

RE: Open Cell Foam Insulation – Clearing up Air Barrier Confusion

There is confusion in the marketplace over air permeance of open cell spray foam insulation materials. Are all open cell foam insulation materials air impermeable? Do they meet the requirement of an air permeance that is equal to or less than $0.02 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ so as to be classified as an air barrier material?

The air permeance of insulation material is measured using ASTM E 283 as listed in section R806.4.2 of the 2006 IRC (International Residential Code). ASTM E 283 is the Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

The fact is that Icynene® has qualified as an air barrier as per ASTM E 283, using only wood fiberboard as the testing substrate. The wood fiberboard material was deliberately selected because the material offers little if any resistance to air movement.

Testing was conducted by Bodycote Materials Testing Canada Inc. Bodycote is an International Code Council – Evaluation Service (ICC-ES) accepted laboratory facility.

Test specimens were constructed using $3 \frac{1}{2}$ " of Icynene® foam insulation applied to a $\frac{1}{2}$ " thick wood fiberboard substrate. Prior to preparation of the foamed samples, the air leakage rates of the fiberboard specimens were determined in accordance with the ASTM E 283 test method at a pressure differential of 75 Pa. The air leakage rates of the bare fiberboard specimens were so high that no measurable pressure differential could be generated. The air leakage rates of $3 \frac{1}{2}$ " Icynene® on $\frac{1}{2}$ " wood fiberboard were then tested in accordance with ASTM E 283 within a 0 – 250 Pascal pressure range. The average air permeance of the $3 \frac{1}{2}$ " thick Icynene® samples was found to be $0.009 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$. This is well below the maximum air leakage rate of $0.02 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$, required to meet an air barrier material designation.¹

Another open cell foam insulation manufacturer has conducted air permeance testing in accordance with ASTM E 283. The samples, however, were prepared by spraying the open cell spray foam insulation on to Fiberglass Reinforced Panels, FRP panels. FRP panels are made up from a modified polyester copolymer and inorganic fillers and pigments. The temperature service range for FRP is up to 150° F . The temperature generated during the application of the open cell foam would be in the range of 250° F : well above the service temperature limit.²

The test result for $3 \frac{1}{2}$ " of this foam which was removed from the FRP, was $0.000 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$ and for $7 \frac{1}{2}$ " it was still $0.000 \text{ L/s}\cdot\text{m}^2 @ 1500 \text{ Pa}$. These results reflect air tightness values that are far greater than expected for an open cell spray foam insulation material. As a comparison, the air permeance of $3/8$ " plywood sheathing is $0.0067 \text{ L/s}\cdot\text{m}^2 @ 75 \text{ Pa}$. So apparently, $3/8$ " plywood sheathing is more air permeable than this manufacturer's open celled foam insulation material. How can this be? We do not have an explanation, however we speculate that perhaps melting of the FRP resin created a seal on the surface of the test specimen creating an air impermeable film.

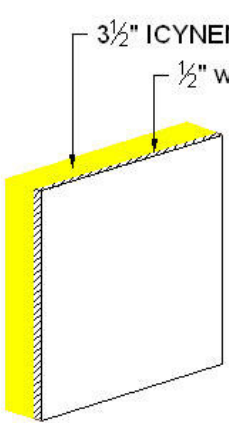
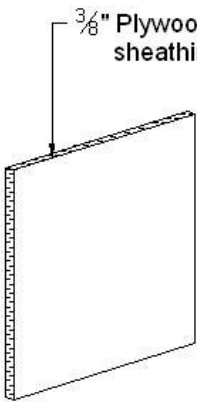
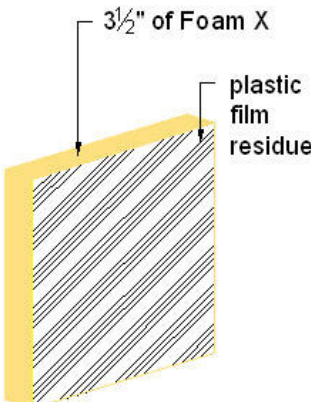
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What we do know is that the ICC-ES has recently modified their AC-12 Acceptance Criterion for foam plastic insulation materials. Air permeance testing must now be conducted using 1/2" wood fiberboard as the substrate against which the foam sample is sprayed. The data contained in the ICC-ES evaluation reports will be from ASTM E 283 testing using the wood fiberboard open cell foam samples. FRP substrates will not be allowed. This standardization will eliminate marketplace confusion.

1. Bodycote Materials Testing Canada Inc. Evaluation of The Icynene Insulation System[®] according to the CCMC Technical guide for Air Barrier Materials, ASTM E 283, June 5, 2002.
2. Technical Bulletin: Fiberglass reinforced plastic (frp) wall panel.

AIR PERMEABILITY COMPARISON

<p>Test assembly in accordance with ICC-ES AC-12</p>  <p style="text-align: center;">Assembly tested as per requirements of ASTM-E283</p> <p>Air Permeance : 0.009 L/s·m² @ 75 Pa</p>	<p>Test specimen of general interest</p>  <p style="text-align: center;">Assembly tested as per requirements of ASTM-E283</p> <p>Air Permeance : 0.0067 L/s·m² @ 75 Pa</p>	<p>Test assembly <u>not</u> in accordance with ICC-ES AC-12</p>  <p style="text-align: center;">Assembly tested as per requirements of ASTM-E283</p> <p>Air Permeance : 0.000 L/s·m² @ 75 Pa</p>
<p>No pressure loss across wood fiber board. (★) Air flows freely through the fiber board.</p>		
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> AN OPEN CELL FOAM WITH LOWER AIR PERMEANCE THAN SOLID PLYWOOD SHEATHING ?? </div>		



1-800-758-7325
www.icynene.com