CONSTRUCTION

Evaluation Report CCMC 13459-R
Isofoil

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that “Isofoil”, when used as a vapour barrier and a thermal insulation board faced with a low-emissivity material (LEM) that is installed in conjunction with a furred-airspace assembly in enclosed foundation walls in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Sentence 9.25.2.2.(1) Insulation Materials
  - Sentence 9.25.4.2.(1) Vapour Barrier Materials
  - Article 9.25.4.3. Installation of Vapour Barriers

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.25.2.2.(1) Insulation Materials
  - Article 9.25.4.2. Vapour Barrier Materials

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report Holder.

Ruling No. 14-02-298 (13459-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling,was made by the Minister of Municipal Affairs and Housing on 2014-09-22 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

Note: The evaluation of “Isofoil” as a thermal insulation was two-fold: 1) first, the product itself was evaluated to determine its compliance to the code using Sentence 9.25.2.2.(1) under Clause 1.2.1.1.(1)(a) of Division A; and 2) secondly, the product installed in conjunction with a furred-airspace assembly was evaluated to determine its compliance to the code as an alternative solution to Sentence 9.25.2.2.(1) under Clause 1.2.1.1.(1)(b) of Division A.

2. Description

The product consists of a 76-mm-thick moulded expanded polystyrene insulation board (Type 1), which is laminated on one side with a facer of aluminized kraft paper with low-emissivity (LEM) characteristics.

The product is nailed to the interior side of 200-mm-thick poured concrete foundation walls with its low-emissivity facer facing a furred-air-space assembly (FAA) (i.e. air cavity, furring and gypsum board interior finish) and the joints of the product are sealed with 50-mm-wide aluminum tape.

The configuration of the FAA varies depending on furring size, orientation and spacing. Five configurations of FAA were evaluated in con-junction with an insulated foundation wall (see Tables 4.2.1 to 4.2.5).

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "Isofoil" being used in accordance with the conditions and limitations set out below.

- The product is permitted for use in buildings that fall under the scope of Part 9, Housing and Small Buildings, of Division B of the NBC 2010.
- The product must be installed within the wall systems specified in Tables 4.2.1 to 4.2.5 and must be installed in accordance with the manufacturer's installation instructions and Part 9, Housing and Small Buildings, of Division B of the NBC 2010.
- The aluminum foil surface of the product must be clean and free of defects.
- The joints of the product must be sealed with 50-mm-wide aluminum tape.
- The concrete density used to establish the thermal resistance of the wall configurations specified in Tables 4.2.1 to 4.2.5 is 2 400 kg/m^3, which corresponds to the normal concrete density referenced in CSA-A23.1-09, "Concrete Materials and Methods of Concrete Construction." Since, as per the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE), a range of concrete conductivity values are assigned to the concrete density of 2 400 kg/m^3, the lowest (k_1 = 1.4 W/m·K) and highest (k_2 = 2.9 W/m·K) thermal conductivity values assigned to this concrete density have been considered. Tables 4.2.1 to 4.2.5 state three thermal resistance values per wall assembly: i) the thermal resistance value of the wall excluding the interior and exterior air films, ii) the design thermal resistance value, which includes the air films, and iii) the thermal resistance contribution of the FAA. These values are valid if there is no construction imperfections, no condensation in the cavity, and no dust on the surface of the aluminum foil.

  Note: Should additional insulation material be added to the wall assemblies specified in Tables 4.2.1 to 4.2.5, testing or numerical modeling must be conducted to accurately assess the overall thermal resistance of the modified wall assemblies; the thermal resistance provided by the additional insulation cannot be added algebraically to the published thermal resistance of the wall assemblies.

- The wall configurations specified in Tables 4.2.1 to 4.2.5 must meet the requirements for air barriers stated in Subsection 9.25.3., Air Barrier Systems, of Division B of the NBC 2010. The product must be installed in conjunction with ISOLOFOAM Group's proprietary air barrier system, which must be approved by the building official or evaluated by CCMC.
- The FAA must be enclosed by a 12.7-mm-thick gypsum board interior finish conforming to Subsection 9.29.5., Gypsum Board Finish (Taped Joints), of Division B of the NBC 2010. The air space must also be sealed at the interior finish to prevent any air exchange between the furred-airspace and the interior space. Sealing the air space at the perimeter of the wall, around outlets, etc., must be carried out in accordance with the manufacturer's installation instructions.
- All ends and edges of the gypsum board must occur over furring members or joints must be taped.
- The heat transfer, vapour diffusion and air barrier control details between the floor joists at the rim board must meet the NBC 2010 requirements.
- Where applicable, the concealed spaces created by the FAA must include fire blocks complying with Subsection 9.10.16., Fire Blocks, of Division B of the NBC 2010.
- Product packaging must be identified with the following information:
  - the manufacturer's name or logo; and
  - the phrase "CCMC 13459-R"

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

Evidence based on numerical modeling has also been submitted to CCMC; see Section 4.2.1 of this Report.

4.1 Material Requirements

4.1.1 Insulation Board (76-mm-thick “Isofoil” Board)

Table 4.1.1

Property	Unit	Requirement	Result
Board conforms to CAN/ULC-S701-05	No unit	Pass	Pass: Type 1
Water vapour permeance conforms to ASTM E 96/E 96M-05, Desiccant Method)	ng/Pa·s·m²	≤ 60	4.23
Water vapour permeance after weathering and heat aging	ng/Pa·s·m²	≤ 60	5.08

4.1.2 Low-Emissivity Material (Foil Only)

Table 4.1.2

Property	Unit	Requirement	Result
Foil conforms to CAN/CGSB-51.33-M89	No unit	Pass	Pass: Type 2
Emissivity	No unit	Report value	0.036
Emissivity after weathering and heat aging	%	maximum 5% higher than original value	-2.7
Water vapour permeance	ng/Pa·s·m²	≤ 60	2.1
Water vapour permeance after weathering and heat aging	ng/Pa·s·m²	≤ 60	14.4
Adhesion strength (peel force)	N	Report value	2.9
Adhesion strength after weathering and heat aging	%	≥ 85% of original value	89.7

4.2 Performance Requirements

4.2.1 Heat Transfer Control (“Isofoil” Board with a Furred-Airspace Assembly)

The thermal resistance of the manufacturer's designated wall assembly shown in Figure 1 was determined based on testing in accordance with ASTM C 1363-11, “Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus,” and modeling using the hygIRC-C model. The test program included full-scale testing of a complete wall assembly and a base wall assembly (complete wall without the FAA). To facilitate testing, both full-scale wall assemblies incorporated a plywood layer instead of the 200-mm-thick concrete layer mentioned in Section 2. The test results were used to validate the hygIRC-C model, which was then used to determine the thermal resistance values of the actual wall assembly shown in Figure 1 with a concrete layer: these values are reported in Table 4.2.1. The thermal resistance values of the manufacturer's designated wall assemblies shown in Tables 4.2.2 to 4.2.5 were determined based on modeling using the hygIRC-C model.

Table 4.2.1 Thermal Resistance Values for the Manufacturer's Designated Wall Assembly No. 1

Property	Unit	Requirement	Result	
			L_1[1]	L_2[1]
Room-side air temperature	°C	Report value	20	20
Weather-side air temperature	°C	Report value	-35	-35
Thermal resistance of the wall[2]	$m^2 \cdot K/W$	Report value	3.10	3.03
Design thermal resistance of the wall[3]	$m^2 \cdot K/W$	Report value	3.25	3.18
Contribution of the furred-airspace assembly to the thermal resistance of the wall[4][5]	$m^2 \cdot K/W$	Report value	0.62	0.55

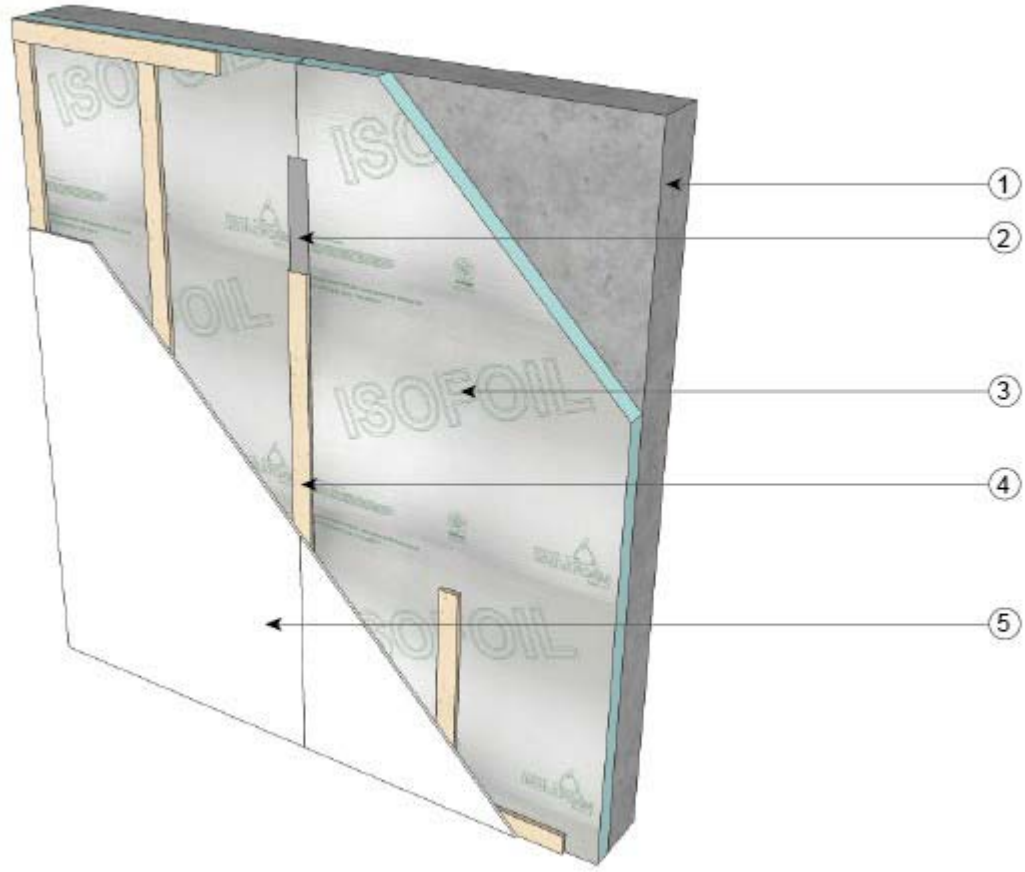

Figure 1. "Isofoil" adjacent to the furred-airspace assembly installed within the manufacturer's designated wall assembly No. 1:

1. **concrete wall (200 mm thick)**
2. **aluminum tape**
3. **"Isofoil" (76 mm thick) with low-emissivity material facing the furred-airspace**
4. **wood furring (19 mm x 64 mm) installed vertically at 600 mm o.c.**
5. **gypsum board (12.7 mm thick) installed vertically**

Table 4.2.2 Thermal Resistance Values for the Manufacturer's Designated Wall Assembly No. 2

Property	Unit	Requirement	Result	
			L_1[1]	L_2[1]
Room-side air temperature	°C	Report value	20	20
Weather-side air temperature	°C	Report value	-35	-35
Thermal resistance of the wall[2]	$m^2 \cdot K/W$	Report value	3.02	2.95
Design thermal resistance of the wall[3]	$m^2 \cdot K/W$	Report value	3.17	3.10
Contribution of the furred-airspace assembly to the thermal resistance of the wall[4][5]	$m^2 \cdot K/W$	Report value	0.54	0.47

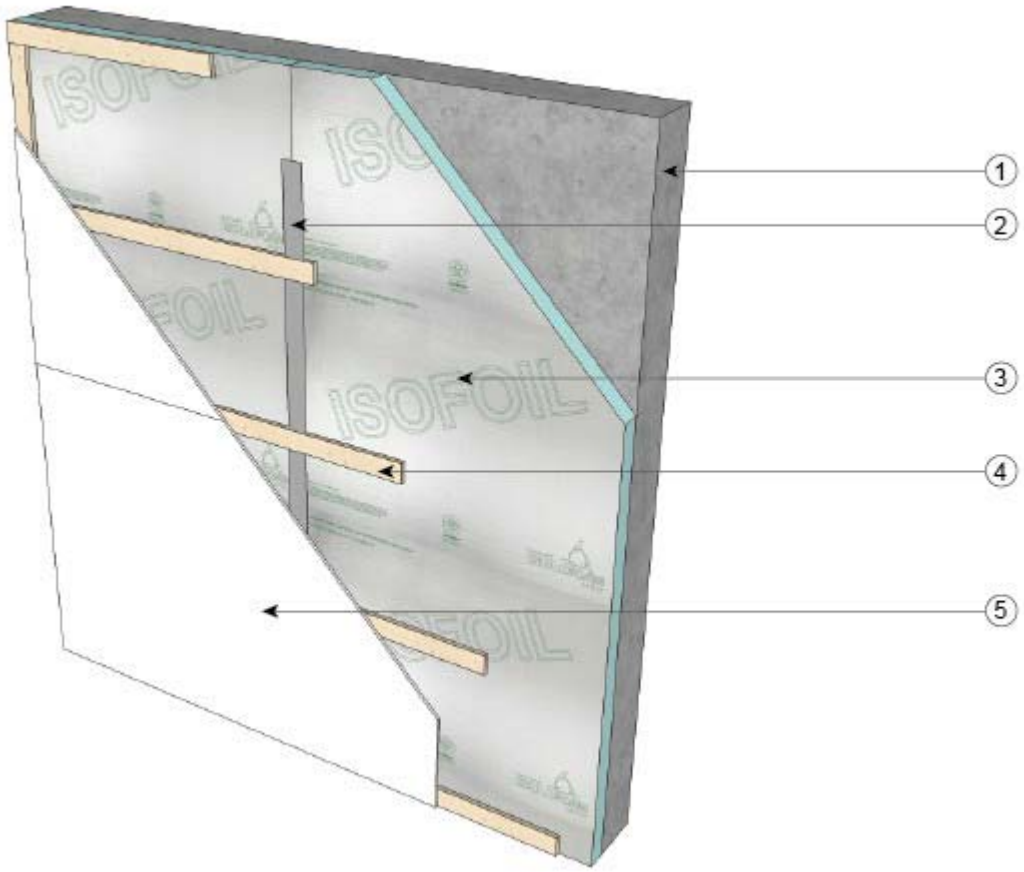

Figure 2. “Isofoil” adjacent to the furred-airspace assembly installed within the manufacturer's designated wall assembly No. 2:

1. **concrete wall (200 mm thick)**
2. **aluminum tape**
3. **“Isofoil” (76 mm thick) with low-emissivity material facing the furred-airspace**
4. **wood furring (19 mm x 64 mm) installed horizontally at 600 mm o.c.**
5. **gypsum board (12.7 mm thick) installed horizontally**

Table 4.2.3 Thermal Resistance Values for the Manufacturer's Designated Wall Assembly No. 3

Property	Unit	Requirement	Result	
			L_1[1]	L_2[1]
Room-side air temperature	°C	Report value	20	20
Weather-side air temperature	°C	Report value	-35	-35
Thermal resistance of the wall[2]	$m^2 \cdot K/W$	Report value	2.96	2.89
Design thermal resistance of the wall[3]	$m^2 \cdot K/W$	Report value	3.11	3.04
Contribution of the furred-airspace assembly to the thermal resistance of the wall[4][5]	$m^2 \cdot K/W$	Report value	0.48	0.41

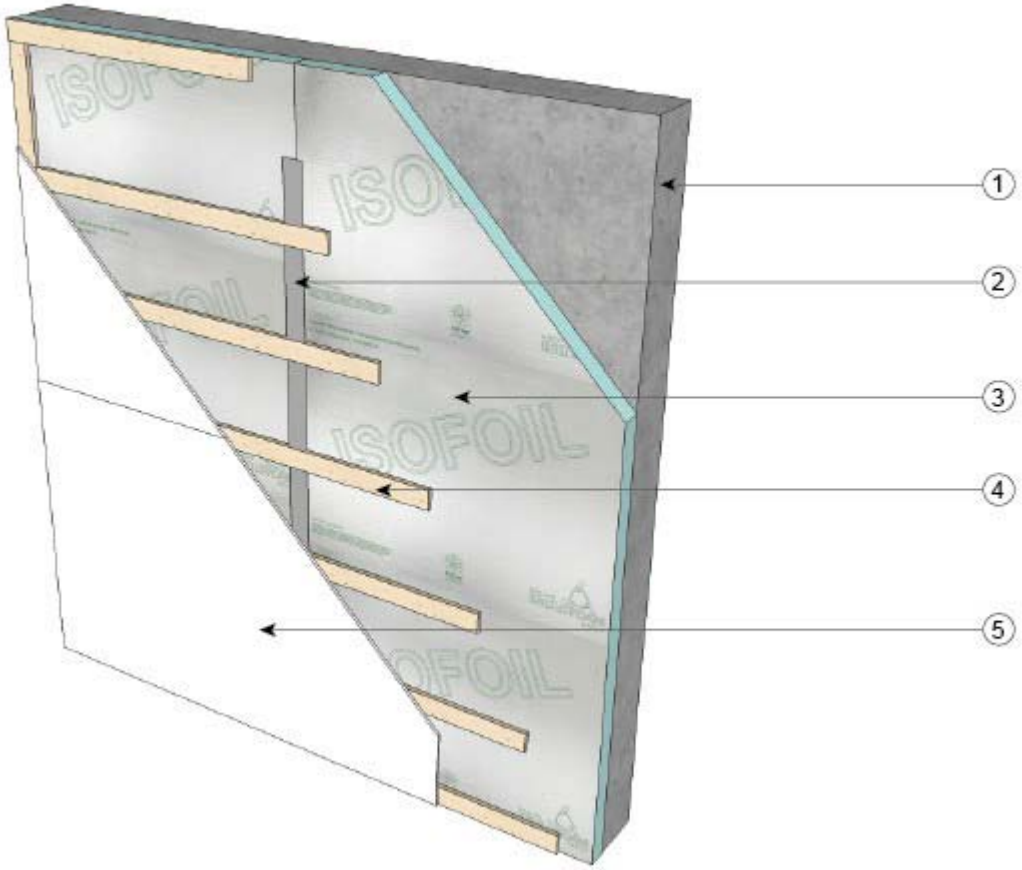

Figure 3. "Isofoil" adjacent to the furred-airspace assembly installed within the manufacturer's designated wall assembly No. 3:

1. **concrete wall (200 mm thick)**
2. **aluminum tape**
3. **"Isofoil" (76 mm thick) with low-emissivity material facing the furred-airspace**
4. **wood furring (19 mm x 64 mm) installed horizontally at 400 mm o.c.**
5. **gypsum board (12.7 mm thick) installed horizontally**

Table 4.2.4 Thermal Resistance Values for the Manufacturer's Designated Wall Assembly No. 4

Property	Unit	Requirement	Result	
			ι_1[1]	ι_2[1]
Room-side air temperature	°C	Report value	20	20
Weather-side air temperature	°C	Report value	-35	-35
Thermal resistance of the wall[2]	$m^2 \cdot K/W$	Report value	3.16	3.09
Design thermal resistance of the wall[3]	$m^2 \cdot K/W$	Report value	3.31	3.24
Contribution of the furred-airspace assembly to the thermal resistance of the wall[4][5]	$m^2 \cdot K/W$	Report value	0.68	0.61

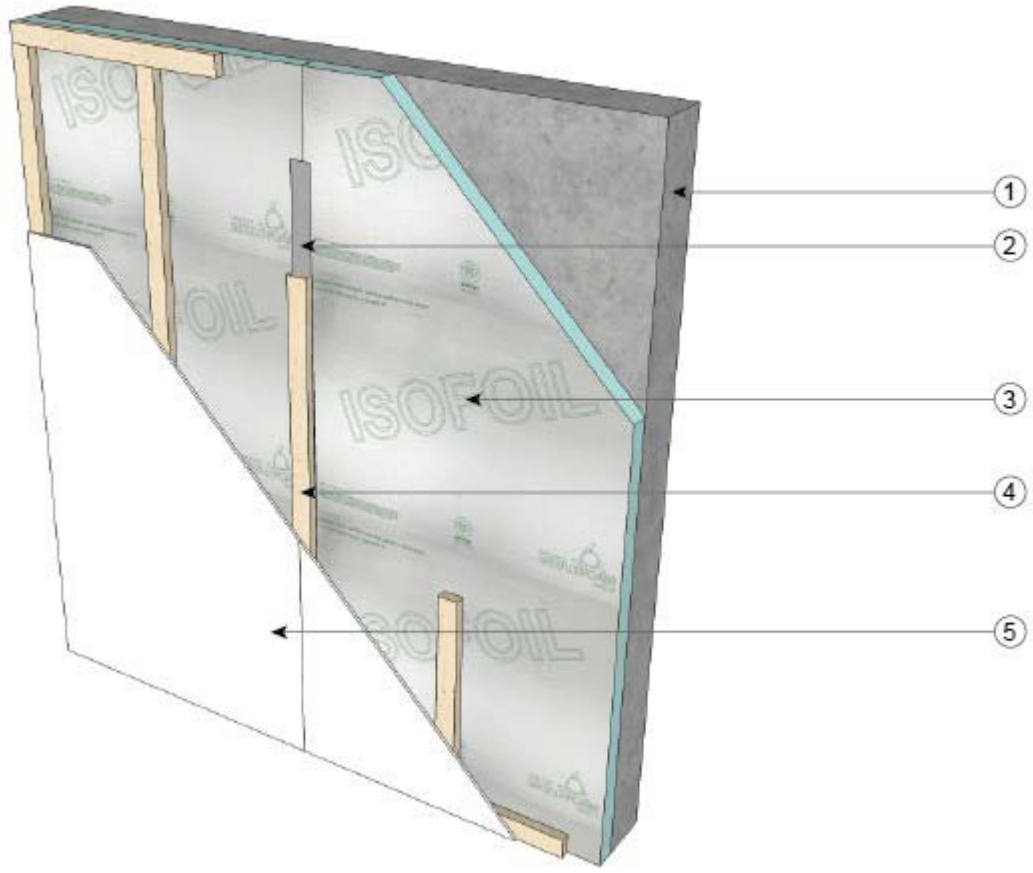

Figure 4. “Isofoil” adjacent to the furred-airspace assembly installed within the manufacturer's designated wall assembly No. 4:

1. **concrete wall (200 mm thick)**
2. **aluminum tape**
3. **“Isofoil” (76 mm thick) with low-emissivity material facing the furred-airspace**
4. **wood furring (38 mm x 64 mm) installed vertically at 600 mm o.c.**
5. **gypsum board (12.7 mm thick) installed vertically**

Table 4.2.5 Thermal Resistance Values for the Manufacturer's Designated Wall Assembly No. 5

Property	Unit	Requirement	Result	
			ι_1[1]	ι_2[1]
Room-side air temperature	°C	Report value	20	20
Weather-side air temperature	°C	Report value	-35	-35
Thermal resistance of the wall[2]	$m^2 \cdot K/W$	Report value	3.15	3.08
Design thermal resistance of the wall[3]	$m^2 \cdot K/W$	Report value	3.30	3.23
Contribution of the furred-airspace assembly to the thermal resistance of the wall[4][5]	$m^2 \cdot K/W$	Report value	0.67	0.60

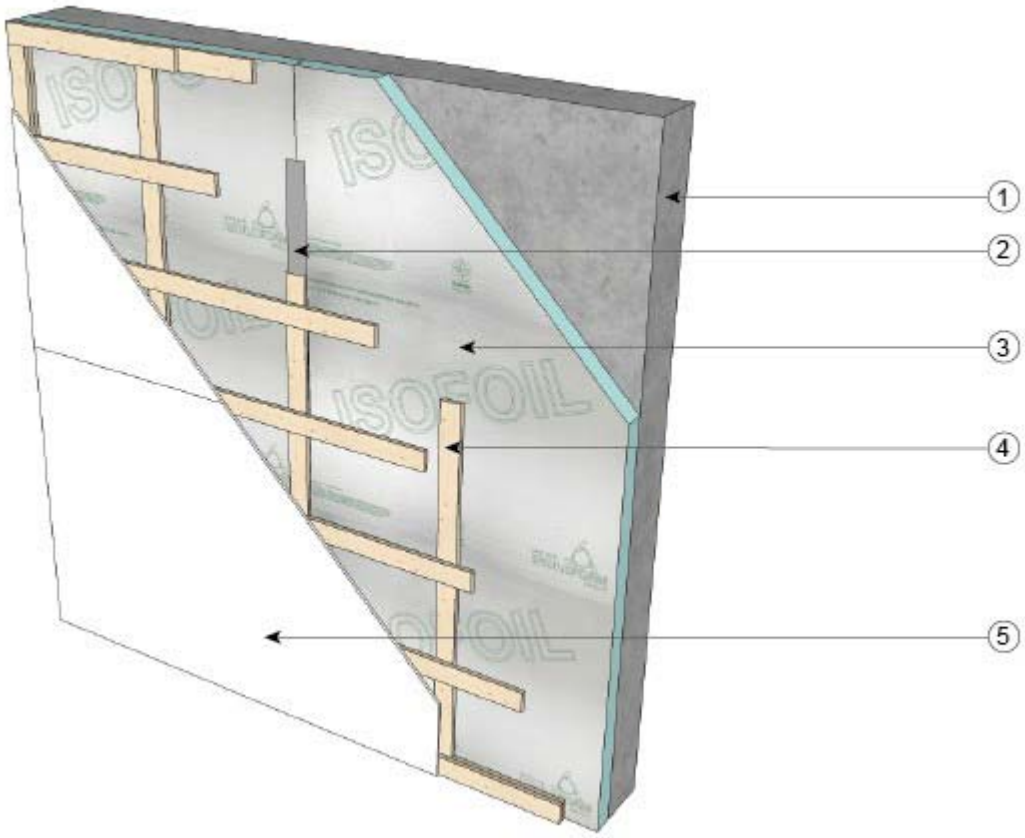

Figure 5. "Isofoil" adjacent to the furred-airspace assembly installed within the manufacturer's designated wall assembly No. 5:

1. **concrete wall (200 mm thick)**
2. **aluminum tape**
3. **"Isofoil" (76 mm thick) with low-emissivity material facing the furred-airspace**
4. **double wood furring: 19 mm x 64 mm furring installed vertically at 600 mm o.c. and 19 mm x 64 mm furring installed horizontally at 400 mm o.c.; the total thickness of the FAA is 38 mm.**
5. **gypsum board (12.7 mm thick) installed horizontally**

Notes to Tables 4.2.1 to 4.2.5:

1 The concrete layer considered in the numerical modeling is 200 mm thick with a density of 2 400 kg/m^3 and a conductivity of 1.4 W/m·K for k_1 and 2.9 W/m·K for k_2. As per the ASHRAE Handbook, the average conductivity for concrete with a density of 2 400 kg/m^3 is 2.2 W/m·K.

2 Excludes room- and weather-side air films.

3 This value takes into account the interior and exterior air film conductance data from the ASHRAE Handbook of 8.29 W/m^2·K (corresponding resistance is 1/8.29) and 34.00 W/m^2·K (corresponding resistance is 1/34.00) respectively. This is the design thermal resistance value to be used for Code compliance.

4 The furred-airspace assembly consists of the LEM within a sealed air space with furring. Room- and weather-side air films are excluded.

5 The contribution of the furred-airspace assembly to the thermal resistance of the complete wall is calculated as the difference between the thermal resistance of the tested complete wall and the base wall.

Report Holder

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