QAI LABORATORIES
CERTIFICATION TESTING INSPECTION

3980 North Fraser Way
Burnaby, BC V5J 5K5
(604) 527-8378 ph. | (604) 527-8368 fx.
www.qai.org

CLIENT: **SUPERFORM ICF LTD.**
1065 Willow Road, Pincher Creek, AB
T0K 1W0

Engineering Evaluation Report No: T1333-3c	**Issue Date: February 17, 2021**

PRODUCT ID: Thermal resistance evaluation of Superform Insulated Concrete Form (ICF) wall system composed of expanded polystyrene (EPS) panels made with NEOPOR® 2000 series graphite impregnated expandable polystyrene beads, 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, 6.5 inch and 8 inch ICF form thicknesses.

CONCUSION: 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

	6.5'' SUPERFORM ICF Type 2 EPS Panel	8'' SUPERFORM ICF Type 2 EPS Panel
Effective R-Value,Ft^2*hr*F/Btu^4	**29**	**29**
Effective RSI Value, m^2K/W	**5.0**	**5.1**
U-Value, W/m^2K	**0.20**	**0.20**

Prepared By:

Matt Lansdowne, P.Eng.
Vice President of Operations

Signed for and on behalf of QAI Laboratories Ltd.

Lawrence Gibson
Executive Vice President

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.

This evaluation considers Superform ICF EPS panels molded from BASF NEOPOR® graphite impregnated expandable polystyrene beads. The noted BASF NEOPOR® expandable beads are used for increasing R-value of EPS foam, and these beads are listed for R-values per EPS Type as outlined in QAI listing B1055-2.

Superform ICF products are available in different concrete core thicknesses, with slight differences in EPS panels. Superform ICF products evaluated by QAI including panel dimensions are outlined in Table 2 below.

Table 2. Superform ICF Product Details

	MATERIAL THICKNESSES FOR SUPERFORM ICF PRODUCTS	
COMPONENT	**Superform 6.5’’**	**Superform 8’’**
EPS Panel	2-3/4’’	2-3/4’’
Concrete Core	6-1/2’’	8’’

Product details above are as outlined in Superform ICF Ltd. Third-Party Factory Inspection Procedures RJ1923-E Rev.7 revision date August 20, 2020.

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

Table 3: Components of Superform ICF Finished Wall Assembly Included in Effective R-Value Evaluation[1]

COMPONENT	R-VALUE
Siding – Aluminum, Vinyl, Steel Hollow Backed	0.61 total
Building Membrane – Poly or plastic Film	-
BASF NEOPOR® Type 2 EPS	4.6 / inch
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.
- National Building Code of Canada 2015 (NBC).
- Superform ICF Ltd. Third-Party Factory Inspection Procedures RJ1923-E Rev.7 revision date August 20, 2020.
- QAI certification listing B1055-2 for NEOPOR® Expandable Polystyrene Beads.

4.0 ENGINEERING EVALUATION:

4.1 Requirements

For the purposes of this evaluation thermal values of the Superform EPS panels were taken BASF NEOPOR® QAI listed data for Type 2 EPS (R-value of 4.6 per inch per QAI listing B1055-2) or ASHRAE 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.

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

	THEORETICAL EFFECTIVE THERMAL RESISTANCE	
COMPONENT	6.5'' SUPERFORM ICF Type 2 EPS Panel	8'' SUPERFORM ICF Type 2 EPS Panel
Exterior Air Film[2]	0.17	0.17
Vinyl Siding / Hollow Backed Steel	0.61	0.61
Exterior EPS Panel Type 2	13	13
Concrete Core	0.65	0.8
Interior EPS Panel Type 2	13	13
½'' Gypsum	0.45	0.45
Indoor Air Film[3]	0.68	0.68
Effective R-Value, Ft^2*hr*F/Btu[4]	**29**	**29**
Effective RSI Value, m^2K/W	**5.0**	**5.1**
U-Value, W/m^2K	**0.20**	**0.20**

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

	THEORETICAL EFFECTIVE THERMAL RESISTANCE	
COMPONENT	6.5'' SUPERFORM ICF Type 2 EPS Panel	8'' SUPERFORM ICF Type 2 EPS Panel
Exterior Air Film[2]	0.17	0.17
Vinyl Siding / Hollow Backed Steel	0.61	0.61
Exterior EPS Panel Type 2	13	13
Concrete Core	0.65	0.8
Interior EPS Panel Type 2	13	13
½'' Gypsum	0.45	0.45
Indoor Air Film[3]	0.68	0.68
Effective R-Value, Ft^2*hr*F/Btu[4]	**29**	**29**
Effective RSI Value, m^2K/W	**5.0**	**5.1**
U-Value, W/m^2K	**0.20**	**0.20**

5.0 REVISION HISTORY:

Date	Revision	Change Description	Initials
February 17, 2021**Error! Reference source not found.**	-	Original Report	ML

**********<END OF REPORT>**********