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Mr. Robert Sculthorpe
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**Thermal Resistance Calculations of Fox Block Insulated Concrete Forms
Project No. 1018**

Dear Mr. Sculthorpe:

At your request, Ms. VanGeem has performed calculations to determine the thermal resistance (R-value) of five fully constructed Fox Block insulated concrete form (ICF) wall system assemblies (www.foxblocks.com) distributed by Airlite Plastics Co. The walls are designated as 4, 6, 8, 10, and 12 in. (100, 150, 200, 250, and 300 mm) and are based on the thickness of the concrete core (or cavity) in the ICF.

BLOCK CONFIGURATION AND THERMAL PROPERTIES

Thermal resistance calculations were performed in accordance with procedures in Chapters 25 and 26 in the *ASHRAE Handbook – 2009 Fundamentals* and *ASHRAE Standard 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings*.

The constructed Fox Block ICF wall system consists of expanded polystyrene (EPS) insulation panels on either side of a concrete core. The 4, 6, 8, 10, and 12 in. (100, 150, 200, 250, and 300 mm) wall-system designations refer to the thicknesses of the concrete core (the ICF cavity) between the expanded polystyrene insulation panels. Based on the information provided by you, the EPS insulation panels are flat and are 2-5/8 in. (67 mm) thick for all five wall designations. The nominal density of the EPS insulation, provided by you, is 1.5 lb/ft³ (24 kg/m³) with a corresponding thermal conductivity of 0.243 Btu·in./hr·ft²·°F (0.0351 W/m·K) as provided by the average of results from six Intertek test reports dated July 6, 2009; June 30, 2010; November 30, 2011; Feb. 16, 2010; July 31, 2012; and Aug. 7, 2012. The concrete is assumed to have a thermal conductivity of 16 Btu·in./hr·ft²·°F (2.3 W/m·K). The calculations are performed for materials with a mean temperature of approximately 75°F (24°C) consistent with the U.S. Federal Trade Commission requirements.

The inside surface of the wall is assumed to be finished with 1/2-in. (13-mm) gypsum wallboard with an R-value of 0.46 hr·ft²·°F/Btu (RSI of 0.080 m²·K/W). The outside surface is assumed to be finished with 5/16-in. (8-mm) fiber cement board siding with an R-value of 0.15 hr·ft²·°F/Btu (RSI of 0.026 m²·K/W).¹

Also according to you, the Fox Block ICF utilizes injection-molded plastic ties made from polypropylene regrind resin. These ties are used to connect the two insulation panels before concrete placement and remain in place. These ties penetrate the concrete in a completed wall system. The thermal effect of the ties is not included in the calculations because they do not significantly affect the results. Previous work has shown that nonmetallic materials penetrating concrete do not have a measurable effect on the thermal resistance of an insulated concrete wall when they represent a small cross sectional area.

THERMAL RESISTANCE AND THERMAL TRANSMITTANCE

Tables 1a (IP units) and 1b (SI units) present the calculations of the total thermal resistance (R-value), total thermal transmittance (U-factor), and added R-value of the insulation only for the 4, 6, 8, 10, and 12 in. (100, 150, 200, 250, and 300 mm) wall assemblies.

Table 1a – Calculated Thermal Resistance (R-value), Thermal Transmittance (U-factor), and Added R-value of Insulation of Constructed Fox Block™ ICF Walls with Concrete Core Thickness Indicated (IP units)

Component	Thermal Resistance, hr·ft ² ·°F/Btu (unless noted) for Concrete Core Thickness Indicated				
	4 in.	6 in.	8 in.	10 in.	12 in.
Interior air film (still air)	0.68	0.68	0.68	0.68	0.68
Gypsum wallboard, 1/2 in.	0.46	0.46	0.46	0.46	0.46
Insulation, two 2-5/8-in. panels	21.58	21.58	21.58	21.58	21.58
Concrete core	0.25	0.38	0.50	0.63	0.75
Fiber cement siding, 5/16 in.	0.15	0.15	0.15	0.15	0.15
Exterior air film (15 mph wind)	0.17	0.17	0.17	0.17	0.17
Total R-value	23.3	23.4	23.5	23.7	23.8
Total U-factor, Btu/hr·ft²·°F	0.0429	0.0427	0.0425	0.0423	0.0420
Added R-value of insulation only	21.6	21.6	21.6	21.6	21.6

¹ HardiePanel Siding ICC-ES Evaluation Report ESR-1844 reissued November 1, 2011

Table 1b – Calculated Thermal Resistance (RSI-value), Thermal Transmittance (U-factor), and Added RSI-value of Insulation of Constructed Fox Block™ ICF Walls with Concrete Core Thickness Indicated (SI units)

Component	Thermal Resistance, m ² ·K/W (unless noted) for Concrete Core Thickness Indicated				
	100 mm	150 mm	200 mm	250 mm	300 mm
Interior air film (still air)	0.12	0.12	0.12	0.12	0.12
Gypsum wallboard, 13 mm	0.08	0.08	0.08	0.08	0.08
Insulation, two 67-mm panels	3.80	3.80	3.80	3.80	3.80
Concrete core	0.04	0.07	0.09	0.11	0.13
Fiber cement siding, 8 mm	0.03	0.03	0.03	0.03	0.03
Exterior air film (24 km/hr wind)	0.03	0.03	0.03	0.03	0.03
Total RSI-value	4.10	4.12	4.14	4.17	4.19
Total U-factor, W/m²·K	0.244	0.243	0.241	0.240	0.239
Added RSI-value of insulation only	3.80	3.80	3.80	3.80	3.80

The R-value, or RSI-value as appropriate, of the Fox Block wall assemblies without interior and exterior finish materials can be determined by subtracting the R-value of the finishes from the Total R-value. If an interior finish with a higher R-value is used, the additional rating of the interior finish above R-0.46 (RSI-0.080) may be added to the Total R-value of the system. If a siding with a higher R-value is used, the additional rating of the siding above R-0.15 (RSI-0.026) may be added to the Total R-value of the system.

Please contact me if you have any questions.

Sincerely,



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