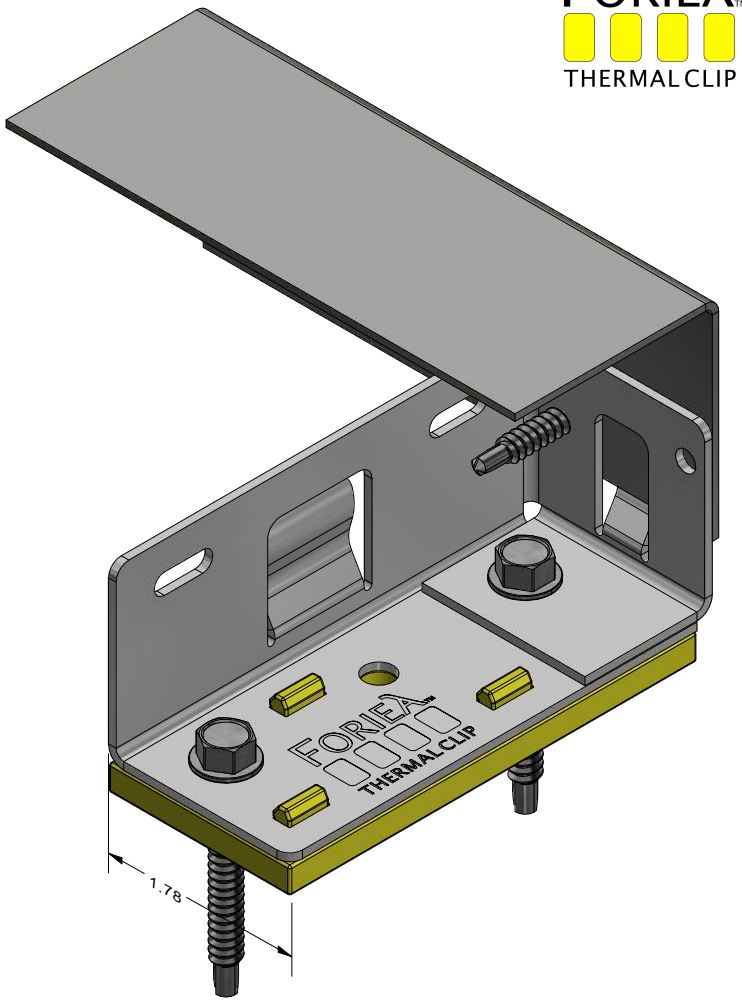
APPROVED			
		SIZE A	DWG NO / REV
	SCALE .75		

FORIEA™
THERMAL CLIP





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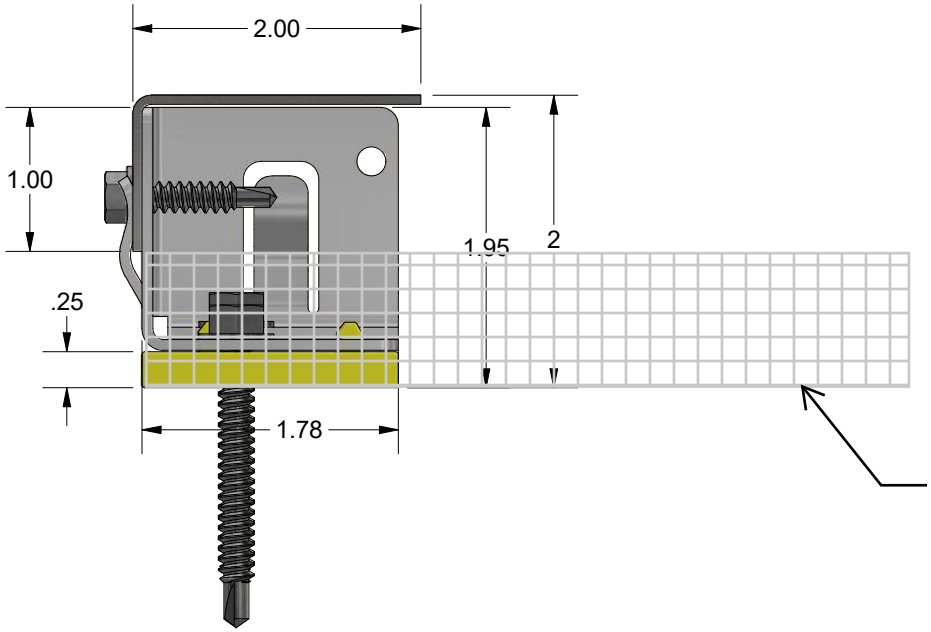
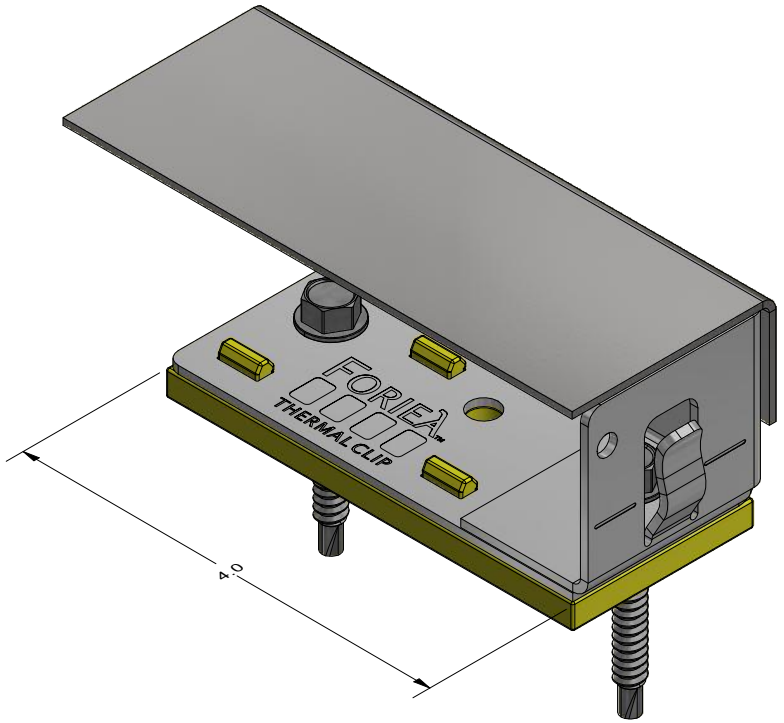
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

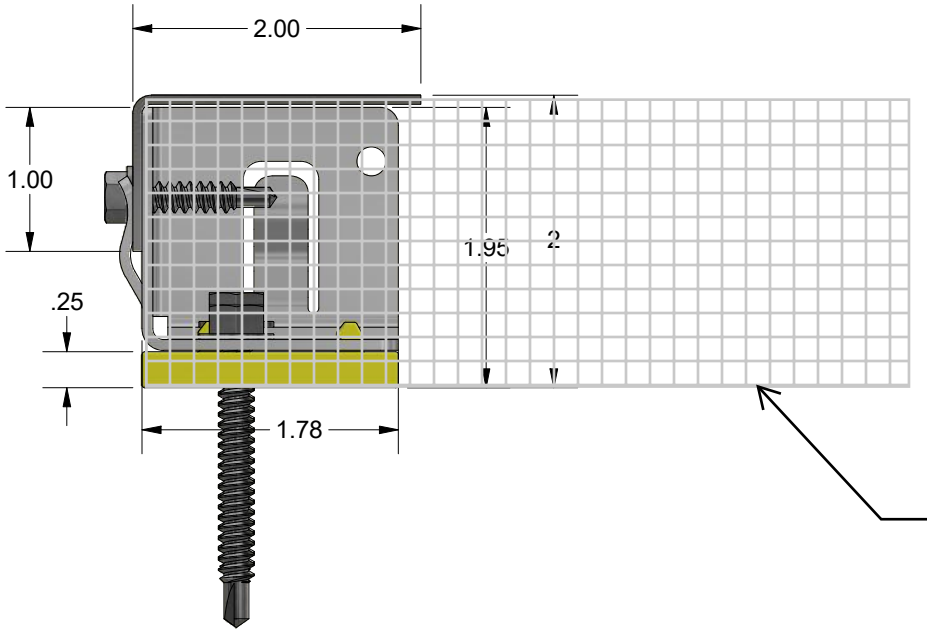
FORIEA™
THERMAL CLIP

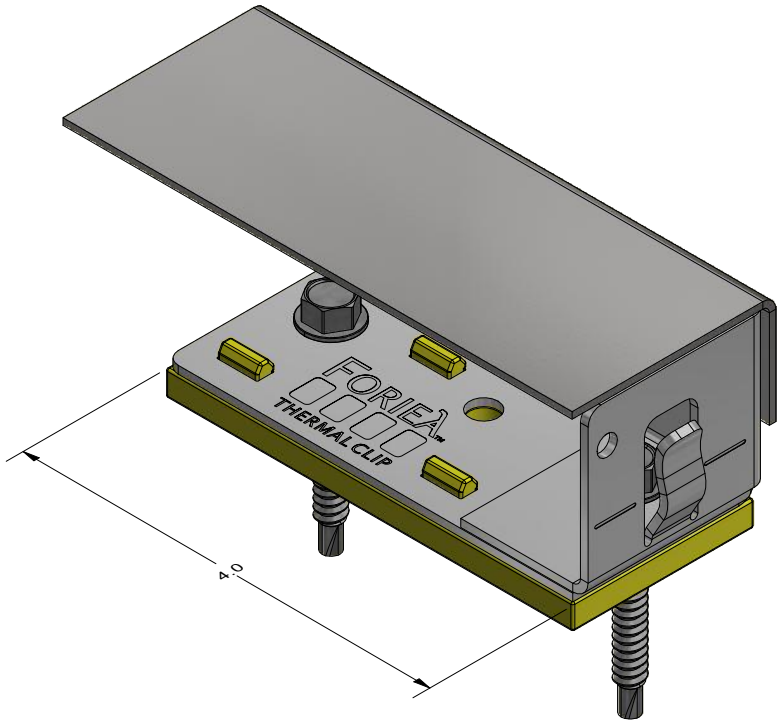




DRAWN LC	4/22/2020	JOB NAME FORIEA THERMAL CLIP		
CHECKED		2" FORIEA THERMAL CLIP @ 2" DEPTH VERTICAL FURRING / 1" INSULATION		
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

FORIEA™
THERMAL CLIP





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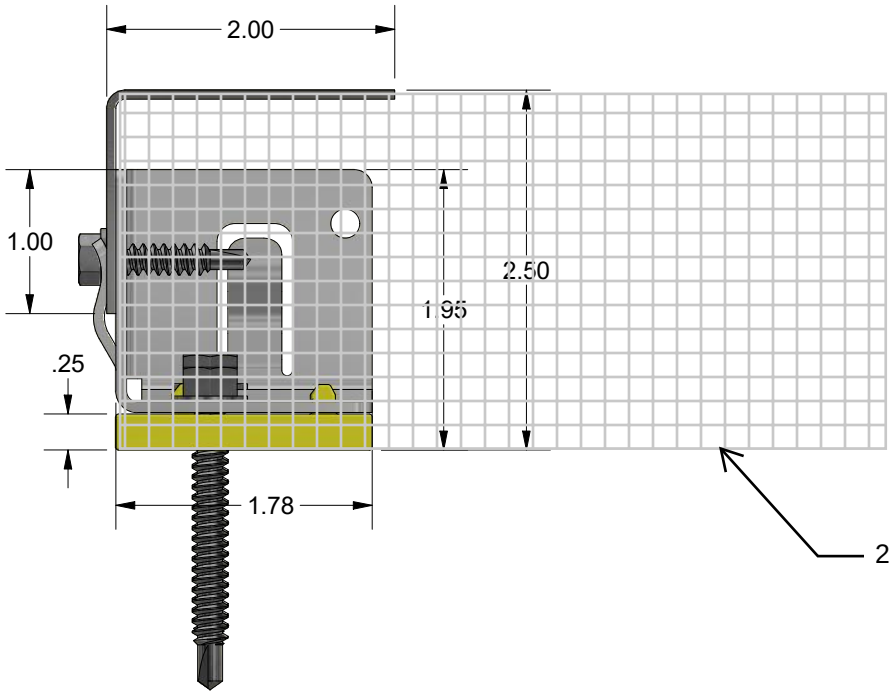
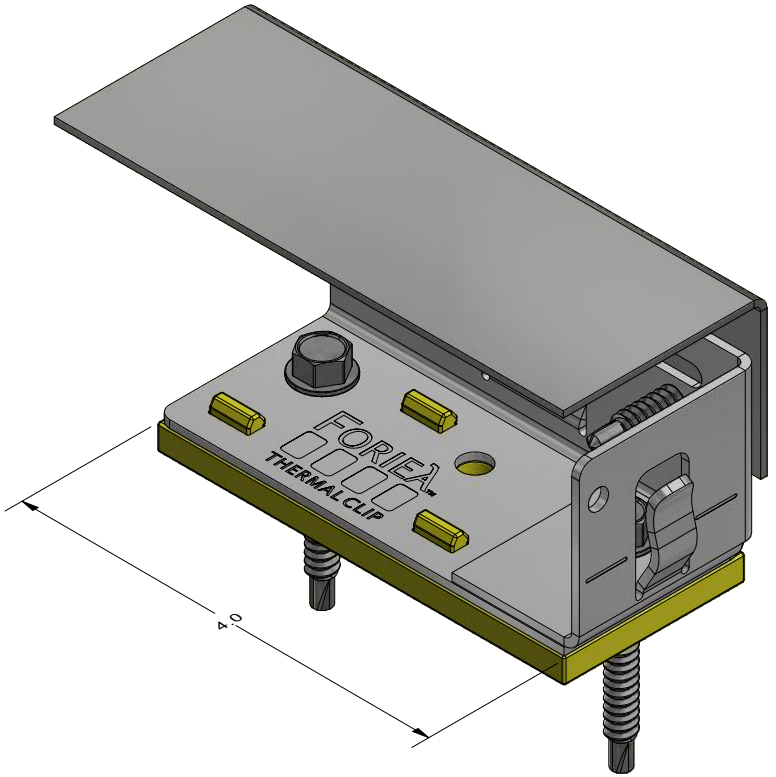
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

FORIEA™
THERMAL CLIP





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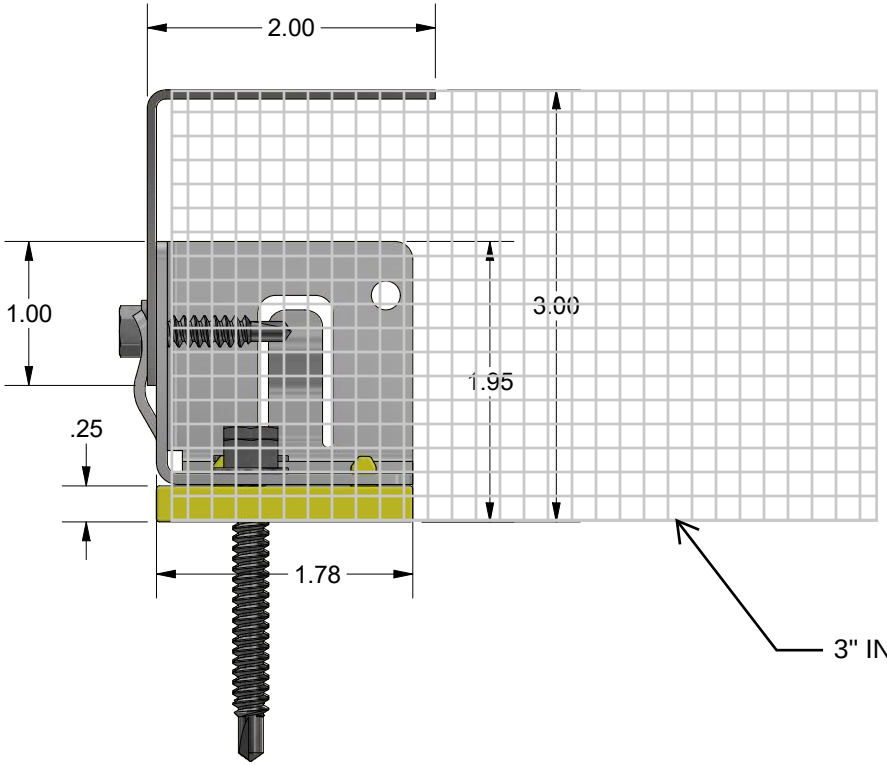
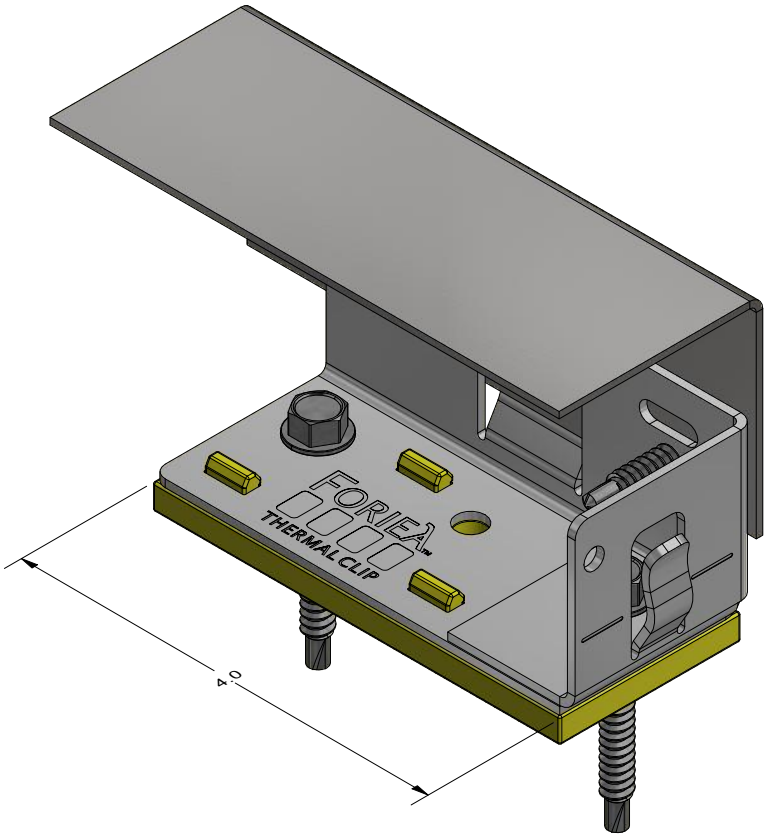
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

FORIEA™
THERMAL CLIP





DRAWN LC	4/22/2020	JOB NAME FORIEA THERMAL CLIP		
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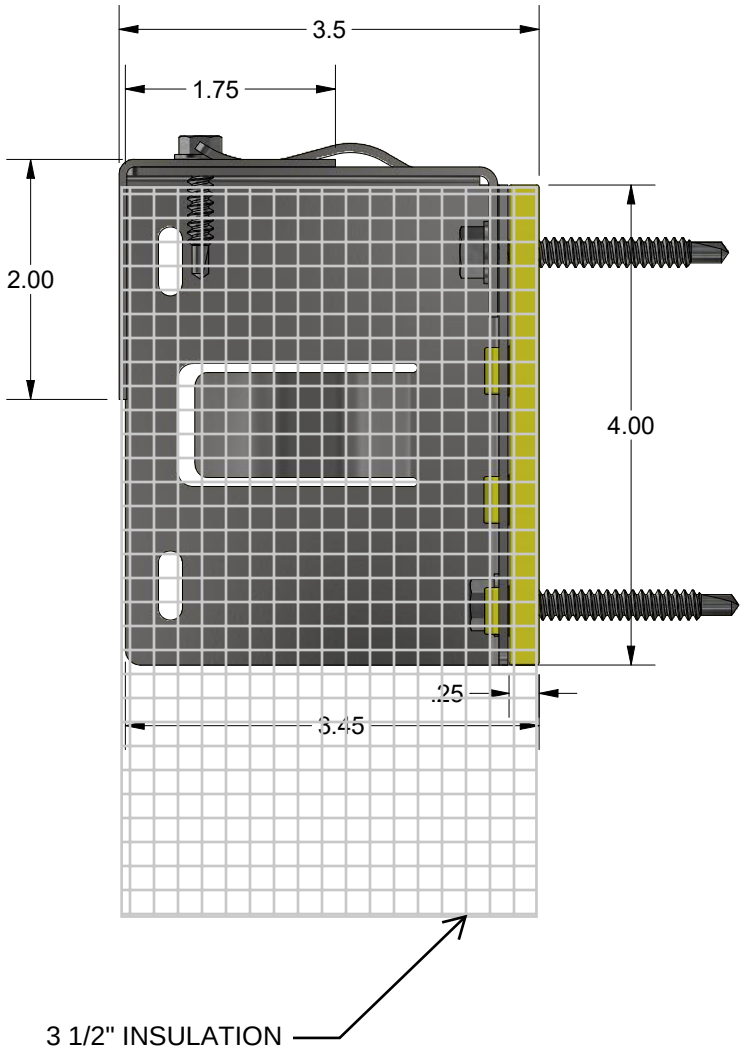
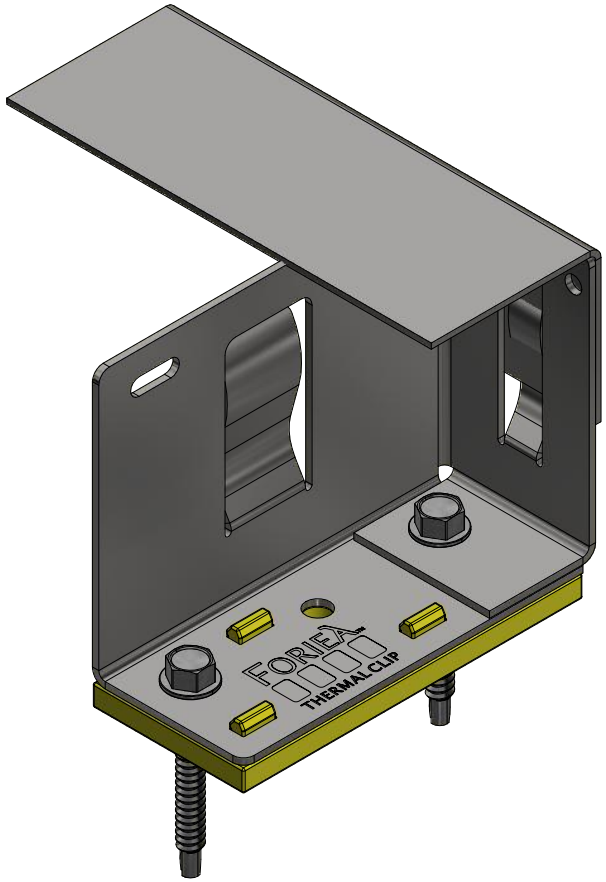
APPROVED				
		SIZE A	DWG NO	REV
	SCALE .75			

FORIEA™
THERMAL CLIP





DRAWN LC	4/22/2020	JOB NAME FORIEA THERMAL CLIP		
CHECKED		3 1/2" FORIEA THERMAL CLIP @ 3 1/2" DEPTH HORIZONTAL FURRING / 3 1/2" INSULATION		
APPROVED				
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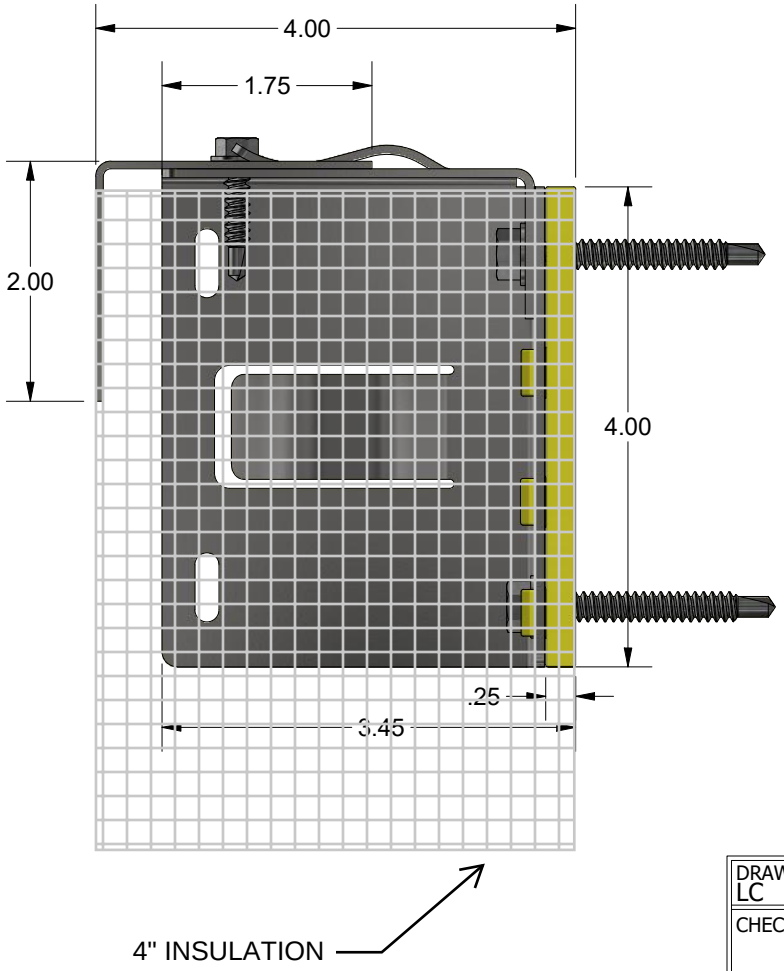
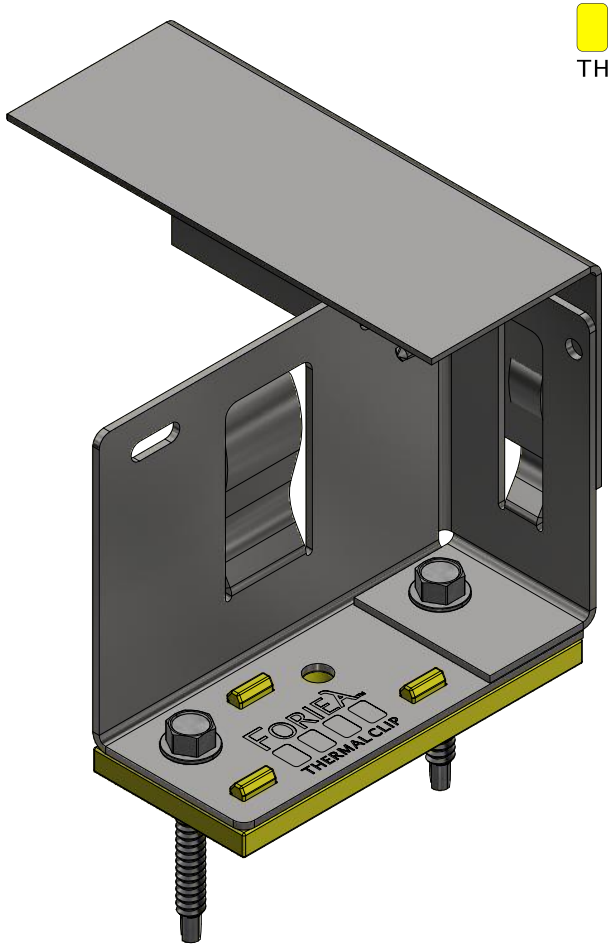
	SCALE .625			

FORIEA™
THERMAL CLIP





DRAWN LC	4/22/2020	JOB NAME FORIEA THERMAL CLIP		
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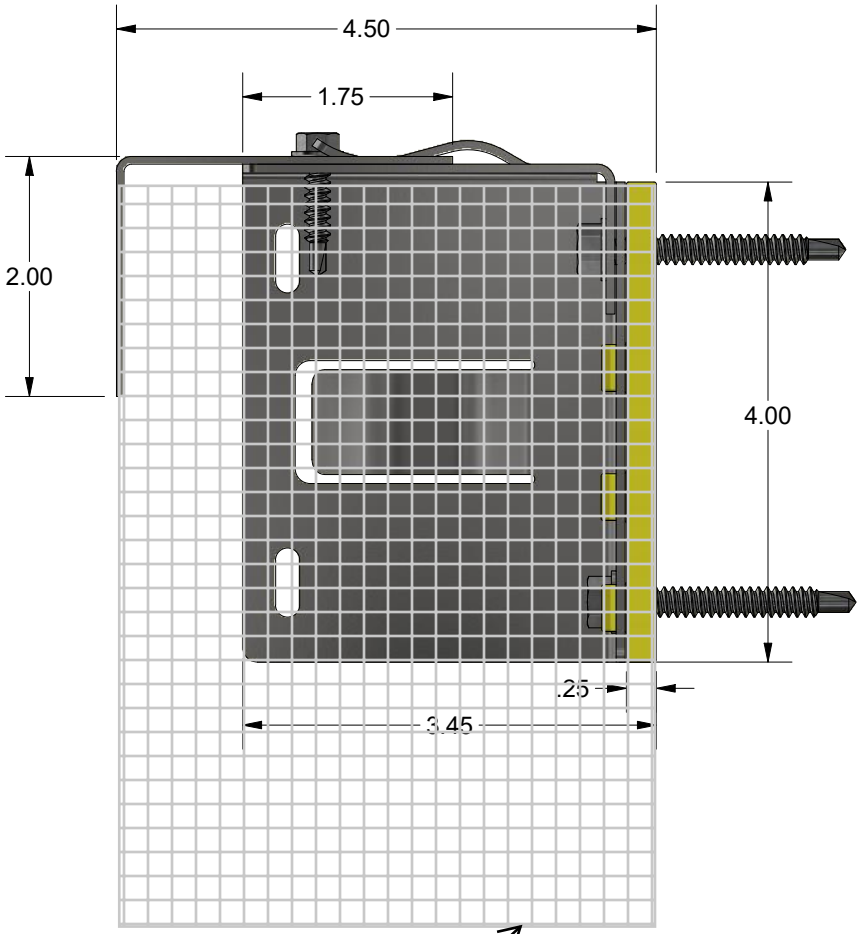
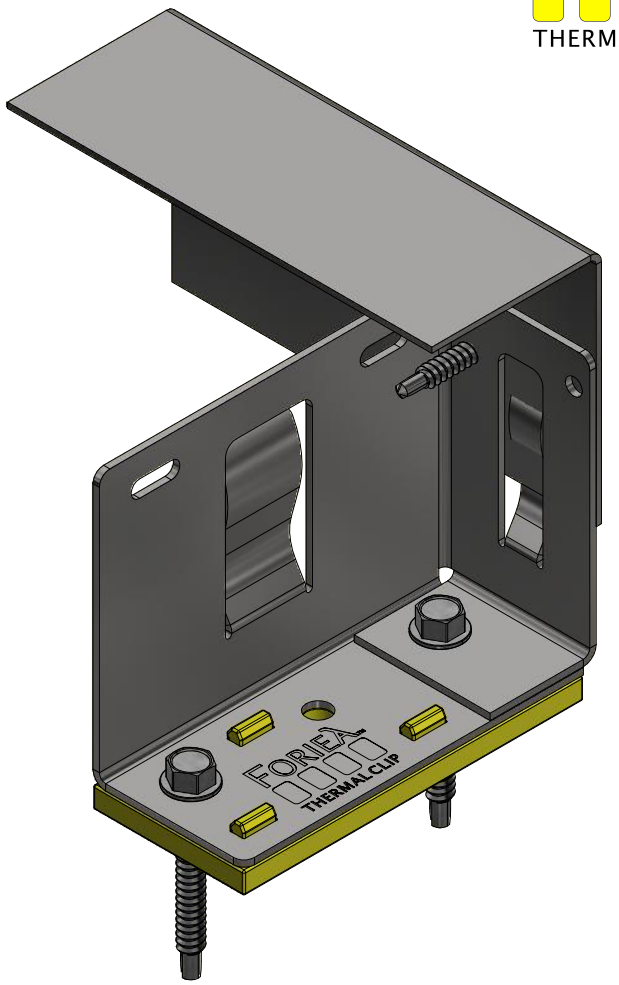
	SCALE .625			

FORIEA™
THERMAL CLIP





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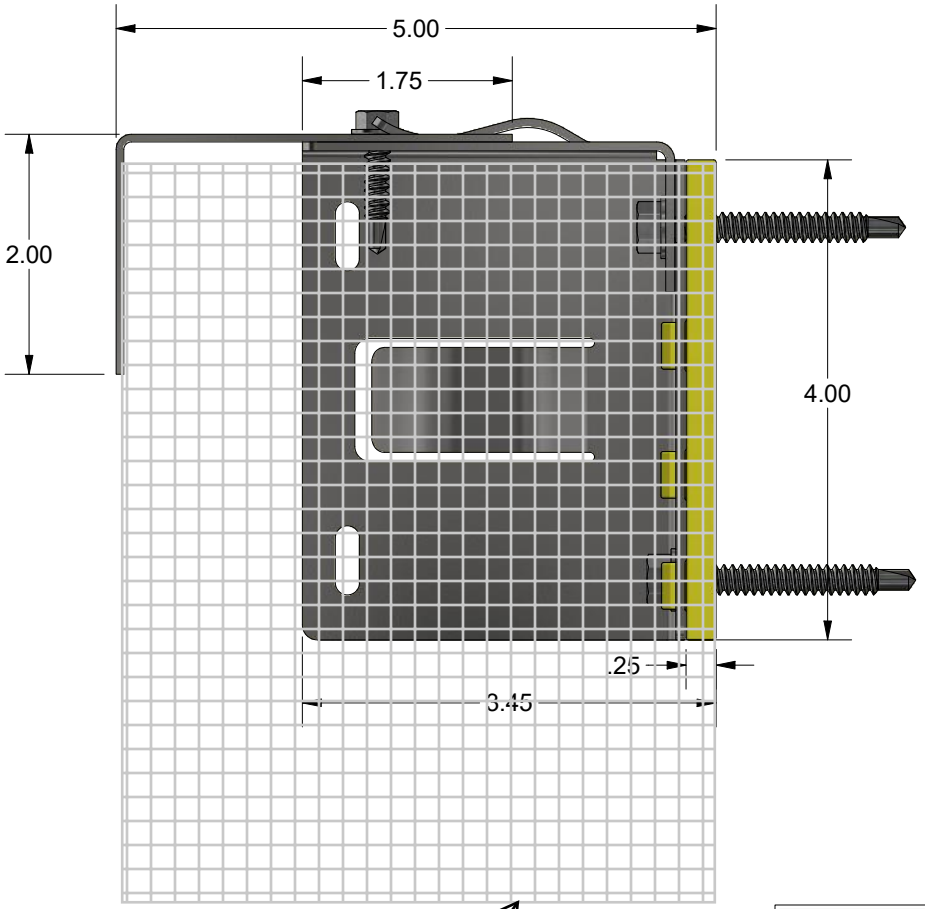
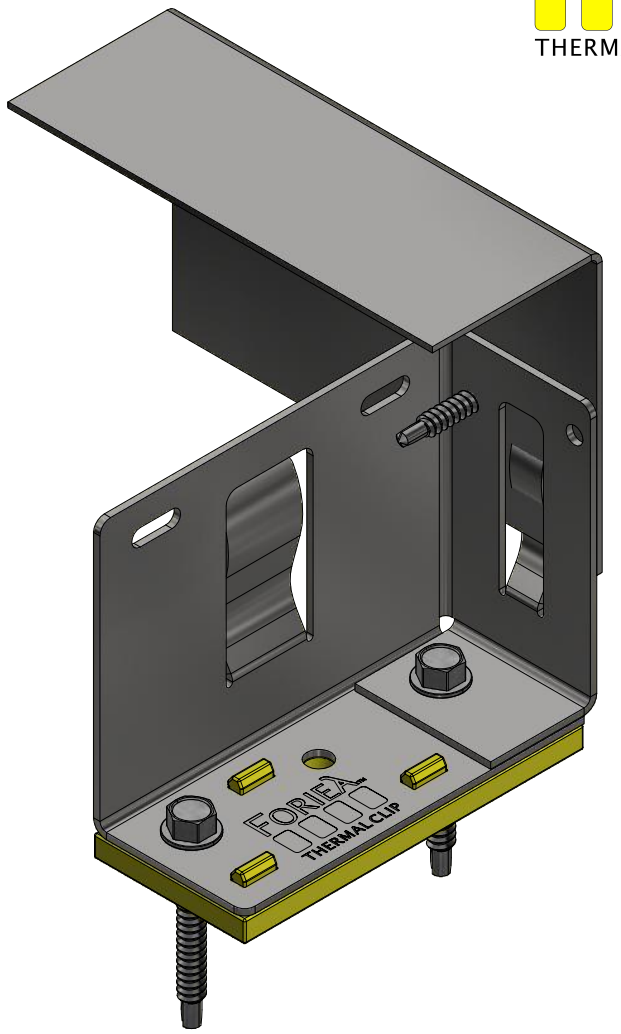
FORIEA™
THERMAL CLIP





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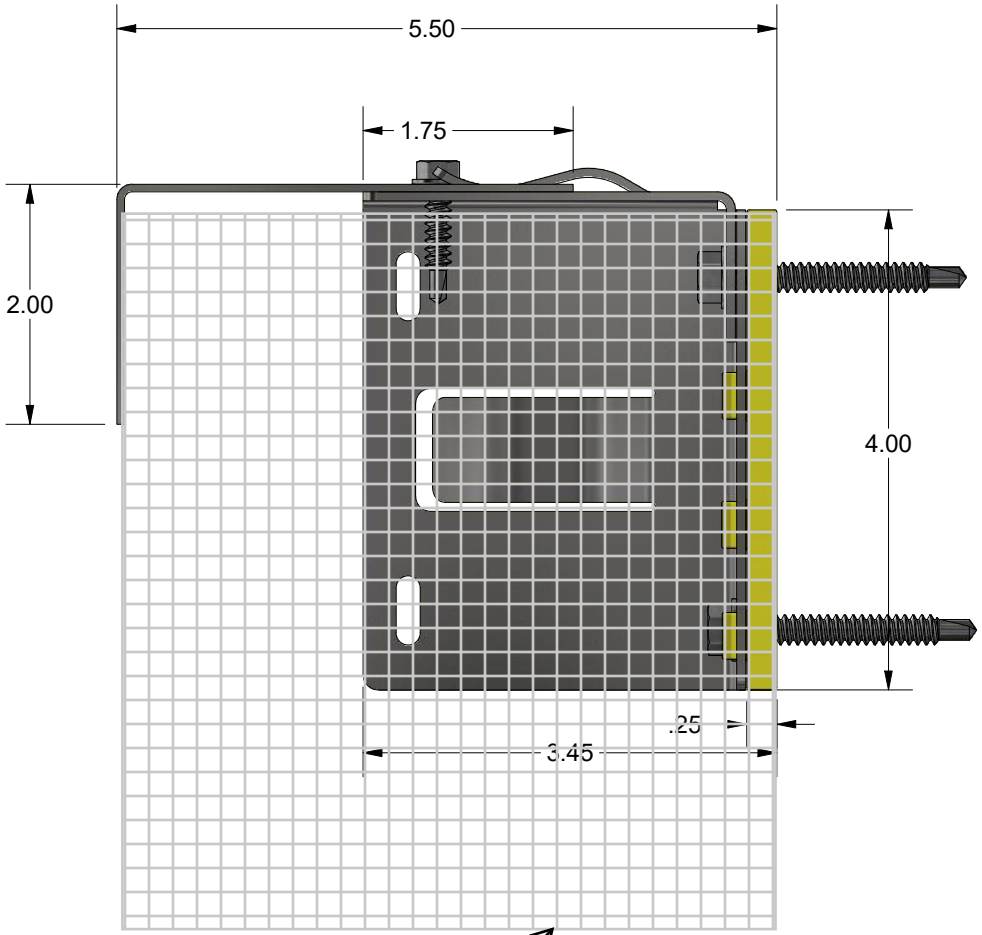
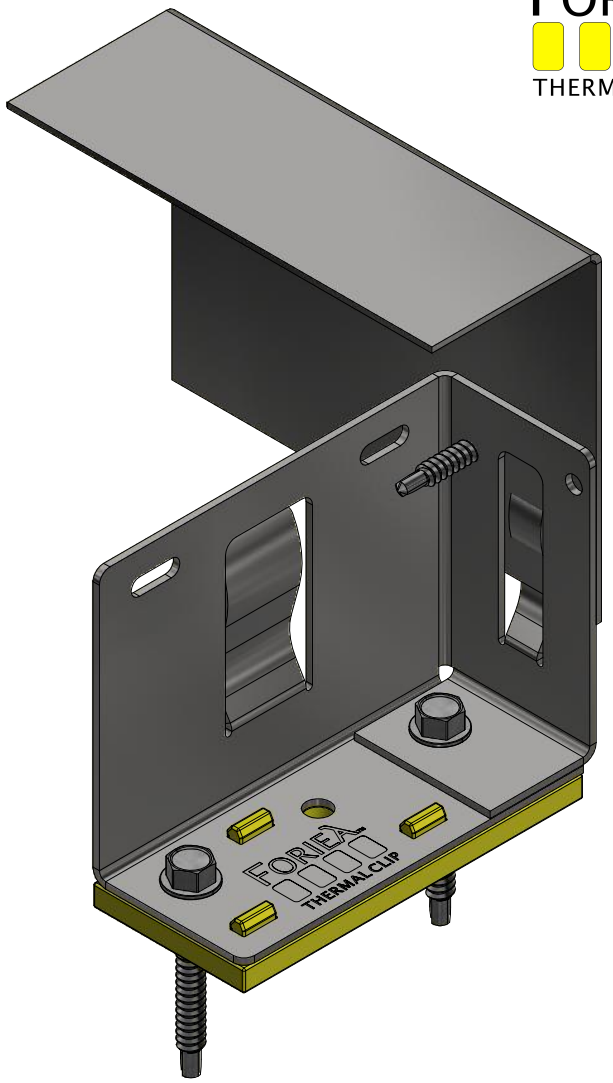
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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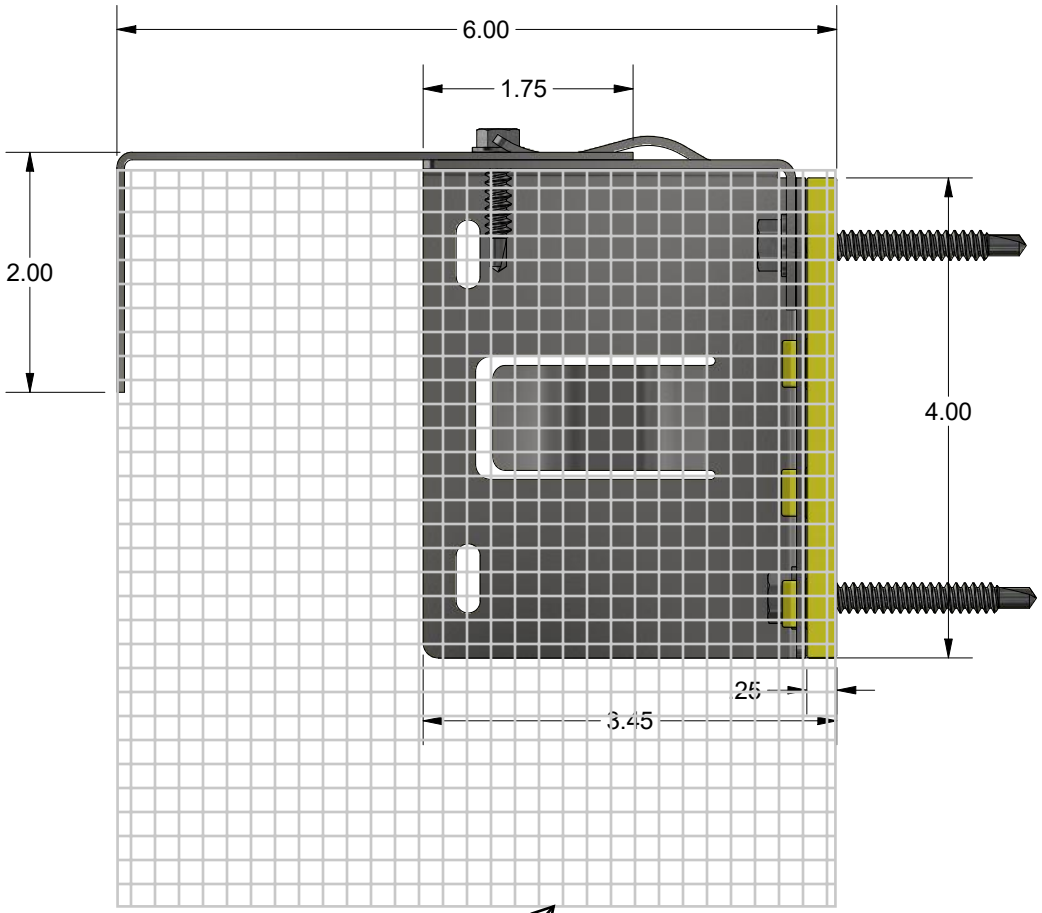
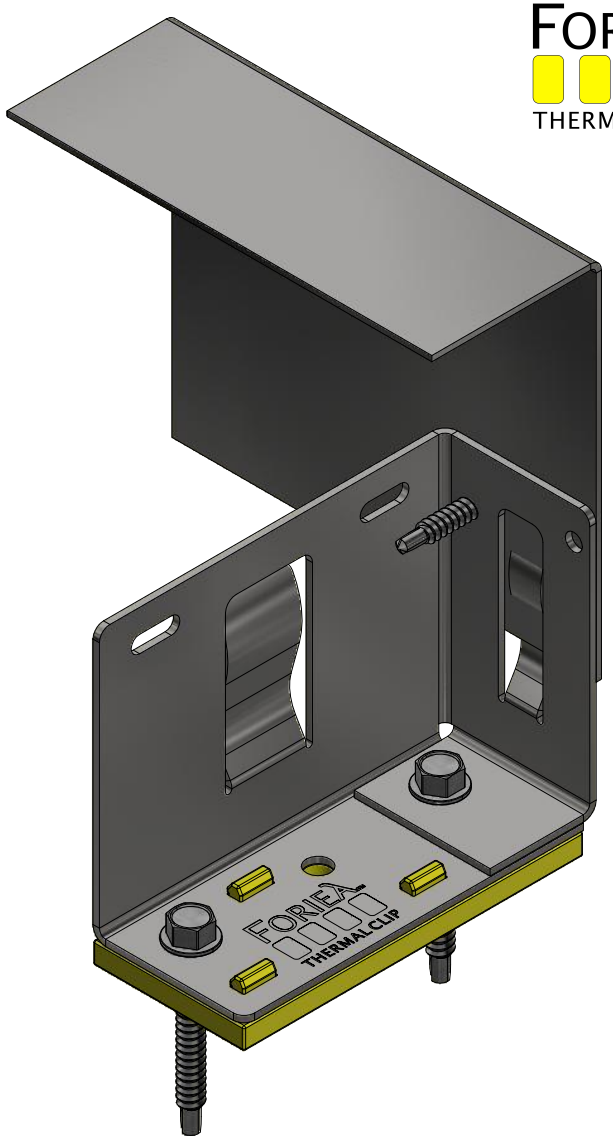
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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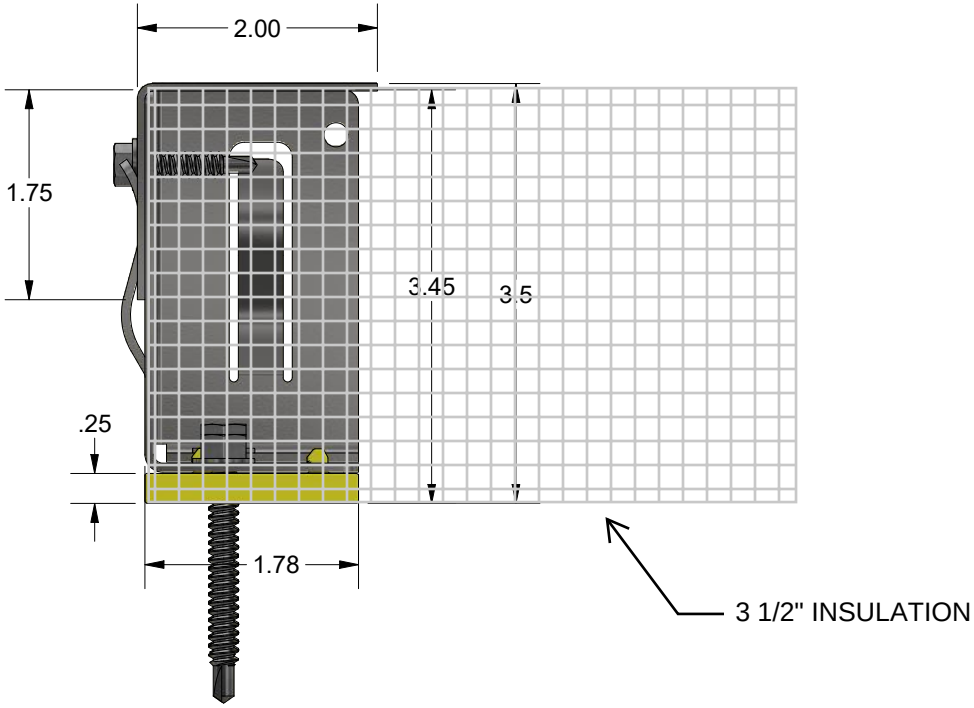
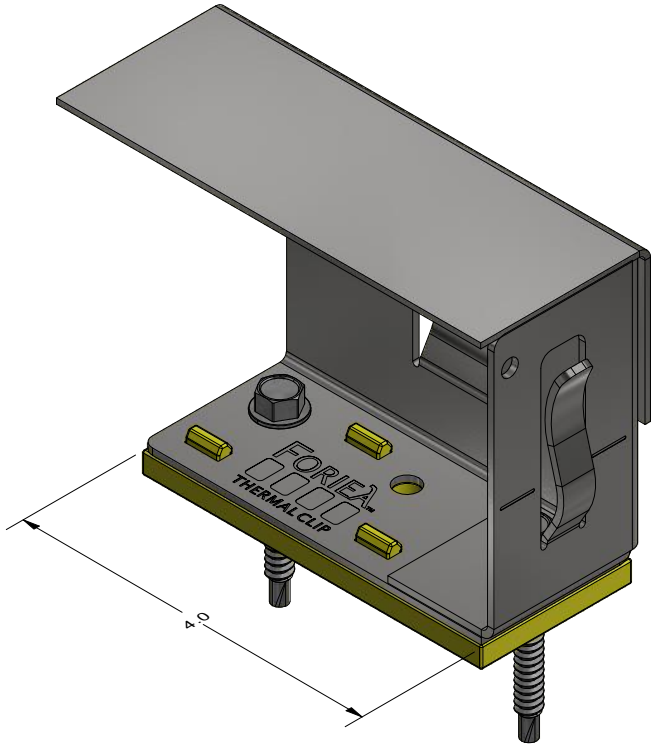
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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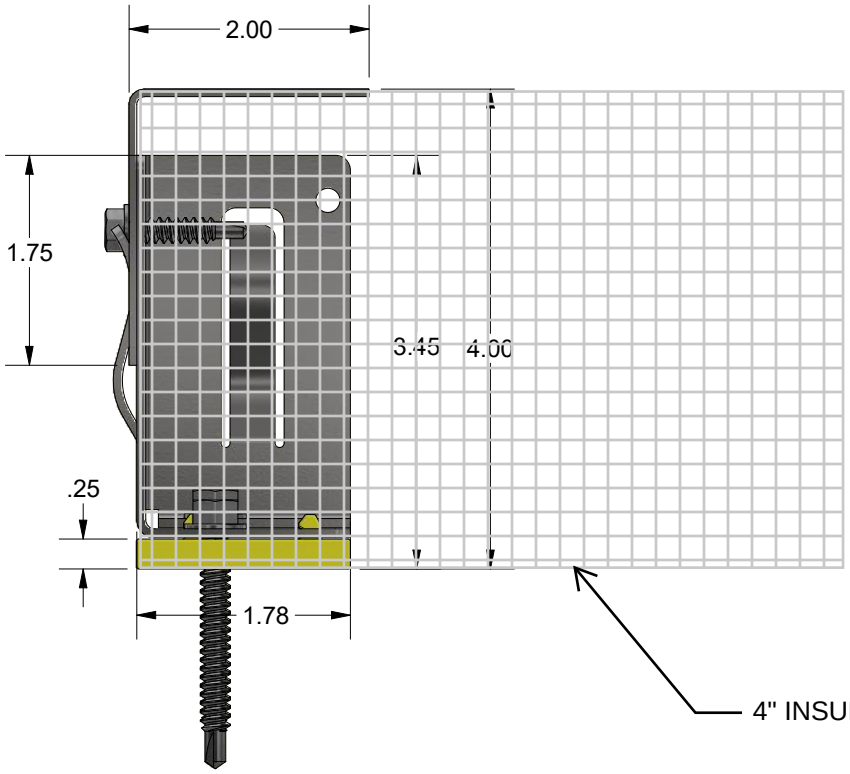
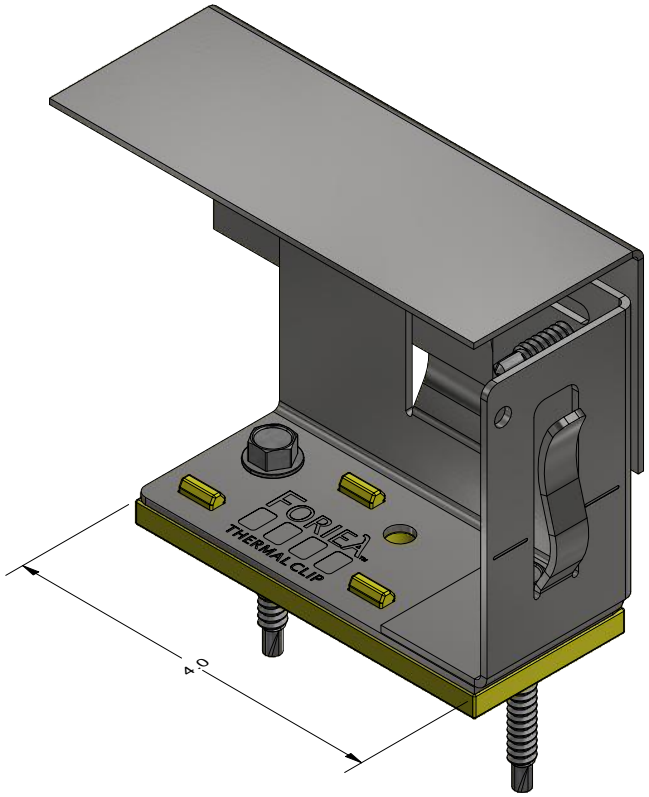
	SCALE .625			

FORIEA™
THERMAL CLIP





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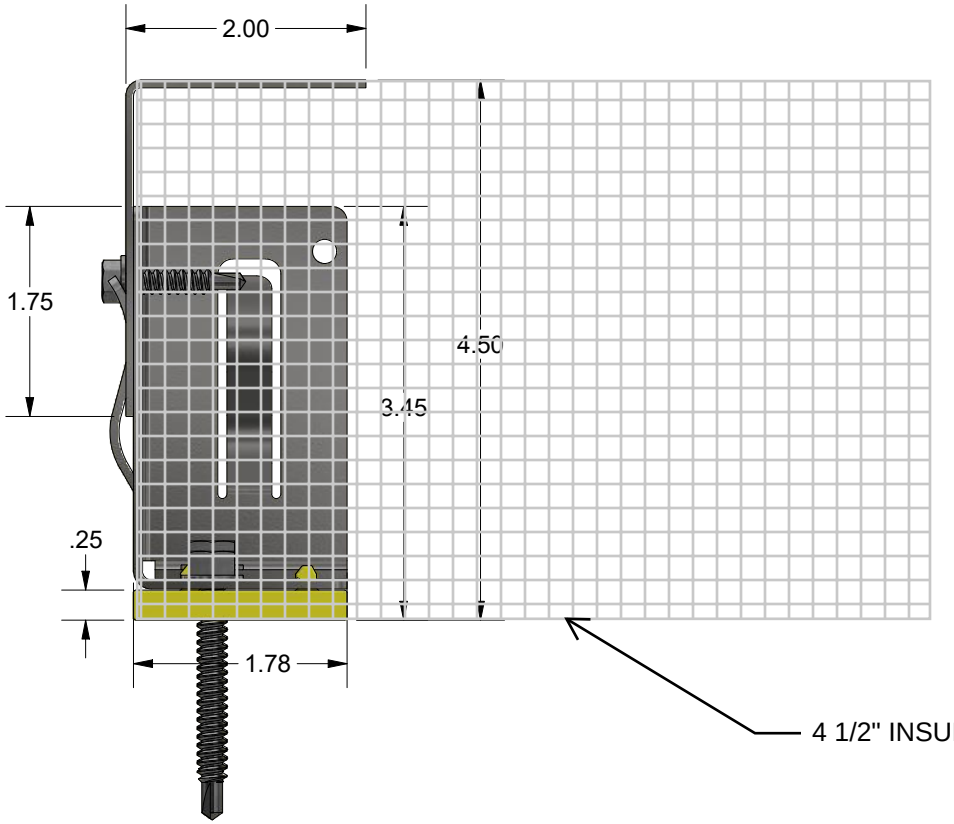
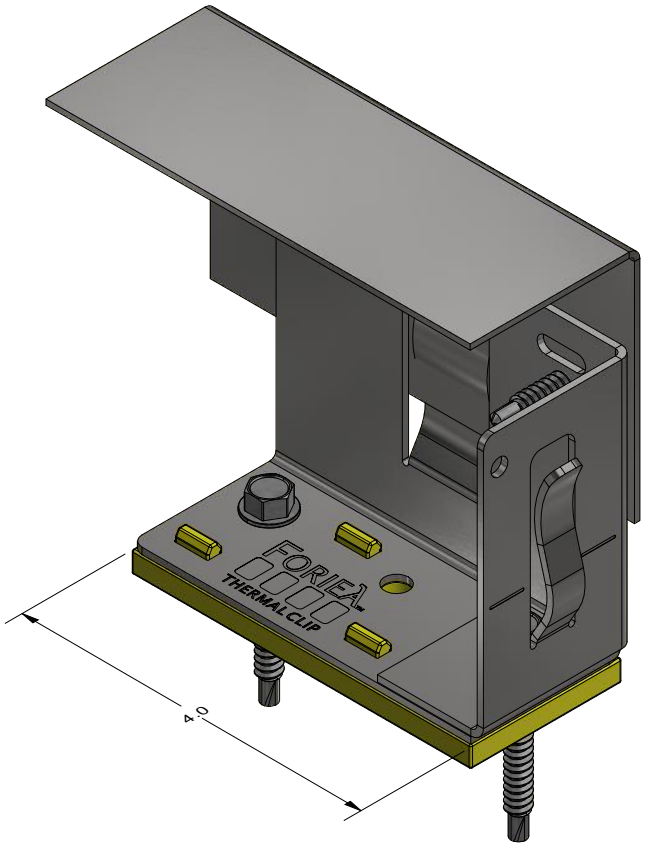
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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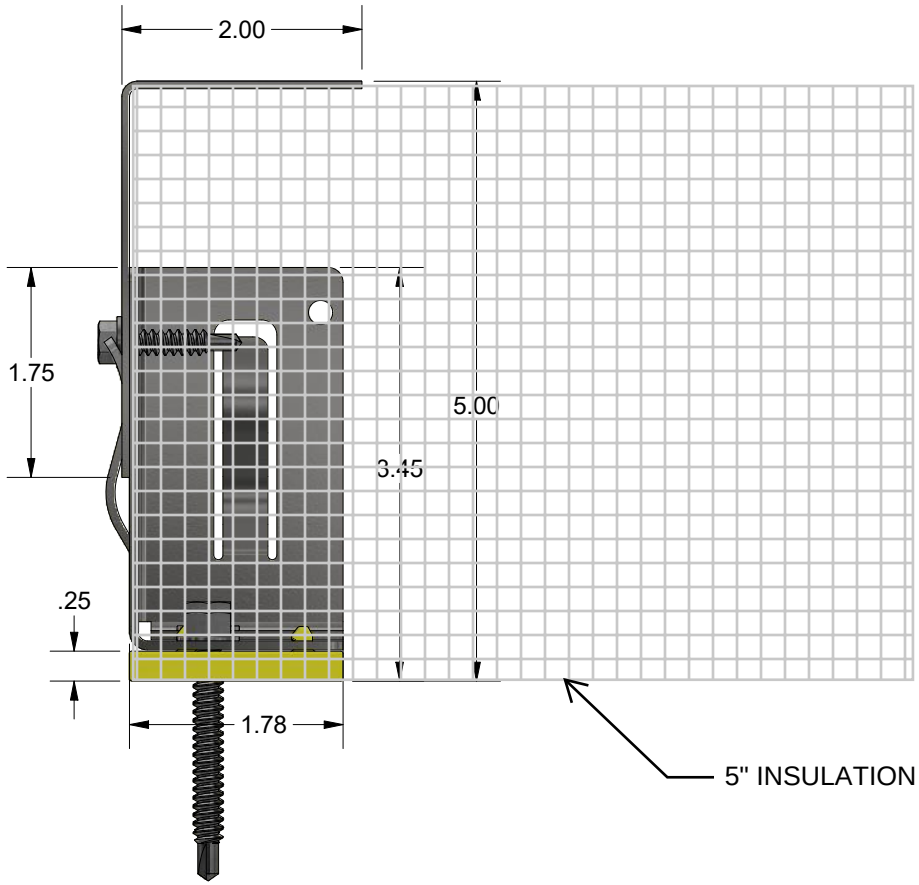
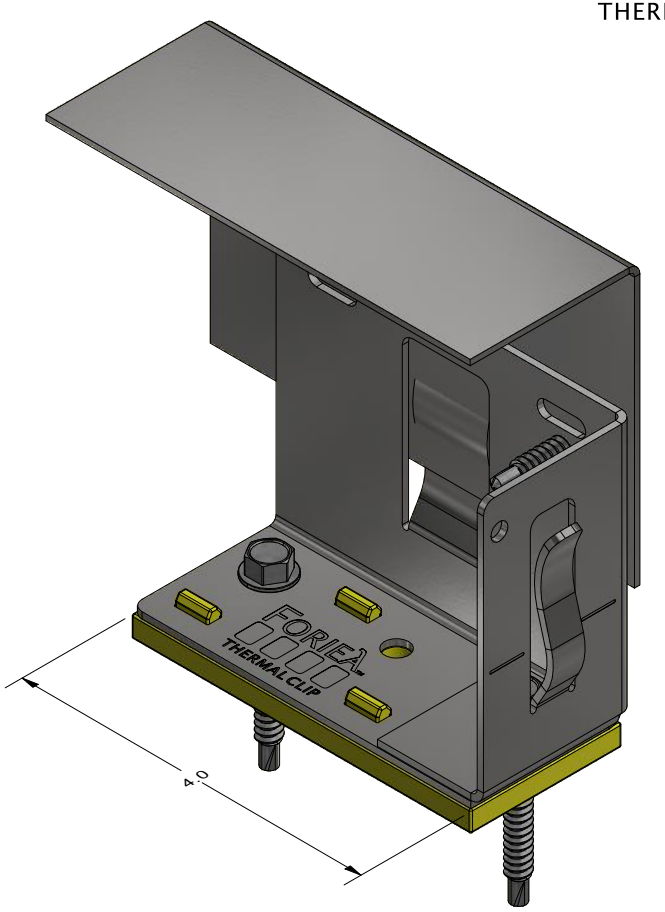
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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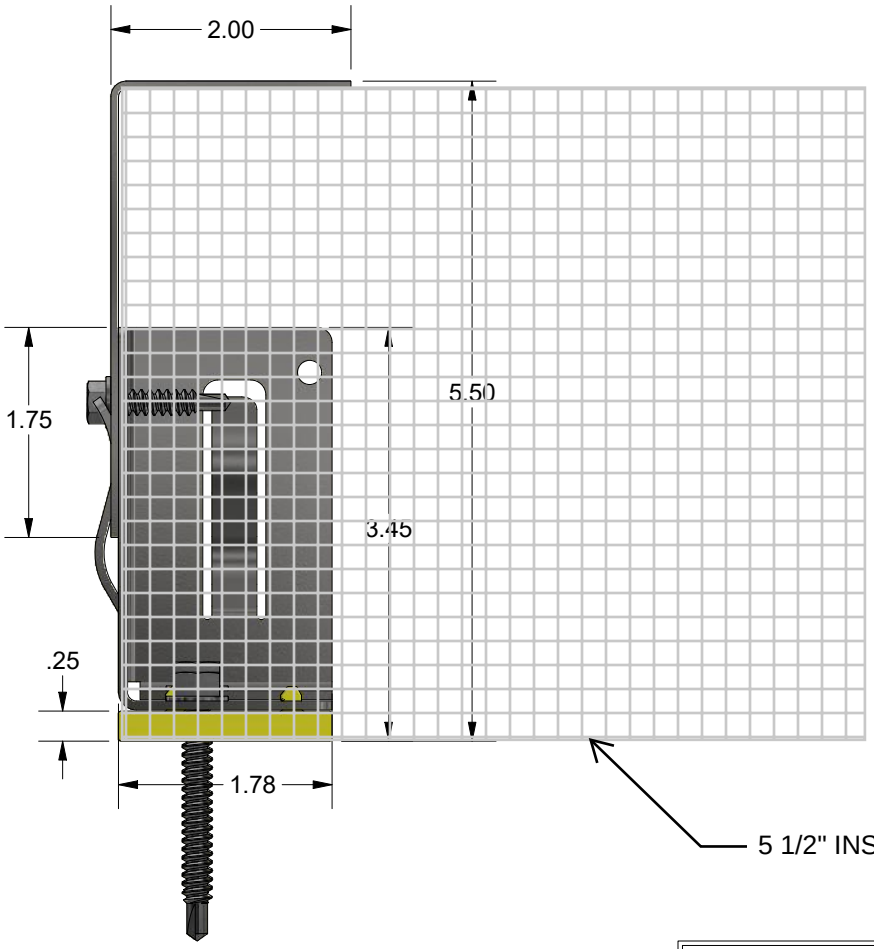
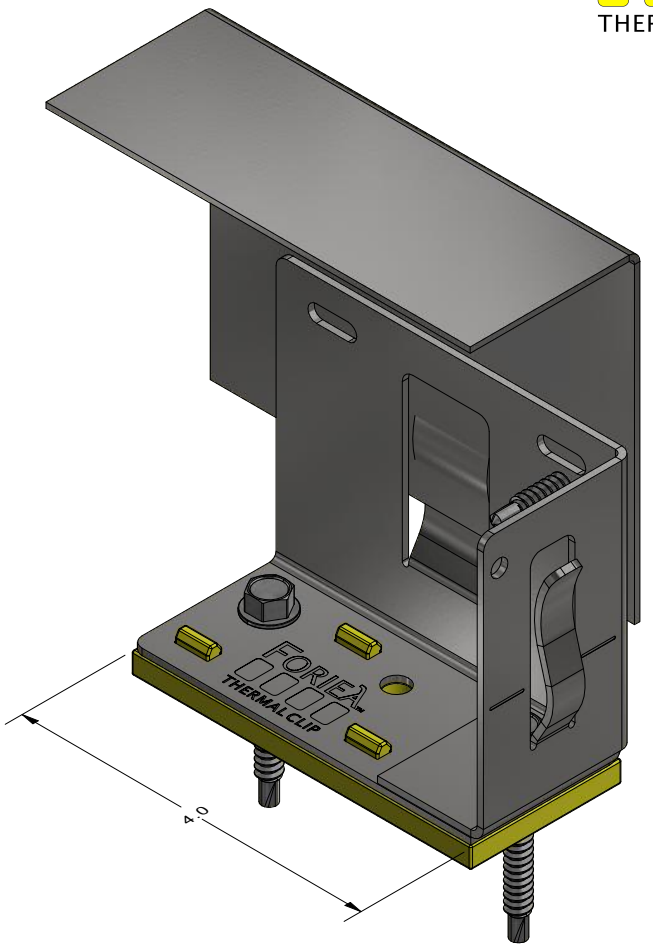
	SCALE .625			

FORIEA™
THERMAL CLIP





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APPROVED				
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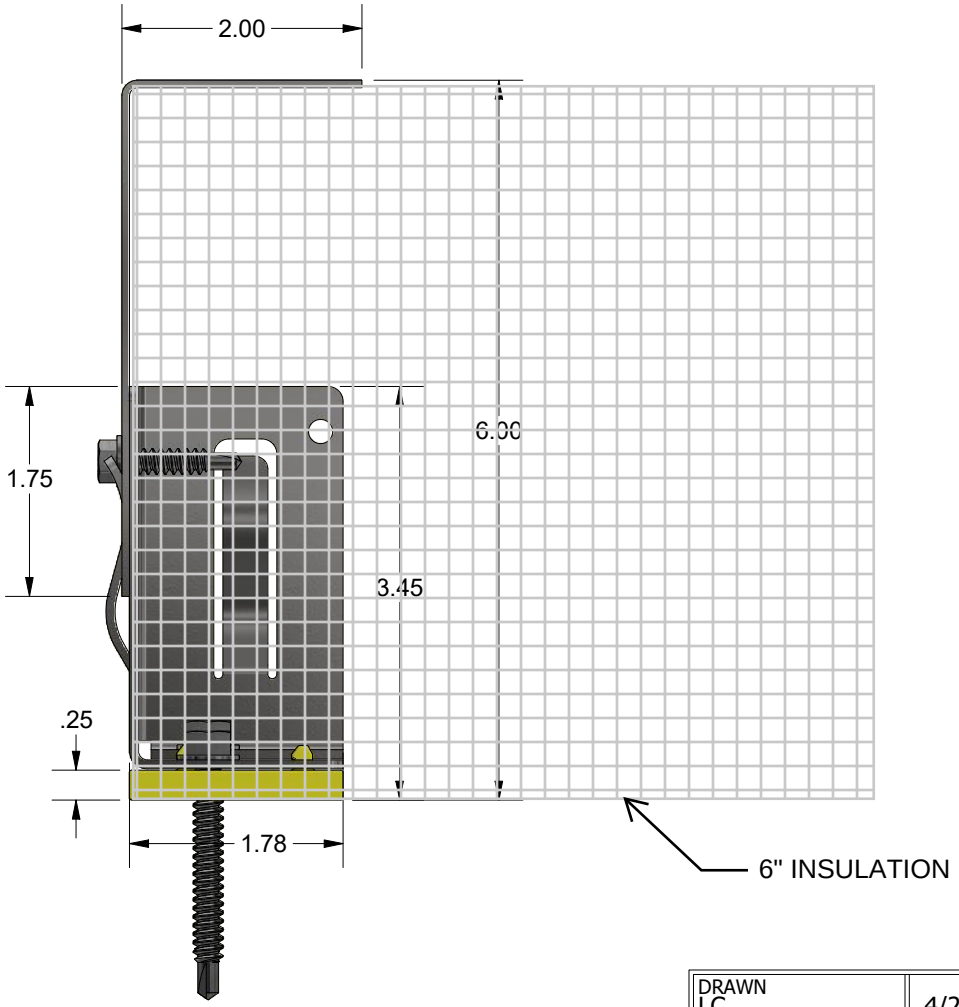
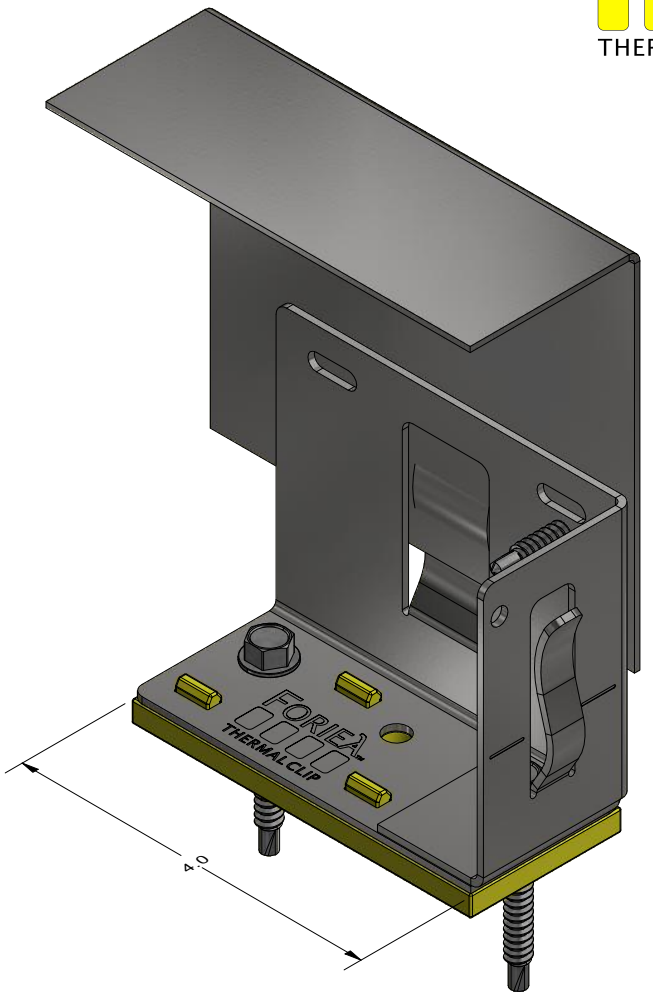
	SCALE .625			

FORIEA™
THERMAL CLIP





DRAWN LC	4/22/2020	JOB NAME FORIEA THERMAL CLIP	
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APPROVED			
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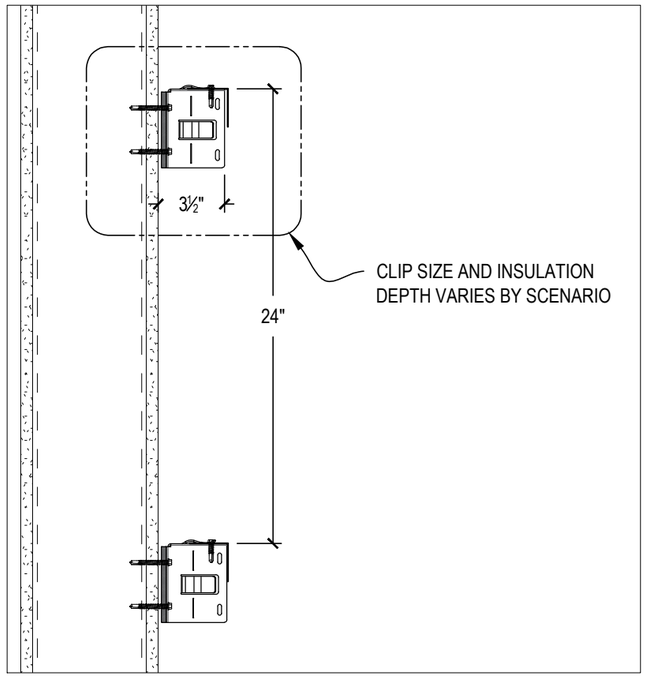
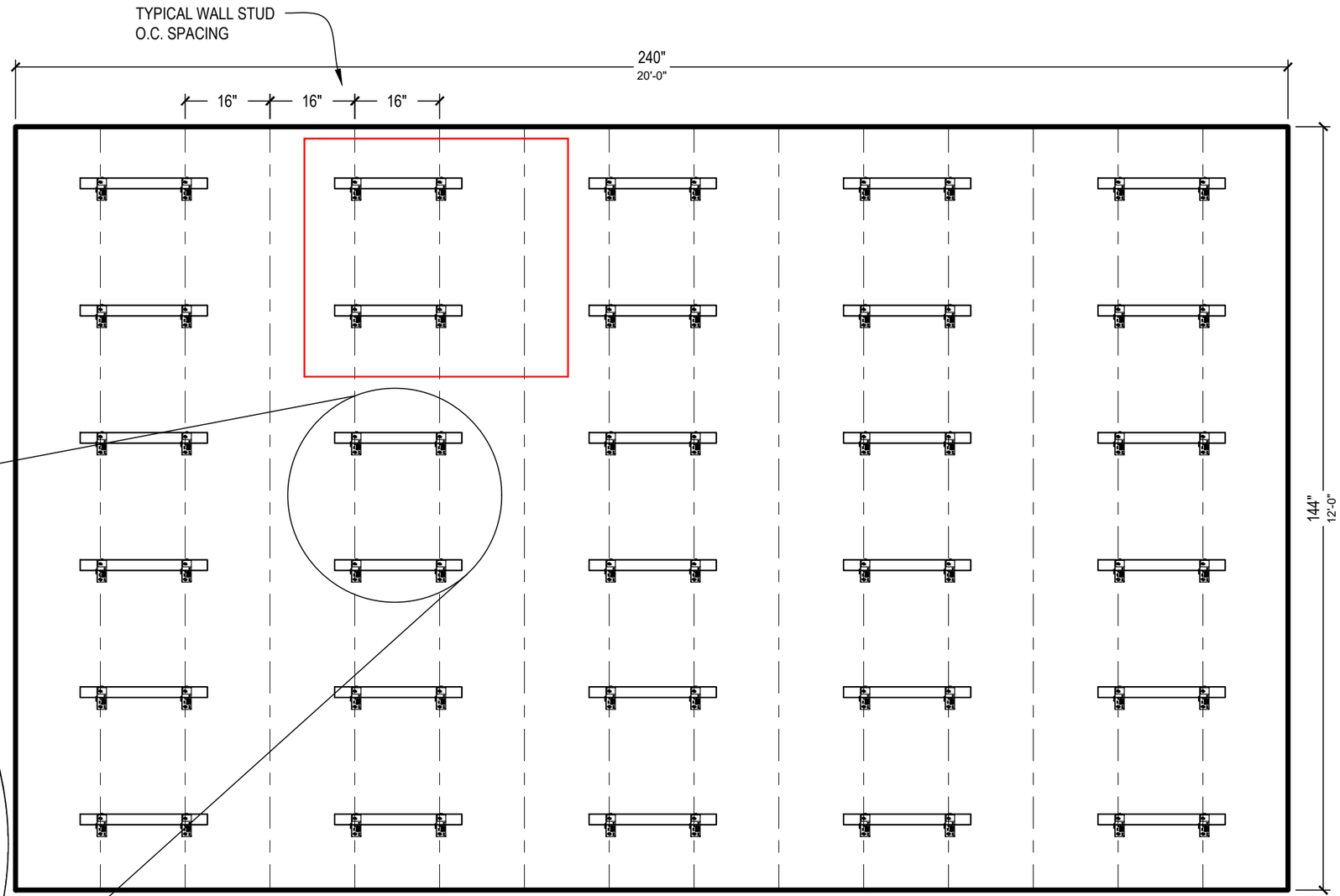
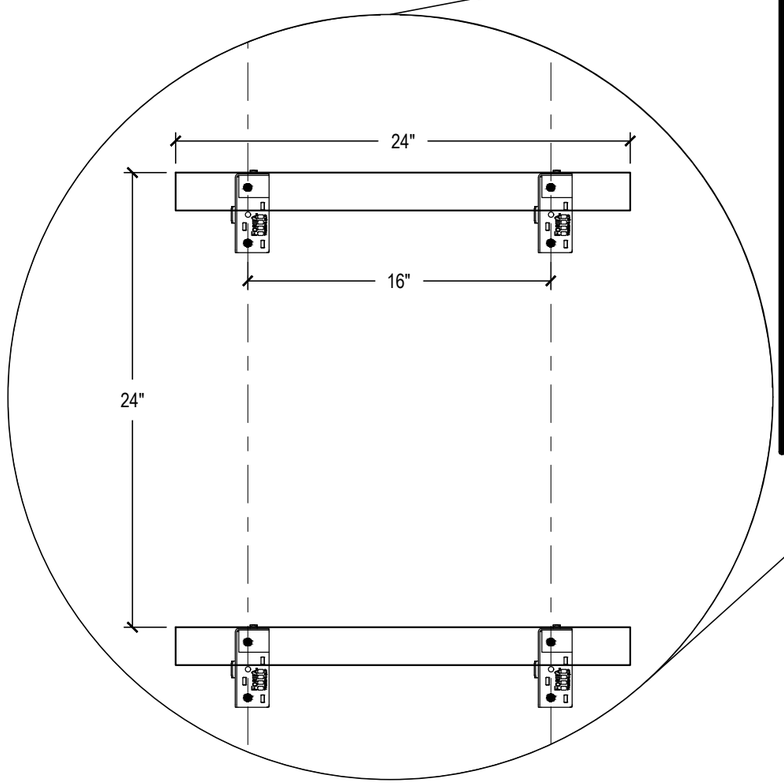
	SCALE .625		



SECTION VIEW



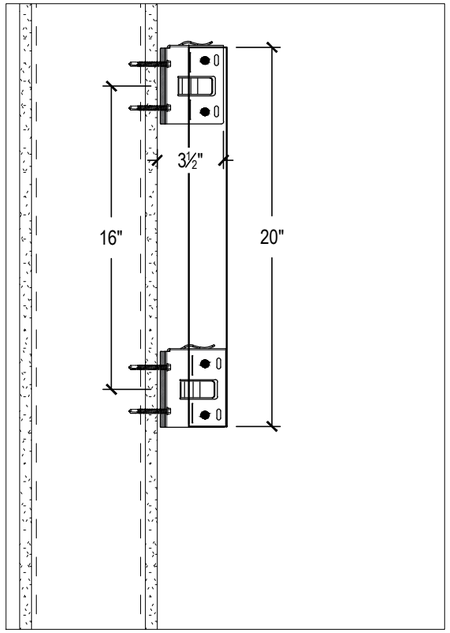


240SQFT FIELD ZONE

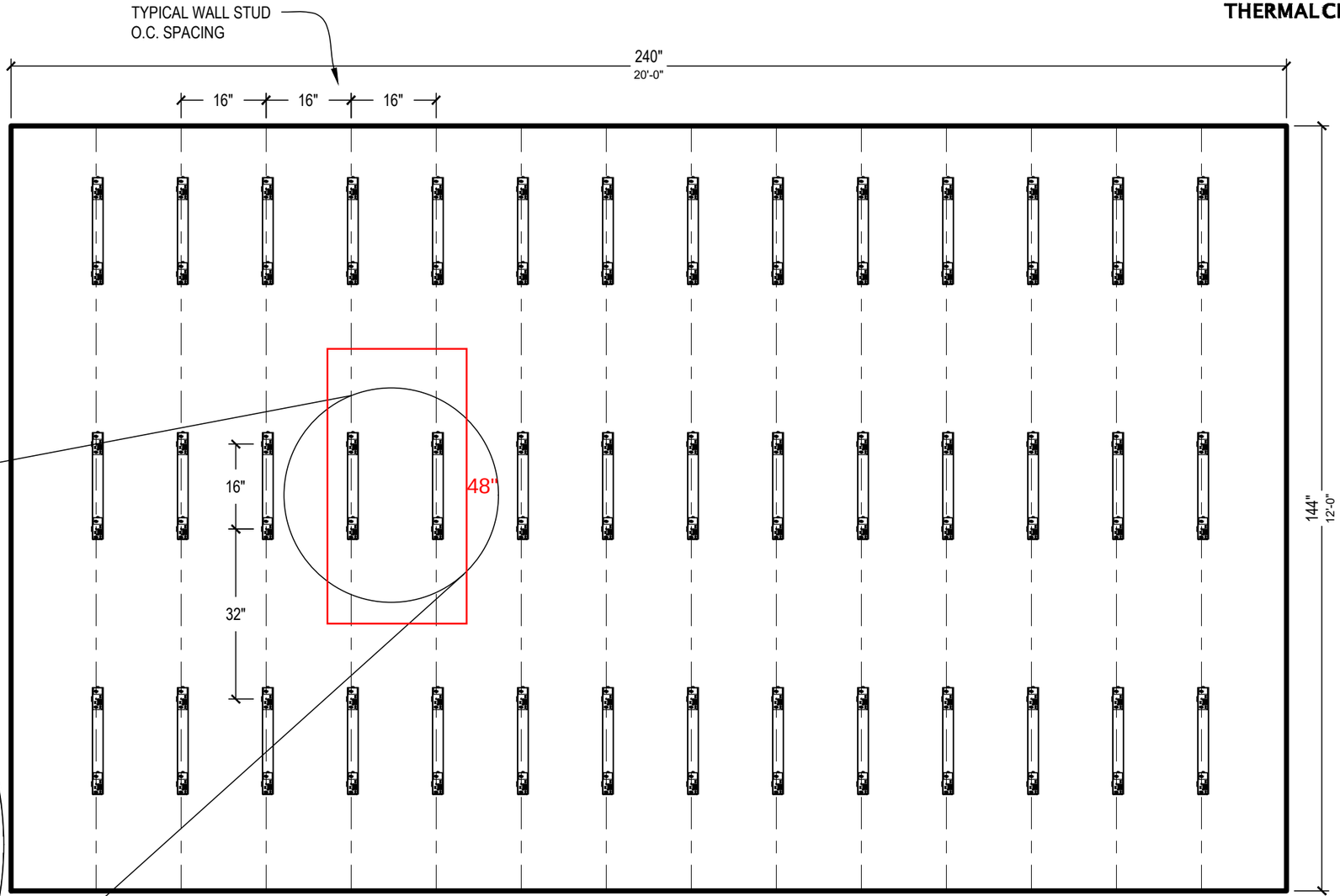
60 FORIEA CLIPS
120 FASTENER PENETRATIONS
60LF OF METAL FURRING

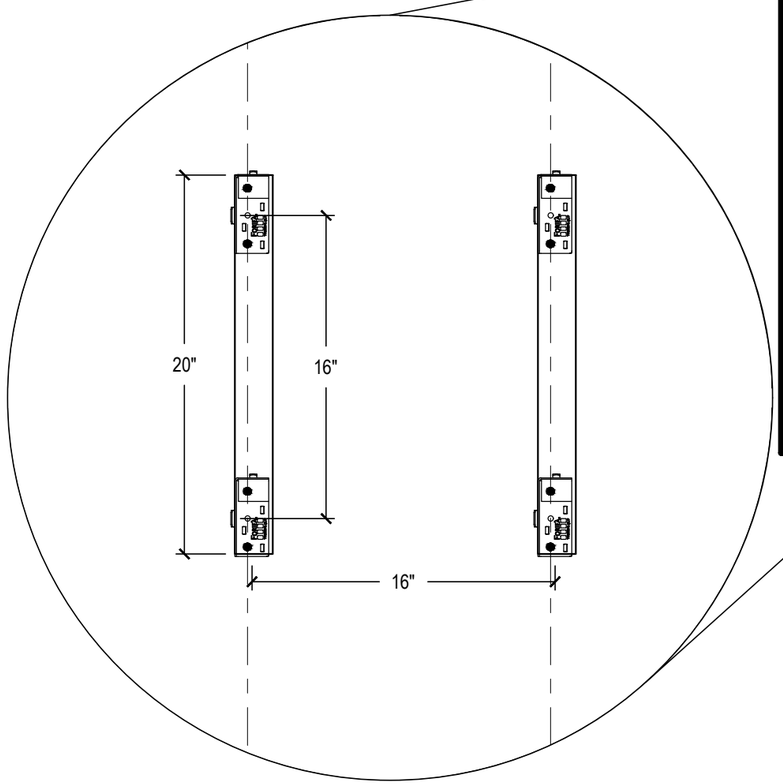
DRAWN JY	4/23/2020	JOB NAME FORIEA THERMAL CLIP	
CHECKED		CLIP AND FURRING LAYOUT INTERMITTENT	
APPROVED			
		SIZE B	DWG NO / REV
	SCALE		

FORIEA™
THERMAL CLIP



SECTION VIEW





240SQFT FIELD ZONE

60 FORIEA CLIPS
120 FASTENER PENETRATIONS
60LF OF METAL FURRING

DRAWN JY	4/23/2020	JOB NAME FORIEA THERMAL CLIP	
CHECKED		CLIP AND FURRING LAYOUT INTERMITTENT	
APPROVED			
		SIZE B	DWG NO / REV
	SCALE		SHEET 20 OF 20

APPENDIX B:
MODELLING PARAMETERS AND ASSUMPTIONS

1. GENERAL MODELLING APPROACH

For this report, a steady-state conduction model was used. The following parameters were also assumed:

- Material properties were taken from information provided by Skyline Sheet Metal, Inc. and the ASHRAE Handbook – Fundamentals for common materials.
- Enclosed air spaces were modelled with an equivalent thermal conductivity of the air that includes the impacts of convection and radiation within the enclosure. Calculations for this equivalent conductivity were based on ISO 10077-2.
- Interior/exterior air films were taken from Table 10, p. 26.21 of 2017 ASHRAE Handbook – Fundamentals depending on surface orientation. The exterior air films were based on an exterior wind speed of 15 mph.
- In ASHRAE 1365-RP, for rain screen cavity systems, most lightweight claddings have an insignificant impact on the thermal performance other than shielding the insulation from direct wind exposure. The cladding and secondary structure outboard of the clip system were not explicitly modelled but were incorporated into the exterior film coefficient.
- From the calibration in 1365-RP, contact resistances between materials were modelled and varied between R-0.01 and R-0.2 depending on the materials and interfaces.
- Insulation and other components were considered tight to adjacent interfaces.
- The clear field transmittances included in this analysis include uniform thermal bridges such as studs, clips, and girts.

2. TEMPERATURE INDEX

The temperature index is the ratio of the surface temperature relative to the interior and exterior temperatures. The temperature index has a value between 0 and 1, where 0 is the exterior temperature and 1 is the interior temperature. If T_i is known, Equation 1 can be rearranged for $T_{surface}$. This arrangement allows the modelled surface temperatures to be applicable to any climate.

$$T_i = \frac{T_{surface} - T_{outside}}{T_{inside} - T_{outside}} \qquad \text{EQ 1}$$

Note, these indices shown in the temperature profiles for this analysis are for general information only and are not intended to predict in-service surface temperatures subject to transient conditions, variable heating systems, and/ or interior obstructions that restrict heating of the assembly. For full limitations of this modelling approach, see ASHRAE 1365-RP.

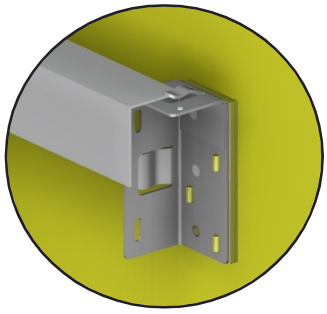
3. BOUNDARY CONDITIONS

Table B3.1: Boundary Conditions

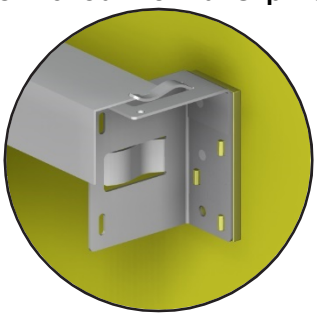
Boundary Location	**Combined Convective and Radiation Heat Transfer Coefficient** Btu/h ft^2 °F (W/m^{2}K)
Exterior Wall Surfaces with Generic Cladding	1.5 (8.3)
Interior Walls	1.5 (8.3)

APPENDIX C:
MATERIAL PROPERTIES

1. EXTERIOR INSULATED STEEL STUD ASSEMBLY



2 inch Foriea Thermal Clip Detail

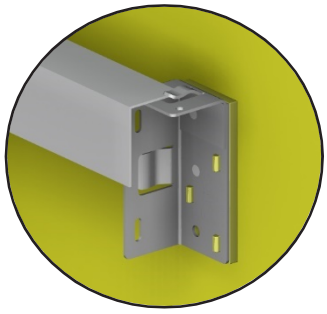


3.5 inch Foriea Thermal Clip Detail

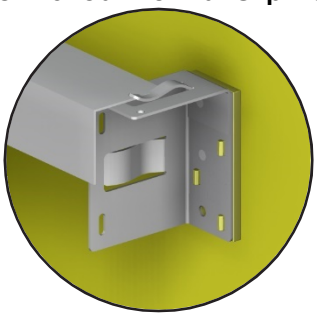
Component	Material	Thickness in (mm)	Thermal Conductivity Btu in / ft² h °F (W/m K)	Nominal Resistance ft² h °F / Btu (m² K/W)
Interior Film	-	-	-	R-0.7 (0.12 RSI)
Gypsum	Gypsum	1/2 (13)	1.1 (0.16)	R-0.5 (0.08 RSI)
Stud Cavity	Air	6 (152)	-	R-0.9 (0.16 RSI)
Steel Stud	Galvanized Steel	18 ga.	430 (62)	-
Sheathing	Gypsum	5/8 (16)	1.1 (0.16)	R-0.6 (0.10 RSI)
Exterior Insulation	Mineral Wool	Varies	0.24 (0.034)	R-8.4 to R-25.2 (1.48 to 4.44 RSI)
Foreia Clip	Galvanized Steel	14ga.	430 (62)	-
Fasteners	Steel	1/4 (6.4) θ	347 (50)	-
Thermal Break	Nylon 6	1/4 (6.4)	1.74 (0.25)	-
Girt	Galvanized Steel	16ga.	430 (62)	-
Air Spaces[2]	Air	Varies	Varies	-
Exterior Film	-	-	-	R-0.7 (0.12 RSI)
Overall Wall Assembly 1D	-	-	-	R-11.7 to R-28.5 (2.06 to 5.02 RSI)

[2] The thermal conductivities of the air spaces were determined according to ISO 10077-2

2. SPLIT INSULATED STEEL STUD ASSEMBLY



2 inch Foriea Thermal Clip Detail

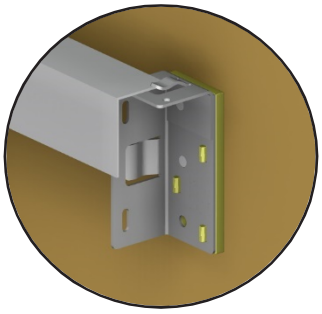


3.5 inch Foriea Thermal Clip Detail

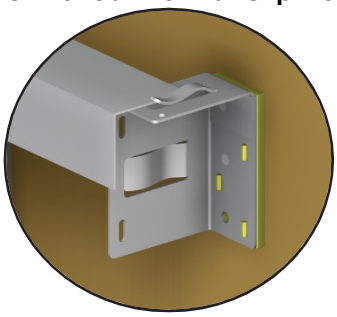
Component	Material	Thickness in (mm)	Thermal Conductivity Btu in / ft² h °F (W/m K)	Nominal Resistance ft² h °F / Btu (m² K/W)
Interior Film	-	-	-	R-0.7 (0.12 RSI)
Gypsum	Gypsum	1/2 (13)	1.1 (0.16)	R-0.5 (0.08 RSI)
Stud Cavity	R-19 Batt Insulation	6 (152)	0.32 (0.046)	R-19.0 (3.35 RSI)
Steel Stud	Galvanized Steel	18 ga.	430 (62)	-
Sheathing	Gypsum	5/8 (16)	1.1 (0.16)	R-0.6 (0.10 RSI)
Exterior Insulation	Mineral Wool	Varies	0.24 (0.034)	R-8.4 to R-25.2 (1.48 to 4.44 RSI)
Foreia Clip	Galvanized Steel	14ga.	430 (62)	-
Fasteners	Steel	1/4 (6.4) θ	347 (50)	-
Thermal Break	Nylon 6	1/4 (6.4)	1.74 (0.25)	-
Girt	Galvanized Steel	16ga.	430 (62)	-
Air Spaces[2]	Air	Varies	Varies	-
Exterior Film	-	-	-	R-0.7 (0.12 RSI)
Overall Wall Assembly 1D	-	-	-	R-29.8 to R-46.6 (5.25 to 8.20 RSI)

[2] The thermal conductivities of the air spaces were determined according to ISO 10077-2

3. WOOD FRAME ASSEMBLY



2 inch Foriea Thermal Clip Detail

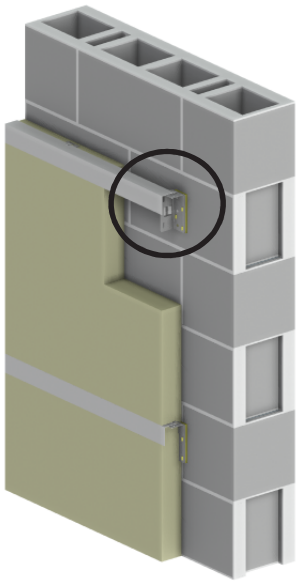


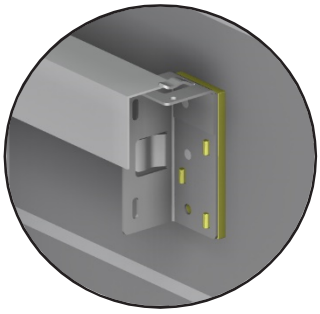
3.5 inch Foriea Thermal Clip Detail

Component	Material	Thickness in (mm)	Thermal Conductivity Btu in / ft² h °F (W/m K)	Nominal Resistance ft² h °F / Btu (m² K/W)
Interior Film	-	-	-	R-0.7 (0.12 RSI)
Gypsum	Gypsum	1/2 (13)	1.1 (0.16)	R-0.5 (0.08 RSI)
Stud Cavity	R-18 Batt Insulation	5.5 (140)	0.31 (0.044)	R-18.0 (3.17 RSI)
Wood Stud	Wood	18 ga.	0.69 (0.10)	-
Sheathing	Plywood	1/2 (13)	0.69 (0.10)	R-0.7 (0.13 RSI)
Exterior Insulation	Mineral Wool	Varies	0.24 (0.034)	R-8.4 to R-25.2 (1.48 to 4.44 RSI)
Foreia Clip	Galvanized Steel	14ga.	430 (62)	-
Fasteners	Steel	1/4 (6.4) θ	347 (50)	-
Thermal Break	Nylon 6	1/4 (6.4)	1.74 (0.25)	-
Girt	Galvanized Steel	16ga.	430 (62)	-
Air Spaces[2]	Air	Varies	Varies	-
Exterior Film	-	-	-	R-0.7 (0.12 RSI)
Overall Wall Assembly 1D	-	-	-	R-28.9 to R-45.7 (5.10 to 8.06 RSI)

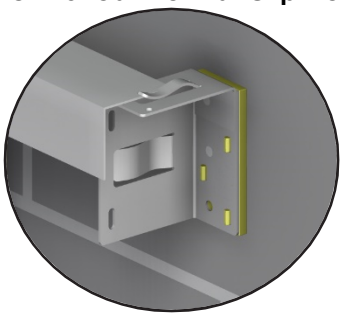
[2] The thermal conductivities of the air spaces were determined according to ISO 10077-2

4. CMU ASSEMBLY





2 inch Foriea Thermal Clip Detail



3.5 inch Foriea Thermal Clip Detail

Component	Material	Thickness in (mm)	Thermal Conductivity Btu in / ft² h °F (W/m K)	Nominal Resistance ft² h °F / Btu (m² K/W)
Interior Film	-	-	-	R-0.7 (0.12 RSI)
Standard Concrete Blocks	Concrete	8 (203)	10.4 (1.50)	-
Exterior Insulation	Mineral Wool	Varies	0.24 (0.034)	R-8.4 to R-25.2 (1.48 to 4.44 RSI)
Foreia Clip	Galvanized Steel	14ga.	430 (62)	-
Fasteners	Steel	1/4 (6.4) θ	347 (50)	-
Thermal Break	Nylon 6	1/4 (6.4)	1.74 (0.25)	-
Girt	Galvanized Steel	16ga.	430 (62)	-
Air Spaces[2]	Air	Varies	Varies	-
Exterior Film	-	-	-	R-0.7 (0.12 RSI)
Overall Wall Assembly 1D	-	-	-	R-11.3 to R-28.1 (1.98 to 4.94 RSI)

[2] The thermal conductivities of the air spaces were determined according to ISO 10077-2

APPENDIX D:
SIMULATED TEMPERATURE PROFILES

As an example of the thermal profiles of the Foriea Thermal Clip system, the following figures illustrate a typical temperature distribution for the 3.5 inch Foriea Thermal Clip with 4 inches of exterior insulation (R-16.8). The continuous girt assemblies have a clip spacing of 16 inches o.c. horizontal and 24 inches o.c. vertical. The profiles are presented as a temperature index (between 0 and 1). See Appendix B.2 for more information.

1. EXTERIOR INSULATED STEEL STUD ASSEMBLY

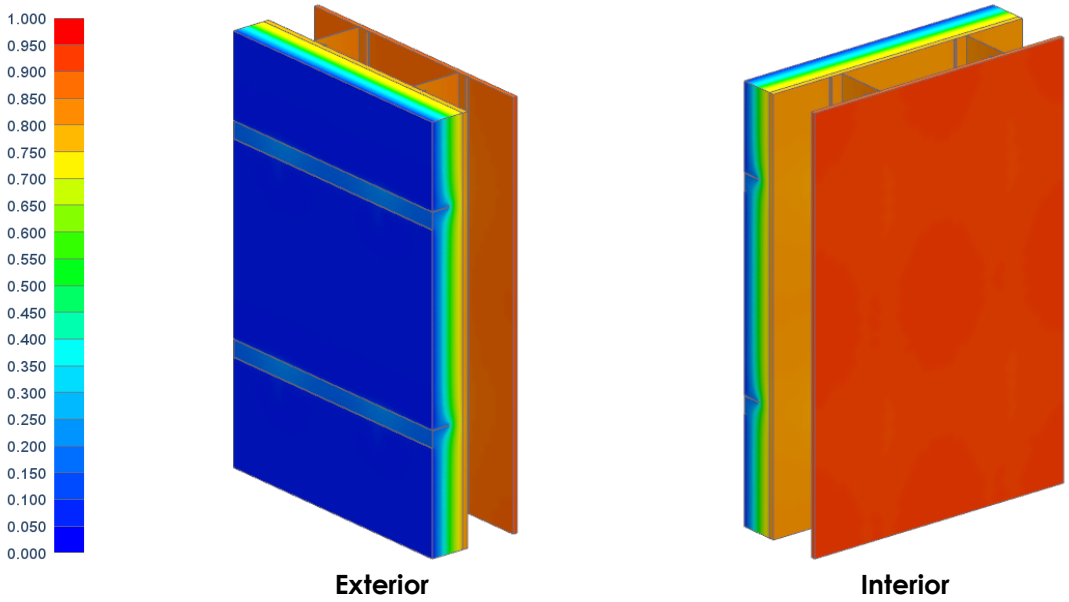


Figure D1.1: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Horizontal Girt, Exterior Insulated Steel Stud Assembly

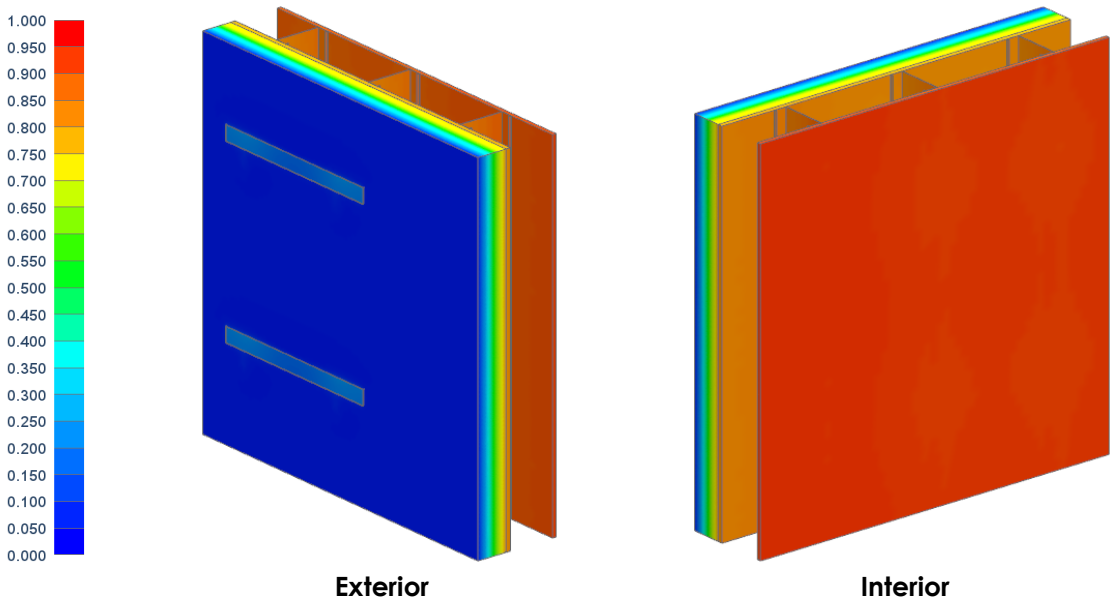


Figure D1.2: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with an Intermittent Horizontal Girt, Exterior Insulated Steel Stud Assembly

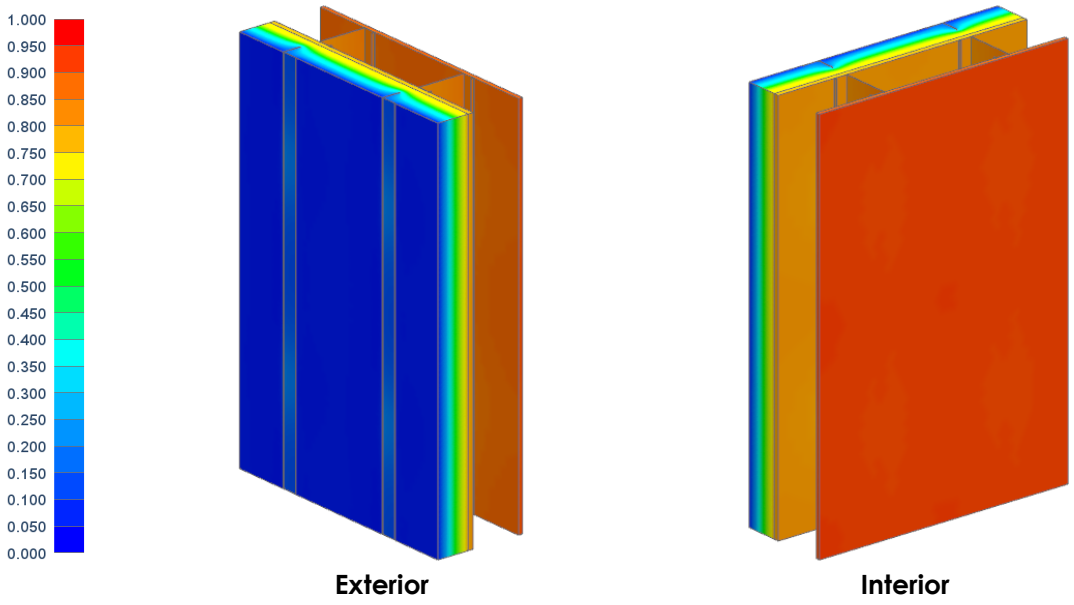


Figure D1.3: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Vertical Girt, Exterior Insulated Steel Stud Assembly

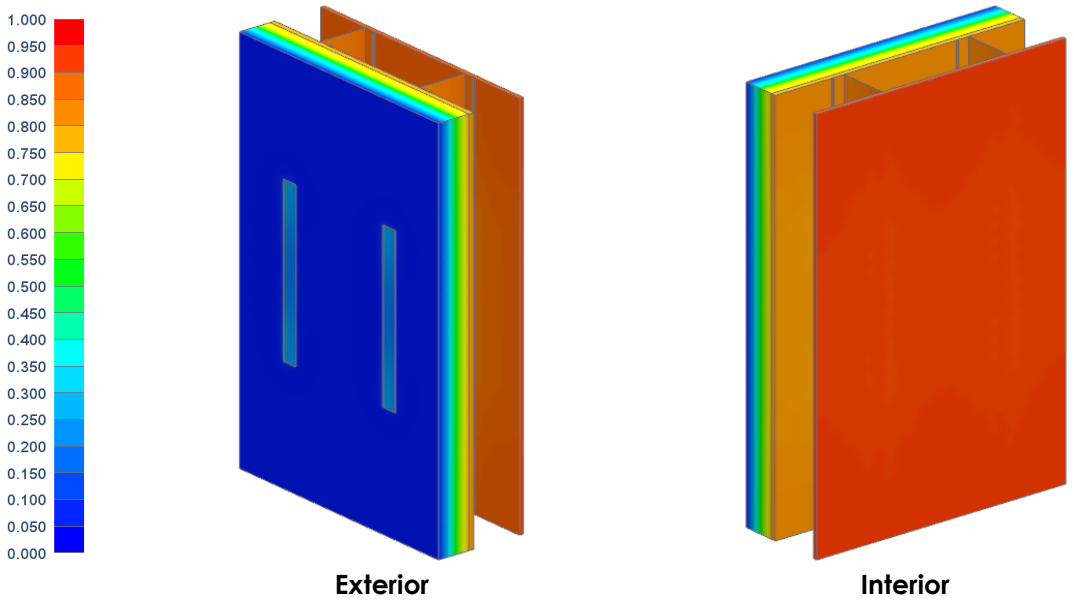


Figure D1.4: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 16" o.c. with an Intermittent Vertical Girt, Exterior Insulated Steel Stud Assembly

2. SPLIT INSULATED STEEL STUD ASSEMBLY

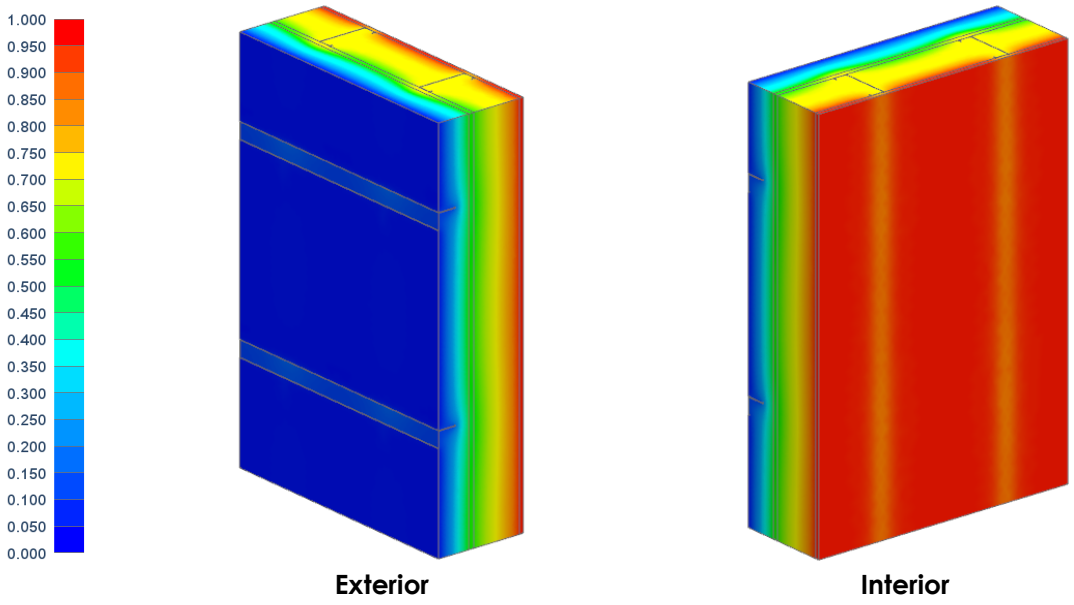


Figure D2.1: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Horizontal Girt, Split Insulated Steel Stud Assembly

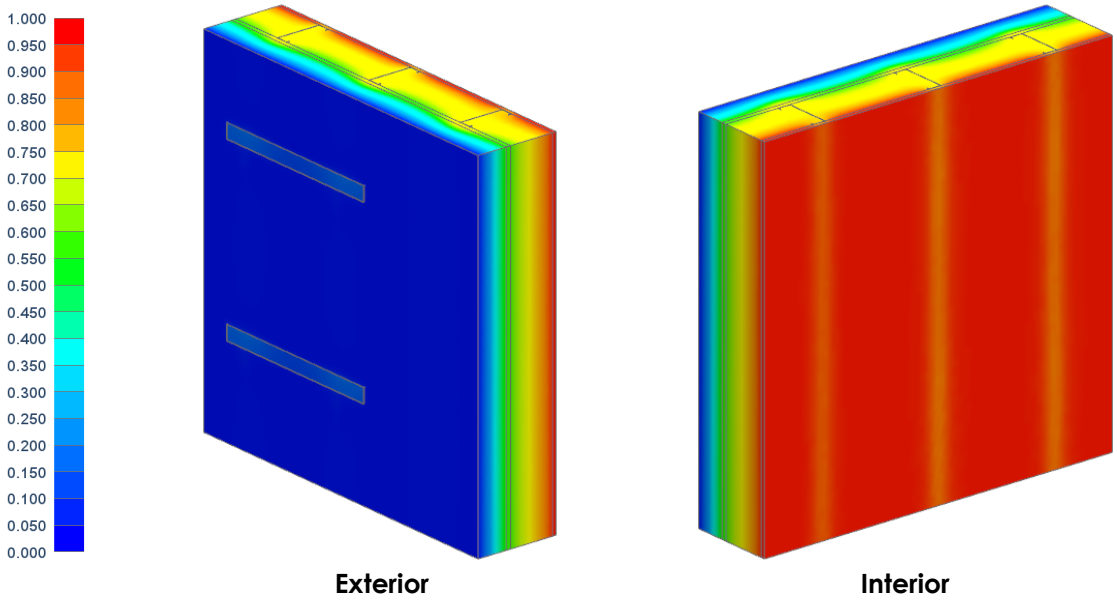


Figure D2.2: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with an Intermittent Horizontal Girt, Split Insulated Steel Stud Assembly

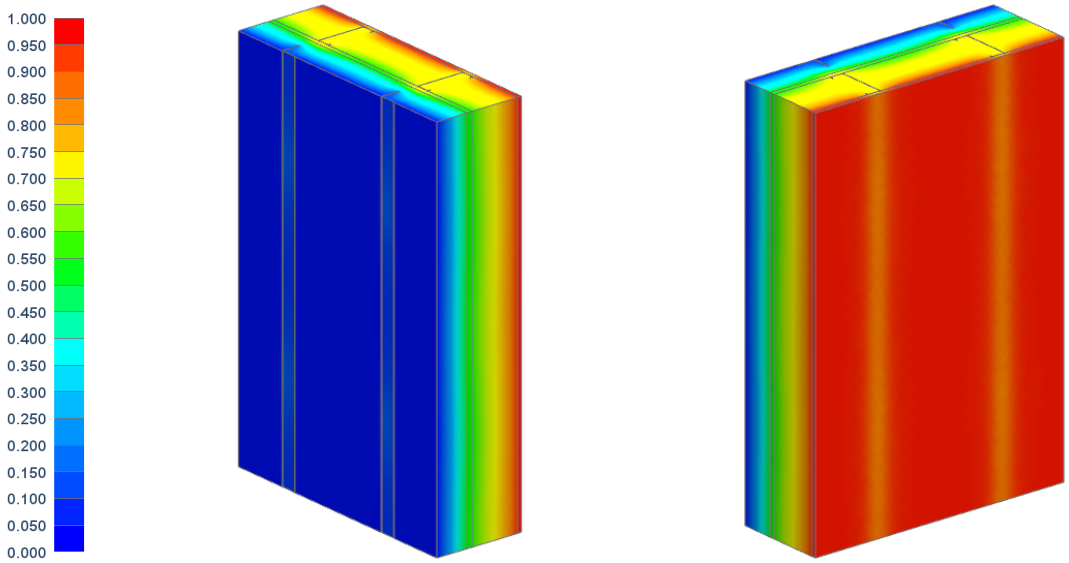


Figure D2.3: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Vertical Girt, Split Insulated Steel Stud Assembly

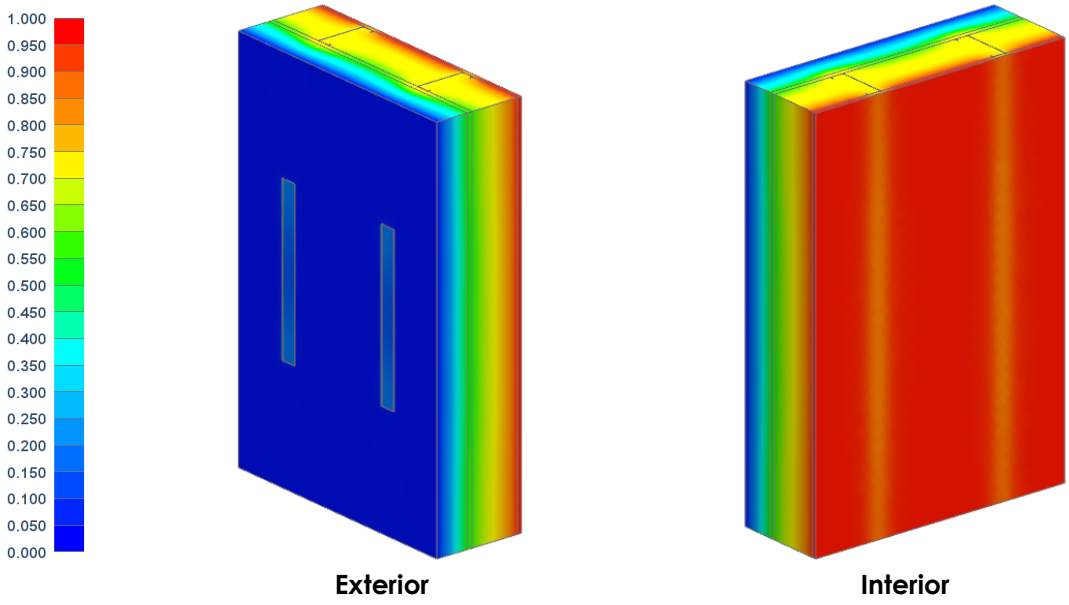


Figure D2.4: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 16" o.c. with an Intermittent Vertical Girt, Split Insulated Steel Stud Assembly

3. WOOD FRAME ASSEMBLY

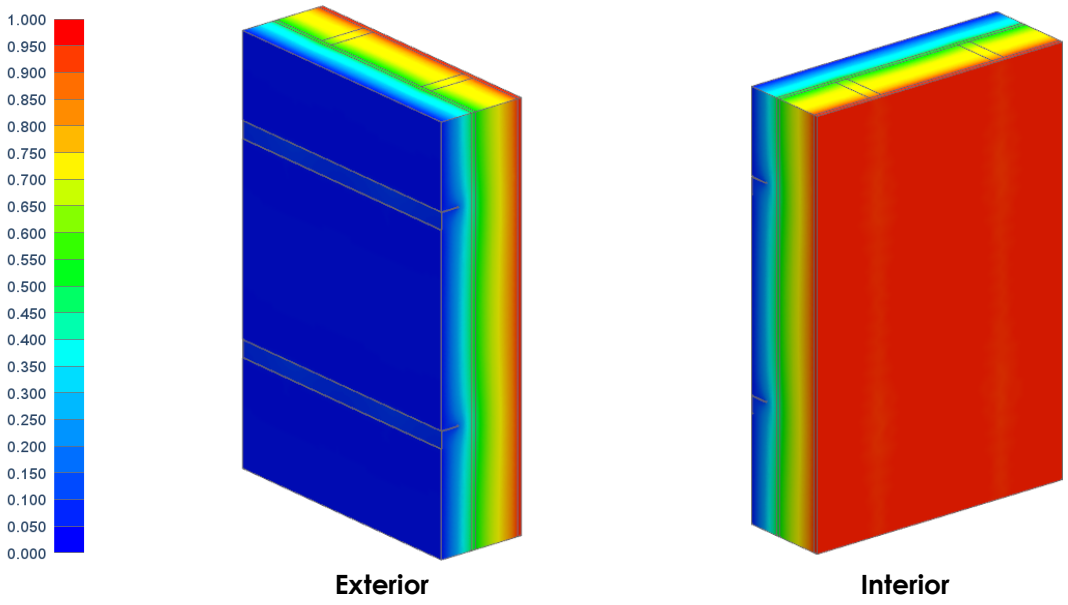


Figure D3.1: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Horizontal Girt, Wood Frame Assembly

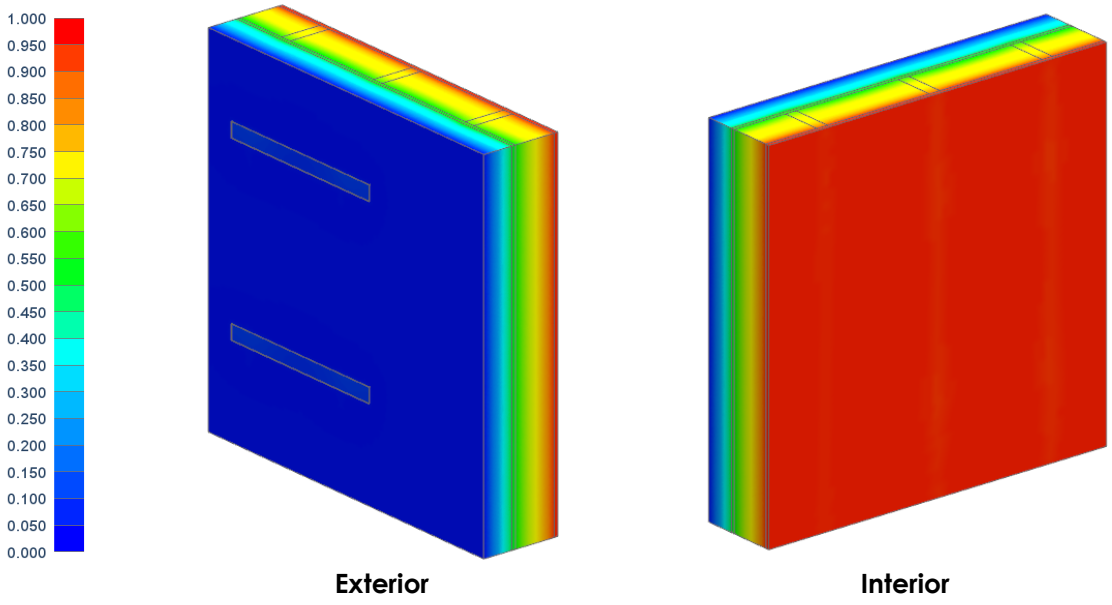


Figure D3.2: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with an Intermittent Horizontal Girt, Wood Frame Assembly

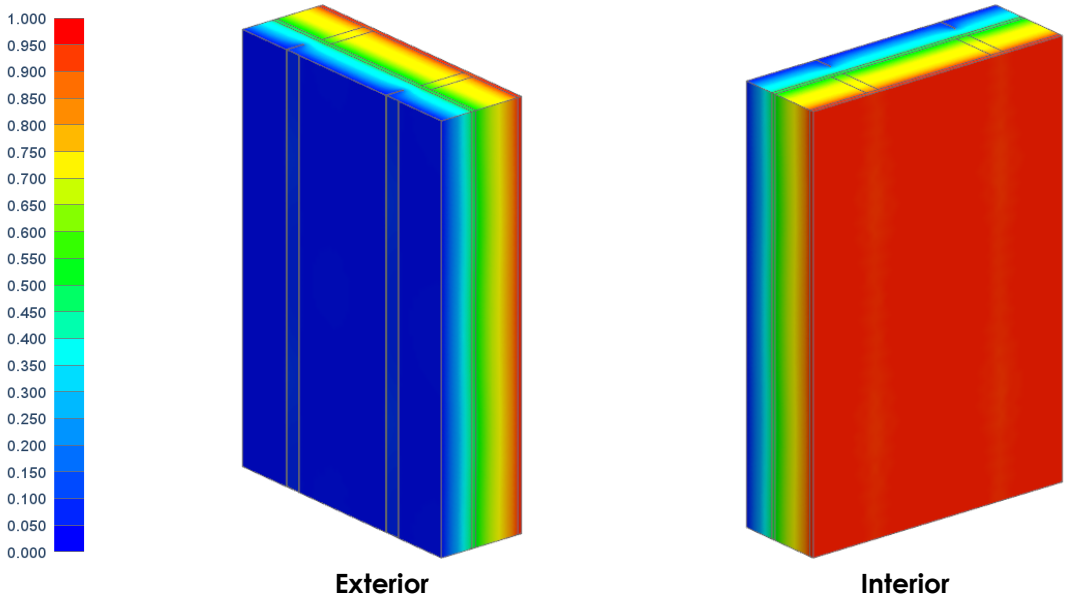


Figure D3.3: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Vertical Girt, Wood Frame Assembly

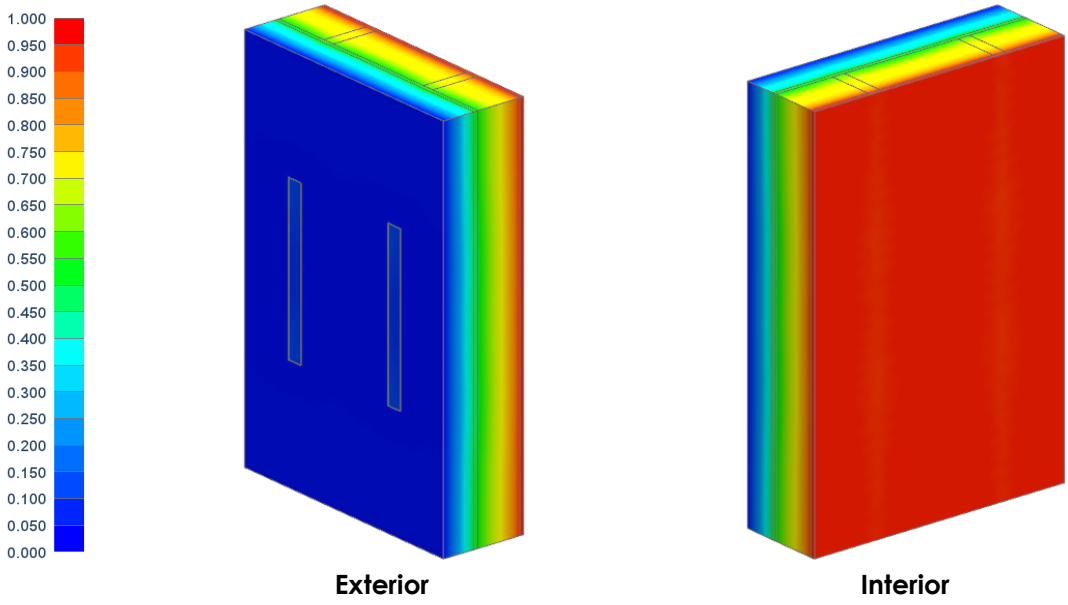


Figure D3.4: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 16" o.c. with an Intermittent Vertical Girt, Wood Frame Assembly

4. CMU ASSEMBLY

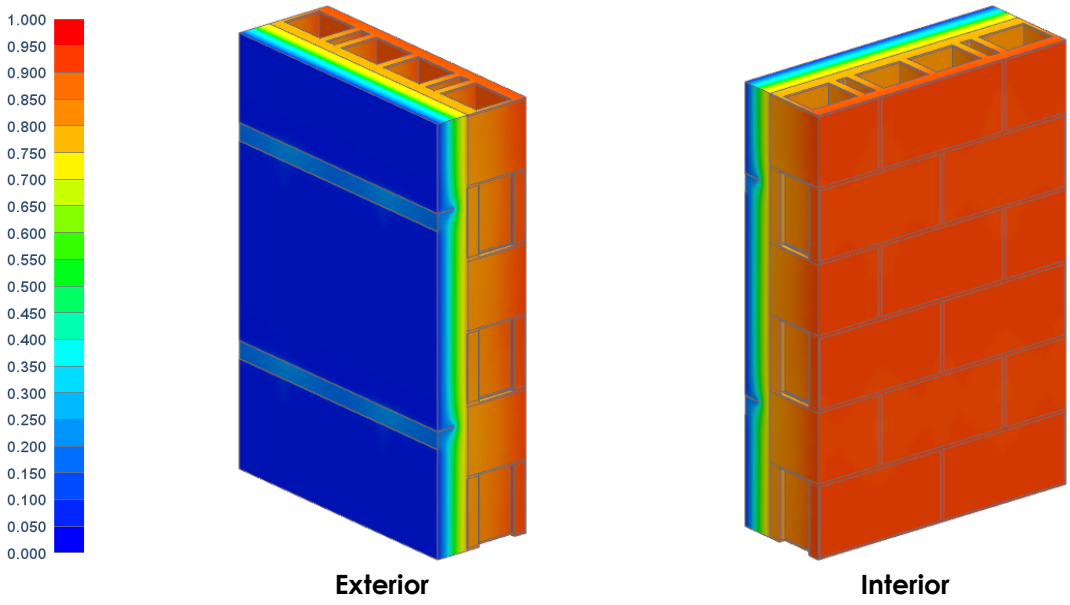


Figure D4.1: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Horizontal Girt, CMU Assembly

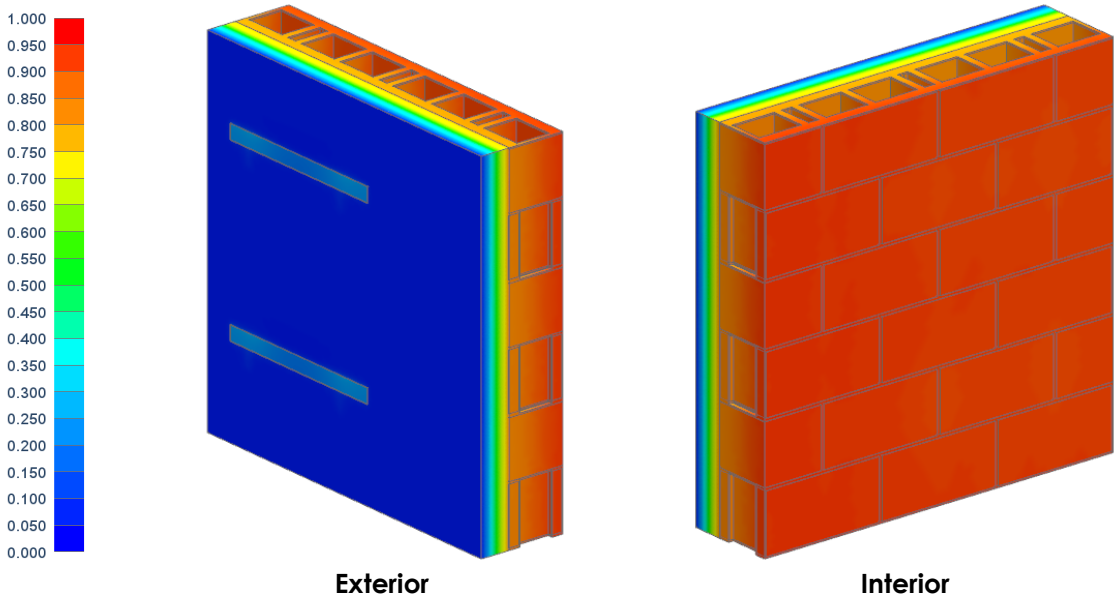


Figure D4.2: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with an Intermittent Horizontal Girt, CMU Assembly

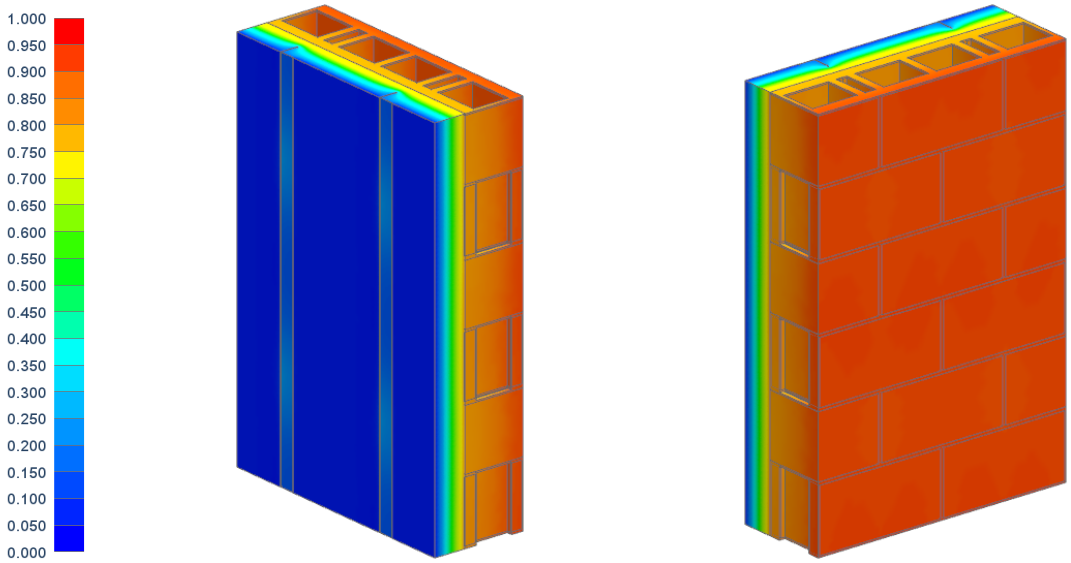


Figure D4.3: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 24" o.c. with a Continuous Vertical Girt, CMU Assembly

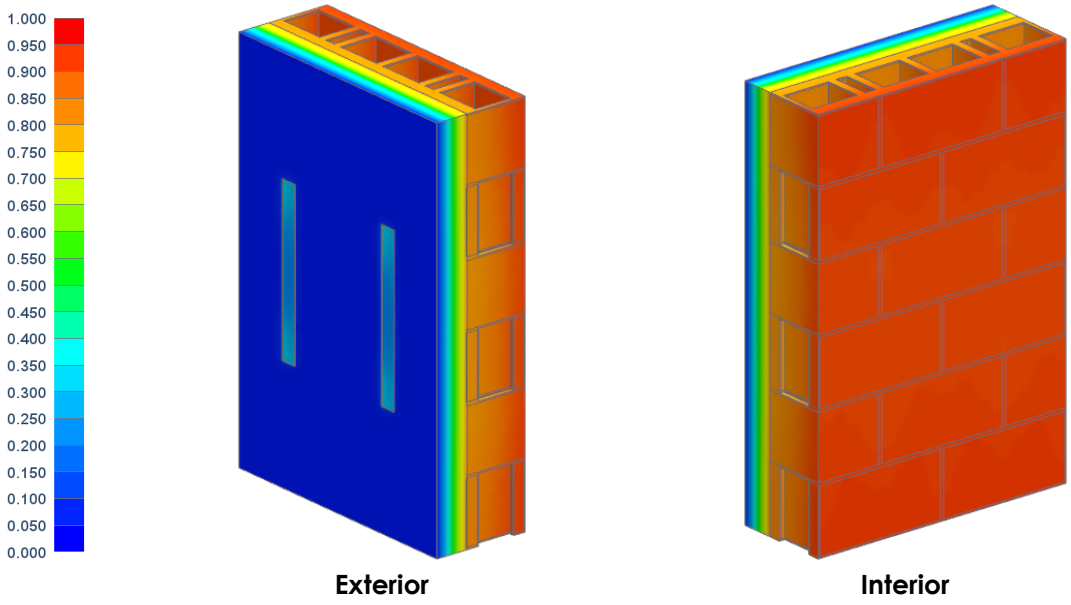


Figure D4.4: Temperature Profile of the 3.5 inch Foriea Thermal Clip Spaced 16" o.c. x 16" o.c. with an Intermittent Vertical Girt, CMU Assembly