CertainTeed

MemBrain™

Continuous Air Barrier & Smart Vapor Retarder

TECHNICAL BROCHURE

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SAINT-GOBAIN

Managing Air & Moisture Flow to Create Comfortable, Healthy Buildings

A Complete Approach

Whether you are an architect, builder, contractor, distributor or code official, you are being bombarded by countless challenges in the buildings you are helping to create. It is your responsibility to minimize problems (e.g. mold, mildew, etc.) and increase value (i.e. energy efficiency) for your customers and you are being held accountable for addressing multiple challenges while also providing added value:

– Developing sustainable structures that are durable and energy efficient
– Ensuring occupant health and safety by designing for optimum indoor air quality
– Planning for unpredictable moisture management

Any person knowledgeable in the physics of buildings will tell you that a complete approach must be taken to address these issues to ensure that you provide your customers with comfortable, healthy buildings. Two of these flows – air & moisture – can be easily addressed by understanding how the mechanics of the building work and knowing which solutions can be leveraged to accomplish your goals.

A Changing Environment

Not making things any easier is the advent of new business challenges: popular cladding products hold moisture, the rate of building failures due to moisture keeps increasing, building codes are driving tighter construction and enhanced energy efficiency, and there is a growing shortage of skilled labor and training available.

Our walls are also wetter than they have ever been. This is not because the physics have changed, but because new construction practices are not as easily allowing the moisture that's getting in, to get out. We have a growing need for increased R-values in our building assemblies along with a steep reduction in air movement through the wall. While these efforts are great from an energy-efficiency standpoint, the lower rate of drying is now presenting our industry with new challenges that cannot be neglected. Once these walls get wet, they stay wet.

The Hidden Costs of Change

The building industry is now spending more than $9 billion per year on moisture repair and litigation, and these amounts are only expected to increase as we drive toward more energy-efficient wall assemblies. Average builders can spend anywhere from $500 to $1500 per home in moisture callbacks. Many builders are also averaging up to 11-20% in callbacks per year (Building America Study). At these rates, a large production builder could be averaging 50-100 callbacks per year at up to $150,000. With the current labor challenges and changes in energy-efficient construction, callback costs are almost guaranteed to increase.

Building Business – Not Callbacks

In order to prevent building failures, building professionals must focus on developing products and systems that can help manage the moisture that gets into their buildings. More than 80% of building failures are due to excess moisture, so until this problem is addressed, it will not only continue, but its effects can be expected to increase in frequency.

The ideal road map for mitigating these challenges is to start by incorporating higher standards in product choice and selection for your projects. A great first step is to focus on the management of air and moisture flow through the building envelope. Smart vapor retarders are able to address both air flow and manage the moisture profile of the exterior wall cavity. This helps to minimize and limit the risk of moisture-based building issues while adding no additional labor. A simple solution with a big payoff. Property owners are even willing to consider upgrades like this when presented as an option, as they want to minimize their risks as well.

By offering advanced solutions, you are enhancing the value of your business to your customers. Some builders have even seen a 50% reduction or more in callbacks simply by incorporating higher standards into their construction methods (2004 Harvard Study, Norberg-Bohm and White).

Managing Air: Selecting the Right Air Barrier Approach

A leaky structure can compromise an entire building envelope, and air tightness has a tremendous effect on every other performance aspect of the building envelope: thermal comfort, indoor air quality (IAQ) and energy efficiency.

The two primary functions of these materials are:

1. To provide a vapor-permeable layer that allows moisture trapped in the wall to escape.
2. To be an energy-efficient air barrier that stops air infiltration and exfiltration through the wall.

Exterior air barriers have the additional challenge of providing a weather barrier behind the exterior cladding while protecting the sheathing. This is why relying on them to also provide air tightness is not advisable.

If an exterior housewrap is left exposed on a job site for longer than its UV rating permits, it is susceptible to material degradation that could result in tears and holes. In many instances, the housewrap is treated as an exterior air barrier; however, critical details that can affect performance are often missed — such as missing tape at seams or overlapping corners.

AIR TIGHTNESS IS KEY!

OVERALL COMFORT

Leaky cracks and joints will invariably cause uncomfortable drafts.

INDOOR AIR QUALITY

Excellent air quality in buildings can only be achieved by exchanging indoor air with fresh outdoor air at regular intervals; this ventilation efficiency can't be guaranteed without good air tightness.

ENERGY EFFICIENCY

Even small leaks add up to significant energy costs.

Most of these issues can be overcome by the builder, superintendent or project manager with proper planning and attention to detail; however, it is impossible to monitor the job site all the time. There are a few strategies — such as the airtight drywall approach or a simple caulk and seal, for example — that the insulation contractor can employ to ensure that the insulation installed performs as intended. But there is only one solution that actually addresses both the need for air tightness and active moisture management in one application: installing a smart vapor retarder as a continuous air barrier.

The Air Barrier Association of America (ABAA) requires the following characteristics to be considered when considering exterior air barriers:

Air Resistance

- Most exterior air barriers are tested for their resistance to air movement; however, these testing standards provide a limited account of the impact of seams and penetrations that are critical to their function as an air barrier system.
- Continuity is also critical, and vital details are often missed in the application of these products.
- While the application of these systems is valuable, a more effective air barrier system also addresses the air tightness at the interior air control layer.

Water Resistance

- These materials are required to withstand bulk water.

Vapor Permeability

- Vapor permeance is a key attribute when considering an air barrier as it affects everything from comfort and IAQ to the energy efficiency of the building envelope.

Durability

- Physical durability is required for a material to be able to withstand the rigors of the job site and last for the lifecycle of the building.

The newest editions of the International Energy Conservation Code® (IECC) 2012 & 2015 have made air sealing requirements much more stringent. The 2012 IECC has several new requirements for air sealing and moisture protection in new construction and additions. Two of these flows — air and moisture — can be easily addressed by understanding how the mechanics of the building work and knowing which solutions can be leveraged to accomplish your goals.

Common Methods

Exterior Air Barriers	Interior Air Barriers
Fluid-Applied Membranes	Spray-polyurethane Foam (SPF)
Insulation Board	Polyethylene Vapor Retarder Sheeting
Pre-bonded membranes	**Smart Vapor Retarder**
Water-Resistive Barriers (WRBs) – Mechanically-fastened – Self-adhered	Airtight Drywall Approach
	Simple Caulk & Seal

Understanding 2012 & 2015 IECC Requirements

The air sealing checklist in both the 2012 & 2015 IECC is Table R402.4.1.1, "Air Barrier and Insulation Installation." The table is based on the earlier checklist (2009 IECC, Table 402.4.2) and includes the requirement of a continuous air barrier in the building envelope. However, while the previous codes allowed a blower door test to substitute for the checklist, the 2012 and 2015 IECC versions make both the checklist and a blower door test mandatory. The test must verify:

Climate Zone	Temperature	Required ACH (Air Changes/Hour)	Vapor Retarder Required
1, 2 & 3	Hot & humid, very few heating days	5 or less	No
4	Mixed climate — hot & humid, with several heating months in the winter	3 or less	No
4C (Marine), 5, 6, 7 & 8	Mixed climate — hot & humid, with several heating months in the winter	3 or less	Yes

When it comes to air infiltration and exfiltration, "air out always equals air in," meaning that an interior air barrier can block air flow equally as well as an exterior air barrier. In fact, in terms of practical application, an interior air barrier generally outperforms exterior ones such as housewrap over the lifecycle of the building. In fact, housewrap is subject to several known failures — rips, tears, blown-off wrap — which can cause multiple breaches in the continuous air seal needed. An interior air barrier is far better protected from these hazards and offers a number of other advantages over exterior barriers:

- It is easier to apply consistently without gaps
- It prevents conditioned air from entering the insulation layer — keeping conditioned air within the conditioned space
- It reduces condensation risk — keeping interior humid air away from the cold exterior
- It is protected from the temperature extremes of the outside environment — improving longevity

Managing Moisture:
The Challenges of Vapor Retarder Solutions

The wall was built tight, so where does the water come from? How does it get in?

We all have to accept it at some point—there is no such thing as a waterproof wall. Moisture gets into a wall in many different ways, but it can be narrowed down to two primary types of moisture flow:

- Liquid moisture movement.
- Airborne moisture movement (e.g., vapor).

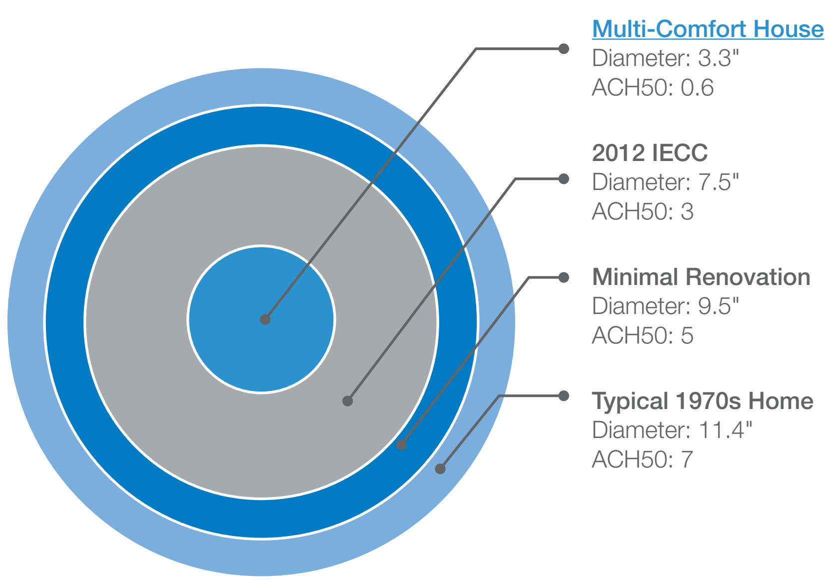
Weather-resistive barriers have greatly improved the way we are able to manage bulk water infiltrating our walls, but these systems are still prone to failure: joints can fail, seals can break and moisture finds its way into the wall. This is why we must develop systems that will allow that excess moisture to escape the assembly.

Airborne moisture movement is tied to two key principles of building physics—diffusion and air leakage. Diffusion is often noticed when an improperly installed vapor barrier begins showing signs of condensation on the material.

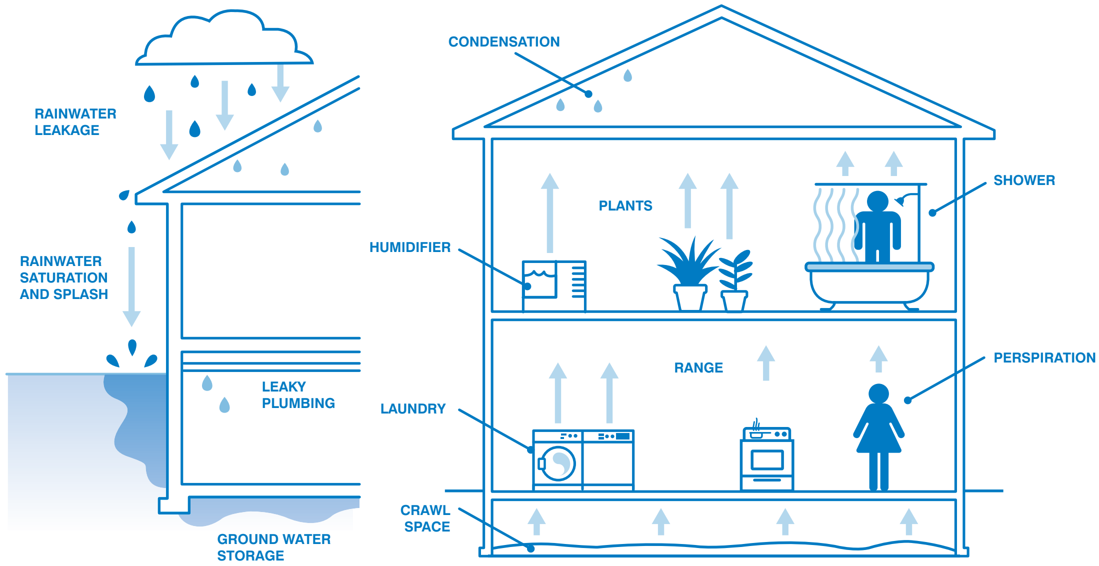
Air movement between the interior and exterior side of the wall can transport significantly higher amounts of water vapor through the same wall. In colder climates during the heating season, 1/3 quart of airborne water passes through a sheet of gypsum board via diffusion, whereas 30 quarts of water can be transported through a small hole in the wall. It is for these reasons that air flow and moisture flow must be managed simultaneously.

When there is a pressure difference, air will find every penetration point into and out of a home, which is why proper air sealing must create a continuous seal. Small gaps can add up. A typical 1970s home experiences enough air leakage to equal an 11.4" diameter hole in the wall. Because of air leakage and its drying potential, those homes, while not energy efficient, did not experience large-scale moisture issues. As we decrease air leakage, moisture vapor management will become critical.

Equivalent hole size for typical leakage rates



Where does the moisture come from?



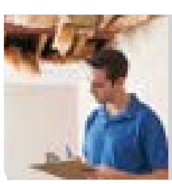
Moisture can enter the cavity from both indoor and outdoor sources. An average family of four can create two to three gallons of water vapor per day by cooking, bathing, washing dishes and doing laundry.

The Consequences of Excess Moisture

If the building envelope is not sufficiently airtight, moist room air can penetrate a wall, condense and cause damage. Just a 0.04"-wide gap can allow up to 1 oz./ft^2 water per day to penetrate the wall. On the other hand, an airtight home that does not properly manage moisture can actually trap moisture in.

- **Mold:** Moisture buildup can cause health issues through mold growth that releases potentially harmful spores into the air.

- **Sick Building Syndrome:** Mold issues, especially in airtight buildings, can cause occupants to experience acute health and comfort problems associated with time spent in the building.



- **Rot:** Persistent moisture can eventually cause expensive structural damage.

- **Thermal Performance:** Excess moisture vapor can compromise the R-value of insulation, reducing thermal efficiency.

- **Liability and Expense:** It can cost up to $26,000 to remove and replace 1,600 ft^2 of roofing damaged by moisture. Additionally, as much as 80% of residential construction defect litigation is due to water and moisture related failures.[1]

It's All About the Potential

Traditional poly vapor retarders block moisture in the winter but trap it during the summer. Historically, building codes have classified vapor retarders as having a water vapor permeance of 1 perm or less when tested in accordance with the ASTM E96 desiccant, or dry cup method. Therefore, most products are only evaluated under dry conditions. Products like polyethylene film or aluminum foil have very low permeance values that remain constant between dry and wet conditions.

Vapor retarders slow the rate of water vapor diffusion, but do not totally prevent its movement. However, as water vapor moves from a warm interior through construction materials to a cooler surface, the water vapor may condense as liquid water that could damage the building. It is for this reason that smart vapor retarders are needed. They not only retard moisture penetration, but also the potential for wet materials to dry; therefore, the drying potential of the wall must always be greater than the wetting potential so that the amount of moisture that gets into the system is less than the amount of moisture that can leave it.

> "Although biological contaminants have been given little attention until relatively recently, substantial proportion of building-related illness (BRI) and sick building syndrome (SBS) … is the result of exposure to such contaminants. … There is abundant evidence from investigations in several countries that symptoms of eye, nose, and throat irritation as well as cough and tiredness and fatigue are present in excess among persons or populations in certain buildings. Although several agents have been suggested as causative, the most extensive evidence is found for dampness and mold."
>
> — American Industrial Hygiene Association[2]

> "Since an interior polyethylene vapor barrier prevents wall assemblies from drying inward during the summer, a layer of poly can actually make the wall wetter than it would be without the poly."
>
> — Green Building Advisor[3]

[1] http://www.buildingmedia.com/stock/moldandmoisture.html
[2] "Field Guide for the Determination of Biological Contaminants in Environmental Samples," AIHA
[3] "Do I Need a Vapor Retarder?" Green Building Advisor, www.greenbuildingadvisor.com/blogs/dept/musings/do-i-need-vapor-retarder

Hidden within building cavities, wet insulation loses R-value. The result is a less energy-efficient building and potential for mold and mildew growth. Further, repeated wetting leads to material deterioration. It is for these reasons that more advanced solutions, like smart vapor retarders, need to be considered for today's wall assemblies because they could make the difference between a healthy, durable wall and one that is subject to failure.

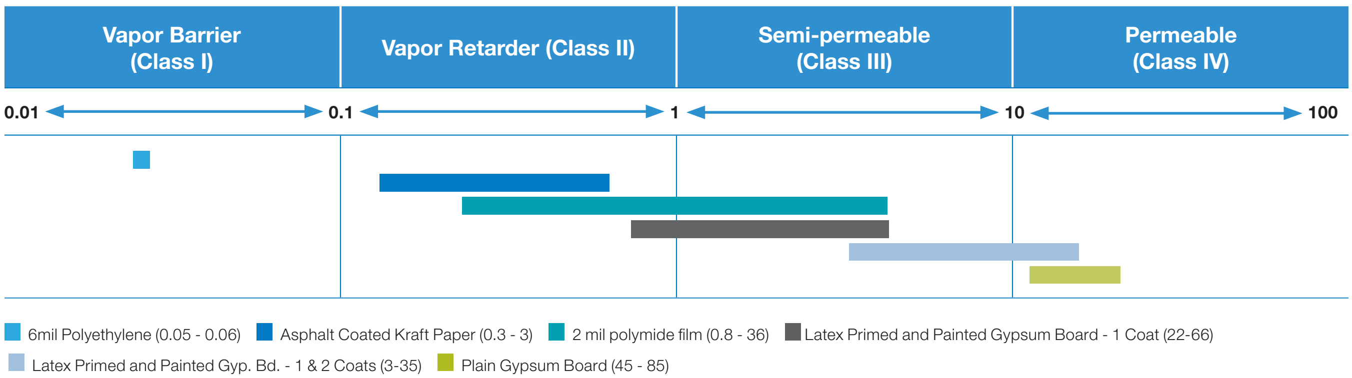
What makes it "smart"?

A "smart" vapor retarder has the unique ability to be able to react to changes in relative humidity by altering its physical structure. During the winter, when relative humidity is low, smart vapor retarders are able to provide resistance to vapor penetration from the interior. However, when the relative humidity increases to 60% or above, its permeance dramatically increases, thus allowing the water vapor to pass through, facilitating the drying of wet building systems.

Climate Influences Vapor Retarder Selection and Placement

In certain climate zones, vapor retarders are mandatory building code requirements, but some may not realize that there are, in fact, sub-categories or vapor retarders, often called “variable” or “smart”, as they are able to to adapt to environmental conditions.

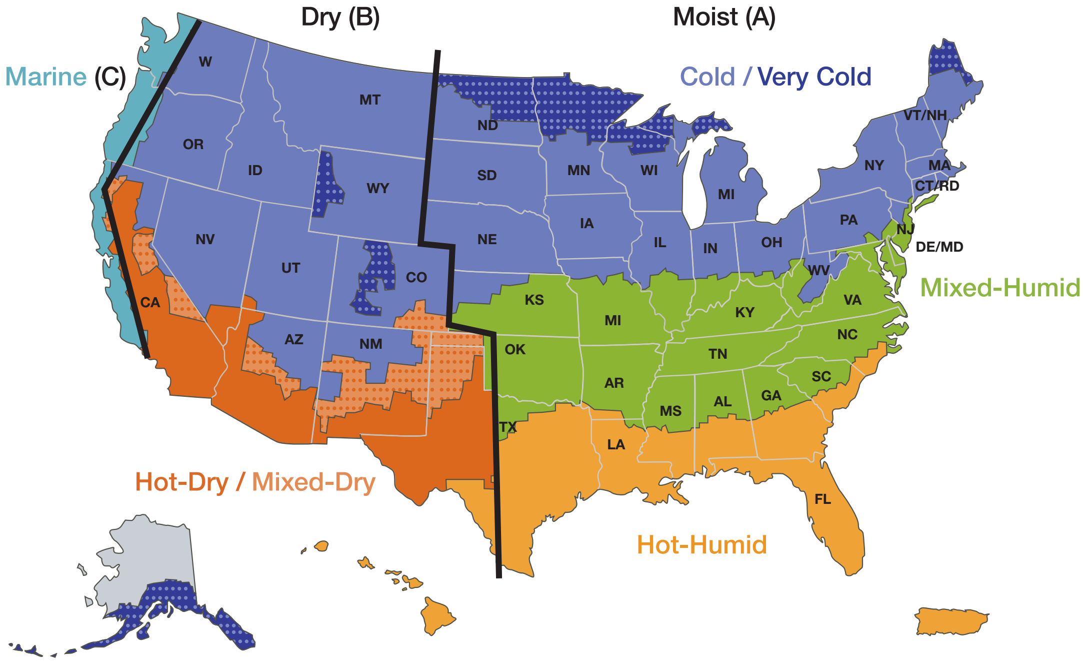
Four Classes of Permeance



When a vapor retarder is required (zones 4C and above), it can present additional challenges as the air tightness of a home increases. Large portions of North America are considered “mixed-climate,” where the moisture-drive direction is balanced between the winter and summer seasons. In these regions, homes using traditional polyethylene vapor retarders may successfully keep moisture out of the cavity in the cold season, but traps it there during summer when the moisture drive reverses. The increased use of moisture-retaining cladding, such as masonry, fiber cement and stucco, which release moisture into the building cavity, can exacerbate this issue.

Cold Climate	Vapor retarders are required and should be placed at the interior. • Avoid low-permeance vapor retarders, such as polyethylene film or aluminum foil in: – Climates with high summertime moisture loads – Building envelopes with moisture storage claddings like concrete or brick – Building envelopes with low permeability exterior sheathings such as extruded polystyrene
Mixed-Humid Climates	• Determine if the climate is heating or cooling-dominated: – If heating-dominated, locate vapor retarder at the interior – If cooling-dominated, locate vapor retarder at the exterior of the building envelope • Avoid low-permeance vapor retarders such as polyethylene film or aluminum foil • Consider semi-permeable vapor retarders like asphalt-coated kraft or vapor-retarding paints or, ideally, install a smart vapor retarder, as it is able to adapt to the varying moisture conditions
Mixed-Dry Climate	• If a vapor retarder is required by code, place at the interior • In most cases, a vapor retarder will not be required because rainfall is light and humidity tends to be low, but defer to your local building code for what is required
Hot-Humid Climate	• Place vapor retarders at the exterior, outside of cavity insulation

The Building America Climate Regions



Mixed-humid climates are defined as regions that receive more than 20 inches of annual precipitation, with approximately 4,500 heating degree days and a monthly average outdoor temperature below 45°F in the winter. Winter temperature is critical for building design since air at 70°F, 35% relative humidity (RH) has a dew point temperature of approximately 40°F. As a result, interior air at 70°F, 35% RH (a realistic condition in a tightly constructed home) will condense on a surface that is 40°F or cooler, thus leading to homeowner comfort issues.

How much water will condense on the interior surface of the exterior sheathing (the first condensing surface) is a function of the dew point temperature of the interior air, the amount of air leakage into the wall, and the vapor permeability of the materials in the wall. Small amounts of condensation will not be a problem if the wall is allowed to dry to the exterior.

Moisture is more of a significant problem in this climate than in areas that receive 20 inches or less of rain per year in a single climate area. That's because the ambient air in mixed-humid climates tends to have significant levels of moisture most of the year. In addition, since air conditioning is installed in most new homes, cold surfaces are present on which condensation can occur.

Since both heating and cooling occur for extended periods in mixed-humid climates, it can be difficult to determine the correct method for moisture control. To add to the confusion, The American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) and the Energy and Environmental Building Association (EEBA) recommend that wall systems be allowed to dry toward the interior or exterior environment in mixed-humid climates and, if possible, allow some drying in both directions.

Additional Considerations

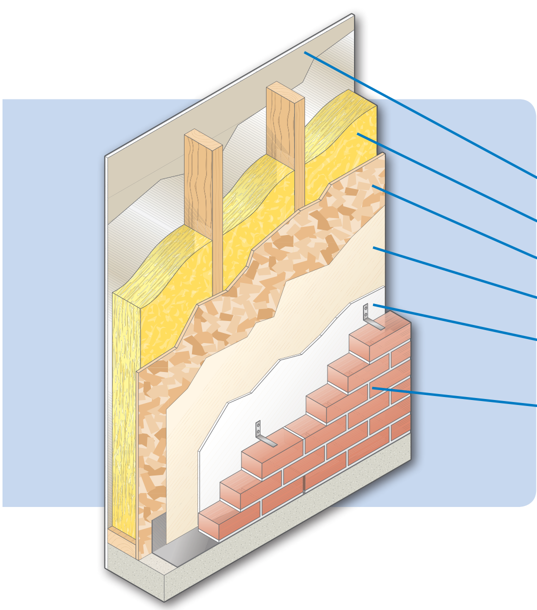
Cladding Type — Moisture-retaining Claddings

According to U.S. Census Bureau 2009 statistics, more than half of all new homes are clad with absorptive materials such as brick, stucco, wood, fiber cement or stone, which are also increasingly prevalent in commercial spaces. These moisture-retaining claddings can worsen moisture challenges in the cavity presented by mixed-humid climates. They have the potential to release their moisture into the structure, creating an inward vapor drive that didn't exist in vinyl cladded assemblies. This can result in more opportunities for problematic condensation with the need dry out to the interior of the building.

Solar heat drives moisture into building materials; this is especially true in the case of moisture storage claddings which can absorb and retain large amounts of moisture. The sun comes out, creating a vapor pressure at the outside of the wall and driving moisture inward into the lower-pressured building assembly. Since it's nearly impossible to prevent moisture from entering 100% of the time, using a smart vapor retarder allows water to escape from building assemblies as water vapor, which permits the assemblies to dry towards the inside of the wall.

The Moisture Sandwich

Many areas of the country are beginning to install exterior insulation. Exterior insulation will help increase your wall's R-value, decrease thermal bridging and reduce the walls permeance level. XPS has a permeance level of 1.0. Anything 1 or below is a vapor retarder. Poly-iso has a permeance level of .03, which is similar to 6-mil poly. Imagine now you have all these factors in place: moisture-retentive cladding (fiber cement/brick/stucco), exterior insulation that acts as a vapor retarder similar to 6-mil poly, OSB which is semi-permeable at 2.0, kraft faced batts at .3-3 or unfaced batts and 6-mil poly with a permeance rating of .05, and, lastly, drywall with a permeance rating of 3-35, depending on paint. This common assembly creates a moisture sandwich: moisture will get into the wall and be trapped between poly-iso foam board on the exterior and 6-mil poly on the interior, with no ability to dry.



Vapor permeance ratings

Any material with a perm rating of 1 or below is considered a vapor retarder:

Drywall (depending on paint)	3 – 35 perms
Unfaced batts with poly	≤ 0.1 perm
OSB sheathing	Approximately 2 perms
Housewrap (water-resistive barrier)	5 – 50 perms
Continuous extruded polystyrene insulation (XPS)	≤ 1 perm
Moisture-retentive cladding (fiber cement/brick/stucco)	Vapor permeable/ moisture retentive

What happens next? Mold and Building Product Deterioration

Take this a step further. Say you have exterior insulation on your structure and you use closed cell foam with a perm rating of .8 at 2.5" thickness for your interior insulation. You think you are doing the right thing. You have 3.5" of spray foam to meet code, plus you have added the exterior insulation. You will have a well-insulated structure but closed cell foam is not smart. It blocks moisture coming and going. Then, with poly-iso or XPS on the exterior, you now have a moisture sandwich again. Remember, any perm rating below 1.0 is a vapor retarder. In this instance, it might be better to use a smart vapor retarder plus fiberglass and your exterior insulation (or go thicker on the spray foam and eliminate the exterior insulation).

The Value of Energy-Efficient Buildings

It has taken some time, but the building industry is finally starting to recognize the value of building energy-efficient and sustainable homes. For many years, the challenge has been that there has been limited understanding of how to quantify and monetize the value of incorporating energy-efficient features into a home. RESNET and the Appraisal Institute have made significant strides in developing tools and methods for quantifying the value of these homes. Some markets, like the Pacific Northwest, have seen these homes stay on the market for 24% less time and at a much higher premium than standard homes in the same market (“An Introduction to Green Homes,” Appraisal Institute). Today’s homeowners are clearly interested in investing in a home that will better address air and moisture flow to ensure their comfort.

Conclusion

MemBrain™ Solves the Air and Moisture Challenges of Mixed-Humid Climates with MoistureSense™ Technology

Many in the industry have called for "breathable" walls as a solution to this problem. A slightly more permeable vapor retarder could allow for necessary moisture diffusion. Drying could occur via vapor diffusion in either direction.

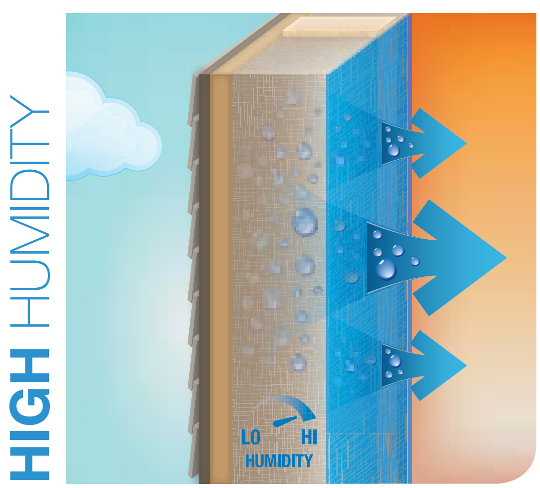
MEMBRAIN™
Continuous Air Barrier & Smart Vapor Retarder

MemBrain™ is the first-to-market and only such technology available. Originally developed, tested and commercialized in Europe, this vapor retarder looks like polyethylene, but is actually nylon-based, which gives it high tensile strength. (A 2-mil sheet of MemBrain has the equivalent strength of a 6-mil polyethylene sheet.) When installed properly with standard tape and sealing practices, MemBrain helps form a continuous barrier that enhances air tightness, improving overall comfort.

MemBrain reacts to changes in relative humidity by altering its physical structure. During the winter, when relative humidity is low, it provides high resistance to vapor penetration from the interior. However, when the relative humidity increases to 60% or above, its permeance dramatically increases, thus allowing water vapor to pass through, which facilitates drying of wet building systems.

This "reactive" ability works as follows: In conditions of low relative humidity, MemBrain's plastic molecules form a tight, impermeable network (1 perm or less using ASTM E96, dry cup method). As soon as the film comes into contact with moisture (60% RH), it swells up and becomes soft as the polar water molecules penetrate between the nylon molecules. As a result, the nylon acquires pores through which further water molecules can penetrate, and the permeance increases to greater than 10 perms (when tested in accordance with ASTM E96, wet cup method). In summer, when the air is humid, the moisture penetrates through the pores into the building interior, allowing building materials to dry out. If the relative humidity decreases, the pores close up again, and MemBrain then acts as a retarder to moisture. In the winter, this retarder protects the building materials behind the MemBrain from condensation.

Remains moisture-tight in winter when humidity in the cavity is low.



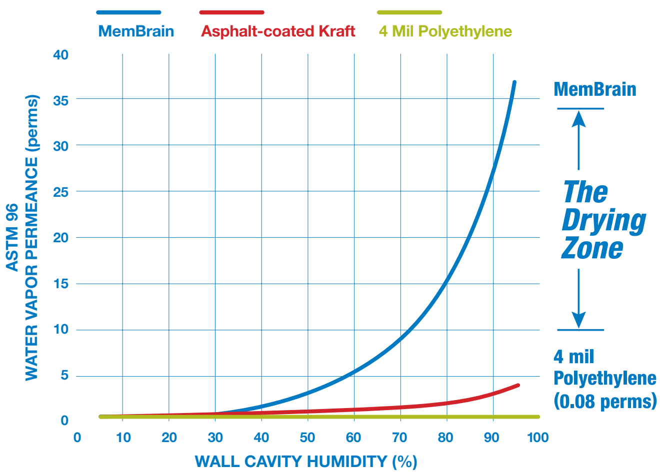
Increases permeability in summer to let moisture escape when needed.

Field tests have proven that MemBrain effectively reduces the risk of moisture damage in the building envelope by increasing the construction's tolerance to moisture load. It is appropriate in cold and mixed climates, but it is not suited for hot climates with high outdoor humidity because it would always be under high, relative humidity conditions. Therefore, it would always be permeable and would not provide vapor retarding benefits. It also would not work well in buildings with exceptionally high, constant indoor humidity levels, such as swimming pools and spas. However, in rooms with short peaks of high humidity (bathrooms and kitchens), MemBrain's performance would not be affected due to the buffering action of interior finishes.

MemBrain's molecular structure changes and reduces vapor permeance ~1 perm during the winter, preventing indoor moisture from penetrating into the cavity.

During the summer, MemBrain's vapor permeance adapts to ~20 perm, so that moist outdoor air penetrating the structure can now escape to the indoors, helping prevent building damage.

MemBrain can adapt from fully closed to open (<1 to 35 perms) to provide greater drying capability.



MemBrain can adapt from <1 to 35 perm to keep moisture out of the cavity in the winter while letting it escape when cavity humidity increases in the summer.

MemBrain Delivers Proven Barrier Technology

- Proven performance backed by more than a decade of usage and performance data worldwide
- Meets Class A fire retarder specifications, ASTM E84, for flame spread

Summary

We have seen a growth in the use of products like stucco, fiber cement and brick—moisture-retaining claddings that increase the moisture load on the wall. Exterior continuous insulation is (increasingly being used) on the exterior sides of walls to meet the growing demand for energy-efficient wall assemblies; however, these designs are affecting the way that moisture gets in and out of your buildings. Today, there is more moisture in our homes than ever before and new construction practices are only trapping the moisture in the wall longer, making its risk of moisture-related failure much greater. Building practices have increased the R-value while reducing the air movement through the wall. The result is a wall with a much lower rate of drying. Once the wall gets wet — and it will! — it stays wet.

MemBrain is an ideal air barrier and moisture management solution for the unique challenges of "mixed-humid" and "cold" climate condition areas in North America. As a certified interior air barrier, it helps create a tighter building envelope to achieve optimal energy efficiency, indoor air quality (IAQ), homeowner comfort and moisture management. And unlike traditional vapor retarders, MemBrain's unique adapting permeability supports an airtight shell that can still maximize drying potential, helping maintain a healthy home throughout seasonal climactic changes.

For more articles and information on the Building Science of air tightness, moisture management and smart vapor retarders, visit **www.certainteed.com/buildingscience**

Glossary of Terms

Building Envelope	A series of interrelated systems designed to provide comfort and safety to the occupants with a high-degree of energy efficiency
Vapor Retarder	A material that is used to resist the diffusion of moisture through a floor, ceiling or wall of a building assembly
Smart Vapor Retarder	A vapor retarder material with the ability to change its permeability based on the ambient humidity condition of its environment
Air-Barrier	A material that is used to manage the air-leakage into and out of a building
Continuous Air-Barrier	An air barrier that is applied in such a manner that it provides a consistent air-barrier across the entirety of the building envelope that is free from cracks and voids
Infiltration (and Exfiltration)	The air-leakage through cracks and leaks around windows and doors, and through floors and walls of the building envelope of any type of building
Perm	A unit of measurement typically used in characterizing the water vapor permeance of materials. It measures the flow of water vapor through a material

Create a More Comfortable Home

CertainTeed
SAINT-GOBAIN
Insulation

At CertainTeed, we believe in a higher level of comfort. We believe in Complete Comfort, where your insulation system successfully controls thermal performance, air tightness, moisture management, and acoustics. That's why we offer a complete line of high performance insulation products that work together to ensure every building achieves Complete Comfort.

Fiberglass | Mold Prevention
Technical | Equipment

learn more at: certainteed.com/insulation

Seal and Insulate with ENERGY STAR — LEARN MORE AT energystar.gov

NAIMA — North American Insulation Manufacturers Association

U.S. Green Building Council Member

UL GREENGUARD GOLD

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