Why Thermal Bridging and Thermal Breaks Matter in Construction

Thermal bridging reduces the overall performance of a home. ***Thermal breaks*** are the answer to this problem. Simple in theory, but thermal bridges have been challenging high-performance home builders for decades. It affects HERS ratings. It impacts continuous insulation. It affects sale-ability. It affects home comfort. So it's a topic worth revisiting.

What is Thermal Bridging?

Thermal bridging occurs when a more conductive (or poorly insulating) material allows an easy pathway for heat flow across a thermal barrier. A classic example of this is the use of steel studs to bridge an insulated wall. The steel creates a pathway for heat to travel out of the home at a much higher rate than the rest of the wall. It's often hidden—the most common is wall studs—but, you must keep it in mind when thinking about heat loss (and the heating bills) at your home.

Areas in the wall assembly can transfer heat quicker than the insulation around it, like studs, plates, headers, and wall posts. In a wood stud wall with R-20 batts, thermal bridging

can bring the effective R-value down as low as R-15. If you put an R-20 batt into a steel stud wall, you may only get an *effective* R-value of approximately R-4. The keyword here is "effective". Because building codes are beginning to require effective R-values rather than the number on the package, thermal bridging becomes more important.

But this isn't about just meeting code; it's also about energy bills. Energy prices tend to go up, so an investment in using less energy is an investment that pays bigger dividends every year.

Another issue with thermal bridges in insulated walls is moisture accumulation. You can see it inside the house as dark stains that telegraph framing members. It happens on ceilings and in closets where a lot of framing gets mashed together. This is often called '*ghosting*' because the moist cool air attracts dust and forms dark lines on the ceiling which 'ghost' the joists.

How to Prevent A Thermal Bridge

So, if thermal bridging acts as a pathway for heat to escape the building more rapidly, a *thermal break*, or thermal barrier, helps block that pathway. Scientifically speaking, it's an "element of low thermal conductivity placed in an assembly to reduce or prevent the flow of thermal energy between conductive materials." For example, insulated glazing is the thermal break for windows. The air or gas between the

panes stops the conductive thermal energy from passing through the glass.

In metal and wood-framed buildings, wrapping a building's envelope with a layer of continuous insulation cuts off *thermal bridging*. However, common issues to look out for include discontinuities in the insulation, particularly at junctions and around openings. Insulating materials such as rigid foam should be cut to fit tightly together and sealed with a thermal break tape to further prevent gaps.

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Common Ways to Reduce Thermal Bridging in Construction

There are a number of ways contractors and builders accomplish thermal breaking. Here are some of the most common:

- Use advanced framing techniques, which reduce the amount of wood by increasing the spacing between framing members. For example, 16 inches on center becomes 24 inches on center for a stud-framed wall. A thermally broken double-stud wall can also be used with advanced framing. (The whole cavity is filled with insulation. This can eliminate thermal bridging in the walls, but it does not address the floor. You can insulate the rim joist, but all of the other floor joists telegraph to the outside.)
- Consider adding a continuous layer of exterior

insulation, such as rigid foam or rock-wool (mineral fiber) board, over the wall before sheathing it.

- A newer approach involves applying strips of insulation over the wood studs to provide a thermal break.
- Use an alternative wall system. For example, the wood I-joist splines in structural insulated panels are thinner than most studs, and panels are usually 48 inches on center (or more), which further reduces thermal bridging.
- Implement proper insulation and thermal breaks around the foundation/slab. A well-insulated slab may mean two pours: one for the foundation wall and one for the slab, so you can provide a layer of rigid foam between the two components.
- Avoid metal fasteners of any kind that span the entire wall assembly.
- Design your basement wall so it is better protected against moisture and water damage. This can allow you to use wood instead of switching to metal as a durability precaution.

As building codes evolve and homeowners become more savvy, more attention is going to be placed on thermal bridging, at every level. Whether you're building a new home to be Zero Energy Ready, or retrofitting an existing building, care should always be taken to minimize and eliminate unnecessary thermal bridging. If you're looking for a high-performance adhesive tape to help with your next project, contact us. We love solving tape challenges!

What’s the Difference Between Air Barriers and Vapor Barriers?

Is it an air barrier? Or is it a vapor barrier?

Are you sure? Although both are extremely important components of high-performance buildings, the two are not the same.

With very different functions to perform in the building assembly, understanding the core differences between air barriers and vapor barriers are paramount to building the high performing homes of the future.

Here's what you need to know about air barriers vs. vapor barriers.

What Is An Air Barrier?

Air barriers are systems of materials designed and constructed to control airflow between a conditioned (indoor) space and an unconditioned (outdoor) space.

Air barriers can be mechanically fastened building wraps, adhesive membranes, fluid-applied materials, insulating board stock, non-insulating board stock, spray polyurethane foam, poured concrete, metal, glass, and a host of other materials.

But no matter what material you choose, all air barriers should be:

- impermeable to air flow;
- continuous over the entire building enclosure or continuous over the enclosure of any given unit;
- able to withstand the forces that may act on them during and after construction;
- durable over the expected lifetime of the building.

Keep in mind there are two kinds of air barriers – interior and exterior – and while both serve similar purposes, each complements and/or enhances the effectiveness of the other. Interior air barriers control leakage of a home's interior air into the wall cavity and attic, limit the ability of moist indoor air to enter the wall cavity during the heating season, and limit convection losses within walls.

Exterior air barriers control infiltration of exterior air into the wall cavity and through the attic, limit the ability of moist outdoor air to enter the wall cavity during the cooling season, and prevent wind-washing of wall insulation (i.e., even though a house tests tight on the interior, it could have a leaky exterior wall and top plate that cause big energy losses). It's a good idea to install both types of air barrier so as not to negate the benefits of one by neglecting the other.

Related: *learn more about building envelopes and why they matter*

What Is A Vapor Barrier?

Vapor barriers (or vapor retarders) are materials used to slow or reduce the movement of water vapor through a material. Vapor barrier materials are installed on the warm side of the insulation in a building assembly, as determined by climatic conditions. In warm climates, it will be on the exterior and in cold climates, it will be on the interior.

A vapor barrier can be a mechanically fastened sheet-material, adhesive membranes (depending on composition), fluid-applied

materials, insulating board stock or medium density spray polyurethane foam. The thickness of the material will impact whether it is a vapor barrier or not.

But Wait… There's More

Here's where things can get confusing. Water vapor may be transported by air leakage, but you address this issue by installing a proper air barrier, not by a vapor barrier.

Vapor barriers are intended to control the rate of diffusion into a building assembly. Therefore, the vapor barrier does not have to be continuous, does not have to be free of holes, does not have to be lapped, does not have to be sealed, etc. A hole for example in a vapor barrier will simply mean that there will be more vapor diffusion in that area compared to the other areas of the vapor barrier.

To simplify, consider this wool sweater analogy: A wool sweater is insulation. It will keep you warm when there is no air movement, but it still allows the wind to move right through it.

A wool sweater with a raincoat will keep you warm, but hold moisture inside and soak your insulation. A wool sweater with a windbreaker will keep you warm, stop the wind from stealing your heat, yet allow moisture to diffuse through it.

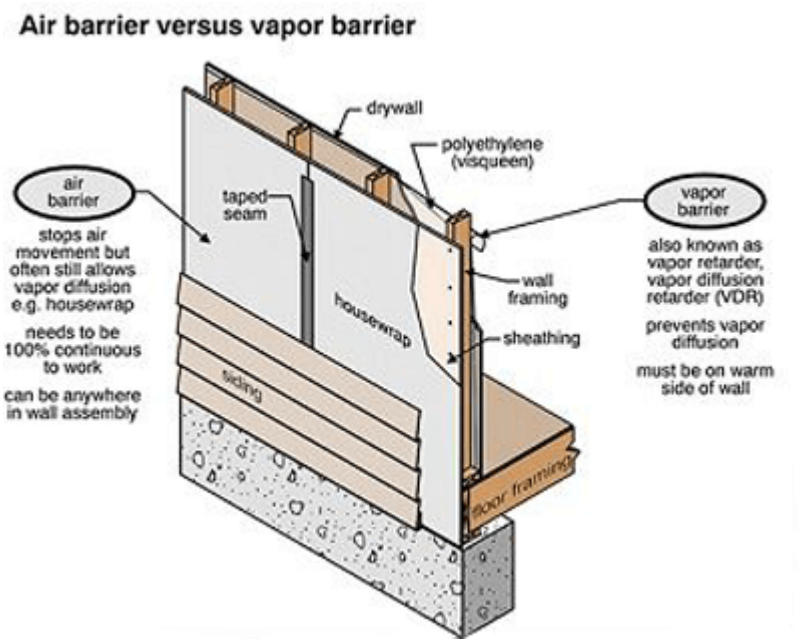
So think of a windbreaker as an air barrier and a raincoat as a vapor barrier.

In high-performance buildings, air barriers and vapor

barriers, as well as water-resistive barriers, can be combined. There are also vapor-permeable air barriers, and there are water resistive barriers which are not air barriers.

It's important to understand the separate functions and then determine whether the material provides more than one function. As an example, you can have two, three or even four air barrier materials in a wall assembly, but its effectiveness will depend on which material you have chosen and how you have connected the air barrier materials together.

Why Do Air Barriers Really Matter?



Now that you understand the difference between air barriers and vapor barriers, the bigger question is **why do they really matter**? That's a question being asked by many architects, contractors, engineers, and building owner-developers, and the answers are varied.

For one, air pressure and moisture control in buildings have become a *very* important element in constructing durable and energy-efficient structures.

Air leaks can cause havoc because air not only short circuits insulation, but air is a "carrier" for unwanted elements

inside a home (i.e. noise, dust, vapor and heat/cold). When there is uncontrolled air movement from outside to inside (and visa versa), there is an increased risk for building failure or lackluster performance. Moisture in all three states (vapor, liquid, solid) is a hazard to a building.

Additionally, the International Energy Conservation Code (IECC) and several state energy codes now require the use of air barriers in building codes. In addition, a growing number of municipal authorities having jurisdiction (AHJs) and green-building trade groups are calling for their use. Some federal agencies and large owner and developer groups also require them.

More important, energy efficiency and occupant comfort—two key ingredients of sustainable design—are driving the use of air barriers across market sectors. Consider this:

> *39 quadrillion British thermal units (BTUs). According to the U.S. Energy Information Administration (EIA), that's how much energy was consumed by all the residential and commercial buildings in the United States in 2015. Those BTUs represent approximately 40 percent of all the energy consumed nationwide. Concurrently, these structures account for about 38 percent of all CO2 emissions in the country.*

This statistic comes from a blog post by our friends over at Barricade Building Products. Like us, they are diligently working on new product innovation addressing the rapidly changing needs of high-performance building products.

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Choosing the right house wrap is much like choosing the right tape. With today's high cost of energy and concerns about Indoor Environmental Quality (IEQ), air barriers are one of several construction systems with a critical role to play.

In order to design and build safe, healthy, durable, comfortable and economical buildings airflow must be controlled. Airflow carries moisture that impacts a building material's long-term performance, integrity and durability, behavior in fire (spread of smoke), indoor air quality (distribution of pollutants and location of microbial reservoirs) and thermal energy. One of the key strategies in the control of airflow is the use of air barriers.

By essentially "wrapping" the building shell, air barriers (a.k.a. air sealing) ensure that the building is protected from the effects of airflow and air leakage. Here are four tangible benefits to air barriers:

1. Preventing the Loss of Conditioned Air

For most consumers, the biggest reason "why" is air barriers are important is comfort.

In summer, we normally cool and dehumidify the air to a lower temperature and humidity than the exterior environment. In winter, we typically heat and humidify the air to a higher temperature and humidity than the exterior.

Controlling interior temperature is paramount to comfort. The United States Department of Energy reports that over 30 – 40 percent of the cost of heating and cooling a home is lost to uncontrolled air leakage. This can hamper the performance of

other building systems such as insulation and HVAC.

Proper air sealing helps reduce uncomfortable temperature fluctuations and often allows for smaller, more efficient HVAC equipment.

2. Lower Utility Bills

Maintaining conditioned air means less energy is needed to recondition the air. Less energy means lower utility bills. And since all building systems must perform well together to optimize the energy efficiency of a home, the savings can add up.

Buildings which have a properly installed air barrier system can operate properly with a smaller HVAC system as the mechanical engineer does not have to compensate for a leaky building. In some cases, the reduction in mechanical equipment size and cost can also offset the cost of the air barrier system in addition to lowering utility bills.

3. Preventing Moisture

Wherever air moves, water vapor can follow. Proper air sealing reduces the risk of water vapor moving into the wall system where prolonged exposure can result in moisture issues such as wood rotting and mold, which can cause expensive structural or health problems. Air leakage has the ability to transport exponentially more moisture into and through the building enclosure than occurs through vapor diffusion alone.

4. Improved Indoor Air Quality

Air barrier systems help keep out pollutants such as suspended particulates, dust, allergens, insects, odors, noise and more.

Lastly, it's important to note that the International Energy Conservation Code (IECC), the DOE Zero Energy Ready Home program and several state energy codes *(see California Title 24)* now require the use of air barriers.

In addition, a growing number of municipal authorities having jurisdiction (AHJs) and green-building trade groups are calling for their use. Some federal agencies and large owner and developer groups also require them.

It's no longer a question of should you use an air barrier, but how to design and install high-performance air barriers that will stand the test of time. Be sure to look at ECHOtape's collection of seaming tape.

Don't see something that meets your specific needs? Let us help! We love solving tape challenges.

Why Seaming Tape Matters More Than Ever

In just about every climate in which we live and build, the No. 1 job of any building enclosure is environmental

separation.

Keeping water, air, and heat locked in or out of buildings can make them more resource-efficient, durable, and safer for occupants.

The greatest challenge in this endeavor is maintaining the continuity of our air barriers, drainage planes, and insulation layers, particularly at penetrations, transitions, and margins of building assemblies.

The answer?

High-performance seaming tape.

Seaming Tape – A Brief History

In the early 1970s, residential builders knew almost nothing about airtightness and air movement. Even engineers were ignorant about hot and cold air leakage in buildings because the basic research hadn't been done yet.

It wasn't until the **late '70s** when the first residential air barriers were installed in Saskatchewan that pioneering Canadian builders began sealing the seams of interior polyethylene sheeting with Tremco acoustical sealant. (The first seaming tape, if you will.) The results were self-evident, and since then, most North American building codes now require builders to include details designed to reduce air leakage.

The same holds true in Europe, where using tape to seal the building envelope is the standard operating procedure in **passive house** (a.k.a. Passivhaus) construction. Passive Haus results in ultra-low energy buildings that require little energy for space heating or cooling.

In fact, tape experts cite Europe as the best example of the overall utilization of acrylic tapes in construction. “In Europe, they tape up everything when building or retrofitting to create an air-tight seal,” says David Joyce, nationally known construction and tape expert, and owner of Synergy Companies Construction LLC. “Energy costs are much higher there, and it’s a matter of necessity.” Joyce notes that the industry here in the U.S. “is just recently becoming more aware of the benefits of air-tight building practices and that acrylic tapes make that much easier.”

It’s easy to see why the practice of seaming is seeing a surge among insulation professionals: The energy benefits of air barriers are huge.

A 2005 study from the National Institute of Standards and Technology, “*Investigation of the Impact of Commercial Building Envelope Airtightness on HVAC Energy Use*” by Steven Emmerich and others, found that just **incorporating an air barrier in a building can reduce its heating and cooling cost by up to 36%.**

Furthermore, uncontrolled air leakage could have consequences beyond increased energy consumption, regarding health and safety of the building occupants, as well as premature deterioration of building materials.

Additionally, the International Energy Conservation Code (IECC) and several state energy codes now **require the use of air barriers**. In addition, a growing number of municipal authorities having jurisdiction (AHJs) and green-building trade groups are calling for their use. Some federal agencies and large owner and developer groups also require them.

More importantly, energy efficiency and occupant comfort—two key ingredients of sustainable design—are driving the use of air barriers across market sectors. With today's high cost of energy and concerns about Indoor Environmental Quality (IEQ), air barriers are one of several construction systems with a critical role to play.

As our building profession evolves to becomes more energy-efficient, more sustainable, and more "green", air sealing every building is going to become the norm. And, of course, more tape will be used to do this.

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Benefits of Seaming Tape in High-Performance Building

There are three primary drivers for the increased usage of seaming tapes on job sites:

1. More stringent codes. Increased building envelope requirements – air and moisture control layers;
2. Improved tape technology.

3. Heightened awareness of the high-value seaming tape by builders, contractors, and building scientists.

Don’t just take our word for it. Consider this direct quote from [Building Energy Code Resource Guide]

> *To limit air leakage, builders use tapes to seal the seams of a variety of membranes and buildings products, including housewrap, polyethylene, OSB, and plywood. Tapes are also used to seal duct seams, to seal leaks around penetrations through air barriers – for example, to seal around plumbing vents – and to seal sheet goods to a variety of materials, including concrete.*

“Tapes have become much more commonplace in the construction industry today than they were 10 years ago,” Joyce says. “And they’re going to become more and more so as air sealing, energy efficiency and durability become more important, and builders are becoming more educated about the benefits of tapes over other sealants or flashing materials.”

Indeed, trend reports indicate that overall, tapes used on job-sites will outpace the overall construction industry growth (3%-5%) with an estimated 6%-7% annual growth rate. New residential tape use will increase the fastest in double digits due to code compliance. In the past, tapes were used sparingly on joists and viewed as a temporary fix or cheap solution.

Today, tapes have transitioned into high value and highly functional products that enhance building airtightness, prevent water intrusion, and even increased roof safety and

integrity in high wind events.

While no single tape works well in every air sealing application, there are four common benefits worth considering:

1. Seaming tape is very easy to use.
2. In context to other building materials, tape is inexpensive.
3. Effective air sealing – air control, moisture control, and "protection" of finished materials – depends on both the materials being used (what are you taping?) and what are the conditions (in heat, in cold, etc.). There are a lot of tapes available so you can match the conditions with the situation.
4. Tape can create a continuous barrier when applied correctly, which is what you need an air seal to be for it to be effective. This is hard to get with other kinds of fastening systems.

Today's newer and higher-performing adhesive tapes offer builders better choices and multiple advantages over conventional building materials. These tapes actually stick better over time, are more durable, and are more weather resistant. Indeed, modern adhesive technology is much more sophisticated as a whole.

The Next Generation of Seaming Tape

When it comes to choosing the best construction tape, the maxim that “if it ain’t broke, don’t fix it” doesn’t cut it. High-performance construction tapes will become more important as the construction industry deals with stricter regulations and as best practices in the industry change with the times. To stay ahead of these changes, and meet the needs of high-performance builders across North America, we’ve recently launched a new seaming tape that uses advanced adhesive technology to stick to just about anything

PE-M4535 is a next-generation seaming tape for the construction professional looking for superior performance. Formulated with a proprietary cold weather adhesive –excellent cold climate adhesion to -4°F! – PE-M4535 is engineered to adhere to a wide range of building materials and surfaces. Made from an advanced polyester backing, it is extremely strong, yet can still be torn by hand, which makes it easy to apply.

Highly adaptable and versatile, PE-M4535 can be used in a wide variety of building envelope sealing applications, such as:

- House wrap
- Insulation, including polysio-cyanurate and reflective insulation
- Exterior sheathing
- Vapor barriers, including polyethylene films
- Flooring and roofing underlayments

At ECHOtape, we’re focused on generating real-world adhesive

solutions that help Building and Construction professionals work more efficiently and cost-effectively on every job site. It’s why we’ve engineered such an extensive line of durable, resilient, weather-resistant construction tapes, including seaming tape, insulation tape, foil tape, stucco tapes, cold weather tape and more. So, no matter what project comes your way, the quality and reliability of your work are guaranteed.