

CLIENT: **SUPERFORM ICF LTD.**
 1065 Willow Road, Pincher Creek, AB
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Engineering Evaluation Report No: T1333-3b	Issue Date: April 28, 2020
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PRODUCT ID: Thermal resistance evaluation of Superform Insulated Concrete Form (ICF) wall system composed of expanded polystyrene (EPS) panels connected with polypropylene cross-ties, used as permanent concrete formwork.

Detailed description of the evaluated product can be found on page 2.

AUTHORIZATION: QAI Proposal 20MB02264R1 to Superform Products Ltd. authorized by Keelan Unruh dated Feb 26, 2020.

EVALUATION REQUESTED: Engineering Services / Engineering Evaluation of Total R-Value of two Superform Insulated Concrete Form (ICF) wall systems.

CONCLUSION: It is QAI's opinion based on the calculations outlined in this report that the Superform ICF walls described in Section 2 will provide the following effective thermal resistance values determined in accordance with ASHRAE Handbook – Fundamentals 2013 per NBC Section A 9.36.2.4.(1) when clad with aluminum / vinyl or steel hollow backed siding with interior ½" (12.7 mm) drywall finish:

Table 1. Superform ICF Finished Wall Effective Thermal Resistance Values

	4" SUPERFORM ICF Type 2 EPS Panel	6" SUPERFORM ICF Type 2 EPS Panel	6.5" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel with 2" Type 2 Insert
Effective R-Value, Ft²*hr*F/Btu⁴	23	23	25	25	33
Effective RSI Value, m²K/W	4.02	4.01	4.33	4.36	5.73
U-Value W/m²K	0.25	0.25	0.23	0.23	0.17

Prepared By:



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Signed for and on behalf of
 QAI Laboratories Ltd.

Lawrence Gibson
 Executive Vice President

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1.0 EVALUATION PURPOSE:

At the request of Superform Products Ltd (Superform), QAI has conducted an evaluation of the effective thermal resistance of finished exterior concrete walls constructed using Superform Insulated Concrete ICF, complete with code prescribed thermal barrier on the interior surface of 12.7 mm (1/2 inch) drywall.

The effective thermal resistance of the building envelope assembly was determined following ASHRAE Fundamentals Handbook 2013 following calculation of effective thermal resistance of an assembly with continuous insulation, Isothermal Planes Method, based on installed wall components provided by Superform ICF Ltd.

Calculations were conducted in accordance with Section A-9.36.2.4.(1) of the National Building Code of Canada 2015.

2.0 PRODUCT DESCRIPTION:

Superform ICF are Type 2 injection molded EPS panels, with virgin polypropylene cross ties, that when stacked together in the field provide permanent formwork for concrete while providing insulation on the interior and exterior of the concrete face.

The products are available in different concrete core thicknesses, with slight differences in EPS panels for each Superform ICF product as outlined in Table 2 below.

Table 2. Superform ICF Product Details

COMPONENT	MATERIAL THICKNESSES FOR SUPERFORM ICF PRODUCTS			
	Superform 4"	Superform 6"	Superform 6.5"	Superform 8"
EPS Panel	2-9/16"	2-17/32"	2-3/4"	2-3/4"
Concrete Core	3-15/16"	5-15/16"	6-1/2"	8"

Product details above are as outlined in Superform ICF Ltd. Third-Party Factory Inspection Procedures RJ1923-E Rev.5 revision date September 17, 2019.

Assembly Description: For the purposes of this evaluation, the Superform ICF assemblies outlined in Table 2 above were considered using wall assembly components provided by Superform ICF as outlined in Table 3.

Table 3: Components of Superform ICF Finished Wall Assembly Included in Effective R-Value¹

COMPONENT	R-VALUE
Siding – Aluminum, Vinyl, Steel Hollow Backed	0.61 total
Building Membrane – Poly or plastic Film	-
Concrete, Sand and gravel aggregate < 50%	0.10 / inch
Gypsum ½ inches	0.45

Note 1: Components noted above are generic materials used in the final Superform ICF wall assembly. R values noted are referenced from ASHRAE Handbook – Fundamentals 2013 Section 25.8 Table 4.

3.0 REFERENCED STANDARDS AND REPORTS:

- ASTM C518 Steady State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- ASHRAE Handbook – Fundamentals 2013 - Chapter 25 Thermal and Water Vapor Transmission Data.
- QAI test report T1333-3 dated 4/23/2020, ASTM C518 results of testing Superform ICF.
- National Building Code of Canada 2015 (NBC).
- Superform ICF Ltd. Third-Party Factory Inspection Procedures RJ1923-E Rev.5 revision date September 17, 2019.

4.0 ENGINEERING EVALUATION:

4.1 Requirements

For the purposes of this evaluation thermal values of the various components were taken from actual testing conducted by Superform Products on their EPS or published data was used as outlined in this evaluation. The entire wall theoretical R-Value was calculated using the methods outlined in ASHRAE Fundamentals handbook, 2013 Chapter 25 based on Isothermal Planes method as building assemblies constructed of Superform ICF represent assemblies with continuous insulation.

Calculations for conductive film coefficient has been applied to both the interior and exterior faces. These conductive films vary depending on several aspects including the speed of air movement across the exposed surface, orientation of the face, air temperature and the surface profiles. The values used assume for this evaluation are outlined in the notes. It should also be noted that the plastic ties were not considered as they are a minor element and would have a negligible effect on the overall R-Value through thermal bridging when compared to the concrete core volume.

Based on ASHRAE Handbook - Fundamentals, for a wall made up of homogeneous layered components the theoretical thermal transmission values (R-Value) of a wall system can be calculated by summing the thermal resistance of each of the components.

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4.2 Findings:

The following tables outline the calculations for Superform ICF wall assemblies evaluated by QAI for effective thermal resistance following Isothermal Planes method outlined in ASHRAE Handbook - Fundamentals 2013.

Table 4. Superform ICF Wall Assemblies Calculated Effective R-Values

COMPONENT	THEORETICAL EFFECTIVE THERMAL RESISTANCE				
	4" SUPERFORM ICF Type 2 EPS Panel	6" SUPERFORM ICF Type 2 EPS Panel	6.5" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel with 2" Type 2 Insert
Exterior Air Film ²	0.17	0.17	0.17	0.17	0.17
Vinyl Siding / Hollow Backed Steel	0.61	0.61	0.61	0.61	0.61
Exterior EPS Panel Type 2	10.25	10.125	11	11	11
Concrete Core	0.4	0.6	0.65	0.8	0.6
Interior EPS Panel Type 2	10.25	10.125	11	11	19
½" Gypsum	0.45	0.45	0.45	0.45	0.45
Indoor Air Film ³	0.68	0.68	0.68	0.68	0.68
Effective R- Value, Ft²*hr*F/Btu⁴	23	23	25	25	33
Effective RSI Value, m²K/W	4.02	4.01	4.33	4.36	5.73
U-Value W/m²K	0.25	0.25	0.23	0.23	0.17

Notes:

- 2) R- Value for an exterior vertical surface for winter & a 15 mph wind.
- 3) R -Value for a non-reflective vertical surface in still air.
- 4) R-Value rounded to nearest whole number after value of 10.0.

5.0 CONCLUSION:

It is QAI's opinion based on the calculations outlined in this report that that the Superform ICF walls described in Section 2 of this report will provide the following theoretical thermal values for effective thermal resistance calculated following ASHRAE Handbook – Fundamentals 2013 as referenced by the NBC Section A9.36.2.4.(1) for the wall components noted:

Table 5. Superform ICF Finished Wall Effective Thermal Resistance Values

COMPONENT	THEORETICAL EFFECTIVE THERMAL RESISTANCE				
	4" SUPERFORM ICF Type 2 EPS Panel	6" SUPERFORM ICF Type 2 EPS Panel	6.5" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel	8" SUPERFORM ICF Type 2 EPS Panel with 2" Type 2 Insert
Exterior Air Film ²	0.17	0.17	0.17	0.17	0.17
Vinyl Siding / Hollow Backed Steel	0.61	0.61	0.61	0.61	0.61
Exterior EPS Panel Type 2	10.25	10.125	11	11	11
Concrete Core	0.4	0.6	0.65	0.8	0.6
Interior EPS Panel Type 2	10.25	10.125	11	11	19
½" Gypsum	0.45	0.45	0.45	0.45	0.45
Indoor Air Film ³	0.68	0.68	0.68	0.68	0.68
Effective R-Value, Ft²*hr*F/Btu⁴	23	23	25	25	33
Effective RSI Value, m²K/W	4.02	4.01	4.33	4.36	5.73
U-Value W/m²K	0.25	0.25	0.23	0.23	0.17

5.0 REVISION HISTORY:

Date	Revision	Change Description	Initials
April 28, 2020 Error! Reference	-	Original Report	ML

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