We construct buildings out of thousands of pieces and parts, assembled in climates with changing weather patterns, temperatures and pressures. Continuous air barrier systems must address joints and seams where sheathing panels meet. Transitions between dissimilar materials, such as sheathing materials and foundations, must be accounted for as well.

Air barrier products must bond structurally to multiple types of substrates and be durable enough to bridge transitions between out-of-plane substrates. Buildings include movement joints to account for anticipated expansion and contraction, so air barrier systems must also accommodate expansion and contraction.

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Self-Adhering Water-Resistive: An Edge for Security

By Peter Barrett, Cosella-Dörken Products Inc.

For designers selecting an air barrier membrane, airtight vapor-permeable self-adhering water-resistive barriers make an excellent choice. These membranes offer many advantages over other air barrier materials. They’re made from multi-layer durable spun-bonded polypropylene, and use a special pressure-sensitive adhesive to fully bond with the substrate.

Full Bond with Substrate

Like fluid-applied membranes, self-adhering vapor-permeable sheets require no fasteners for installation, eliminating hundreds of potential air- and water-leakage points. Self-adhering membranes also fully bond with substrates. That means liquid water can’t collect between the membrane and the substrate. Additionally, the full bond eliminates the pumping action that moves air behind mechanically attached membranes as pressures on the wall assembly alternate between positive and negative.

Assembly-Performance, Code-Compliance Advantages

Many construction professionals consider overlaps to be the weakest points in sheet-membrane systems. Fluid-applied membranes are monolithic and don’t require laps for continuity. Many self-adhering membranes do have difficulty with sticking to themselves. However, designers can specify suitable treatments for overlaps to ensure air barrier continuity. Self-adhering vapor-permeable sheet membranes with front-side adhesive strips create secure, airtight overlaps with no de-bonding concerns. The proper accessory tape seals non-factory edges.

It’s the details, though, that make or break air- and water-tightness. Large wall areas seal relatively easily compared to critical details like windows. Even fluid-applied membranes may rely on the security of a sheet membrane to make these detail areas air- and watertight.

Self-adhering vapor-permeable membranes can also provide security that fluid-applied membranes can’t, for both wall-assembly performance and code compliance.

For wall-assembly performance, factory-made membranes provide dependable, reliable quality. Machines manufacture consistent grades of material. Once the designer has selected the critical performance level, they have the security of knowing they can meet code and exceed expectations.

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Self-adhered membranes use a special pressure-sensitive adhesive to fully bond with the substrate. Here, installers apply a self-adhered membrane over plywood sheathing at the Denver Botanic Gardens. Photo courtesy of Cosella-Dörken Products Inc.
Fluid-applied air barriers are excellent in these conditions. They’re often highly flexible and designed to meet and exceed high elongation requirements utilizing test methods such as ASTM D 412 Tensile Strength Properties of Rubber and Elastomers. While self-adhered barriers might also be flexible, they depend on overlapping the membranes for continuity. Think of a Band-Aid stuck to another Band-Aid to cover a large cut. Instead of bonding structurally to the building substrate, self-adhered barriers must bond to each other. Loss of adhesion can leave the building completely unprotected.

If air barrier systems don’t account for the same stresses that buildings experience, they may not only lose effectiveness, but may create problems within the wall cavity — problems that go undetected until extensive damage is done.

Environmental Advantages

The International Building Code, the International Residential Code and the International Energy Conservation Code have specific requirements that products must meet to qualify as both air barriers and water-resistive barriers. Common tests, such as AATCC Test Method 127 Water Resistance: Hydrostatic Pressure Test, measure a product’s ability to resist water penetration under adverse conditions, such as wind-driven rain, which is simulated by placing the product under hydrostatic pressure. Both fluid-applied and self-adhered barriers typically meet similar performance standards, and so secondary questions become important in deciding which product to include in the design.

Architects face other considerations in specifying products. For example, some self-adhered membranes include petroleum-based products, generating questions ranging from environmental impact to potential combustibility. Fluid-applied barriers, on the other hand, may use any of a variety of chemistries including water-based, which easily meet Environmental Protection Agency standards.

Durable, Easy to Install

Fluid-applied barriers are gaining popularity in both commercial and residential construction due to their ability to form a full monolithic barrier, as well as for their durability and ease of application.

Fluid-applied barriers are generally rolled or sprayed onto sheathing or CMU backup. They fully adhere, becoming part of the structural wall. Similar to paint, fluid-applied barriers take the shape of the buildings they protect, adapting easily to complex geometries. To verify a full bond between the barrier and the substrate, some manufacturers of fluid-applied barriers use adhesion testing, such as ASTM C297 Standard Test Method for Flatwise Tensile Strength of Sandwich Construction.

They often find the adhesion exceeds the substrate strength. While some self-adhered barriers may make similar claims with regard to adhesion, self-adhered barriers are produced in pre-formed rolls or sheets. That means when installers face critical details such as openings, they must know the proper folding, cutting, lapping or self-adhered “origami” to properly install these products.

Improper installation of self-adhered membranes can result in problems such as fish mouths, wrinkles and loss of adhesion. That creates potential for long-term system failure and moisture damage.

Fluid-applied systems may be able to protect structural details using only one or two components. Self-adhered systems often require additional primers and mastics to properly seal and protect.

Redundant Protection

A good fluid-applied system incorporates some method of bridging or filling joints. That may take the form of a separate liquid, top-coated by the fluid-applied barrier, or reinforcing meshes or fabrics might be embedded in the liquid barrier. Addressing joints this way creates a redundant system, like using an umbrella while wearing a rain jacket: You’re doubly sure not to get your clothes wet.

When it comes to protecting buildings, redundancy is not a bad word. That is another advantage of fluid-applied barriers’ liquid nature.

While bridging joints and gaps in fluid-applied air barrier systems may call for multiple components, these products embed in the membrane, maintaining continuity. Self-adhered membranes, as mentioned, rely on overlapping or tape for continuity.

Fluid-applied barriers don’t use nails, screws, staples or other fasteners for installation. That means the holes those fasteners cause in mechanically fastened barriers are
not a concern in fluid-applied. Also, simple roller and/or spray application reduces the possibility of installation error. It also makes repairing incidental damage to the fluid-applied air barrier quick and easy. If proper thickness of the barrier is a concern, a simple wet mil gauge, available at any paint store, is a quick and easy quality-control test.

Fluid-applied air and moisture barriers can make designing and constructing energy-efficient buildings easier. While self-adhered membranes may be excellent products, their proper installation can be more difficult, which can lead to mistakes. A fluid-applied solution makes sense and grants peace of mind.

About the Author
John Chamberlin is product manager for StoGuard and StoEnergy Guard at Sto Corp. These divisions are focused on heat, air and moisture management within the building envelope. Prior to this position, he served as product manager for StoCoatings. Before that, he was the associate product manager for StoPowerwall and StoQuik Silver. Chamberlin has an M.B.A. from Emory University and is a graduate of the University of Tennessee, with a bachelor’s degree in marketing.

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criteria of water-resistance and vapor-permeability, sheet-applied membranes can assure set performance standards. There is no variation in thickness, water holdout ability or permeability across the plane of the membrane.

Sheet membranes are easy to inspect and repair. While fluid-applied membranes are monolithic and free from overlaps that are the weakness of some factory-made membranes, they’re not without their own drawbacks.

Installers create the performance layer of fluid-applied membranes during application. The final product depends on the skill of the applicator. Manufacturers’ data sheets indicate the membranes’ water-resistance and vapor-permeability within “dry film” parameters. Designers, however, have no way to know the consistency of the membrane actually applied on the jobsite.

As the thickness of the film increases, vapor permeability goes down and liquid water-resistance goes up. As thickness decreases, vapor permeability goes up, but liquid water-resistance goes down. As a result, wall assemblies may perform as desired in some areas but not others.

Building code compliance is another point where vapor-permeable sheet air barriers compare favorably to fluid-applied air barriers. The 2012 International Building Code (IBC) defines a vapor-permeable membrane as having “a moisture vapor permeance rating of 10 perms (5.7 x 10^-10 kg/Pa x s x m^2) or greater when tested in accordance with the desiccant method using Procedure A of ASTM E 96 [Standard Test Methods for Water Vapor Transmission of Materials]” (IBC 2012 Definitions, p. 38). The International Residential Code (IRC) requires the same test method, but allows a lower limit of 5 perms (2.9 x 10^-10 kg/Pa x s x m^2) or greater (IRC 2012 Definitions, p. 23).

These requirements are significant for two reasons. One, when selecting a vapor-permeable air barrier, of any type, many manufacturers publish only ASTM
E 96 Method B (Wet Cup Method). They do so because the perm rating using Method B is practically always higher (more favorable) than when testing using Method A. Designers must be careful to interpret the published perm rating correctly and equivalently to comply with code, as well as to achieve the desired wall system performance.

That leads to the second significant point. Air barrier membranes, including some fluid-applied membranes, meet neither of these building code definitions for a vapor-permeable membrane — but their manufacturers claim them to be vapor permeable anyway.

Designers must be careful in selection. A material with a published perm rating of 8 perms under ASTM E96 Method B likely will not be compliant under either IBC or IRC, since ASTM E96 Method A results will be even lower. It’s generally safe to assume that if a manufacturer does not specifically state which method was used to obtain the published perm rating, it was likely Method B.

To make the proper selection, it is important to clearly understand perm ratings in relation to building code requirements and the design goals for wall system performance.

Self-adhering vapor-permeable air barrier membranes make excellent choices for designers who want consistent, factory-controlled and reliable performance.

About the Author
Peter Barrett is product manager for Cosella-Dörken Products. He has been with Cosella-Dörken for more than six years. His involvement with the design and construction of building enclosures, from the footings to the roof, spans over 25 years. He is the author of numerous articles on the topic. He holds a bachelor’s degree (Hons) from Queen’s University and an M.B.A. from Wilfrid Laurier University. The Dörken Group has been manufacturing premium moisture protection systems for over 120 years.