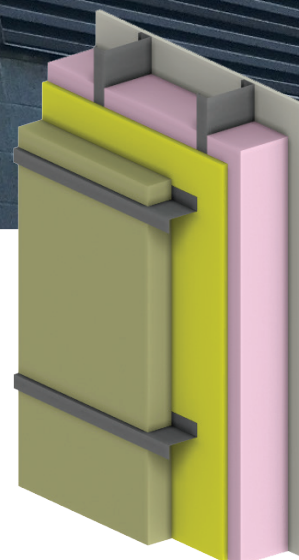




STEEL-FRAME WALLS- THERMAL ANALYSIS



MORRISON HERSHFIELD

Report Number: 220177800
May 1, 2025

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1.0 INTRODUCTION

Morrison Hershfield (MH) was retained by Owens Corning Canada (Owens Corning) to evaluate the thermal performance of various exterior and split-insulated steel-frame clear wall assemblies. This report is a summary of the analysis.

The thermal performance of various exterior and split-insulated steel-frame clear wall assemblies with R-20 (3.52 RSI), R-22 (3.87 RSI), and R-24 (4.22 RSI) batt insulation in the stud cavity were evaluated to determine the effective R-values and overall U-values of the split-insulated steel-frame wall assemblies. The configurations evaluated are shown in Table 1.1 and Table 1.2. For most assemblies, insulation levels required to meet effective R-40 (7.04 RSI) are listed.

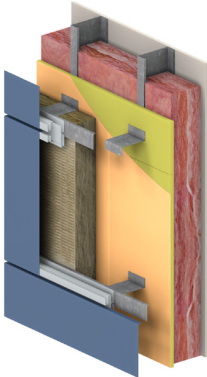
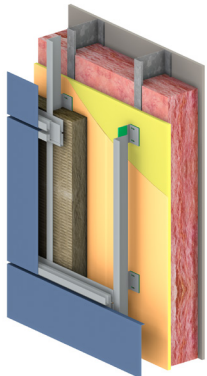
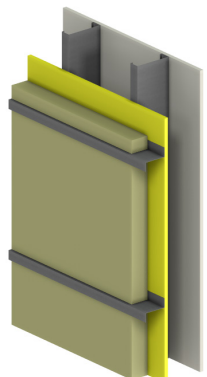
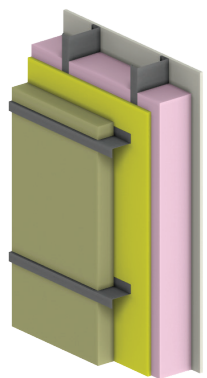
Table 1.1: Evaluated Clear Wall Assembly Scenarios

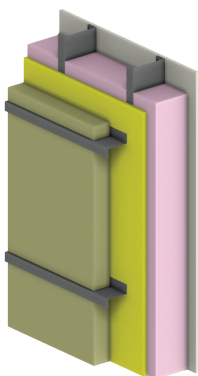
ASSEMBLY	WALL ASSEMBLY DESCRIPTION	STUD CAVITY INSULATION	EXTERIOR INSULATION	
			TYPE	THICKNESS
1	Split-insulated steel stud assembly with intermittent horizontal Z-girts and fiberglass batt insulation	R-20	Thermafiber® RainBarrier® (R-4.3/in)	1.5 in to 10.5 in
		R-22, R-24		1.5 in to 10 in
2	Split-insulated steel stud assembly with thermally isolated aluminum brackets and fiberglass batt insulation	R-20, R-22	Thermafiber® RainBarrier® (R-4.3/in)	1.5 in to 11 in
		R-24		1.5 in to 10.5 in
3	Exterior insulated steel-frame wall with continuous horizontal Z-girts	None	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in)	1 in to 6 in
4	Split-insulated steel-stud wall with continuous horizontal Z-girts	R-20	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in)	1 in to 15.5 in
		R-22	Thermafiber® RainBarrier® CI HC Plus (110) (R 4.1/in)	1 in to 15 in
		R-24	Thermafiber® RainBarrier® CI HC 80 or RainBarrier® (R-4.2/in)	1 in to 14.5 in
5	Split-insulated steel-frame wall with continuous horizontal Z-girts and metal hat channel between studs and drywall	R-20	Thermafiber® RainBarrier® CI HC Plus (110) (R 4.1/in)	2.5 in to 12.5 in
		R-22, R-24		2.5 in to 11.5 in
6	Split-insulated steel-frame wall with continuous horizontal Z-girts and metal hat channel between studs and two layers of drywall	R-20	Thermafiber® RainBarrier® CI HC Plus (110) (R 4.1/in)	2.5 in to 11.5 in
		R-22		2.5 in to 11 in
		R-24		2.5 in to 10.5 in

ASSEMBLY	WALL ASSEMBLY DESCRIPTION	STUD CAVITY INSULATION	EXTERIOR INSULATION	
			TYPE	THICKNESS
7a	Exterior insulated steel-frame wall with continuous insulation and steel fasteners at 12" o.c. vertical spacing	None	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)	1 in to 12 in
7b	Exterior insulated steel-frame wall with continuous insulation and stainless steel fasteners at 12" o.c. vertical spacing		Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in)	1 in to 10.5 in
			Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)	
8	Split-insulated steel-frame wall with continuous insulation and steel fasteners at 12" o.c. vertical spacing	R-20	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in)	1 in to 10 in
			Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)	1 in to 9.5 in
		R-22	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Thermafiber® RainBarrier® CI HC 80 45 (R-4.2/in)	1 in to 9.5 in
			R-24	Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)
		9		Split-insulated steel-stud wall with continuous insulation and stainless steel fasteners at 16" o.c. vertical spacing
Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)	1 in to 7.5 in			
R-22	Thermafiber® RainBarrier® CI HC Max (140)(R-4.0/in) Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)		1 in to 7.5 in	
	R-24		Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in)	
Thermafiber® RainBarrier® CI HC 80 (R-4.2/in)			1 in to 7.5 in	

¹Insulation level to be extrapolated to achieve effective R-40 at 1/2 inch (13 mm) increments

Table 1.1: Evaluated Clear Wall Assembly Scenarios

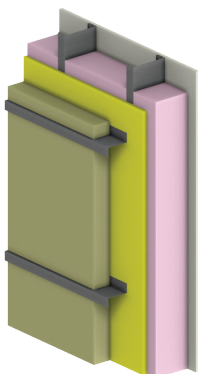
	WALL ASSEMBLY 1 Split-Insulated Steel Stud Assembly with Galvanized Intermittent Horizontal Z-Girts Cladding Attachment • 1/2 inch (13 mm) gypsum • 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs with batt insulation in stud cavity • 1/2 inch (13 mm) exterior gypsum sheathing • Galvanized steel intermittent horizontal Z-girt • Horizontal L-girt • Exterior mineral wool insulation
	WALL ASSEMBLY 2 Split-Insulated Steel Stud Assembly with Thermally Isolated Aluminum Brackets Cladding Attachment • 1/2 inch (13 mm) gypsum • 6 inch x 1 5/8 inch (92 mm x 41 mm) steel studs with batt insulation in stud cavity • 1/2 inch (13 mm) gypsum sheathing • Thermally isolated aluminum brackets • Vertical L-girt • Exterior mineral wool insulation
	WALL ASSEMBLY 3 Exterior Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts • 5/8 inch (16 mm) gypsum • 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with empty cavity • 5/8 inch (16 mm) gypsum sheathing • 18 ga. horizontal Z-girt at 24 inch (610 mm) o.c. vertical spacing • Exterior mineral wool insulation
	WALL ASSEMBLY 4 Split-Insulated Steel Stud Assembly with Continuous Horizontal Z-Girts • 5/8 inch (16 mm) gypsum • 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with batt insulation in stud cavity • 5/8 inch (16 mm) exterior gypsum sheathing • 18 ga. horizontal Z-girt at 24 inch (610 mm) o.c. vertical spacing • Exterior mineral wool insulation



WALL ASSEMBLY 5

Split-Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts and Metal Hat Channel between Studs and Drywall

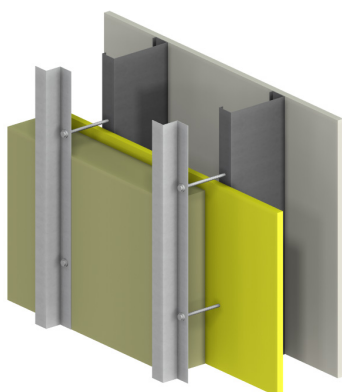
- 5/8 inch (16 mm) gypsum
- 7/8 inch (12 mm) hat channel at 16 inch (406 mm) o.c. spacing in empty cavity
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with batt insulation in stud cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- 18 ga. horizontal Z-girt at 24 inch (610 mm) o.c. vertical spacing
- Exterior mineral wool insulation



WALL ASSEMBLY 6

Split-Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts and Metal Hat Channel between Studs and Two Layers of Drywall

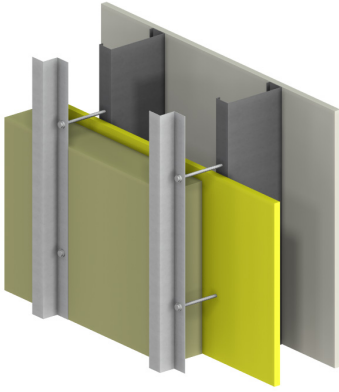
- Two layers of 5/8 inch (16 mm) gypsum
- 7/8 inch (12 mm) hat channel at 16 inch (406 mm) o.c. spacing in empty cavity
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with batt insulation in stud cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- 18 ga. horizontal Z-girt at 24 inch (610 mm) o.c. vertical spacing
- Exterior mineral wool insulation



WALL ASSEMBLY 7A

Exterior Insulated Steel-Frame Wall with Continuous Insulation and Steel Fasteners at 12" o.c. Vertical Spacing

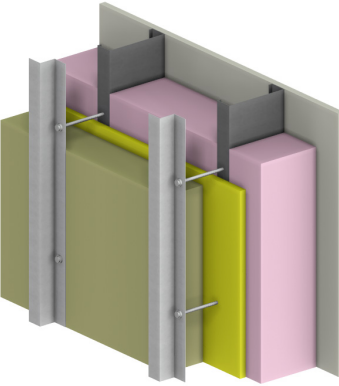
- 5/8 inch (16 mm) gypsum
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with empty cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- #12 galvanized steel fasteners at 16 inch (406 mm) o.c. horizontal spacing and 12 inch (305 mm) o.c. vertical spacing
- 18 ga. vertical Z-girt at 16 inch (406 mm) o.c. horizontal spacing
- Exterior mineral wool insulation



WALL ASSEMBLY 7B

Exterior Insulated Steel-Frame Wall with Continuous Insulation and Stainless Steel Fasteners at 12" o.c. Vertical Spacing

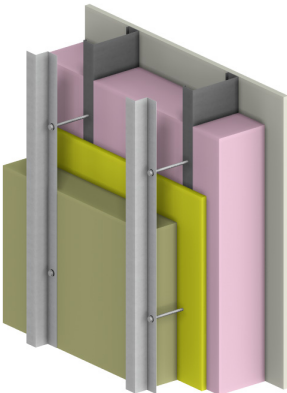
- 5/8 inch (16 mm) gypsum
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with empty cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- #12 stainless steel fasteners at 16 inch (406 mm) o.c. horizontal spacing and 12 inch (305 mm) o.c. vertical spacing
- 18 ga. vertical Z-girt at 16 inch (406 mm) o.c. horizontal spacing
- Exterior mineral wool insulation



WALL ASSEMBLY 8

Split-Insulated Steel-Frame Wall with Continuous Insulation and Steel Fasteners at 12" o.c. Vertical Spacing

- 5/8 inch (16 mm) gypsum
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with batt insulation in stud cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- #12 galvanized steel fasteners at 16 inch (406 mm) o.c. horizontal spacing and 12 inch (305 mm) o.c. vertical spacing
- 18 ga. vertical Z-girt at 16 inch (406 mm) o.c. horizontal spacing
- Exterior mineral wool insulation



WALL ASSEMBLY 9

Split-Insulated Steel-Frame Wall with Continuous Insulation and Stainless Steel Fasteners at 16" o.c. Vertical Spacing

- 5/8 inch (16 mm) gypsum
- 6 inch x 1 5/8 inch (152 mm x 41 mm) steel studs at 16 inch (406) o.c. with batt insulation in stud cavity
- 5/8 inch (16 mm) exterior gypsum sheathing
- #12 stainless steel fasteners at 16 inch (406 mm) o.c. horizontal spacing and 16 inch (406 mm) o.c. vertical spacing
- 18 ga. vertical Z-girt at 16 inch (406 mm) o.c. horizontal spacing
- Exterior mineral wool insulation

2.0 MODELLING PROCEDURES

The thermal performance of the split-insulated steel-frame wall assemblies was evaluated by combining the effective R-value of the exterior assembly from the previous analysis with the effective R-value of various interior insulated steel-frame back-up wall assemblies. The thermal performance of the additional insulation scenarios for the exterior and split-insulated steel-frame wall assemblies was determined by extrapolating from the previously evaluated clear wall assemblies.

The thermal performance of the previously evaluated clear wall assemblies and all steel-frame back-up wall assemblies used in this analysis 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 $\pm 5\%$ 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 (BETB). The thermal analysis utilized steady-state conditions, published thermal properties of materials, and information provided by Owens Corning. Additional assumptions for the thermal analysis are listed in Appendix B.

The effective R-value of the exterior assembly was found by subtracting the effective R-value of the insulated steel-frame back-up wall listed in Detail 5.1.1 and Detail 5.1.2 of version 1.6 of the BETB Guide.

The effective R-value of the insulated steel-frame back-up wall assemblies considers the impact of exterior insulation on the effectiveness of stud cavity insulation. The presence of exterior insulation increases the effectiveness of the stud cavity insulation resulting in higher back-up wall effective R-values. This change in back-up wall effective R-value was determined by evaluating split-insulated steel-frame assemblies through thermal modelling with continuous exterior insulation and subtracting the thermal resistance of the exterior insulation and air film. The variation in effective R-values of the insulated steel-frame back-up walls influenced by the presence of exterior insulation for various stud cavity insulation levels is plotted in the graphs attached in Appendix A.

3.0 THERMAL RESULTS

The estimated U-values and effective R-values of the various exterior and split-insulated steel-frame clear wall assemblies are shown in Tables 3.1.1 to 3.9.2.

3.1 Wall Assembly 1: Split-Insulated Steel Stud Assembly with Intermittent Horizontal Z-Girts and Fiberglass Batt Insulation

Table 3.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Galvanized Intermittent Horizontal Z-Girts, and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation (**Assembly 1**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.058 (0.331)	R-17.1 (3.02 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.054 (0.304)	R-18.7 (3.29 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.046 (0.262)	R-21.7 (3.82 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.041 (0.233)	R-24.4 (4.30 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.037 (0.210)	R-27.0 (4.75 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.035 (0.201)	R-28.3 (4.98 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.034 (0.192)	R-29.5 (5.20 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.032 (0.185)	R-30.8 (5.42 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.031 (0.177)	R-32.0 (5.64 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.030 (0.170)	R-33.3 (5.87 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.029 (0.164)	R-34.6 (6.09 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.028 (0.158)	R-35.9 (6.32 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.027 (0.153)	R-37.2 (6.55 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.026 (0.148)	R-38.4 (6.76 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.025 (0.143)	R-39.6 (6.98 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.024 (0.139)	R-40.9 (7.20 RSI)

Table 3.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Galvanized Intermittent Horizontal Z-Girts, and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation (**Assembly 1**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.057 (0.323)	R-17.6 (3.10 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.052 (0.297)	R-19.1 (3.37 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.045 (0.257)	R-22.1 (3.89 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.040 (0.229)	R-24.8 (4.37 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.036 (0.207)	R-27.4 (4.83 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.035 (0.198)	R-28.7 (5.06 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.033 (0.189)	R-30.0 (5.28 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.032 (0.182)	R-31.2 (5.50 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.031 (0.175)	R-32.5 (5.72 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.030 (0.168)	R-33.7 (5.94 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.029 (0.162)	R-35.0 (6.17 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.028 (0.156)	R-36.3 (6.40 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.027 (0.151)	R-37.6 (6.62 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.026 (0.146)	R-38.8 (6.83 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.025 (0.142)	R-40.1 (7.05 RSI)

Table 3.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Galvanized Intermittent Horizontal Z-Girts, and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation (**Assembly 1**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.055 (0.313)	R-18.1 (3.19 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.051 (0.290)	R-19.6 (3.45 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.044 (0.252)	R-22.6 (3.98 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.039 (0.223)	R-25.4 (4.48 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.036 (0.203)	R-28.0 (4.94 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.034 (0.194)	R-29.3 (5.16 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.033 (0.186)	R-30.6 (5.38 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.031 (0.178)	R-31.8 (5.60 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.030 (0.172)	R-33.1 (5.83 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.029 (0.165)	R-34.4 (6.05 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.028 (0.159)	R-35.7 (6.28 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.027 (0.154)	R-37.0 (6.51 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.026 (0.149)	R-38.2 (6.73 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.025 (0.144)	R-39.4 (6.95 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.025 (0.140)	R-40.7 (7.17 RSI)

3.2 Wall Assembly 2: Split-Insulated Steel Stud Assembly with Thermally Isolated Aluminum Brackets Cladding Attachment

Table 3.2.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Thermally Isolated Aluminum Brackets and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation (**Assembly 2**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.058 (0.329)	R-17.2 (3.04 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.055 (0.311)	R-18.3 (3.22 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.049 (0.276)	R-20.6 (3.63 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.043 (0.242)	R-23.4 (4.12 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.039 (0.219)	R-25.9 (4.56 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.037 (0.209)	R-27.1 (4.77 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.035 (0.201)	R-28.3 (4.99 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.034 (0.192)	R-29.5 (5.20 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.033 (0.185)	R-30.7 (5.41 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.031 (0.178)	R-32.0 (5.63 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.030 (0.171)	R-33.2 (5.85 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.029 (0.165)	R-34.4 (6.07 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.028 (0.159)	R-35.7 (6.28 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.027 (0.154)	R-36.8 (6.49 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.026 (0.149)	R-38.0 (6.70 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.025 (0.145)	R-39.2 (6.91 RSI)
11 (279)	R-47.3 (8.33 RSI)	0.025 (0.140)	R-40.4 (7.12 RSI)

Table 3.2.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Thermally Isolated Aluminum Brackets and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation (**Assembly 2**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.056 (0.320)	R-17.7 (3.12 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.053 (0.302)	R-18.8 (3.32 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.048 (0.270)	R-21.0 (3.70 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.042 (0.238)	R-23.8 (4.19 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.038 (0.216)	R-26.3 (4.63 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.036 (0.206)	R-27.5 (4.85 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.035 (0.198)	R-28.7 (5.06 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.033 (0.190)	R-30.0 (5.28 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.032 (0.182)	R-31.2 (5.49 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.031 (0.175)	R-32.4 (5.70 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.030 (0.169)	R-33.6 (5.92 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.029 (0.163)	R-34.9 (6.14 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.028 (0.157)	R-36.1 (6.35 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.027 (0.152)	R-37.3 (6.56 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.026 (0.148)	R-38.5 (6.77 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.025 (0.143)	R-39.7 (6.98 RSI)
11 (279)	R-47.3 (8.33 RSI)	0.024 (0.139)	R-40.9 (7.20 RSI)

Table 3.2.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Thermally Isolated Aluminum Brackets and Thermafiber® RainBarrier® (R-4.3/in) Exterior Insulation **(Assembly 2)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1.5 (38)	R-6.5 (1.14 RSI)	0.055 (0.310)	R-18.3 (3.22 RSI)
2 (51)	R-8.6 (1.51 RSI)	0.052 (0.294)	R-19.3 (3.40 RSI)
3 (76)	R-12.9 (2.27 RSI)	0.046 (0.263)	R-21.6 (3.80 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.041 (0.234)	R-24.3 (4.28 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.037 (0.211)	R-26.9 (4.74 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.036 (0.202)	R-28.2 (4.96 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.034 (0.193)	R-29.4 (5.18 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.033 (0.185)	R-30.7 (5.41 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.031 (0.178)	R-32.0 (5.63 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.030 (0.171)	R-33.2 (5.85 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.029 (0.164)	R-34.5 (6.08 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.028 (0.158)	R-35.8 (6.31 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.027 (0.153)	R-37.1 (6.53 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.026 (0.148)	R-38.3 (6.75 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.025 (0.143)	R-39.6 (6.97 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.024 (0.139)	R-40.8 (7.19 RSI)

3.3 Wall Assembly 3: Exterior Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts

There are no values listed for the exterior insulated steel-frame wall with continuous horizontal Z-girts beyond 6 inches of insulation since there is no feasible level of insulation thickness to achieve an effective R-40 (7.04 RSI)

Table 3.3.1: Thermal Performance of Exterior Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 3**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.153 (0.870)	R-6.5 (1.16 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.116 (0.658)	R-8.6 (1.52 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.093 (0.529)	R-10.7 (1.89 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.082 (0.465)	R-12.2 (2.15 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.073 (0.414)	R-13.7 (2.42 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.067 (0.379)	R-15.0 (2.64 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.061 (0.346)	R-16.4 (2.89 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.056 (0.321)	R-17.7 (3.12 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.053 (0.299)	R-19.0 (3.35 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.049 (0.280)	R-20.3 (3.58 RSI)
11 (279)	R-44.0 (7.75 RSI)	0.046 (0.263)	R-21.6 (3.81 RSI)
12 (305)	R-48.0 (8.45 RSI)	0.044 (0.248)	R-22.9 (4.04 RSI)
13 (330)	R-52.0 (9.16 RSI)	0.041 (0.235)	R-24.2 (4.26 RSI)
14 (356)	R-56.0 (9.86 RSI)	0.039 (0.223)	R-25.5 (4.49 RSI)
15 (381)	R-60.0 (10.57 RSI)	0.037 (0.212)	R-26.8 (4.72 RSI)
16 (406)	R-64.0 (11.27 RSI)	0.036 (0.202)	R-28.1 (4.95 RSI)

3.4 Wall Assembly 4: Split-Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts

Table 3.4.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.063 (0.357)	R-15.9 (2.80 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.054 (0.308)	R-18.5 (3.25 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.048 (0.272)	R-20.9 (3.68 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.044 (0.250)	R-22.7 (4.00 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.041 (0.232)	R-24.5 (4.31 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.038 (0.218)	R-26.0 (4.59 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.037 (0.212)	R-26.8 (4.72 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.036 (0.206)	R-27.5 (4.85 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.035 (0.201)	R-28.3 (4.99 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.034 (0.195)	R-29.1 (5.12 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.033 (0.190)	R-29.9 (5.26 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.033 (0.185)	R-30.7 (5.40 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.032 (0.181)	R-31.4 (5.54 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.031 (0.177)	R-32.2 (5.66 RSI)
10.5 (267)	R-42.0 (7.40 RSI)	0.030 (0.173)	R-32.9 (5.80 RSI)
11 (279)	R-44.0 (7.75 RSI)	0.030 (0.169)	R-33.7 (5.93 RSI)
11.5 (292)	R-46.0 (8.10 RSI)	0.029 (0.165)	R-34.4 (6.06 RSI)
12 (305)	R-48.0 (8.45 RSI)	0.028 (0.161)	R-35.2 (6.19 RSI)
12.5 (318)	R-50.0 (8.81 RSI)	0.028 (0.158)	R-35.9 (6.32 RSI)
13 (330)	R-52.0 (9.16 RSI)	0.027 (0.155)	R-36.7 (6.46 RSI)
13.5 (343)	R-54.0 (9.51 RSI)	0.027 (0.152)	R-37.4 (6.59 RSI)
14 (356)	R-56.0 (9.86 RSI)	0.026 (0.149)	R-38.2 (6.72 RSI)
14.5 (368)	R-58.0 (10.21 RSI)	0.026 (0.146)	R-38.9 (6.85 RSI)
15 (381)	R-60.0 (10.57 RSI)	0.025 (0.143)	R-39.7 (6.98 RSI)
15.5 (394)	R-62.0 (10.92 RSI)	0.025 (0.141)	R-40.4 (7.12 RSI)

Table 3.4.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.060 (0.343)	R-16.5 (2.91 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.052 (0.297)	R-19.1 (3.37 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.046 (0.263)	R-21.6 (3.80 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.043 (0.242)	R-23.4 (4.13 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.040 (0.225)	R-25.2 (4.44 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.037 (0.212)	R-26.8 (4.72 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.036 (0.206)	R-27.5 (4.85 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.035 (0.201)	R-28.3 (4.98 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.034 (0.195)	R-29.1 (5.12 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.034 (0.190)	R-29.8 (5.25 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.033 (0.186)	R-30.6 (5.39 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.032 (0.181)	R-31.4 (5.53 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.031 (0.177)	R-32.2 (5.66 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.030 (0.173)	R-32.9 (5.79 RSI)
10.5 (267)	R-42.0 (7.40 RSI)	0.030 (0.169)	R-33.6 (5.92 RSI)
11 (279)	R-44.0 (7.75 RSI)	0.029 (0.165)	R-34.4 (6.06 RSI)
11.5 (292)	R-46.0 (8.10 RSI)	0.028 (0.162)	R-35.1 (6.19 RSI)
12 (305)	R-48.0 (8.45 RSI)	0.028 (0.158)	R-35.9 (6.32 RSI)
12.5 (318)	R-50.0 (8.81 RSI)	0.027 (0.155)	R-36.6 (6.45 RSI)
13 (330)	R-52.0 (9.16 RSI)	0.027 (0.152)	R-37.4 (6.58 RSI)
13.5 (343)	R-54.0 (9.51 RSI)	0.026 (0.149)	R-38.1 (6.72 RSI)
14 (356)	R-56.0 (9.86 RSI)	0.026 (0.146)	R-38.9 (6.85 RSI)
14.5 (368)	R-58.0 (10.21 RSI)	0.025 (0.143)	R-39.6 (6.98 RSI)
15 (381)	R-60.0 (10.57 RSI)	0.025 (0.141)	R-40.4 (7.11 RSI)

Table 3.4.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.058 (0.332)	R-17.1 (3.01 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.051 (0.287)	R-19.8 (3.48 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.045 (0.255)	R-22.3 (3.92 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.041 (0.236)	R-24.1 (4.25 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.039 (0.219)	R-25.9 (4.57 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.036 (0.207)	R-27.5 (4.84 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.035 (0.201)	R-28.2 (4.97 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.034 (0.196)	R-29.0 (5.11 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.034 (0.191)	R-29.8 (5.24 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.033 (0.186)	R-30.5 (5.38 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.032 (0.181)	R-31.3 (5.52 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.031 (0.177)	R-32.1 (5.66 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.030 (0.173)	R-32.9 (5.80 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.030 (0.169)	R-33.6 (5.92 RSI)
10.5 (267)	R-42.0 (7.40 RSI)	0.029 (0.165)	R-34.4 (6.05 RSI)
11 (279)	R-44.0 (7.75 RSI)	0.028 (0.162)	R-35.1 (6.19 RSI)
11.5 (292)	R-46.0 (8.10 RSI)	0.028 (0.158)	R-35.9 (6.32 RSI)
12 (305)	R-48.0 (8.45 RSI)	0.027 (0.155)	R-36.6 (6.45 RSI)
12.5 (318)	R-50.0 (8.81 RSI)	0.027 (0.152)	R-37.4 (6.58 RSI)
13 (330)	R-52.0 (9.16 RSI)	0.026 (0.149)	R-38.1 (6.71 RSI)
13.5 (343)	R-54.0 (9.51 RSI)	0.026 (0.146)	R-38.9 (6.85 RSI)
14 (356)	R-56.0 (9.86 RSI)	0.025 (0.143)	R-39.6 (6.98 RSI)
14.5 (368)	R-58.0 (10.21 RSI)	0.025 (0.141)	R-40.4 (7.11 RSI)

Table 3.4.2.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.1 (0.72 RSI)	0.062 (0.354)	R-16.0 (2.82 RSI)
2 (51)	R-8.2 (1.44 RSI)	0.054 (0.308)	R-18.5 (3.25 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.047 (0.269)	R-21.1 (3.72 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.044 (0.248)	R-22.9 (4.04 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.040 (0.230)	R-24.7 (4.35 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.038 (0.216)	R-26.2 (4.62 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.037 (0.210)	R-27.0 (4.75 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.036 (0.205)	R-27.7 (4.89 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.034 (0.194)	R-29.3 (5.16 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.033 (0.189)	R-30.1 (5.30 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.032 (0.184)	R-30.9 (5.44 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.032 (0.179)	R-31.6 (5.57 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.031 (0.175)	R-32.4 (5.70 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.030 (0.171)	R-33.1 (5.83 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.030 (0.168)	R-33.9 (5.96 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.029 (0.164)	R-34.6 (6.10 RSI)
12 (305)	R-49.2 (8.67 RSI)	0.028 (0.161)	R-35.4 (6.23 RSI)
12.5 (318)	R-51.3 (9.03 RSI)	0.028 (0.157)	R-36.1 (6.36 RSI)
13 (330)	R-53.3 (9.39 RSI)	0.027 (0.154)	R-36.9 (6.49 RSI)
13.5 (343)	R-55.4 (9.75 RSI)	0.027 (0.151)	R-37.6 (6.62 RSI)
14 (356)	R-57.4 (10.11 RSI)	0.026 (0.148)	R-38.4 (6.76 RSI)
14.5 (368)	R-59.5 (10.47 RSI)	0.026 (0.145)	R-39.1 (6.89 RSI)
15 (381)	R-61.5 (10.83 RSI)	0.025 (0.142)	R-39.9 (7.02 RSI)
15.5 (394)	R-63.6 (11.19 RSI)	0.025 (0.140)	R-40.6 (7.15 RSI)

Table 3.4.2.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.1 (0.72 RSI)	0.060 (0.341)	R-16.6 (2.93 RSI)
2 (51)	R-8.2 (1.44 RSI)	0.052 (0.297)	R-19.1 (3.37 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.046 (0.260)	R-21.8 (3.84 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.042 (0.240)	R-23.6 (4.16 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.039 (0.223)	R-25.4 (4.48 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.037 (0.210)	R-27.0 (4.75 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.036 (0.205)	R-27.7 (4.89 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.034 (0.194)	R-29.3 (5.15 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.033 (0.189)	R-30.0 (5.29 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.032 (0.184)	R-30.8 (5.43 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.032 (0.180)	R-31.6 (5.56 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.031 (0.175)	R-32.4 (5.70 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.030 (0.172)	R-33.1 (5.83 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.030 (0.168)	R-33.8 (5.96 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.029 (0.164)	R-34.6 (6.09 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.028 (0.161)	R-35.3 (6.22 RSI)
12 (305)	R-49.2 (8.67 RSI)	0.028 (0.157)	R-36.1 (6.36 RSI)
12.5 (318)	R-51.3 (9.03 RSI)	0.027 (0.154)	R-36.8 (6.49 RSI)
13 (330)	R-53.3 (9.39 RSI)	0.027 (0.151)	R-37.6 (6.62 RSI)
13.5 (343)	R-55.4 (9.75 RSI)	0.026 (0.148)	R-38.3 (6.75 RSI)
14 (356)	R-57.4 (10.11 RSI)	0.026 (0.145)	R-39.1 (6.88 RSI)
14.5 (368)	R-59.5 (10.47 RSI)	0.025 (0.143)	R-39.8 (7.02 RSI)
15 (381)	R-61.5 (10.83 RSI)	0.025 (0.140)	R-40.6 (7.15 RSI)

Table 3.4.2.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.1 (0.72 RSI)	0.058 (0.330)	R-17.2 (3.03 RSI)
2 (51)	R-8.2 (1.44 RSI)	0.051 (0.287)	R-19.8 (3.48 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.044 (0.253)	R-22.5 (3.96 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.041 (0.233)	R-24.3 (4.28 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.038 (0.217)	R-26.1 (4.60 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.036 (0.205)	R-27.7 (4.88 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.035 (0.200)	R-28.4 (5.01 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.034 (0.194)	R-29.2 (5.14 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.033 (0.189)	R-30.0 (5.28 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.033 (0.185)	R-30.8 (5.42 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.032 (0.180)	R-31.6 (5.56 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.031 (0.176)	R-32.3 (5.70 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.030 (0.172)	R-33.1 (5.83 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.030 (0.168)	R-33.8 (5.96 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.029 (0.164)	R-34.6 (6.09 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.028 (0.161)	R-35.3 (6.22 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.028 (0.157)	R-36.1 (6.35 RSI)
12 (305)	R-49.2 (8.67 RSI)	0.027 (0.154)	R-36.8 (6.49 RSI)
12.5 (318)	R-51.3 (9.03 RSI)	0.027 (0.151)	R-37.6 (6.62 RSI)
13 (330)	R-53.3 (9.39 RSI)	0.026 (0.148)	R-38.3 (6.75 RSI)
13.5 (343)	R-55.4 (9.75 RSI)	0.026 (0.145)	R-39.1 (6.88 RSI)
14 (356)	R-57.4 (10.11 RSI)	0.025 (0.143)	R-39.8 (7.01 RSI)
14.5 (368)	R-59.5 (10.47 RSI)	0.025 (0.140)	R-40.6 (7.15 RSI)

Table 3.4.3.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC 80 or RainBarrier® (R-4.2/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.062 (0.352)	R-16.1 (2.84 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.054 (0.306)	R-18.6 (3.27 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.047 (0.268)	R-21.2 (3.74 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.043 (0.245)	R-23.1 (4.07 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.040 (0.228)	R-24.9 (4.39 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.038 (0.215)	R-26.4 (4.66 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.037 (0.209)	R-27.2 (4.79 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.036 (0.203)	R-28.0 (4.92 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.035 (0.198)	R-28.7 (5.06 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.034 (0.192)	R-29.5 (5.20 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.033 (0.187)	R-30.3 (5.34 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.032 (0.183)	R-31.1 (5.48 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.031 (0.178)	R-31.8 (5.60 RSI)
10 (254)	R-42.0 (7.40 RSI)	0.031 (0.174)	R-32.6 (5.73 RSI)
10.5 (267)	R-44.1 (7.77 RSI)	0.030 (0.170)	R-33.3 (5.87 RSI)
11 (279)	R-46.2 (8.14 RSI)	0.029 (0.167)	R-34.1 (6.00 RSI)
11.5 (292)	R-48.3 (8.51 RSI)	0.029 (0.163)	R-34.8 (6.13 RSI)
12 (305)	R-50.4 (8.88 RSI)	0.028 (0.160)	R-35.6 (6.26 RSI)
12.5 (318)	R-52.5 (9.25 RSI)	0.028 (0.156)	R-36.3 (6.39 RSI)
13 (330)	R-54.6 (9.62 RSI)	0.027 (0.153)	R-37.1 (6.53 RSI)
13.5 (343)	R-56.7 (9.99 RSI)	0.026 (0.150)	R-37.8 (6.66 RSI)
14 (356)	R-58.8 (10.36 RSI)	0.026 (0.147)	R-38.6 (6.79 RSI)
14.5 (368)	R-60.9 (10.73 RSI)	0.025 (0.144)	R-39.3 (6.92 RSI)
15 (381)	R-63.0 (11.10 RSI)	0.025 (0.142)	R-40.1 (7.06 RSI)
15.5 (394)	R-65.1 (11.47 RSI)	0.025 (0.139)	R-40.8 (7.19 RSI)

Table 3.4.3.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC 80 or RainBarrier® (R-4.2/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.060 (0.339)	R-16.8 (2.95 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.052 (0.295)	R-19.2 (3.39 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.046 (0.259)	R-21.9 (3.86 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.042 (0.238)	R-23.9 (4.20 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.039 (0.221)	R-25.6 (4.52 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.037 (0.209)	R-27.2 (4.79 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.036 (0.203)	R-27.9 (4.92 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.035 (0.198)	R-28.7 (5.06 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.034 (0.193)	R-29.5 (5.19 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.033 (0.188)	R-30.2 (5.33 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.032 (0.183)	R-31.0 (5.46 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.031 (0.179)	R-31.8 (5.60 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.031 (0.175)	R-32.5 (5.73 RSI)
10 (254)	R-42.0 (7.40 RSI)	0.030 (0.171)	R-33.3 (5.86 RSI)
10.5 (267)	R-44.1 (7.77 RSI)	0.029 (0.167)	R-34.0 (5.99 RSI)
11 (279)	R-46.2 (8.14 RSI)	0.029 (0.163)	R-34.8 (6.13 RSI)
11.5 (292)	R-48.3 (8.51 RSI)	0.028 (0.160)	R-35.5 (6.26 RSI)
12 (305)	R-50.4 (8.88 RSI)	0.028 (0.156)	R-36.3 (6.39 RSI)
12.5 (318)	R-52.5 (9.25 RSI)	0.027 (0.153)	R-37.0 (6.52 RSI)
13 (330)	R-54.6 (9.62 RSI)	0.026 (0.150)	R-37.8 (6.65 RSI)
13.5 (343)	R-56.7 (9.99 RSI)	0.026 (0.147)	R-38.5 (6.79 RSI)
14 (356)	R-58.8 (10.36 RSI)	0.025 (0.145)	R-39.3 (6.92 RSI)
14.5 (368)	R-60.9 (10.73 RSI)	0.025 (0.142)	R-40.0 (7.05 RSI)
15 (381)	R-63.0 (11.10 RSI)	0.025 (0.139)	R-40.8 (7.18 RSI)

Table 3.4.3.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC 80 or RainBarrier® (R-4.2/in) Exterior Insulation (**Assembly 4**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.058 (0.327)	R-17.3 (3.05 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.050 (0.286)	R-19.9 (3.50 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.044 (0.251)	R-22.6 (3.98 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.041 (0.231)	R-24.5 (4.32 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.038 (0.216)	R-26.3 (4.64 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.036 (0.204)	R-27.9 (4.91 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.035 (0.198)	R-28.6 (5.04 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.034 (0.193)	R-29.4 (5.18 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.033 (0.188)	R-30.2 (5.32 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.032 (0.183)	R-31.0 (5.45 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.031 (0.179)	R-31.8 (5.60 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.031 (0.174)	R-32.6 (5.73 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.030 (0.171)	R-33.3 (5.86 RSI)
10 (254)	R-42.0 (7.40 RSI)	0.029 (0.167)	R-34.0 (5.99 RSI)
10.5 (267)	R-44.1 (7.77 RSI)	0.029 (0.163)	R-34.8 (6.12 RSI)
11 (279)	R-46.2 (8.14 RSI)	0.028 (0.160)	R-35.5 (6.26 RSI)
11.5 (292)	R-48.3 (8.51 RSI)	0.028 (0.157)	R-36.3 (6.39 RSI)
12 (305)	R-50.4 (8.88 RSI)	0.027 (0.153)	R-37.0 (6.52 RSI)
12.5 (318)	R-52.5 (9.25 RSI)	0.026 (0.150)	R-37.8 (6.65 RSI)
13 (330)	R-54.6 (9.62 RSI)	0.026 (0.147)	R-38.5 (6.78 RSI)
13.5 (343)	R-56.7 (9.99 RSI)	0.025 (0.145)	R-39.3 (6.92 RSI)
14 (356)	R-58.8 (10.36 RSI)	0.025 (0.142)	R-40.0 (7.05 RSI)
14.5 (368)	R-60.9 (10.73 RSI)	0.025 (0.139)	R-40.8 (7.18 RSI)

3.5 Wall Assembly 5: Split-Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts and Metal Hat Channel between Studs and Drywall

Table 3.5.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 5**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.051 (0.290)	R-19.5 (3.44 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.049 (0.275)	R-20.6 (3.63 RSI)
3.5 (89)	R-14.4 (2.53 RSI)	0.045 (0.258)	R-22.0 (3.87 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.043 (0.247)	R-23.0 (4.05 RSI)
4.5 (114)	R-18.5 (3.25 RSI)	0.042 (0.236)	R-24.0 (4.23 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.040 (0.227)	R-25.1 (4.41 RSI)
5.5 (140)	R-22.6 (3.97 RSI)	0.038 (0.218)	R-26.1 (4.59 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.037 (0.209)	R-27.1 (4.77 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.036 (0.202)	R-28.1 (4.95 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.034 (0.195)	R-29.2 (5.14 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.033 (0.188)	R-30.2 (5.32 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.032 (0.182)	R-31.2 (5.50 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.031 (0.176)	R-32.2 (5.68 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.030 (0.171)	R-33.3 (5.86 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.029 (0.166)	R-34.3 (6.04 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.028 (0.161)	R-35.3 (6.22 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.028 (0.156)	R-36.3 (6.40 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.027 (0.152)	R-37.4 (6.58 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.026 (0.148)	R-38.4 (6.76 RSI)
12 (305)	R-49.2 (8.67 RSI)	0.025 (0.144)	R-39.4 (6.94 RSI)
12.5 (318)	R-51.3 (9.03 RSI)	0.025 (0.140)	R-40.4 (7.12 RSI)

Table 3.5.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 5**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.049 (0.281)	R-20.2 (3.56 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.047 (0.266)	R-21.3 (3.75 RSI)
3.5 (89)	R-14.4 (2.53 RSI)	0.045 (0.253)	R-22.4 (3.95 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.043 (0.242)	R-23.5 (4.14 RSI)
4.5 (114)	R-18.5 (3.25 RSI)	0.041 (0.231)	R-24.6 (4.33 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.039 (0.221)	R-25.7 (4.53 RSI)
5.5 (140)	R-22.6 (3.97 RSI)	0.037 (0.212)	R-26.8 (4.72 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.036 (0.203)	R-27.9 (4.92 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.034 (0.196)	R-29.0 (5.11 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.033 (0.189)	R-30.1 (5.30 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.032 (0.182)	R-31.2 (5.50 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.031 (0.176)	R-32.3 (5.69 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.030 (0.170)	R-33.4 (5.88 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.029 (0.165)	R-34.5 (6.08 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.028 (0.159)	R-35.6 (6.27 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.027 (0.155)	R-36.7 (6.46 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.026 (0.150)	R-37.8 (6.66 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.026 (0.146)	R-38.9 (6.85 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.025 (0.142)	R-40.0 (7.05 RSI)

Table 3.5.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 5**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.048 (0.272)	R-20.9 (3.68 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.046 (0.258)	R-22.0 (3.87 RSI)
3.5 (89)	R-14.4 (2.53 RSI)	0.043 (0.246)	R-23.1 (4.07 RSI)
4 (102)	R-16.4 (2.89 RSI)	0.041 (0.235)	R-24.2 (4.26 RSI)
4.5 (114)	R-18.5 (3.25 RSI)	0.040 (0.224)	R-25.3 (4.46 RSI)
5 (127)	R-20.5 (3.61 RSI)	0.038 (0.215)	R-26.4 (4.65 RSI)
5.5 (140)	R-22.6 (3.97 RSI)	0.036 (0.206)	R-27.5 (4.85 RSI)
6 (152)	R-24.6 (4.33 RSI)	0.035 (0.198)	R-28.7 (5.05 RSI)
6.5 (165)	R-26.7 (4.69 RSI)	0.034 (0.191)	R-29.8 (5.24 RSI)
7 (178)	R-28.7 (5.05 RSI)	0.032 (0.184)	R-30.9 (5.44 RSI)
7.5 (191)	R-30.8 (5.42 RSI)	0.031 (0.177)	R-32.0 (5.63 RSI)
8 (203)	R-32.8 (5.78 RSI)	0.030 (0.171)	R-33.1 (5.83 RSI)
8.5 (216)	R-34.9 (6.14 RSI)	0.029 (0.166)	R-34.2 (6.03 RSI)
9 (229)	R-36.9 (6.50 RSI)	0.028 (0.161)	R-35.3 (6.22 RSI)
9.5 (241)	R-39.0 (6.86 RSI)	0.027 (0.156)	R-36.4 (6.42 RSI)
10 (254)	R-41.0 (7.22 RSI)	0.027 (0.151)	R-37.6 (6.62 RSI)
10.5 (267)	R-43.1 (7.58 RSI)	0.026 (0.147)	R-38.7 (6.81 RSI)
11 (279)	R-45.1 (7.94 RSI)	0.025 (0.143)	R-39.8 (7.01 RSI)
11.5 (292)	R-47.2 (8.30 RSI)	0.024 (0.139)	R-40.9 (7.20 RSI)

3.6 Wall Assembly 6: Split-Insulated Steel-Frame Wall with Continuous Horizontal Z-Girts and Metal Hat Channel between Studs and Two Layers of Drywall

Table 3.6.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 6**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.048 (0.273)	R-20.8 (3.66 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.046 (0.260)	R-21.8 (3.85 RSI)
3.5 (89)	R-15.1 (2.65 RSI)	0.043 (0.244)	R-23.3 (4.10 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.041 (0.234)	R-24.3 (4.28 RSI)
4.5 (114)	R-19.4 (3.41 RSI)	0.039 (0.221)	R-25.7 (4.52 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.038 (0.213)	R-26.7 (4.70 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.036 (0.203)	R-28.0 (4.93 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.034 (0.196)	R-29.0 (5.10 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.033 (0.187)	R-30.3 (5.34 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.032 (0.181)	R-31.3 (5.51 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.031 (0.174)	R-32.7 (5.75 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.030 (0.169)	R-33.7 (5.93 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.029 (0.162)	R-35.1 (6.17 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.028 (0.158)	R-36.0 (6.35 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.027 (0.152)	R-37.3 (6.57 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.026 (0.149)	R-38.0 (6.69 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.026 (0.147)	R-38.7 (6.81 RSI)
11 (279)	R-47.3 (8.33 RSI)	0.025 (0.143)	R-39.7 (6.98 RSI)
11.5 (292)	R-49.5 (8.71 RSI)	0.024 (0.139)	R-41.0 (7.22 RSI)

Table 3.6.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 6**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.047 (0.264)	R-21.5 (3.79 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.044 (0.252)	R-22.6 (3.98 RSI)
3.5 (89)	R-15.1 (2.65 RSI)	0.042 (0.236)	R-24.0 (4.23 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.040 (0.226)	R-25.2 (4.43 RSI)
4.5 (114)	R-19.4 (3.41 RSI)	0.038 (0.216)	R-26.3 (4.63 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.036 (0.207)	R-27.4 (4.83 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.034 (0.192)	R-29.6 (5.21 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.033 (0.185)	R-30.7 (5.40 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.031 (0.179)	R-31.8 (5.60 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.030 (0.173)	R-32.9 (5.79 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.029 (0.167)	R-34.0 (5.98 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.029 (0.162)	R-35.1 (6.18 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.028 (0.157)	R-36.2 (6.37 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.027 (0.152)	R-37.2 (6.56 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.026 (0.148)	R-38.3 (6.75 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.025 (0.144)	R-39.4 (6.94 RSI)
11 (279)	R-47.3 (8.33 RSI)	0.025 (0.140)	R-40.5 (7.13 RSI)

Table 3.6.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Continuous Horizontal Z-Girts and Thermafiber® RainBarrier® CI HC Plus (110) (R-4.1/in) Exterior Insulation (**Assembly 6**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
2.5 (64)	R-10.3 (1.81 RSI)	0.045 (0.256)	R-22.2 (3.90 RSI)
3 (76)	R-12.3 (2.17 RSI)	0.043 (0.244)	R-23.2 (4.09 RSI)
3.5 (89)	R-15.1 (2.65 RSI)	0.040 (0.230)	R-24.7 (4.35 RSI)
4 (102)	R-17.2 (3.03 RSI)	0.039 (0.220)	R-25.9 (4.55 RSI)
4.5 (114)	R-19.4 (3.41 RSI)	0.037 (0.210)	R-27.0 (4.75 RSI)
5 (127)	R-21.5 (3.79 RSI)	0.036 (0.202)	R-28.1 (4.95 RSI)
5.5 (140)	R-23.7 (4.17 RSI)	0.034 (0.194)	R-29.2 (5.14 RSI)
6 (152)	R-25.8 (4.54 RSI)	0.033 (0.187)	R-30.3 (5.34 RSI)
6.5 (165)	R-28.0 (4.92 RSI)	0.032 (0.181)	R-31.4 (5.53 RSI)
7 (178)	R-30.1 (5.30 RSI)	0.031 (0.175)	R-32.5 (5.72 RSI)
7.5 (191)	R-32.3 (5.68 RSI)	0.030 (0.169)	R-33.6 (5.91 RSI)
8 (203)	R-34.4 (6.06 RSI)	0.029 (0.164)	R-34.7 (6.11 RSI)
8.5 (216)	R-36.6 (6.44 RSI)	0.028 (0.158)	R-35.8 (6.31 RSI)
9 (229)	R-38.7 (6.82 RSI)	0.027 (0.154)	R-36.9 (6.50 RSI)
9.5 (241)	R-40.9 (7.19 RSI)	0.026 (0.150)	R-38.0 (6.69 RSI)
10 (254)	R-43.0 (7.57 RSI)	0.026 (0.145)	R-39.0 (6.88 RSI)
10.5 (267)	R-45.2 (7.95 RSI)	0.025 (0.142)	R-40.1 (7.06 RSI)

3.7 Wall Assembly 7: Exterior Insulated Steel-Frame Wall with Steel Fasteners

Table 3.7.1: Thermal Performance of Exterior Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., **Galvanized Steel Fasteners** and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 7a**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.138 (0.786)	R-7.2 (1.27 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.096 (0.545)	R-10.4 (1.84 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.074 (0.420)	R-13.5 (2.38 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.061 (0.344)	R-16.5 (2.91 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.055 (0.315)	R-18.0 (3.17 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.051 (0.291)	R-19.5 (3.44 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.048 (0.270)	R-21.0 (3.70 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.044 (0.252)	R-22.5 (3.97 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.042 (0.236)	R-24.0 (4.23 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.039 (0.222)	R-25.5 (4.50 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.037 (0.210)	R-27.0 (4.76 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.033 (0.189)	R-30.0 (5.29 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.032 (0.180)	R-31.5 (5.55 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.030 (0.172)	R-33.0 (5.82 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.029 (0.164)	R-34.5 (6.08 RSI)
10.5 (267)	R-42.0 (7.40 RSI)	0.028 (0.158)	R-36.0 (6.34 RSI)
11 (279)	R-44.0 (7.75 RSI)	0.027 (0.151)	R-37.5 (6.61 RSI)
11.5 (292)	R-46.0 (8.10 RSI)	0.026 (0.145)	R-39.0 (6.87 RSI)
12 (305)	R-48.0 (8.45 RSI)	0.025 (0.140)	R-40.5 (7.14 RSI)

Table 3.7.2: Thermal Performance of Exterior Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., **Galvanized Steel Fasteners** and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Exterior Insulation (**Assembly 7a**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.135 (0.765)	R-7.4 (1.31 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.093 (0.529)	R-10.7 (1.89 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.071 (0.405)	R-14.0 (2.47 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.059 (0.333)	R-17.0 (3.00 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.054 (0.306)	R-18.5 (3.26 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.050 (0.284)	R-20.0 (3.53 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.046 (0.264)	R-21.5 (3.79 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.043 (0.247)	R-23.0 (4.06 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.041 (0.232)	R-24.5 (4.32 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.038 (0.218)	R-26.0 (4.58 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.036 (0.206)	R-27.5 (4.85 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.034 (0.196)	R-29.0 (5.11 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.033 (0.186)	R-30.5 (5.38 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.031 (0.177)	R-32.0 (5.64 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.030 (0.169)	R-33.5 (5.90 RSI)
10 (254)	R-42.0 (7.40 RSI)	0.029 (0.162)	R-35.0 (6.17 RSI)
10.5 (267)	R-44.1 (7.77 RSI)	0.027 (0.155)	R-36.5 (6.43 RSI)
11 (279)	R-46.2 (8.14 RSI)	0.026 (0.149)	R-38.0 (6.70 RSI)
11.5 (292)	R-48.3 (8.51 RSI)	0.025 (0.144)	R-39.5 (6.96 RSI)
12 (305)	R-50.4 (8.88 RSI)	0.024 (0.138)	R-41.0 (7.23 RSI)

Table 3.7.3: Thermal Performance of Exterior Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., Stainless Steel Fasteners and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Exterior Insulation (**Assembly 7b**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.135 (0.765)	R-7.4 (1.31 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.092 (0.520)	R-10.9 (1.92 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.069 (0.391)	R-14.5 (2.56 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.055 (0.315)	R-18.0 (3.17 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.051 (0.287)	R-19.8 (3.48 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.046 (0.264)	R-21.5 (3.79 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.043 (0.244)	R-23.3 (4.10 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.040 (0.227)	R-25.0 (4.41 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.037 (0.212)	R-26.8 (4.72 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.033 (0.188)	R-30.3 (5.33 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.031 (0.177)	R-32.0 (5.64 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.030 (0.168)	R-33.8 (5.95 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.028 (0.160)	R-35.5 (6.26 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.027 (0.152)	R-37.3 (6.56 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.026 (0.145)	R-39.0 (6.87 RSI)
10.5 (267)	R-42.0 (7.40 RSI)	0.025 (0.139)	R-40.8 (7.18 RSI)

Table 3.7.4: Thermal Performance of Exterior Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., **Stainless Steel Fasteners** and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Exterior Insulation (**Assembly 7b**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.131 (0.745)	R-7.6 (1.34 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.088 (0.501)	R-11.3 (1.99 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.067 (0.378)	R-15.0 (2.65 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.053 (0.303)	R-18.7 (3.30 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.049 (0.276)	R-20.6 (3.62 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.045 (0.253)	R-22.4 (3.95 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.041 (0.234)	R-24.3 (4.28 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.038 (0.217)	R-26.1 (4.60 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.036 (0.203)	R-28.0 (4.93 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.034 (0.190)	R-29.8 (5.25 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.032 (0.179)	R-31.7 (5.58 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.030 (0.169)	R-33.5 (5.90 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.028 (0.161)	R-35.4 (6.23 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.027 (0.153)	R-37.2 (6.56 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.026 (0.145)	R-39.1 (6.88 RSI)
10 (254)	R-42.0 (7.40 RSI)	0.024 (0.139)	R-40.9 (7.21 RSI)

3.8 Wall Assembly 8: Split-Insulated Steel-Frame Wall with Continuous Insulation and Steel Fasteners at 12" o.c. Vertical Spacing

Table 3.8.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 8)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.064 (0.366)	R-15.5 (2.73 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.054 (0.306)	R-18.6 (3.27 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.046 (0.263)	R-21.6 (3.80 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.041 (0.233)	R-24.4 (4.30 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.039 (0.220)	R-25.8 (4.55 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.037 (0.209)	R-27.2 (4.79 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.035 (0.199)	R-28.6 (5.03 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.033 (0.190)	R-29.9 (5.27 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.032 (0.181)	R-31.3 (5.51 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.031 (0.174)	R-32.6 (5.75 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.029 (0.167)	R-34.0 (5.99 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.028 (0.160)	R-35.4 (6.23 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.027 (0.154)	R-36.8 (6.48 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.026 (0.149)	R-38.2 (6.72 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.025 (0.144)	R-39.5 (6.96 RSI)
10 (254)	R-40.0 (7.04 RSI)	0.024 (0.139)	R-40.9 (7.20 RSI)

Table 3.8.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 8)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.062 (0.353)	R-16.1 (2.83 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.052 (0.298)	R-19.0 (3.35 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.045 (0.257)	R-22.1 (3.90 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.040 (0.228)	R-25.0 (4.39 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.038 (0.215)	R-26.4 (4.64 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.036 (0.205)	R-27.7 (4.89 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.034 (0.195)	R-29.1 (5.13 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.033 (0.186)	R-30.5 (5.37 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.031 (0.178)	R-31.8 (5.61 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.030 (0.171)	R-33.2 (5.85 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.029 (0.164)	R-34.6 (6.09 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.028 (0.158)	R-35.9 (6.33 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.027 (0.152)	R-37.3 (6.57 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.026 (0.147)	R-38.7 (6.82 RSI)
9.5 (241)	R-38.0 (6.69 RSI)	0.025 (0.142)	R-40.1 (7.05 RSI)

Table 3.8.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 8)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.061 (0.344)	R-16.5 (2.91 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.051 (0.292)	R-19.5 (3.43 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.045 (0.253)	R-22.5 (3.96 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.039 (0.223)	R-25.5 (4.48 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.037 (0.211)	R-26.9 (4.74 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.035 (0.200)	R-28.4 (5.00 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.033 (0.190)	R-29.9 (5.26 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.032 (0.181)	R-31.3 (5.51 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.031 (0.173)	R-32.7 (5.76 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.029 (0.166)	R-34.2 (6.02 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.028 (0.160)	R-35.6 (6.27 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.027 (0.153)	R-37.0 (6.52 RSI)
8.5 (216)	R-34.0 (5.99 RSI)	0.026 (0.147)	R-38.5 (6.78 RSI)
9 (229)	R-36.0 (6.34 RSI)	0.025 (0.142)	R-40.0 (7.04 RSI)

Table 3.8.2.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 8**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.064 (0.363)	R-15.6 (2.75 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.053 (0.301)	R-18.9 (3.32 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.046 (0.259)	R-21.9 (3.86 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.040 (0.228)	R-24.9 (4.38 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.038 (0.215)	R-26.4 (4.64 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.036 (0.204)	R-27.8 (4.90 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.034 (0.194)	R-29.3 (5.15 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.033 (0.185)	R-30.7 (5.41 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.031 (0.177)	R-32.1 (5.66 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.030 (0.169)	R-33.6 (5.91 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.029 (0.162)	R-35.0 (6.16 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.027 (0.156)	R-36.5 (6.42 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.026 (0.150)	R-37.9 (6.68 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.025 (0.144)	R-39.4 (6.94 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.025 (0.139)	R-40.8 (7.18 RSI)

Table 3.8.2.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 8**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.062 (0.353)	R-16.1 (2.83 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.052 (0.293)	R-19.3 (3.41 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.044 (0.252)	R-22.5 (3.97 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.039 (0.223)	R-25.5 (4.49 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.037 (0.211)	R-27.0 (4.75 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.035 (0.200)	R-28.4 (5.01 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.033 (0.190)	R-29.9 (5.26 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.032 (0.181)	R-31.3 (5.51 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.031 (0.173)	R-32.7 (5.77 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.029 (0.166)	R-34.2 (6.02 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.028 (0.160)	R-35.6 (6.27 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.027 (0.153)	R-37.0 (6.52 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.026 (0.147)	R-38.5 (6.78 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.025 (0.142)	R-39.9 (7.04 RSI)
9.5 (241)	R-39.9 (7.03 RSI)	0.024 (0.137)	R-41.4 (7.29 RSI)

Table 3.8.2.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Galvanized Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 8**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.060 (0.341)	R-16.6 (2.93 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.051 (0.287)	R-19.8 (3.48 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.044 (0.248)	R-22.9 (4.03 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.039 (0.219)	R-25.9 (4.57 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.036 (0.207)	R-27.4 (4.83 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.035 (0.196)	R-28.9 (5.10 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.033 (0.187)	R-30.4 (5.36 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.031 (0.178)	R-31.9 (5.62 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.030 (0.170)	R-33.3 (5.87 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.029 (0.163)	R-34.8 (6.13 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.028 (0.156)	R-36.3 (6.39 RSI)
8 (203)	R-33.6 (5.92 RSI)	0.026 (0.150)	R-37.8 (6.65 RSI)
8.5 (216)	R-35.7 (6.29 RSI)	0.025 (0.145)	R-39.3 (6.92 RSI)
9 (229)	R-37.8 (6.66 RSI)	0.025 (0.139)	R-40.8 (7.18 RSI)

3.9 Wall Assembly 9: Split-Insulated Steel-Frame Wall with Continuous Insulation and Stainless Steel Fasteners at 16" o.c. Vertical Spacing

Table 3.9.1.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 9)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.062 (0.355)	R-16.0 (2.82 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.051 (0.287)	R-19.8 (3.48 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.043 (0.243)	R-23.4 (4.12 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.037 (0.209)	R-27.1 (4.78 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.035 (0.196)	R-29.0 (5.10 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.032 (0.184)	R-30.8 (5.42 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.031 (0.174)	R-32.6 (5.75 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.029 (0.165)	R-34.4 (6.06 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.028 (0.157)	R-36.2 (6.38 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.026 (0.149)	R-38.0 (6.70 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.025 (0.142)	R-39.9 (7.02 RSI)
8 (203)	R-32.0 (5.64 RSI)	0.024 (0.136)	R-41.7 (7.34 RSI)

Table 3.9.1.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 9)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.060 (0.341)	R-16.6 (2.93 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.049 (0.278)	R-20.4 (3.60 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.041 (0.236)	R-24.1 (4.24 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.036 (0.204)	R-27.8 (4.90 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.034 (0.191)	R-29.7 (5.23 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.032 (0.180)	R-31.5 (5.55 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.030 (0.170)	R-33.4 (5.88 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.028 (0.161)	R-35.2 (6.20 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.027 (0.153)	R-37.0 (6.52 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.026 (0.146)	R-38.8 (6.83 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.025 (0.140)	R-40.6 (7.15 RSI)

Table 3.9.1.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC Max (140) (R-4.0/in) Continuous Exterior Insulation **(Assembly 9)**

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.0 (0.70 RSI)	0.058 (0.330)	R-17.2 (3.03 RSI)
2 (51)	R-8.0 (1.41 RSI)	0.047 (0.270)	R-21.1 (3.71 RSI)
3 (76)	R-12.0 (2.11 RSI)	0.040 (0.229)	R-24.8 (4.36 RSI)
4 (102)	R-16.0 (2.82 RSI)	0.035 (0.199)	R-28.5 (5.02 RSI)
4.5 (114)	R-18.0 (3.17 RSI)	0.033 (0.187)	R-30.4 (5.35 RSI)
5 (127)	R-20.0 (3.52 RSI)	0.031 (0.176)	R-32.2 (5.67 RSI)
5.5 (140)	R-22.0 (3.87 RSI)	0.029 (0.167)	R-34.1 (6.00 RSI)
6 (152)	R-24.0 (4.23 RSI)	0.028 (0.158)	R-35.9 (6.32 RSI)
6.5 (165)	R-26.0 (4.58 RSI)	0.027 (0.151)	R-37.7 (6.64 RSI)
7 (178)	R-28.0 (4.93 RSI)	0.025 (0.144)	R-39.5 (6.96 RSI)
7.5 (191)	R-30.0 (5.28 RSI)	0.024 (0.137)	R-41.3 (7.28 RSI)

Table 3.9.2.1: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-20 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 9**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.062 (0.350)	R-16.2 (2.86 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.050 (0.283)	R-20.1 (3.54 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.042 (0.236)	R-24.0 (4.23 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.036 (0.204)	R-27.8 (4.90 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.034 (0.191)	R-29.7 (5.24 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.032 (0.180)	R-31.6 (5.57 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.030 (0.170)	R-33.5 (5.90 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.028 (0.161)	R-35.3 (6.22 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.027 (0.153)	R-37.2 (6.55 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.026 (0.145)	R-39.1 (6.88 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.024 (0.139)	R-40.9 (7.21 RSI)

Table 3.9.2.2: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-22 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 9**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.059 (0.337)	R-16.9 (2.97 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.048 (0.274)	R-20.7 (3.65 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.040 (0.230)	R-24.7 (4.35 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.035 (0.199)	R-28.6 (5.03 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.033 (0.186)	R-30.5 (5.36 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.031 (0.176)	R-32.3 (5.70 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.029 (0.166)	R-34.2 (6.03 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.028 (0.157)	R-36.1 (6.36 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.026 (0.150)	R-37.9 (6.68 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.025 (0.143)	R-39.8 (7.01 RSI)
7.5 (191)	R-31.5 (5.55 RSI)	0.024 (0.136)	R-41.7 (7.34 RSI)

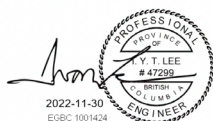
Table 3.9.2.3: Thermal Performance of Split-Insulated Steel Stud Wall Assembly with 6" x 1 5/8" Studs at 16" o.c., R-24 Batt Interior Insulation, Stainless Steel Fasteners at 16" o.c. Vertical Spacing and Thermafiber® RainBarrier® CI HC 80 (R-4.2/in) Continuous Exterior Insulation (**Assembly 9**)

EXTERIOR INSULATION THICKNESS INCH (MM)	EXTERIOR INSULATION NOMINAL R-VALUE FT ² .H.°F/BTU (M ² K/W)	U-VALUE BTU/H.FT ² °F (W/M ² K)	EFFECTIVE R-VALUE FT ² .H.°F/BTU (M ² K/W)
1 (25)	R-4.2 (0.74 RSI)	0.057 (0.325)	R-17.4 (3.07 RSI)
2 (51)	R-8.4 (1.48 RSI)	0.047 (0.265)	R-21.4 (3.77 RSI)
3 (76)	R-12.6 (2.22 RSI)	0.039 (0.224)	R-25.4 (4.47 RSI)
4 (102)	R-16.8 (2.96 RSI)	0.034 (0.194)	R-29.2 (5.15 RSI)
4.5 (114)	R-18.9 (3.33 RSI)	0.032 (0.182)	R-31.1 (5.49 RSI)
5 (127)	R-21.0 (3.70 RSI)	0.030 (0.172)	R-33.0 (5.82 RSI)
5.5 (140)	R-23.1 (4.07 RSI)	0.029 (0.163)	R-34.9 (6.15 RSI)
6 (152)	R-25.2 (4.44 RSI)	0.027 (0.154)	R-36.8 (6.48 RSI)
6.5 (165)	R-27.3 (4.81 RSI)	0.026 (0.147)	R-38.6 (6.81 RSI)
7 (178)	R-29.4 (5.18 RSI)	0.025 (0.140)	R-40.5 (7.13 RSI)

We believe that this report meets your objective for evaluating the thermal performance of various exterior and split-insulated steel-frame clear wall assemblies. If you have any questions or comments related to the above, please do not hesitate to contact the undersigned.

Yours truly,

MORRISON HERSHFIELD



Ivan Lee, M.A.Sc., P.Eng.
Principal, Building Science Consultant

APPENDIX A: BACK-UP WALL EFFECTIVE R-VALUES

1. BACK-UP WALL EFFECTIVE R-VALUES

The effective R-value of the insulated steel-frame back-up walls was determined based on 3D thermal modelling described in the report following the assumptions listed in Appendix B. For split-insulated steel-frame wall assemblies, the effectiveness of the interior insulation in between the stud changes depending on the level of exterior insulation. The figure below shows how the effective R-value of the steel-frame back-up walls changes in the presence of various levels of exterior insulation. The back-up wall effective R-values were determined by subtracting the effective R-value of a split-insulated steel-frame wall assembly with continuous exterior insulation by the nominal R-value of the exterior insulation and exterior air film.

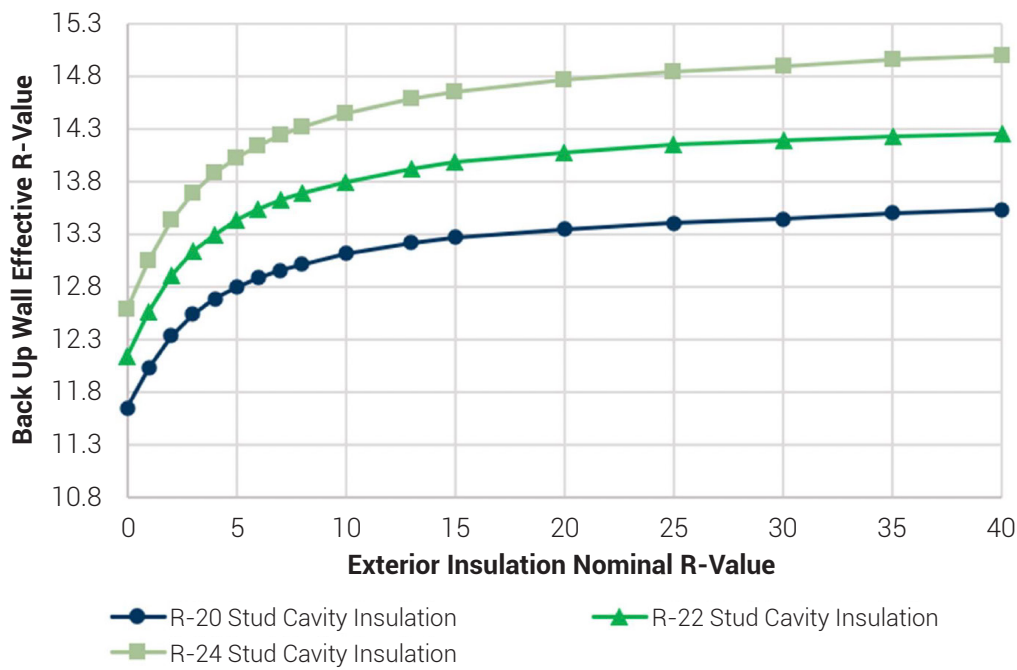


Figure A1: Effective R-Values of Interior Insulated Steel-Frame Back-Up Wall Assemblies with R-20, R-22 and R-24 Insulation in the Stud Cavity and Various Exterior Insulation Levels

APPENDIX B: MODELLING PARAMETERS AND ASSUMPTIONS

1. THERMAL MODELLING ASSUMPTIONS

The thermal analysis completed for this report was based on results from steady-state conduction models with the following assumed parameters:

- Material properties were taken from information provided by Owens Corning Canada and ASHRAE Handbook – Fundamentals for common materials.
- Interior/exterior air films were taken from Table 10, p. 26.21 of the 2017 ASHRAE Handbook – Fundamentals depending on surface orientation. The exterior air films were based on an exterior wind speed of 15 mph.
- From the calibration in 1365-RP, contact resistances between materials were modeled 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 steel studs and alternative cladding system attachments.

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.

$$T_i = \frac{T_{surface} - T_{outside}}{T_{inside} - T_{outside}}$$

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 modeling 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)





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Pub. No. 600222A. Printed in Canada. May 2025.
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