

## Thermal Performance Assessment Report

### ThermaSteel Wall Panel System

**Project No.:** P6415.01-304-56  
**Report Date:** 5/2/23

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prepared for

ThermaSteel Inc.  
609 West Rock Road  
Radford, VA 24141

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prepared by

Intertek - Building Science Solutions  
3011 South Huson St. Suite A  
Tacoma, WA 98409

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**1. SCOPE**

This report summarizes the thermal performance assessment of ThermaSteel wall panels with the following objectives:

- 1.1 Calculate effective R-value of the panel
- 1.2 Compare ThermaSteel R-value to typical insulated wood frame wall
- 1.3 Calculate potential energy savings of using ThermaSteel wall panel system

**2. PANELS ANALYZED**

No	Description	Thickness (in)	Insulation Density	Panel Size
1	5.5" Exterior Wall Panel	5.5"	Normal Density (1.0 pcf)	4' x 8'
2	7.5" Exterior Wal Panel	7.5"	High Density (1.5 pcf)	4' x 8'

**3. METHODOLOGY**

- 3.1 Analysis based on ASHRAE 90.1 Standard wood and steel frame assembly wall components as per ASHRAE 90.1-2019, Appendix A 3.3 and A3.4
- 3.2 Effective thermal conductivity of ThermaSteel panel studs, bottom and top tracks calculated using THERM models
- 3.3 Parallel path method and area averaging used to calculate effective R-value of the ThermaSteel wall panels in comparable wall construction as per ASHRAE Standard mentioned above.

**4. MATERIAL PROPERTIES**

Layer Description	R-value (h.ft <sup>2</sup> .°F / Btu)	Source / Reference
Interior/Exterior Gypsum Board	0.68	ASHRAE 90.1-2019, Appendix A 3.3 and A3.4
Stucco	0.08	
Wood/Steel Stud cavity Insulation (Fiberglass Batt)	19	
ThermaSteel Insulation – Normal Density – 5.5" Stud	24.0	Based on R-4.5 per inch (Assuming industry standard performance)
ThermaSteel Insulation – High Density – 7.5" Stud	35.7	Based on R-5.0 per inch (Assuming industry standard performance)

**5. ANALYSIS SUMMARY**

- 5.1 Analysis based on ASHRAE 90.1 Standard wood and steel frame assembly wall components as per ASHRAE 90.1-2019, Appendix A 3.3 and A3.4. This assembly includes stucco, exterior gypsum sheathing, stud cavity insulation and interior gypsum board.
- 5.2 Thermal bridging effect at the stud channels and tracks modeled using LBNL THERM as per attached thermal models in Figure 1.
- 5.3 Area weighted average U-factor calculations for total wall assemblies are calculated using the clear field thermal bridging and track edge effective U-factors with the nominal insulation R-value of insulation uninterrupted by C-channels or tracks. Tables 1 and 2 provide the summary of effective R-value calculation.

- 5.4 Air leakage impact is accounted by considering the whole building air tightness of achieving 1.5 ACH with Thermasteel system offering superior air tightness with continuous EPS compared to typical 6 ACH for fiberglass insulated assemblies. This represents 50% lower heatloss in Thermasteel assemblies compared to woodframe wall assemblies due to air infiltration.

## 6. SUMMARY

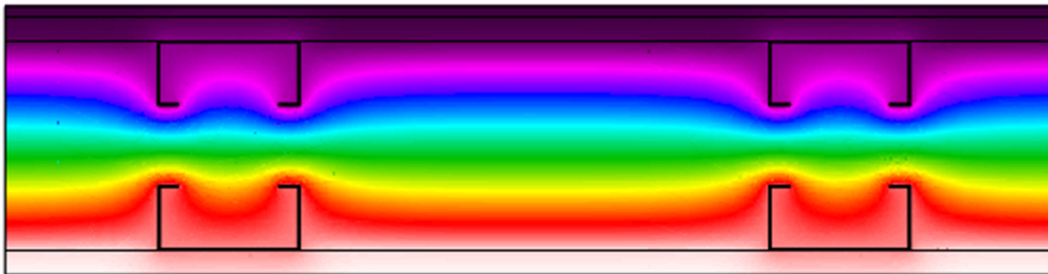
No	Description	Effective R-value for code compliance	R-value performance equivalent	
			Wood Frame Walls	Steel Frame Walls
1	5.5" Exterior Wall Panel Normal Density (1.0 pcf)	R-20	R-42	>R-51
2	7.5" Exterior Wal Panel High Density (1.5 pcf)	R-33	R-51	>R-61

- 6.1 As per ASHRAE 90.1 Appendix-A normative calculation methodology, the effective R-value of ThermaSteel panels are R-22.4 and R-33. These meet the ASHRAE 90.1 requirements for 2x6 wood frame and steel frame wall assemblies.
- 6.2 Based on overall heatloss reduction due to airtightness of Thermasteel insulation, the thermal performance of ThermSteel 5.5" normal density wall system is equivalent to 2x6 wood frame construction with R-42 overall thermal resistance.
- 6.3 Based on thermal modeling and comparison analysis, ThermaSteel wall system performance is attributed to the C-Channels providing the wall insulation as equivalent to continuous insulation and reducing the thermal bridging occurring in typical stud walls, in addition to the airtightness attributed to the insulation material properties.

# Figure 1: Thermal Modeling

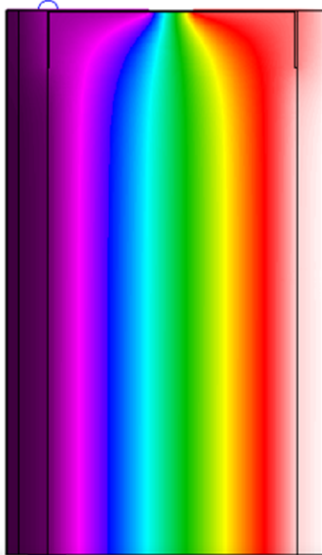
## Clear Wall Thermal Bridging Models

### 1. C-Channel Studs (5.5" Wall Section)



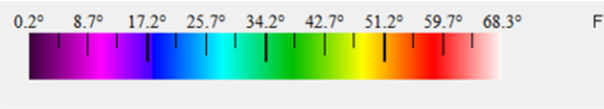
	R-Value h-ft <sup>2</sup> -F/Btu	delta T F	Length inches
Frame	14.7401	70.4	3.65918
Opaque Wall	27.6718	70.4	12.3766

### 2. Top Track (5.5" Wall Section)



	R-Value h-ft <sup>2</sup> -F/Btu	delta T F	Length inches
Opaque Wall	22.7497	70.4	10.7107
Edge	12.2203	70.4	1.25

Color Legend



**Table 1:**  
**U-factor Calculation for 5.5” ThermaSteel Panel Wall**

(as per ASHRAE Standard Wall Construction):

<i>Component Name</i>	<i>Area (sf)</i>	<i>U-factor</i>	<i>R-value</i>	<i>UA</i>
Uninterrupted Insulation	23.90	0.040	25.10	0.951
C-Channel studs	7.60	0.074	13.58	0.560
Bottom/Top Tracks	0.50	0.086	11.63	0.043
<b>Total</b>	<b>32.00</b>			<b>1.554</b>
Area-weighted Assembly U-factor		0.05		
Effective Assembly R-value		20.59		

**Table 2:**  
**U-factor Calculation for 7.5” ThermaSteel Panel Wall**

(as per ASHRAE Standard Wall Construction):

<i>Component Name</i>	<i>Area (sf)</i>	<i>U-factor</i>	<i>R-value</i>	<i>UA</i>
Uninterrupted Insulation	23.90	0.026	39.00	0.612
C-Channel studs	7.60	0.045	22.30	0.342
Bottom/Top Tracks	0.50	0.052	19.30	0.026
<b>Total</b>	<b>32.00</b>			<b>0.980</b>
Area-weighted Assembly U-factor		0.03		
Effective Assembly R-value		32.66		

**Table 3:**  
**Effective R-value and U-factor Calculation for 5.5” and 7.5” ThermaSteel Panels compared to ASHRAE 90.1 2x6 Wood Frame and Steel Frame Walls**

	ASHRAE 90.1 2x6 Wood Frame	ASHRAE 90.1 2x6 Steel Frame	ThermaSteel 5.5" Studs Normal Density	ThermaSteel 7.5" Studs High Density
<i>Nominal Insulation R value</i>	R-19	R-19	R-24	R-36
<i>Effective R-value of Assembly</i>	R-15	R-9	R-20	R-33
<i>Effective U-factor</i>	0.067	0.109	0.05	0.03
<i>Air leakage (cfm/sf) (Typical assembly)</i>	0.04	0.04	0.004	0.004
<b><i>Total Effective R-value (conductive + reduced infiltration)</i></b>	<b>R-15</b>	<b>R-9</b>	<b>R-22.4</b>	<b>R-42.5</b>
<b><i>Compared to Wood Frame</i></b>				
<i>Conductive Heatloss Reduction</i>	-	-	25%	51%
<i>Infiltration Heatloss Reduction</i>	-	-	50%	50%
<i>Total heatloss reduction</i>	-	-	34%	65%
<b><i>ThermaSteel Effective Insulation %Better than Wood Frame</i></b>			<b>50%</b>	<b>183.0%</b>
<b><i>Thermasteel Insulation Nominal R-value</i></b>			<b>R-42</b>	<b>R-51</b>
<b><i>Compared to Steel Frame</i></b>				
<i>Conductive Heatloss Reduction</i>			55%	72%
<i>Infiltration Heatloss Reduction</i>	-	-	50%	50%
<i>Total heatloss reduction</i>	-	-	59%	78%
<b><i>ThermaSteel Effective Insulation %Better than Steel Frame</i></b>			<b>148%</b>	<b>372%</b>
<b><i>Thermasteel Insulation Nominal R-value</i></b>			<b>&gt;R-51</b>	<b>&gt;R-61</b>