

# Complications for mechanically attached single-ply membranes

New code requirements may limit roof system design

by Mark S. Graham

*The 2012 International Energy Conservation Code*® (IECC 2012) includes new requirements intended to limit air leakage through buildings' thermal envelopes, including roof assemblies. These requirements are changes from the code's previous editions and could make designing mechanically attached single-ply membrane roof assemblies more complicated.

## Air retarders

IECC 2012 Section C402.4—Air Leakage (Mandatory) requires buildings' thermal envelopes for all commercial (nonresidential)

buildings, except those in Climate Zones 1 through 3, to include a continuous air barrier. Areas where a continuous air barrier is not required include Alabama, Florida, Hawaii, Louisiana, Mississippi, South Carolina and portions of Arizona, Arkansas, California, Georgia, Nevada, New Mexico, North Carolina, Oklahoma, Tennessee, Texas and Utah.

The assemblies option allows assemblies of multiple materials to comply with an average air leakage if they do not exceed 0.04 cfm/ft<sup>2</sup> under a pressure differential of 0.3 inches of water gauge when tested according to ASTM E2357, "Standard Test Method for Determining Air Leakage of Air Barrier Assemblies"; ASTM E1677, "Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls"; or ASTM E283, "Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."

The whole building option requires complete buildings be tested and the resulting air leakage rate not exceed 0.4 cfm/ft<sup>2</sup> under a pressure differential of 0.3 inches of water gauge when tested according to ASTM E7979, "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization."

## Roof assemblies

IECC 2012 permits an air retarder to be located inside or outside a building thermal envelope, within assemblies composing the building thermal envelope or any combination of these options.

For roof systems, built-up, polymer-modified bitumen and fully adhered single-ply membranes comply with IECC's deem-to-comply materials option without additional testing. For these roof system types, the roof membrane functions as the air retarder.

However, other roof system types, including mechanically attached single-ply membrane systems, require system-specific testing to document their compliance with IECC 2012's air barrier requirements.

Testing roof systems' air retarder properties using IECC 2012's assemblies option

generally is not feasible because the code's prescribed test methods apply only to buildings' façades and not horizontal roof systems. Also, because a mechanically attached single-ply membrane likely will flutter when experiencing a pressure differential (evidence of air infiltration into the assembly), such testing would lead to inconclusive results.

Some manufacturers promote the use of an air retarder layer complying with IECC 2012's materials option installed over a roof deck followed by the installation of a mechanically attached single-ply membrane system. This configuration likely does not meet the code's intent because an air retarder generally is not intended to be penetrated by fasteners. Also, if this assembly were tested using IECC 2012's assemblies or whole building options, it likely would not comply with the code's prescribed maximum allowable air leakage rates.

Currently, the only viable option for providing an effective air retarder when using a mechanically attached single ply is to provide the air retarder in a below-deck application.

## Research

NRCA, The Roofing Industry Alliance for Progress, Canadian Roofing Contractors Association and SPRI are undertaking a research project at the National Research Council Canada intended to provide data about air infiltration and leakage of mechanically attached single-ply membranes. The data should help develop code change proposals to IECC 2012 to more adequately address mechanically attached single-ply membranes' air retarder properties. 📊🔍

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Mechanically attached single-ply membrane systems require system-specific testing

IECC 2012 provides three compliance options for air barrier selection and evaluation: materials, assemblies or whole building testing.

Using IECC 2012's materials option, a material with an air permeability no greater than 0.004 cfm/ft<sup>2</sup> under a pressure differential of 0.3 inches of water gauge tested according to ASTM E2178, "Standard Test Method for Air Permeance of Building Materials," complies. Also, some materials, including built-up, polymer-modified bitumen and adhered single-ply membranes, are considered deemed-to-comply without testing.