Moisture In Metal Buildings



This is a comprehensive guide to everything you need to know condensation and moisture in metal buildings, including what *causes* moisture/condensation inside metal buildings and how to *prevent or eliminate* it from happening. We will also explain how to make the building significantly cooler and more comfortable in the hot summer months. Imagine the difference in your building if you had a big shade tree over the building - we're talking results like that!

There is a lot of info here but we promise, if you read all the way through, you should have a complete understanding of what causes condensation in metal buildings, and you will learn some real solutions how to fix it.

Part I: Causes

What buildings does this guide include?

When we use the term “metal buildings” interchangeably, we mostly mean any non-conditioned building. This includes garages, barns, sheds, airplane hangars, agriculture facilities, and storage units. Buildings that are typically not using air conditioning inside.

In some cases, the building may be classified as “semi-conditioned” and this just means that you may heat or cool the building occasionally on as as-needed basis. For example, a garage that you use on weekends to fix cars, or a metal building that is used as a photo studio. These kinds of structures are not usually buildings that you want to keep at a constant temperature when it’s hot or cold, you just want them comfortable when they're in use.

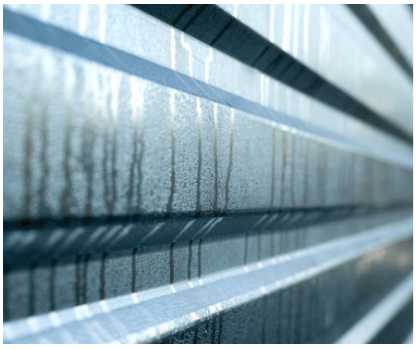
When you have a building, you want to keep at a constant temperature (like an office building or a barn-dominium), these buildings are referred to as “conditioned buildings" and they need to be treated differently.

Will BlueTex™ fix the moisture problem?

We get this question every day. **The first thing to understand is that in order to control moisture, you need a *process* more than a specific product.** Will our product fix your moisture problem? Maybe, but we need a lot more information before we can say definitively either way. Many times, how you install a product is key to how it performs and what results you can get.

What causes condensation?

Let's get technical for a minute and talk about the science behind condensation (or moisture). So, why does a building "sweat?" What happens to cause condensation?




The most basic rule that never changes is this: **moisture (also called condensation) occurs when relatively warm-moist air comes in contact with a relatively cold surface.** The key word here is “relatively” because condensation can occur at pretty much any temperature if given the right circumstances. However, for most metal buildings we are usually talking about when it’s cold outside.

Below are a couple examples of condensation. Notice how they have different temperatures and the details for each. In all examples warm-moist air is present.

***Example #1*:** If you close the bathroom door and turn on the hot shower, eventually the glass shower door and the walls (and maybe the mirror) in the bathroom will start to get condensation (fog) on them. The air inside the shower and bathroom is obviously warm and moist, and the glass shower doors, walls, and mirror are relatively cold compared to the air temperature – even if it’s 75-80 degrees inside the bathroom.

Example #2: Go back to the same scenario in example #1 except use a hair dryer on the mirror for a minute or two before the shower is turned on. Now, the mirror probably won’t fog up because the glass has been warmed up and it is no longer a *relatively* cold surface.

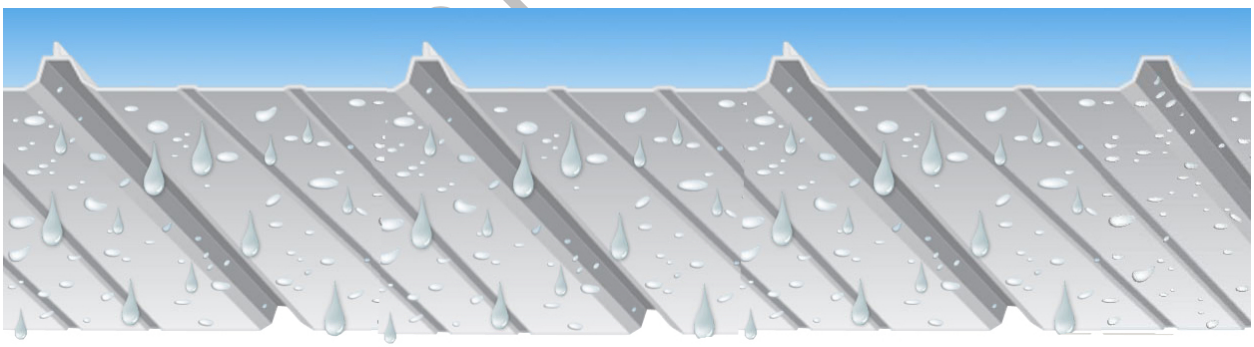
Example #3: If you exhale on to a cold window, it will probably fog up from your breath. Once again, you are breathing out warm-moist air, and the window is a cold surface. If you do this experiment on a warm day, you usually don't get any condensation because the window is not cold enough.

Condensation in metal buildings

Now, let's talk about what's going on inside of your building and how condensation might occur. Remember, the first basic rule: ***relatively warm-moist air needs to come in contact with a relatively cold surface.***

Here is a typical scenario: You have a garage, barn, shed, airplane hangar, or some other metal building, and it's a sunny, but cool 40º - 60º day. You open up the doors and the building warms up throughout the day. Even if you DON'T open the doors, the air inside the building will still continue to heat up throughout the day. At the end of the day, you close all the doors and the sun goes down, and the outside nighttime temperature drops to around 40º or less.

What happens? Two things happen in this scenario. First, the metal cools down quickly and get pretty close to the outside temperature (in this example, 40º). Second, you still have 40-60 degree air trapped inside the building. Now remember the rule and consider what's going to happen. If you said that the warm moist air inside the building will come in contact with the cold metal and create condensation, you are right! Under the right circumstances (between temperature and humidity) it can actually rain inside of your building, because condensation is typically most common on the roof area and the upper parts of the walls.



Sometimes under the right circumstances, condensation can occur with only a few degrees difference between the inside and the outside temperature. Under these conditions it's almost impossible to totally eliminate condensation without adding some additional heat to the inside surface. Remember the example above where we talked about how using the hair dryer warmed up the cold surface of the mirror?

However, adding enough heat to a plain metal building will get very expensive if you just try to heat the building without any other efforts. What you have to do is create a NEW interior

surface that can easily stay above the dew point (unlike the metal). *See Part II: Moisture Prevention about how to do this.*

Even more confusing is that you can have two identical days (as far as temperature), but on one day you will have condensation inside your building, and on the other day you will not. What's happening here? This is based on what is called **relative humidity** and this is a deep dive into a whole other topic we're not going to cover here. You can find more information about that topic by referring to a "psychrometric chart" that considers the air temperature and the relative humidity to determine the dew point of a surface. This is helpful because it can tell you the temperature of the metal at which point moisture in the air will start to form condensation (or liquid water). Here is a link to an online "dew point calculator" if you want more info on this.

What could be contributing to the moisture in a metal building?

We want to emphasize that having some moisture (condensation) is not usually a big problem. In the building science world, it's OK for something to get wet, to dry out, and get wet again. Yes, even if this cycle happens over and over. Problems with moisture usually occur when things *stay* wet, for an extended period of time and can't dry out. This is problematic because it can lead to mold, rot, rust etc.

Here are some examples of things that can contribute to moisture problems inside your building. Under normal circumstances, we know the metal is almost always going to be the cold surface in the scenario, so the question becomes: *"Where is the warm-moist air coming from?"*

- Anything that involves using water inside the building. This includes washing / cleaning / drying things - especially with hot water or steam.
- Storage of any type of plants, seed, feed, produce, hay, grains, etc.
- Indoor GROW facilities. Water and lights create a lot of moisture in the air.
- Storage of compost, dirt, manure etc. These items tend to have a high moisture content in them.
- Animals and livestock. Heat and moisture from breathing puts lots of moisture in the air, as does their food and water supply.
- Wet slabs. Poor drainage around the building can put water into the slab since concrete can absorb the water like a giant sponge.
- New slabs may also contribute to moisture issues. When first poured, they need some time to dry out. A 1,000 sq. ft. new concrete slab can easily put over 200 gallons of water into the air. We recommend leaving doors and windows open for a couple weeks to "vent" the moisture from a new slab.

Any of these situations can produce a high level of moisture in the air. When you combine these with cold metal, you will get condensation every time!

Part II: Prevention

In the first half of this guide, we explained what *causes* moisture in metal buildings; if you have not read it yet, we suggest you read it before continuing on. In this section of the guide, we will go over different ways to *prevent (or eliminate) condensation* / sweating in metal buildings.

What buildings does this include?

Throughout this guide, when we discuss condensation in “metal buildings”, we're generally talking about buildings that are non-conditioned or semi-conditioned. This usually means no air conditioning or heating is being used inside them or, if it is, it's limited to maybe a single window unit or heater to take the edge off on an occasional basis. If the building is fully conditioned (cooled and heated regularly) to maintain a constant temperature, then we need to treat it more like a house and that requires a different approach to the insulation.

Eliminating moisture inside the building

In the first article we emphasized the basic rule of moisture where *relatively* warm-moist air comes in contact with a *relatively* cold surface. Since we know the conditions that cause moisture problems, we can now develop a strategy to **prevent / eliminate** it. As stated in Part 1, we know that the metal skin of the building is usually the "cold" surface and the warm-moist air comes from INSIDE the building.

It’s really pretty simple and we recommend you choose one of two approaches:

1. Reduce or eliminate the source of the warm-moist air by using ventilation.
2. Raise the temperature of the cold surface to above the point of condensation (dew point) by creating a **new, interior surface inside** the metal building that is warmer (or at least above the dew point). This new surface will keep the warm-moist air from ever coming in contact with the cold metal exterior skin of the building.

What about adding ventilation in the building to stop moisture?

One method to reduce moisture inside of metal buildings is through ventilation. In the example from Part I, we talk about when the outside temperatures drop at night and cause the metal temperature to drop below the dew point. However, despite the cold temperatures outside, the inside the building can have warm moist air trapped inside it. Ventilation can help flush out this trapped warm air. To accomplish this, any air circulation inside the building will help. Read: Ventilation Basics

If possible, leave doors/windows open overnight and, most importantly, you want a way for the warm air to get out the top of the building too. Colder air is heavier and denser than the warmer air, so cooler air will actually PUSH the warmer air out the top of the building. To do this, you need some type of exhaust holes in the top of the building for the warm air to get out. We want relatively cold and drier air to replace the warm moist air. You *WANT* the building to be COLD INSIDE!

Another option is to use vents (or a fan) in the top portion of the building to suck the warm-moist air out. If you use active ventilation (fans), make sure you have some other places for the colder air to get in, or else you can easily burn out the motor due to the increased static pressure on the fan. If possible, place the intake vents as far away from the fan or the vents in the top of the building to maximize cross-flow ventilation. Even a ceiling fan or a floor fan pointing up toward the roof will help reduce the concentration of warm-moist air at the ceiling or roof level.

Why ventilation alone isn't always the best approach

The main problem with the ventilation-only method is that the building can be SUPER COLD in the winter. This may be OK if the building is just used for storage. However, if you're using it for anything else, you probably want it to be halfway comfortable inside. Also, in the summer a plain metal building can be SUPER HOT! (Even with good ventilation.) It's really no different

than a car parked in the sun with the windows down. It may have great ventilation, but it's still SUPER hot due the radiant heat from the sun.

BlueTex™ insulation is the best option

This is what the BlueTex™ products are specifically designed for. Our foil / foam products both eliminate moisture / condensation issues and they include a radiant barrier that will reflect radiant heat **BEFORE** it can enter the building and this will keep the building much cooler. All the BlueTex™ foil / foam products will also help keep heat in during colder months.

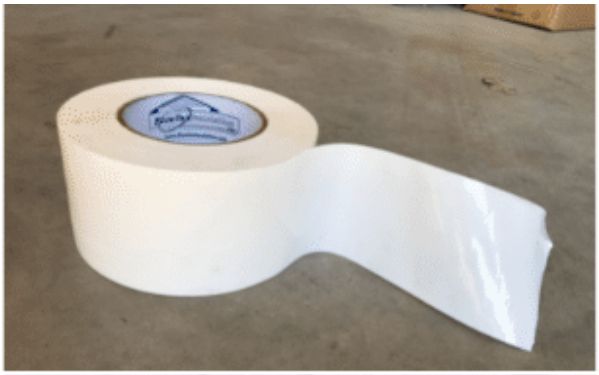
The key to this process is to create a *new* inner surface inside the building (that will stay warmer than the metal). BlueTex™ products work great for both new construction AND existing buildings.

Installation instructions can be found here: New Construction or Retrofitting Existing Buildings

Creating a new interior surface to stop condensation

Existing (Retrofit) Construction

For existing construction, you will essentially create an interior "envelope" or "skin" inside the building framing. Depending on whether it's wood or metal framing, you can use staples, cap nails, or BlueTex™ self-drilling screws/locking washers to attach the BlueTex™ insulation. How to install BlueTex™ in an existing metal building.



New Construction

For new construction, you are going to wrap the framing with the foil side facing out before you apply the exterior metal or wood siding. The key to reflecting the heat is that the foil side must face an airspace of at least about ½". This is usually achieved by installing horizontal hat channels on metal frame buildings or wood girts on wood frame buildings. Also, all BlueTex™ foil-foam products have easy peel and stick tabs to quickly seam the pieces together.

Note: you **CANNOT** apply metal panels directly on top of the foil surface (directly touching the foil) and still reflect the radiant heat - this will not work unless the foil has an air gap. When you eliminate the required airspace, the foil can no longer reflect the heat coming off the metal. In fact, if you do this, the foil will become a conductor and the heat will flow right through it by conduction. Unfortunately, we see this all the time with metal buildings where a foil product is installed in direct contact with the metal making it basically worthless at reflecting heat. This is true for any foil product; a foil layer installed in direct contact with the metal is basically doing nothing and providing no additional benefit.

With BlueTex™ (or any foil radiant barrier product), the foam layer will still provide SOME

benefit for conductive heat, but the ability to reflect any radiant heat will be lost if the foil is sandwiched against the metal. Browse our frequently asked questions for more info on the best practices for installing BlueTex™.

Stop moisture and COOL DOWN with BlueTex™ insulation products

BlueTex™ is a unique insulation product because it blocks heat and it stops moisture from forming in your building. On top of that, it's super strong so it makes for a good-looking, and economical interior finish.

How BlueTex™ Stops Moisture

How does adding BlueTex™ stop moisture problems and make the building cooler in the summer? Remember the part about warm-moist air coming in contact with the cold surface causing condensation? If the outside temperature drops, the metal is still going to get cold just like it normally would. The inside of the building will still have relatively warm-moist air compared to the cold metal.

By adding BlueTex™ inside the metal, we MOVED the interior surface of the building to the INSIDE surface of the BlueTex insulation - it's no longer the cold metal!

The airspace between the exterior metal skin and the foil layer provides some insulation. When we combine that with the foil and foam layers on BlueTex™, the NEW interior surface will stay much warmer, and usually the temperature will stay above the dew point temperature. This is true whether you choose foil or white as your interior surface using BlueTex™ products. Back to the basic rule of moisture: if the interior surface temperature is above the dew point, then the physics prove: you really CAN'T have condensation.

However, there **will be** times where the relative humidity level is at 100%. When this happens, condensation will naturally occur. Think of a typical foggy day - *everything will get wet*. Good News! If you install BlueTex™ insulation inside the building, all you need is just a little bit of heat to prevent condensation on these days! Even something simple as leaving on a couple of old fashioned incandescent light bulbs (the kind that get HOT) inside a building insulated with BlueTex™ will put just enough heat into the building to keep the inside surface warm enough so it stays above the dew point. CONDENSATION PROBLEM FIXED!

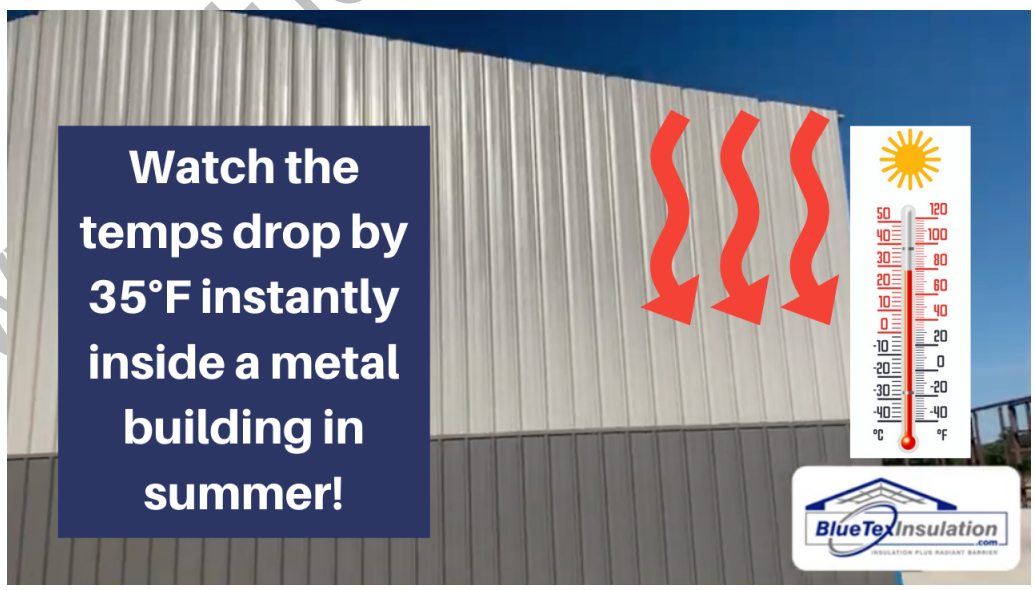
How BlueTex™ Blocks Heat

Here is the BEST part about BlueTex™: the FOIL LAYER!

Have you ever put your hand a couple inches away from the interior metal on a hot-sunny day? You can FEEL the radiant heat coming off of it. This is why it feels so hot inside a metal building. It's not the *air temperature* that makes it so miserably hot, it's the **radiant heat**! This is just like a car parked in the sun that can unbearably hot, even with the windows open.

The foil layer on the BlueTex™ Insulation will reflect back 97% of the radiant heat coming off the metal. This means when you put your hand close to the BlueTex™ you will no longer feel any radiant heat coming from the metal. Watch this video to see a live demo of a 35F drop instantly!

Radiant heat is the invisible part of the light spectrum that we *feel,* but don't see. When the metal skin gets hot, it emits radiant heat and that heat travels at the speed of light until it's either absorbed or reflected. Without a radiant barrier, the metal skin emits this heat and it is absorbed by all the contents in the building, including the concrete slab and even you!



Why Radiant Barrier is Better

Installing BlueTex™ insulation is like a giant shade tree instantly landing over the building. Once you block (stop) the radiant heat from entering at the walls or ceiling, all the contents inside (including the floor) will be much cooler. Everything you touch inside the building will be cooler and if you're inside, you will feel the difference. Big fans and cross ventilation are OK, but they will do nothing to reduce radiant heat because air absorbs virtually no radiant heat. Otherwise, we could not have both a **cold** *and* **sunny** day.

To illustrate this, I'll ask you: Would you rather park your car in the SUN with the windows DOWN with NO air conditioning? Or park your car in the SHADE with the windows up? Of course, you know from experience that a car parked in the shade with the windows up will be cooler. This is the perfect example of how **radiant barrier is so effective and there's nothing else like it**.

Curious about how we compare to standard bubble foil products? Read more here: BlueTex™ compared to bubble foil.

It's important to get ahead on this and design BlueTex insulation into the building from the start. If you are building a garage, barn, shed, airplane hangar, agriculture facility, mini-storage units, or any other type building, please give us a call ***before*** you start the project.

Start by ordering FREE samples of our products and let us work hand-in-hand with your builder to get it right. We also offer special pricing for builders and contractors.

If you need help with an existing building, please call us or send us your questions along with some pictures of your building to support@BlueTexInsulation.com and we will be glad to offer our expertise to you for your project.

www.BlueTexInsulation.com
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