Contractor’s Field Guide to The Building Envelope

What is the Building Envelope and why does it matter? How can it fail? What role does tape play in air sealing?

In this post, we demystify the building envelope, helping builders and contractors identify weak spots in building tightness in order to improve air sealing, and create more structures that are sustainable, cost-effective and comfortable in all conditions.

What is a Building Envelope?

By nature, we do not expect our environment to maintain a consistent, 74-degree-Fahrenheit, 50% humidity, climate.

Our perception of comfort is quite adaptive and is based on circumstance, the expectation of environmental conditionals and activities. We use umbrellas when it’s raining. We dress in layers when it’s cold. We use sunscreen when exposed to summer’s intense UV rays.

And yet, we expect our homes to provide thermal comfort and protection from the natural elements, at a consistent 74-degrees, every day.

Walls, roofs, windows, and doors all play a role, but really it's the building envelope that makes this possible.

At its simplest definition, *the building envelope is the exterior or shell of a building that repels the elements*.

At its most complex definition, it's an engineering system that meshes elements such as structural integrity, moisture control, temperature control, and air pressure boundaries into a single design strategy.

It is the physical separator between the conditioned and unconditioned environment of a building including the resistance to air, water, heat, light, and noise transfer. It's the part of the house that you can draw a line around: the roof, the walls, and the foundation.

While the building envelope is a silhouette of sorts, it's important to remember that these are compounded layers. Each part of the building envelope must be thought of as a collection of smaller pieces working together to provide structural support.

The way the foundation and walls are built is essential in creating a sturdy structure, or a base, for the rest of the building. This is one of the main functions of construction because a well-constructed envelope is necessary to simply keep the structure standing.

The building's design must be measured and carried out meticulously to ensure that there are no open edges, cracks

between the windows and walls and imperfections between the roof and the walls, or between the walls and the foundation. It is all included within the building envelope concept.

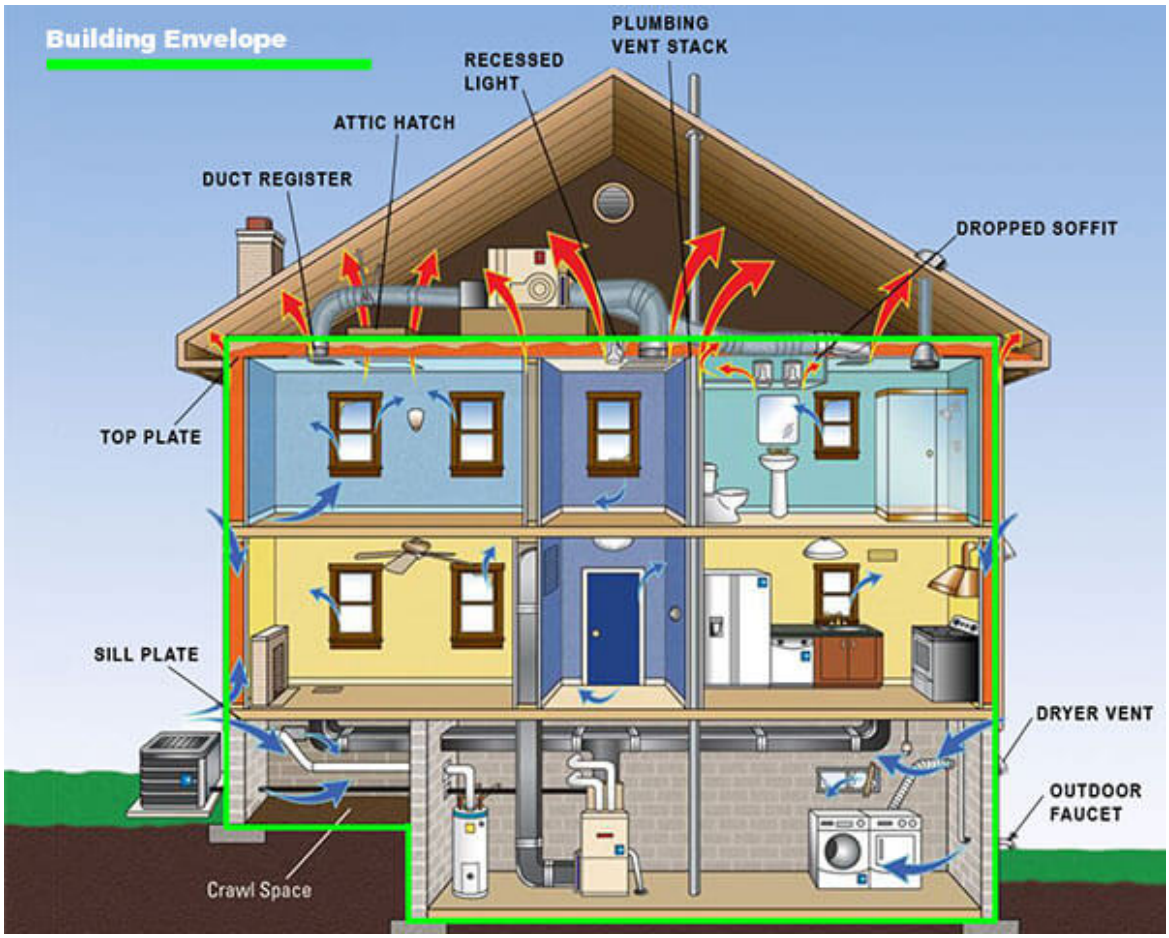
That said, each part of the enclosure faces different challenges.

- Roofs are bombarded by heat, rain, and hail
- Walls contend with wind and rain
- Foundations are always surrounded by wet, damp earth

On a construction level, the home's building envelope is a series of composite layers –whether it be wood, glass, veneer, drywall, etc. – each with their own permeable properties that must be considered.

A proper building enclosure works together to achieve the same goals of stopping or slowing the flow of air, water, and heat while still allowing the inevitable intrusion of water as a way to dry out.

Why Do Building Envelopes Matter?



Understanding Air Flow, Air Sealing and the Building Envelope | Image via U.S. EPA

All told, building envelope components work together to perform four basic, but critical functions: structural support, moisture management, temperature regulation, and air flow.

The latter three—moisure, air and thermal—characterize the "control" functions of the building envelope, those facets that ensure a house is energy efficient, comfortable, and sustainable.

1. Moisture control. The most important element of the envelope's control is its ability to regulate the transfer of moisture. Moisture presents a distinct danger to the overall integrity of a building and must be taken into account.

Moisture can and will impact your building over your head (roof), under your feet (basement/floor), and on your sides (walls). Each component must be addressed to prevent unwanted transfer from causing expensive damage. It's essential in all climates, but cold climates and hot-humid climates are especially demanding.

2. Air control. Controlling air flow is key to controlling energy consumption, ensuring indoor air quality, avoiding condensation, and providing comfort.

Control of air movement includes flow through the enclosure or through components of the building envelope itself, as well as into and out of the interior space. So, for example, when we talk of a house's draftiness, we're talking about the control of air flow.

3. Thermal control. Thermal transfer brings to mind how comfortable we feel inside our own homes.

Is it too hot? Is it too cold? If you want to address this question, it is easiest to look up. As we learned in elementary school, heat rises, and if you don't have enough resistance in the building to prevent heat from rising right through the roof, it is time to raise your building envelope IQ to prevent heat (and money) from escaping.

What is Building Tightness?

Building envelopes are often characterized as either “tight” or “loose.”

A loose building envelope allows more of a natural air transfer to occur, which improves indoor air quality which can remove the need for mechanical ventilation.

These types of building envelopes make the building more drafty and uncomfortable, it also makes the building harder to regulate temperature levels. This creates a higher chance of mold or mildew, and higher quantities of heated or cooled air are able to escape through leaks in the loose building envelope. This will increase energy bills along with negatively impacting the environment by releasing more greenhouse gases.

A tight building envelope allows for a high level of control over indoor air quality, temperature, humidity levels, and energy consumption.

This requires more insulation, caulk, adhesive tape, sealants, and energy-efficient windows to acquire a tight shell for the building. This leads to fewer drafts and a more comfortable building for its occupants, which often results in less waste in heating and cooling costs.

Tight envelopes also have a lower chance of producing mold or

mildew from moisture infiltration, this can help prolong the life of the building components. The downside to a tighter building envelope is it requires more extensive mechanical ventilation systems because it limits how much natural ventilation can occur.

Additionally, good building envelopes which prevent drafts and other air leaks allow for tighter control of the air pressure inside as well as the temperature.

Without that, cooling and heating sources are constantly fighting the exterior elements that are making their way inside the building. Not only is this expensive, it makes being inside the building uncomfortable. For example, a home where the air conditioning system has been shut off all weekend would take longer to cool on Monday morning if the building design allows for leaks and drafts.

The tight envelope provides the ability to adequately control the quality of the air, making the interior of the building more comfortable and pleasant.

What are Best Practices for Building Envelope Systems?

We've said it before and we'll say it again: **Build it tight; vent it right**.

Without a virtually airtight, well-insulated building envelope, achieving the energy performance levels required for current IECC Building Codes and California Title 24 is nearly impossible without a massive investment in renewable energy systems.

The good news for builders is that getting the building envelope right is one of the lower-cost, higher-return investments when designing for net-zero performance. It all boils down to good building practices.

According to ProBuilder.com, to make air sealing your top priority, concentrate on insulation. Focus on sealing the areas along the top and bottom plates, particularly around the perimeter in the attic area and along the foundation, whether it's a basement, crawlspace, or slab, so that you're not getting convective loops in your walls.

Why Do Building Envelope Systems Fail?

When the building envelope system is designed and constructed properly, very few occupants pay attention. But when the building envelope fails (and even the best-built projects do in time), everyone notices.

Those failures can include aesthetic loss, corrosion, poor indoor air quality, energy inefficiencies, and, in some cases,

life-threatening structural failure and eventual litigation—a builder's worst nightmare.

1. Design deficiencies. Architects occasionally specify materials or design systems that are inappropriate for their intended use. Common mistakes include specifying materials that are incompatible with materials with which they come into contact or have inadequate performance criteria for thermal movement, structural capacity, or water penetration resistance.

Issues also arise when subcontractors try to reduce the weight, size, or amount of building envelope components (aluminum, glass, sealants, flashing, etc.) required on a project. This can lead to inadequate performance or capacity of the materials specified.

2. Material failure. It's also common for properly specified materials to fail to meet the published performance levels. This could be a result of errors in the manufacturing, handling, or storing of the product or components within the product.

Common examples include degrading sealant adhesion, laminated glass delamination, and metal fatigue. While the anticipated performance levels are often based upon measured statistical performance, the strength of materials varies.

3. Poor workmanship. During construction booms, the problem of poor workmanship is exasperated as a result of having many inexperienced, unsupervised, and untrained personnel working

on projects. It is common to find building envelope components not installed per the manufacturing specifications.

Word to the wise: Putting the right people in the right job goes a long way toward proper installation and overall profitability.

4. Acts of nature. Even with flawless installations, bad things can happen to good work when environmental conditions exceed those that were anticipated during design. The effects of hurricane-force wind loads, driving rain, and extreme temperature fluctuations can overload a properly designed and constructed building envelope, causing damage to the system and making it vulnerable to further deterioration or failure.

While failures of this type cannot be stopped, many can be prevented through routine inspection and maintenance to identify small problems before they become big ones.

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10 Reasons Contractors Should Use Tape to Seal the Building Envelope

As customers demand more energy-efficient homes and building energy codes become stricter, more and more contractors are using adhesive tape to seal the building envelope.

Today’s newer and higher-performing seaming 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.

But don't just take our word for it. **Here are 10 great reasons to seal the building envelope with tape.**

1. **No holes.** Unlike nails or rivets, tape does not make holes. Fewer holes mean less opportunity for air leakage.
2. **Clean, easy application.** Unlike liquid and foam sealants, adhesive tape is not messy and it's easier to apply.
3. **It's affordable.** Using tape to seam is more affordable than spray foam or liquid adhesives.
4. **Versatility.** Unlike other construction materials, tape has a unique ability to withstand extreme temperatures, harsh environments and to bond securely with a host of different substrates and materials
5. **It's energy efficient.** Using tape to seal the building envelope is the standard in Europe where **passive house** (a.k.a. Passivhaus) is the norm. 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 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.”

6. **The Department of Energy recommends it**. 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.
7. **The Green Building Advisor is obsessed with tape.** Check out these articles: Backyard Tape Test and Air Sealing Tapes and Gaskets.
8. Leaders in performance building, like **Matt Rissinger**, use it all of the time. Check out Tight House Construction and 4 Tips to Building an Efficient House, for example.
9. And **Hank Spies**, who uses tape in metal roof sealing. Quoted here: *The most effective approach is to seal all joints with butyl*

sealing tape… It is more effective than caulk, and since the butyl does not cure, it tends to creep within joints to absorb the movement of the metal with changes in temperature.

10. **Twice as nice.** More and more builders are using double-sided tape as a housewrap tape so they can overlap seams and ensure no water gets through.

Clearly, the home's building envelope is a critical concept to grasp. At ECHOtape, we've embraced the fact that a better building envelope leads to a healthier, more sustainable building.

We're excited about the expanding role adhesive tape will play in building envelope design, or redesign, and our goal is to help builders and contractors find the weak spots in building tightness, improve air sealing, and create more structures that are sustainable, cost-effective and comfortable in all conditions.

Because a well-maintained and regularly observed building envelope doesn't just save on energy bills; it will be better built to stand the test of time and mother nature.

Contractor’s Field Guide to House Wrap & Seaming

In this Field Guide to House Wrap & Seaming, we’ve gathered the most important installation and seaming tape tips to build quality, energy-efficient buildings.

We will cover building code best practices, how to install housewrap (the right way), how to prevent common house wrap problems, reasons why housewrap can still leak, and how seaming tape can make your building project airtight and moisture-proof.

House Wrap vs Vapor Barrier – What’s the Difference?

House wraps are installed to the outside surface of a home’s envelope, undersiding, or exterior cladding.

Housewraps must be **permeable enough to allow water vapor to pass through them from the warm side, but still, stop bulk water like rain from entering on the cold side** – similar to a Gore-Tex jacket.

Per Building America guidance, house wrap should be lapped shingle style over any exterior wall flashings installed

around openings, penetrations, or where the walls intersect roofs, foundations, or other transitions. Any holes through the wall, such as for windows, water spigots, exhaust vent outlets, HVAC condensate lines, or light fixtures and receptacles, should be carefully sealed and flashed. It's very important for any water vapor that makes it to the backside of an air barrier to keep moving so it gets to the air around the home.

Vapor barriers, on the other hand, are used to **stop water vapor from entering a wall cavity**, where the gas can turn into liquid water if it contacts a cold surface. If this happens and the water can't evaporate quickly, wood rot, mold, and mildew become a reality. A reality that is trapped on the inside of your wall.

No bueno.

The placement and permeability of vapor barriers and house wraps are addressed by building codes but vary by region. **Vapor barriers are put on the inside face of wall studs in cold climates but they're put on the exterior of homes in hot and humid climates.**

The method? You want the vapor barrier as far away from the coolest wall surface as possible. In hot, humid climates, the cool side of the wall is the inside of the home, where the air conditioning is operating.

For an in-depth look at moisture in buildings, check out Building America's moisture flow guide.

Related: *read about the difference between air barriers and vapor barriers.*

Why Does Perm Rate Matter?

Permeability (aka Perm rate) is the rate at which a house wrap allows water vapor to pass through it.

Inexpensive or poorly made house wraps often have perm ratings in the 8 to 12 range, and they should be avoided.

This is especially true for older homes in cold climates with little or no moisture barriers. Moisture will escape through the wall cavity and sheathing, and if the house wrap doesn't allow it to pass through fast enough, it will condense and accumulate in the form of frost and ice. When the ice thaws, you'll end up with wet sheathing and/or wall cavities—not good.

Instead, choose high-quality house wrap with a perm rating over 50.

Building Code is Best Practice for

House Wrap Installation

Though many builders think of the IRC as the bare minimum requirement, when it comes to WRB installation the code is actually 'best practice.' It's all in section R703 – Exterior Covering of the 2018 IRC.

> *R703.1.1 "The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior cladding … and a means of draining to the exterior water that penetrates the exterior cladding."*

R703.2 addresses the Water-resistive barrier, giving builders and contractors two options for materials: #15 lb tar paper meeting ASTM D226 requirements OR "other approved water-resistive barrier" (Meaning: approved by the local building official.) The manufacturers of house wraps and other WRB materials generally obtain an ICC Evaluation Service Report that code officials rely on when determining whether to accept an alternative material to #15 tar paper or not.

When "Other *approved* materials… are used as a WRB they shall be installed in accordance with the water-resistive barrier manufacturer's installation instructions." There it is – the manufacturer's installation instructions are referenced in the code and are enforceable by the local official.

It's critical to select the right house wrap for a home's

climate, from the dozens of varieties available; but even before that, you'll need to find out if a house wrap is required for code compliance in your jurisdiction. Once you've determined if it's necessary to meet code, you must be sure to install the product in strict adherence to manufacturer specifications so that it functions as intended.

How to Install House Wrap The Right Way with Seaming Tape

While manufacturer instructions for installing housewrap vary, generally there are three main tasks involved: wrapping, taping, and flashing. (Click here to watch an exterior house wrap installation, courtesy of the NAHB Research Center.)

Wrapping

Wrapping should start at the foundation, or the base of the wall assembly, extending at least an inch past the wall-to-

foundation intersection and continuing upwards like shingle installation with the higher course overlapping the lower.

Horizontal seams should overlap at least 2 inches and vertical seams a minimum of 6 inches.

We found this post on avoiding a bad wrap to be helpful.

Taping

All of the seams for the product should be taped according to manufacturer's instructions. Most house wrap manufacturer installation instructions have minimum horizontal overlaps of 4-6 inches and minimum vertical overlaps of 6 -12 inches.

Most also require or recommend 1 in. plastic or metal cap fasteners. The caps protect the house-wrap from damage during installation and spread the surface area of the fastener over a broader area of the WRB so the fastener is less likely to tear through.

Double-sided seaming tape that's applied on one part of the wrap with another course overlapping (think shingle lap) helps prevents moisture – and meets code requirements.

Flashing

One of the most precise jobs when working with house wrap is properly installing the product around windows and doors. Flashing of exterior windows and doors is critical in casting rainwater away from those areas so that assemblies remain dry

and durable.

Plus, wherever roofs meet walls, kick-out and step flashing must first be installed before continuing the housewrap shingle-fashion over the flashing pieces. Otherwise, the roof/wall intersection creates a place where water will be pushed into the wall, causing major structural damage.

Check out this **Technotes** piece from the Home Innovation Research Labs and the Internal Code Council.

Here are three of our favorite flashing tape tips:

- Leave the outer release paper on until the flashing is stuck to the sill. That reduces the chances of the tape sticking to itself during installation.
- Use a square block to push the tape tight into the corners, being careful not to puncture the corner.
- Use a J-roller to push down the tape. Make sure to roll out any bumps and eliminate 'fish mouth' bubbles.

For more in-depth best practices watch this video from ProTradeCraft on proper house wrap installation.

The following are key takeaways:

- Extend house wrap below the mud sill—for water management, but also for air sealing. Seal the bottom of the house wrap to the sheathing with caulk or tape.
- Overlap the layers shingle-style as you go up the wall—like roofing shingles.

- Overlap vertical seams 6-12 inches.
- Overlap horizontal seams 6 inches (upper layer over lower layer).
- Fasteners: use a cap nailer because slap staples leak.
- Apply house wrap up the gables before installing exterior trim, even if the attic is not conditioned. House wrap is not just for air sealing the insulated parts of the house, it is mainly for water management. If the gable isn't covered, water can get to the framing, and even behind the house wrap below.
- Wrap and seal the underside of cantilevers. Better yet, add a solid sheet good to cover the bottom, and wrap over that.
- Tape seams on flat house wrap with 2-inch tape; use 3-inch tape for wrinkled house wraps.

How To Prevent Common House Wrap Problems

The performance of a high-quality, vapor-permeable, house wrap is dependent on proper installation, careful handling, and limited exposure to UV radiation and outside elements. The goal of house wrap is to create an air and moisture barrier that also prevents moisture accumulation in the wall system. Ultimately, house wrap should boost a home's energy-efficiency and create a healthy, comfortable indoor environment.

Our friends over at Barricade, pulled together the most common house wrap issues. Here's what you need to know:

Improper House Wrap Installation. Experienced and skilled house wrap installers avoid common problems with house wrap by following several key steps when installing house wrap.

- House wrap is typically applied from the bottom of the building up, overlapping the horizontal joints by a minimum of six inches and the vertical joints by a minimum of twelve inches. Expand the house wrap over the footing top by a minimum of two inches.
- The house wrap should be fixed every 12 to 18 inches with specific stapling nails or nails designed to hold down house wrap material.
- Installation of house wrap around the window and door openings involves a Y-cut from corner to corner in the openings. Then, the loose material is folded through the openings and fastened securely.
- Seal all seams with manufacturer recommended tape, including over the layers, the top and bottom edges, and the rough openings. It is also essential to seal the areas cut by subcontractors during the installation of the cladding.

Problems with House Wrap Due to Rough Handling. Rough handling or long exposures to wind and construction debris can tear, rip, and cut the house wrap. These damaged areas of the house wrap will allow air and moisture to enter the wall system. It is critical to seal and repair all damage to the house wrap

due to rough handling and overexposure to wind and construction debris.

Damage Due to Overexposure to UV Radiation. Overexposure of house wrap to the sun's ultraviolet (UV) rays can discolor and photo-degrade the house wrap. UV exposure can also cause the house wrap to lose tensile strength and water repellency. In some cases, this can happen quickly, depending on the house wrap's ultraviolet (UV) rating. The UV-rating of a house wrap is the maximum time a house wrap can withstand exposure from the sun before becoming damaged.

10 Reasons Why House Wrap Can Still Leak

House wrap is an air barrier that creates an airtight structure by stopping air flow through a building's envelope. But for a house wrap to stop air flow, it should be continuous over the entire building enclosure and be durable over the lifetime of the building. **Unfortunately, there are several reasons a house wrap can leak after installation.**

1. Housewrap seams that are **not sealed properly** can cause air leaks. Sealing house wrap joints with the manufacturer's approved seaming tape can improve the wrap's performance by about 20 percent. Sealing the seams after installing the house wrap is essential to an

airtight building.

2. Using the **wrong fasteners** can cause air leaks. It is crucial for airtightness to use manufacturer's stapling nails or nails designed to hold down house wrap material. Also, nails should be at least 1-inch long and spaced 12 to 18 inches on-center.
3. Not repairing the **tears, rips, or cuts** in the house wrap that occur during installation can lead to air leaks. It is *critical* to seal the damaged house wrap with code-approved contractor sheathing tape before covering with siding. Repair of larger tears in house wrap requires a taped 6-inch overlap of house wrap.
4. **Not sealing the bottom edges** of the house wrap can lead to air leaks.
5. Air leaks can occur if the house wrap is **cut to lie flat before installing siding, but not repaired**.
6. Air leaks can occur if the **edges of the house wrap, cut at the rough windows and door, are not sealed**. This error is common when installing utilities, pipes, cable tv, etc. For airtightness, wrap the fabric around the edges of windows and doors to the inside of the frame and seal with house wrap tape.
7. **Improper overlapping** of roles of house wrap can cause air leakage. Overlap and seal vertical seams by at least 6 inches. Overlap and seal horizontal seams by at least 4 inches.
8. Air leakage can occur if the **house wrap does not reach the top of the wall**. The house wrap should wrap up and over the top plate.

9. If the house wrap is **left exposed to excessive UV rays**, the house wrap may deteriorate rapidly.
10. If a house wrap is **not resistant to cold**, it may crack at low temperatures.

Maximizing the air barrier potential of house wrap requires the use of a quality house wrap, along with skilled house wrap installers. **A quality house wrap should have high-tear and tensile strength, UV stability, cold resistance and ease of installation**, which will limit damage and errors during construction.

House wrap and vapor barriers can get complicated. The movement of water, the possibility of drying, which side is warm or cool – these all factor into the success of a building's envelope. However, getting the installation right is the final detail, ensuring that a well-chosen wrap or barrier actually performs as intended. Time spent making sure the details, like taping and flashing and placement, are all correct, means success in the long run.

After years of testing, and working with high-performance building professionals, ECHOtape has released its own seaming tape, PE-M4535 All Weather Construction Seaming Tape in addition to its All Weather Double-Sided Tape. Formulated with a proprietary cold weather adhesive, it is engineered to adhere to a wide range of building materials and surfaces including house wrap, exterior, and rigid insulation, sheathing, vapor barriers, and a variety of underlayments.

If you're a building contractor, ask us about a sample roll.

Field Guide to Insulation for Metal Building

Let’s dispel the myth that metal buildings are for short-term use only.

The truth is quite the opposite.

Long a standard for warehouses, distribution centers and industrial facilities, metal building has evolved to include commercial office buildings, retail storefronts, and even residences.

Why?

Because metal structures are increasingly recognized as reliable, sustainable, energy-efficient, and cost-effective… if they are insulated properly.

When designing a metal building, it may be tempting to skip the insulation. Is insulation really necessary? Aren’t metal buildings known for their durability and low maintenance? What seems like an easy cost-cutting strategy today can actually create more problems down the road. Read on to learn more about metal building insulation.

Top Reasons to Insulate Metal Buildings

When designing a metal building, it may be tempting for builders and contractors to skip the insulation.

Is insulation really necessary? Aren't metal buildings known for their durability and low maintenance?

Well, yes.

When it comes to metal buildings, insulation addresses two important goals—**stabilizing the structure's interior temperature and preventing moisture from entering or collecting via condensation**.

When it comes to **temperature**, insulating metal buildings is essential because metal is a far better heat conductor than wood. Meaning things get hotter, or colder, faster. By controlling the heat transfer rate throughout the building with insulation, temperature fluctuations are better managed and energy usage is reduced.

As for **moisture**, when temperatures vary noticeably between outside and in, condensation will form. Moisture allows unhealthy mildew and mold to grow, particularly harmful to people with allergies. Without proper building maintenance practices, moisture can also cause building rust and

corrosion—something no home- or business-owner wants.

To offset this, most fiberglass insulation includes a vapor retarder, which is a facing that prevents or slows the flow of moisture through to the insulation it is attached to. A low “permeance” indicates a superior vapor retarder. Also, vapor retarders are typically required to be fire retardant.

But wait, there’s more!

Depending on how the structure will be used and where it will be situated, noise may be cause for concern. For example, if the structure will be used as a club or event forum, it may be beneficial to consider the sound implications the building’s usage could have on adjacent properties.

Proper insulation will limit noise pollution (and unhappy neighbors). Insulation also has the ability to absorb interior sounds that reverberate through the building. Which is especially helpful if you have loud machinery running all day.

Another advantage of insulating a building is that it prevents unwanted critters from entering the property. Insulation has proven to be a major deterrent to rodents and birds. By protecting every crevice of your building you leave little ability for wildlife to encroach.

All told, good metal building insulation will have the following benefits/features:

1. High R-value (thermal break)

2. Eliminate condensation
3. Radiant heat barrier
4. Not be affected by humidity
5. Vapor barrier
6. Install easily
7. Not allow nesting for rodents, birds or bugs
8. Recognized by ICCES and Qualified by Energy Star

Types of Fiberglass Insulation

Today, there is a variety of building insulation material options available, and new technologies, as well as long-forgotten ideas, are coming to public attention as thermal resistance and energy savings become more of a concern in

green building design.

For our purposes, the most common types of insulation found in metal or steel buildings is fiberglass, and it's available in several forms:

• **Blanket (often called rolls or batting):** Mineral fibers of rock wool or processed fiberglass make up batt and blanket insulation. Batt is very inexpensive but it must be installed carefully for full effectiveness. Some versions have a radiant barrier backing, the best type for metal buildings. Blanket insulation is a rolled insulation cut to specific widths and lengths. Both batt and blanket have R-values of R-3 per inch. Both batt and blanket insulation are inexpensive, and widely available at virtually any big box store, making it ubiquitous on job sites from coast to coast. Since metal buildings do not have vapor barriers, you will need to choose blanket insulation with a laminated facing.

• **Loose fill** is insulation made up of loose fibers or fiber pellets. The insulation is blown into building cavities rather like shooting water from a hose. It can be more costly than other types of insulation, but it can get blown into corners and places where a blanket might not fit. It can also be installed without disturbing frames or finishes.

• **Foam "rigid boards"** are good for any climate, withstanding even the highest of temperatures. Typically made of polyurethane, fiberglass, or polystyrene, this kind of insulation is available in a variety of performance ratings and can be very effective for dampening noise as well as

resisting heat and moisture. The R-value can range from R-4 to R-8 depending on the thickness of the cut.

It’s relatively easy for a non-professional to install. If you plan to use this type of insulation, be sure to let your metal building provider know so that the proper accommodations can be made, such as longer fasteners and extended panel lengths.

That said: **Fiberglass is not impervious to water.** In fact, it will lose the effectiveness of its insulation properties if exposed to moisture. To prevent this from happening, facing materials are laminated to rolls or batts of fiberglass to serve as a vapor barrier (or vapor retarder). The facing material acts as a vapor barrier or vapor retarder and protects the insulation from moisture. The fiberglass R-value (or the ability to resist heat flow) depends on its thickness.

However, it will lose the effectiveness of its R-value if exposed to moisture. Why?

Fiberglass rolls or batts are an example of open cell insulation. The woven fiber strands contain hundreds are air pockets and air, as we all know, is an excellent insulator. Once those air pockets are filled with moisture the fiberglass loses its ability to act as an insulator. (Along the same lines, fiberglass also loses part of its R-value if it becomes compressed as there are fewer and fewer air pockets to act as insulation.)

And that’s just the tip of the iceberg. Moisture damage can also lead to mold growth and rust damage, which will mean

extensive, time-consuming repairs to your facility.

It is possible to restore the fiberglass if you are able to let it dry out thoroughly and ascertain that is has recovered its full thickness. But a more effective approach would be to seal the vapor barrier properly in the first place. [You can reach more about fiberglass insulation myths here.]

Moisture has the opportunity to get in where there are:

- holes or tears in the facing
- insulation splices have not been properly made
- inadequate sealing around things like plumbing and electrical fixtures

Using the right adhesive may seem like the least important detail in the grand scheme of the building's construction. But it is, in fact, the critical link in sustainable metal building. Without proper sealing, your insulation loses its effectiveness.

With poor insulation, your utility costs go up and you risk significant long-term damage to your building or the equipment and property inside. And no one wants to deal with problems of that magnitude, especially when they can be easily avoided.

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4 Benefits of Metal Building Insulation

Since the introduction of fiberglass insulation in 1938, it has remained the preeminent insulation material for commercial and residential construction. Over the years, fiberglass insulation has proven its ability to make buildings more energy efficient, reduce utility costs and increase occupant comfort. These and other important attributes have given it a new life as the leading insulation material in many of today’s green building projects.

Here’s why:

1. Moisture Resistance

When exposed to moisture, fiberglass insulation neither absorbs nor holds water. If fiberglass insulation does get wet during or after installation, installers should visually inspect it on all six sides for contamination.

If the material appears free of visible defects, installers must dry it thoroughly to restore its full R-Value. Once the area surrounding the insulation has also been inspected, cleaned and fully dried, the fiberglass insulation can be reinstalled and will regain its original R-Value1.

It is important to note that fiberglass insulation must have a vapor barrier in order to be effective. All condensation should collect between the exterior wall and the vapor barrier

because exposure to moisture decreases the effectiveness of fiberglass insulation. In order to prevent this from happening it is important to choose a vapor barrier with a sufficient perm rating and to make sure the barrier is properly sealed with the right adhesive to prevent leakage.

2. Fire Resistance

Made from sand and recycled glass, fiberglass insulation is naturally noncombustible and remains so for the product's life. It requires no additional fire-retardant chemical treatments.

Many building codes also recognize fiberglass insulation as an acceptable fire stop in wood- and steel-framed wall assemblies.

3. Acoustic Control

Fiberglass insulation is a naturally sound-absorbent material that significantly reduces sound transmission in wall, ceiling, floor and HVAC assemblies. The first inch of fiberglass insulation in a building cavity can increase an assembly's sound transmission class (STC) value by three or four points in some constructions. Each additional inch can further increase the STC rating by two points2.

4. Recycled Content

Between 1992 and 2000, the fiberglass insulation manufacturing industry recycled more than 8 billion pounds (3.6 billion kg)

of pre- and post-consumer glass containers, eliminating the need for millions of cubic feet of landfill space3.

Fiberglass insulation has significant recycled content, with some batt, roll and loose-fill insulation products containing up to 80 percent recycled glass4. The other main ingredient in fiberglass insulation, silica sand, is an abundant, naturally renewing resource, limiting environmental impact in the manufacturing process

Fiberglass insulation packs multiple green performance features into one product and still comes at a very competitive price when compared to other insulation materials. After 70 years on the market, it’s an excellent choice with a tried-and-true track record. As part of this growing market, we provide a variety of insulation tapes and protective films, perfect for metal building construction professionals.

How to Choose the Best Fiberglass Insulation Facings

Most insulation facings used in metal buildings are available in only two color finishes—white or black.

White facing has been specifically designed to provide the inside with a bright, finished look since metal buildings typically do not have an interior wall material (such as sheetrock).

Black facings are primarily used for areas such as roofs or ceilings that shouldn't be the focus of attention as it is more cost-effective to use this than to paint white material.

There are several options on the market and each will have its own detailed spec sheet. But the three main factors to consider are:

- Workability: temperature conditions for installation
- Permeability: the rate at which water vapor will pass through
- Durability: how well it will stand up to physical stress without ripping or tearing

The most popular insulation facings are from Alpha, E& H and Lamtec, such as **WMP®-VR,** a white polypropylene reinforced facing which is excellent for chemically hostile environments; or **WMP®-VR-R,** which is recommended for use in high-humidity interior conditions where walls are exposed to heavy traffic. One of our favorites is **WMP®-50,** twice as strong as WMP®-VR-R and extremely workable in freezing conditions up to -40º F.

As always, you want to always make sure that you select the right ECHOtape insulation tape to seam any of these.

How to Make Your Metal Building

More **Efficient**

As more and more architects and builders embrace the clear benefits of using metal as a building material, so goes the attention to its unique insulation requirements. For all its well-known advantages, metal is not exempt from the need for the same good insulation practices like any other structure. Following the best practices outlined above will help, as will sealing leaks and seaming sections with tape.

Keep the following tips in mind:

- To yield the best result for metal building

insulation, a heavy-duty thermal insulation tape will help form the essential vapor barrier. The prevention of thermal energy loss is the outcome when correctly installing insulation.

- For metal buildings erected in areas that suffer extreme temperatures, an insulation tape with aluminum foil coating designed to adhere to temperatures at either end of the spectrum – including cold weather – is the solution.
- Double Coated Tape with high a high-performance adhesive is invaluable in the overall effort to brace a building to endure the elements.

All told, more and more architects, contractors and designers are discovering the advantages of metal building solutions.

For design alternatives, efficiency, durability and sustainability in support of LEED efforts, metal is unlike any other. It ages much more gracefully than traditional construction materials. It doesn’t crumble, its foundations don’t squeak, its walls don’t expand and warp. When its envelope is properly sealed, metal will just march on; proving a sound structure and investment for decades to come.