

Your Guide to Metal Roof Design

Discover all of the design considerations
you need to know to successfully design a
standing seam metal roof or wall system.



WELCOME!

All of us at Sheffield Metals wanted to start by thanking you for downloading the *Your Guide to Metal Roof Design* e-book.

For nearly 25 years, Sheffield Metals has been distributing the premium metal coil and flat stock specified in architectural projects. In that time, we've also emphasized building a world-class Architectural Department that is dedicated to assisting architects, specification writers, design and build architects, and beyond with their metal roofing projects.

As an organization that strongly believes in sharing education, we've compiled a collection of information that gives a high-level look at design considerations for standing seam metal roof systems. After navigating through *Your Guide to Metal Roof Design*, we believe you'll discover something new and ultimately feel more confident in your metal design choices.

Some of the design topics we explore in this e-book include:

- + The general design considerations associated with standing seam metal roofing.
- + How to choose the right metal color based on your project attributes.
- + Engineering requirements and testing as it relates to panel profile selection.
- + Warranty offerings and why each one should be included in a specification.

We thank you for your time! If you have questions or would like to contact us regarding an architectural metals project, we're here to help. Feel free to call us at 802-431-7878 or [fill out the form on the contact page](#) of our website.

Sincerely,

Lori Reynolds Morrow

Lori Reynolds Morrow, CSI, CDT

Architectural Project Manager | Sheffield Metals International



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Chapter One

Top 5 Standing Seam Metal Roof Design Considerations

When designing or specifying a standing seam metal roof or wall, there are specific design elements that need to be taken into consideration so the roof or wall system doesn't fail.



INTRODUCTION

Whether you're an architect, designer, builder, spec writer, or otherwise, there are always key considerations you should keep in mind when designing a project and specifying certain products.

This idea holds true with nearly every product, but specifically exterior building systems, as they are subject to harsher conditions, such as water, wind, and other potentially damaging weather events.

One common system that comes with its own set of important design considerations is the standing seam metal roof system.

If the design considerations we're going to discuss in this chapter are not adhered to, the entire system could fail, leaving you with added costs and an unhappy client. So, let's discuss the core standing seam metal roofing design considerations to remember.



Geographical
Location



Metal Material
Type



Deck
Substrate



Pertinent Testing
Requirements



Areas of
Concern



Consideration #1: Geographical Location

The geographical location of your project is easily one of the most significant factors to consider when specifying a standing seam roof or wall system. Location matters for several attributes that could affect a metal panel system, including:

**Coastline
distance**

**Typical weather
(rainfall, sun,
snow, etc.)**

**Extreme weather
(hurricanes, blizzards,
tornadoes, etc.)**

**Local or state building
codes and regulations**

Coastline Distance & Metal Panel Systems

One consideration that can make or break a metal roofing system is a building's proximity to a coastline or saltwater environment.

For some reference, it's recommended that all properties within a certain distance of a coast use an engineered aluminum roof system, as aluminum resists corrosion and rusting from saltwater (unlike steel or Galvalume) for much longer and still comes with a paint and substrate warranty.

We recommend using aluminum panels for these coastline distances:

- + Within **1,500 feet** of a coastline with a breaking surf.
- + Within **800 feet** of a coastline with a large bay.
- + Within **400 feet** of a coastline with a marsh.





Typical Weather Patterns & Metal Panel Systems

Luckily, metal is one of the best performing roofing materials available, so it's destined to work well in nearly all environments. However, there are still some design considerations to remember. For example, if the property is in a region that gets significant snowfall, you'll want to make sure the standing seam metal system you specify can be fitted with attachment solutions for snow guards or snow retention systems. Or, if the property is in an area with high sun exposure, you'll want to specify metal that has a PVDF paint system, as it performs best and helps to prevent excessive chalking and fading.

We cover more about standing seam metal roofing and weather environments in chapter three of this e-book.



Extreme Weather & Metal Panel Systems

Researching climate data is critical in the design stage. Not only will it tell you common weather patterns, but it will indicate any possible extreme weather events that the property could endure. We already discussed the recommended distances from a coastline when it comes to the metal material, but on top of that, you'll want to specify a roofing profile that is engineered to hold up against extreme weather (such as a double-locked mechanically seamed profile). Or, if your project is in a high wind zone from the threat of hurricanes or tornadoes, it's critical to specify a profile with a wind uplift engineering report that meets the design criteria for your project. Plus, the option to purchase a weathertight warranty for your commercial project is also a great added value.

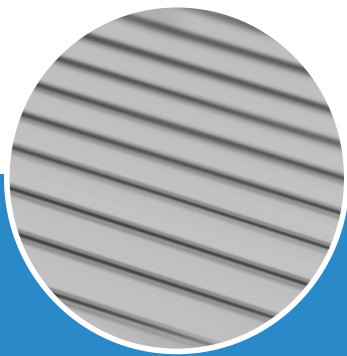


Local or Regional Building Codes & Regulations

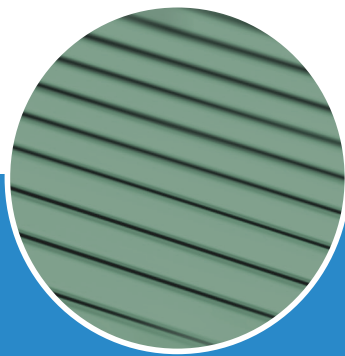
Last but not least, some cities, regions, and states have distinct building codes based on the location's specific needs, which means the roof or wall system you design with must adhere to these regulations and requirements. This includes such requirements as the Florida Building Code (FBC), Miami-Dade County building codes, Texas Department of Insurance (TDI), International Code Council Evaluation Services (ICC-ES).

Consideration #2: Material Types for Metal Roofing & Wall Systems

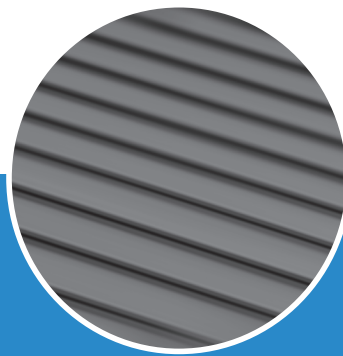
There are five common metals used for architectural metal roofing and wall systems:



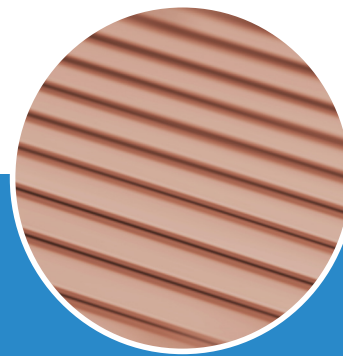
Galvalume



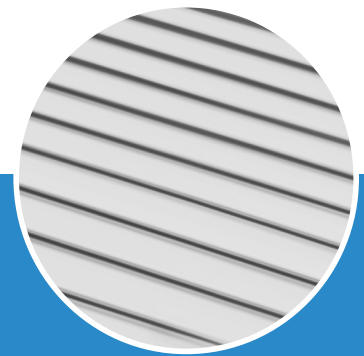
Aluminum



Zinc



Copper



Stainless steel

Galvalume and aluminum are the two metals specified for the majority of projects, as both materials are highly recyclable (and frequently made from already recycled materials), durable, and long-lasting. We explored the significant difference between these two options above in the fact that aluminum is always recommended on coastal properties, as it does not corrode or red rust when in contact with seawater or saltwater.

That being said, Galvalume is the most popularly specified metal material, as it's more rigid than aluminum, costs less, and is more readily available.



Consideration #3: Deck Substrate

Next on the list of design considerations is the deck substrate that the metal roof or wall is installed on. Decks are separated into two common categories: open-framing and solid substrate.

OPEN-FRAMING	SOLID DECKING / SUBSTRATE	SOLID DECKING / SUBSTRATE	SOLID DECKING / SUBSTRATE	SOLID DECKING / SUBSTRATE
Purlins	Plywood	Oriented strand board (OSB)	Metal decking or structural ribbed metal deck (often called B-Deck)	Metal decking with polyiso insulation

What to Know About Deck Substrates

Not all standing seam profiles or metal types can be installed on every decking structure, as some materials have dissimilar properties that could corrode each other, others cannot be installed over specific assemblies, and some profile assemblies do not qualify for engineering on particular substrates.

“

It's critical to look closely at the manufacturer's recommendations and testing requirements for decking substrates, which are typically available where panel profile details are listed.

It's also important to note that you will need to check the thickness of the framing and substrate as well. For reference, the typical thickness of purlins are 16 gauge, the typical thickness of metal decking is 22 gauge, and the typical thickness of plywood or OSB will typically be around 1/2" to 5/8". Make sure you reference the uplift engineering report to ensure that all items in the assembly match the assembly that was tested.





Consideration #4: Pertinent Testing Requirements

In the architectural metals world, testing and engineering of the roofing and wall systems are almost a requirement. No designer or architect wants to specify a panel system that isn't backed by industry standards, which is why it's critical to apply the information you've collected about the location, metal material, and roof deck and ensure it all fits together and was successfully tested by the manufacturer and approved by the standards organizations.

For a little background on the different tests you might encounter during the design phase, let's go through some of the common basic standards and project-specific tests.

Common or Basic Industry Standards & Testing



Wind Uplift Testing Standards

- + **UL 580 / UL 1897:** Standard for Tests for Uplift Resistance of Roof Assemblies (solid decking)
- + **ASTM E1592:** Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference (open framing)



Water Penetration Testing Standard

- + **ASTM E 1646:** Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference



Air Infiltration Testing Standard

- + **ASTM E1680:** Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems



Hail / Impact Resistance Testing Standard

- + **UL 2218:** Standard Test for Impact Resistance of Prepared Roof Covering Materials



Fire Resistance Testing Standard

- + **UL 790:** Standard Test Methods for Fire Tests of Roof Coverings (most common testing standard)

Project-Specific Industry Standards & Testing



Water Submersion Testing Standard

- + **ASTM E2140:** Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head (applies to slopes less than 2/12 pitch)



Missile Impact Testing Standard

- + **ASTM E1886:** Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials



Wind-Driven Rain Testing Standard

- + **TAS 100:** Test Procedure for Wind and Wind-Driven Rain Resistance and/or Increased Windspeed Resistance of Soffit Ventilation Strip and Continuous or Intermittent Ventilation System Installed at the Ridge Area



Foot Traffic Over Purlins Testing Standard

- + **FM 4471:** FM Approved Lap Seam Roofs. Evaluated under approval standard 4471, Class 1 panel roofs, which includes performance requirements for combustibility, above and below roof assembly, wind uplift, foot traffic, and hail damage resistance

The reason that standards and testing exist can be summed up with one word: TRUST. Consumers need to be able to trust the products and services they spend their money on and that it will live up to expectations and solve the problem it's designed to fix. This is why standards exist for nearly everything; from food or medicine, to paper products, to electrical wires, and far beyond.



Consideration #5: Areas of Concern

The final design consideration to keep in mind when specifying a standing seam metal roof or wall system are the areas of concern, some of which are common in architectural projects. Concerning areas can include:

Dead valleys or any area of the roof that water cannot get off of freely.

Intersecting planes or complex designs, especially those that don't allow for proper water drainage.

Penetration points — i.e. skylights, chimneys, vent pipes, hatches, etc.

Unique gutter designs, such as flange back gutters and internal gutters.

All of these are areas of concern because they tend to be the spots where the roof can fail in one way or another. This could be a leak at a complex flashing point or water and debris collecting in a dead valley, which can degrade if standing water is present for a long time. These design elements become a more significant issue when a weathertight warranty is included in the specification. Some conditions may not meet the qualifications for a weathertight warranty and would be excluded if a warranty was to be issued. If any of these areas of concern are part of the design, but you still want a warranty, our Technical and Architectural Department representatives can work with you to ensure the warranty conditions are met.

Final Thoughts on Design Considerations

Designing and specifying a standing seam metal roof or wall panel system is one of the best ways to ensure a building looks fantastic, all while withstanding exposure and protecting the people and property on the inside. So, once you have identified all the topics above, you can then determine the panel profile options and pick the best one to meet your specific project conditions.

Remember:

- + Geographical location plays heavily into the engineering and building code requirements.
- + Galvalume and aluminum have different characteristics that work well in different regions.
- + Not all profiles can be installed on any roof deck substrate.
- + Industry standards and engineering reports for various standing seam profiles are available through the manufacturer.
- + Keep an eye out for areas of concern that could affect the weathertight warranty approval.



Chapter Two

How to Pick the Best Color for a Metal Roofing Project

Specifying a metal roof or wall comes with a critical question: What color would look best on the home or building? Discover the considerations and tips that will help you choose the right paint color.



INTRODUCTION

When designing or specifying a standing seam metal panel system, one of the most challenging decision tends to be what color to choose.

It doesn't help that metal can come in practically any color, as most coil and sheet manufacturers offer custom colors as options.

So, what color should you incorporate into your metal roofing project? Well, it depends. There are many different factors to keep in mind during the decision process.

To help you out, we'll discuss the following topics in this chapter:

- + Factors that can help you choose the right metal roof or wall color.
- + Different types of paint and coatings available.
- + Popular colors selected by Sheffield Metals customers.
- + Steps to take that will help you narrow down color choices.



Factors to Help You Choose the Best Metal Roof Color



Some property owners and clients might know what color they want before the project ever starts. However, not everyone might know what will look best on their home or building. Here's a comprehensive list of factors to keep in mind that can help you narrow down your color and design selections.



Base Color Choice
on Personal
Preference



Complementary
Colors On or
Near the Structure



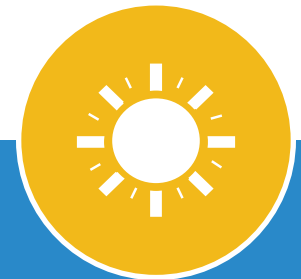
Use Geographic
Location to Guide
the Decision



Know the
Architectural Style
of the Structure



Adhere to Home
Owners Association
(HOA)



Emissivity and Solar
Reflectance Index
(SRI)



Factor #1: Client's Personal Preference

Every building is unique, and every property owner possesses different tastes as far as colors go. It's important to keep yours and your client's design preferences in mind when you decide on the color. We could go on and on about colors that complement each other, but at the end of the day, the color you choose should be one that the client is happy with.

Factor #2: Complementary Colors On & Near the Structure

More factors that can help you with the color decision are the colors that currently exist on the property. You're likely going to want to design for a roof color that looks good when placed next to or nearby the other exterior elements of the property.

Look closer and note what color the following items are:

- + Siding or the color of the exterior walls
- + Exterior trim
- + Gutters and downspouts
- + Door frame(s)
- + Door(s)
- + Window frame(s)
- + Fascia board
- + Column(s)
- + Railing(s)
- + Signs
- + Nearby sheds and barns
- + Landscaping features

Neighborhood Trends

While it's entirely a personal preference, most property owners don't want their roof to stick out too much from others in the same residential or commercial neighborhood.

For instance, if everyone has a colonial red or terra cotta colored roof, you probably wouldn't want to have the Regal Blue roof in the neighborhood.

Take a look at other color schemes that are common near the property, which can help further guide you to the best color.

Once you have an idea of the other colors you need to complement, you'll be more equipped to make a decision that works for the design.



Factor #3: Use Geographic Location to Guide the Decision

Tropical

Projects in tropical locations tend to design metal roofs in colors that are brighter and livelier than non-tropical regions. Favored colors in the tropics include Aged Copper, Patina Green, Slate Blue, Metallics, and custom colors.



Plains

Similar to mountainous areas, colors used on exterior buildings in the Plains tend to be softer earth tones, including Ash Gray, Dove Gray, Surrey Beige, and Mansard Brown.



Mountains and Forests

Most buildings settled in the mountains or forested areas utilize more of the earth tones that match the surroundings. Popular colors for these areas are Hartford Green, Evergreen, Dark or Medium Bronze, and all of the gray finishes.



South

States or regions in the southern United States tend to follow warmer color schemes and are heavily influenced by Latin architecture; for roofing specifically, Spanish tile is prominent. For properties that want the look of Spanish tile and the protection and longevity of metal roofing, standard colors include Terra Cotta and Colonial Red.





Factor #4: Know the Architectural Style of the Structure

Another factor to consider during the color decision revolves around the type of architectural style your project is categorized as. There are hundreds of different kinds of architecture, and some properties might be considered more than one. The following page contains some examples of color choices based on the most common architectural styles.



MODERN

- + Matte Black
- + Regal White
- + Charcoal Gray



RANCH

- + Charcoal Gray
- + Dark Bronze
- + Solar White



CRAFTSMAN

- + Ash Gray
- + Sierra Tan
- + Slate Blue



SPANISH

- + Terra Cotta
- + Colonial Red
- + COR-TEN AZP® RAW



CAPE COD

- + Sandstone
- + Slate Gray
- + Medium
- + Bronze



VICTORIAN

- + Charcoal
- + Gray
- + Dove Gray
- + Hemlock Green

Factor #5: Adhere to Homeowners Associations (HOA)

If the home or property is part of a Homeowners Association (HOA) or your project is in a historic downtown district, there might be some color restrictions that you should be aware of. In fact, some HOAs don't allow metal roofs to be installed at all, which is why it's essential to first check with the municipality before any installation begins.

Additionally, historic properties or buildings in landmark districts might be limited to specific material and color options.

For reference, here are some common reasons HOAs cite to **deny the installation of metal roofing or specific colors:**

- + Metal is often thought of as looking "industrial."
- + Metal might be inconsistent or go against the look or aesthetics of a neighborhood.
- + Some municipalities don't want roof paint finishes to have a high glare.





Factor #6: Emissivity & Solar Reflectance Index (SRI)

One huge draw to metal roofing is the option to install cool metal roofing, which is highly emissive metal that has a higher Solar Reflectance Index (SRI) than other roofing materials.

For a little background on what emissivity and SRI refer to:

Emissivity – How quickly the surface (or metal in this case) releases its absorbed heat and returns to its average temperature.

SRI – How reflective of the sun's rays a surface is (cool metal roofing has a higher SRI), which allows the panels to absorb less heat from the sun's rays. SRI is determined on a scale from 0 to 100:

- + Materials that absorb and retain solar radiation (which become hotter in the sun) have a lower SRI number. These tend to be darker colors, including black and dark browns.

- + Highly reflective materials (which remain cooler in the sun) have a higher SRI number. These tend to be lighter colors, such as white or light gray.

If a structure needs to adhere to specific SRI ENERGY STAR® or LEED 2013 requirements, color choices could be limited. Should you have questions about the color limitations and how to determine the correct SRI value based on the slope, contact the manufacturer and they can help you.

We'll dive deeper into cool metal roofing, SRI, and emissivity in chapter five.

Metal Panel or Trim Paint Coating Categories & Types



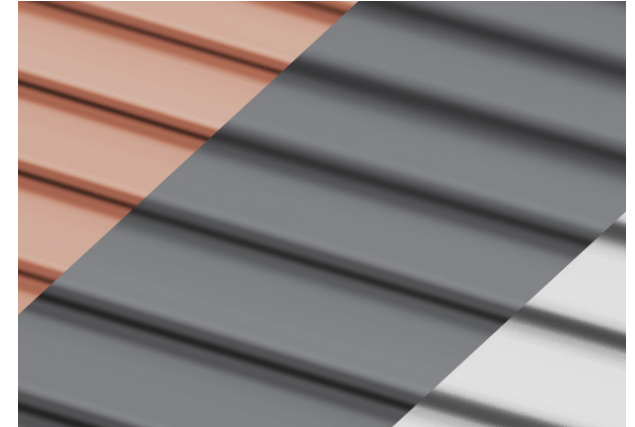
Polyvinylidene Fluoride (PVDF) Coated Galvalume® & Aluminum

This resin is made up of about 70% PVDF and 30% acrylic blend. Commonly referred to as Kynar 500® or Hylar 5000®, PVDF resins are the best protective coatings available to stand up to extreme temperatures, sun exposure, humidity, and pollution particles in the atmosphere. PVDF coated metal is easily the most popular metal roofing option available today.



Silicone-Modified Polyester (SMP) Coated Galvalume® & Aluminum

SMP coatings are a step below PVDF in terms of quality and longevity. However, SMPs have been known to be a great option to defend against extreme weather conditions.



Specialty Colors

Beyond coated and bare Galvalume and aluminum, there are other colors as specialty sheet and coil, including:

- + Copper
- + Zinc (often available in different colors)
- + Stainless steel

The Top 10 Metal Colors at Sheffield Metals

The popularity of colors tends to fluctuate, but several colors are typically at or near the top of the bestsellers list.

Here's a collection of Sheffield Metals' most popular metal roof, wall, and trim colors, which are provided by Sherwin-Williams:



DARK BRONZE



MATTE BLACK



COLONIAL RED



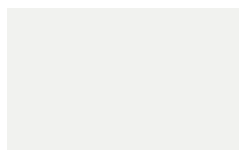
SLATE GRAY



CHARCOAL GRAY



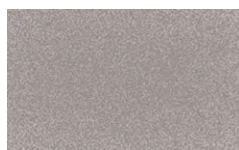
MEDIUM BRONZE



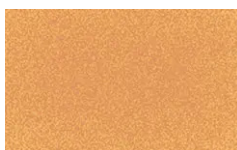
REGAL WHITE



MANSARD BROWN

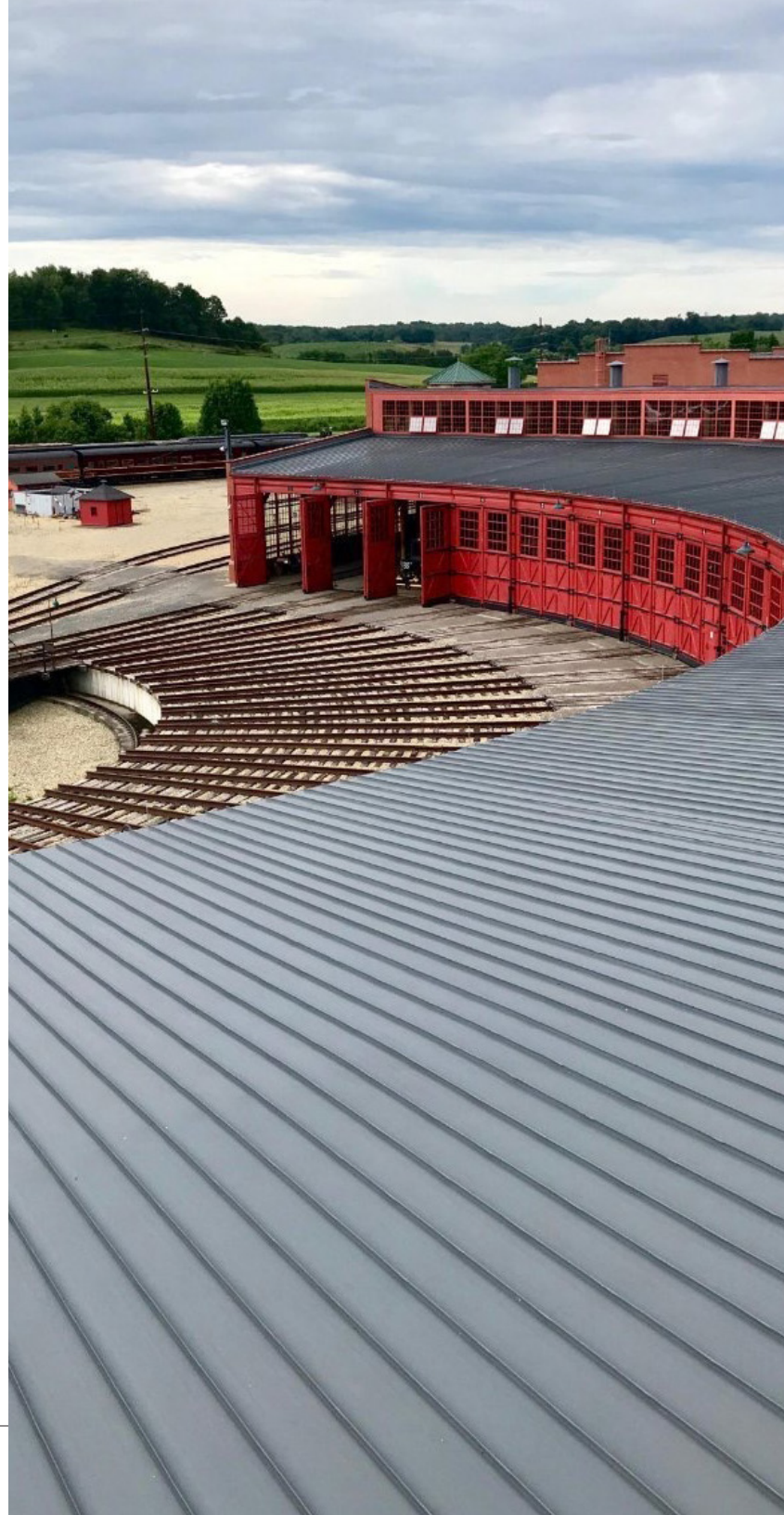


PRE-WEATHERED
GALVALUME



COPPER METALLIC

+ Colors shown are matched as accurately as possible, but may vary slightly from finished product.



Steps to Take for Choosing the Best Metal Roof Color



Step #1: Explore Color Palettes & Photo Galleries

Exploring different exterior color palettes online is one of the best first steps you can take when choosing a color. Sherwin Williams, one of the biggest names in paint and metal coil coatings, offers home and building owners with a variety of resources, including exterior color palettes based on architectural style.

Beyond palettes, look up some manufacturer's photo galleries to gather some inspiration. You might see a color that you've never considered before that might look and function great for your project.

Step #2: Look at Color Choices From Manufacturers

Once you have an idea of the color palette that you like or believe would work well with the building, it's time to take a look at colors offered by different manufacturers.

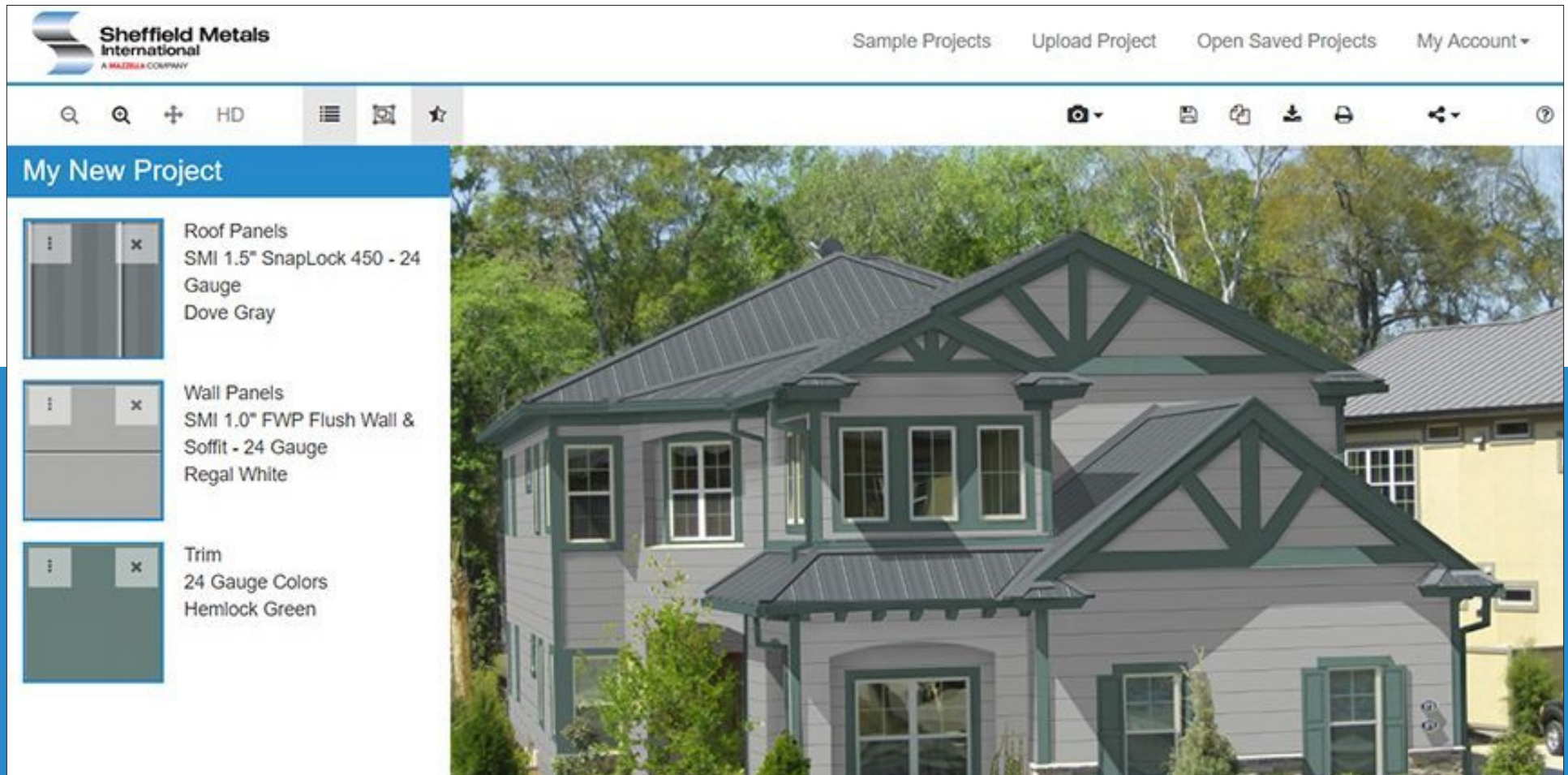
Reputable manufacturers should have their colors listed on their website, which may also be available as a downloadable color card. Most suppliers tend to have similar standard colors, especially if they use one of the prominent paint suppliers, such as Sherwin-Williams (Valspar) or PPG. If you want a color that is more vibrant, unique, or specific to a branding style, there's also the option for custom colors.

If you're looking at colors but are struggling to envision what the final product would look like, step #3 can help ease some of that stress.

Step #3: Use a Visualizing Tool & Upload Photo of the Structure

The ability to see different colors on a structure makes a difference, especially if you're deciding between two or more colors. Roof visualizers are designed to help.

In fact, Sheffield Metals has a free Color Visualizer tool where you can upload a photo of your project, whether it's residential, commercial, architectural, agricultural, etc., and see what each of our colors would look like on the roof, wall, and trim areas. Or, if you don't want to take a picture of the structure or don't have one, there are also standard building photos available to choose from if you just want a better idea of how colors differ when seen on a physical property.





Step #4: Request Metal Color Chips from the Manufacturer

While the Color Visualizer is an excellent tool for some, we understand that not everyone wants to rely on a digital mockup of their project. That's why you can request color samples that'll be shipped directly to you to provide the most realistic representation of the color you can expect.

Once you receive the colors you wanted samples of, you can go compare the colors with the other elements of the building and environment. That way you have a better visual of the final product and can feel the most confident in picking the best color.

Final Thoughts on Choosing a Metal Color

It might seem stressful to choose the right color for a metal roof or wall project. But if you do your due diligence and use the resources made available by manufacturers and designers, your decision will be easier and you'll be happier with the end design.

To recap, remember:

- + Exterior colors will differ for every property based on geographic location, architectural style, environment, temperature, surrounding elements, and local organizations.
- + There are various types of colors and textures available as metal roofing, including custom colors that can be matched by paint suppliers.
- + Use a manufacturer's roof visualizer tool to see how a specific color will look on a property, or request physical color samples for the most authentic representation.
- + If you're having difficulty deciding, contact the metal sheet and coil manufacturer. They often have experienced design personnel who can help with projects.



Chapter Three

Metal Roofing & Weather: Warm & Cold Climate Considerations

Whether you're designing a standing seam metal roof in a hot or cold weather climate, there are specific design considerations that can affect the system you choose.



INTRODUCTION

Weather effects everyone and every project. It doesn't matter if your project is in a region that gets 100+ degree temperatures, several feet of snowfall, or somewhere in between — there are weather-related design considerations to keep in mind.

Designing a standing seam metal roof according to the weather events it will experience helps to ensure the roof doesn't prematurely degrade or fail due to the environment. Plus, it protects the often significant investment of the client you're working with.



In this chapter, we'll discuss some of the most important warm and cold weather climate design considerations. Before we begin, we recommend reading through both the hot and cold weather design considerations, as it could help you verify that all design angles are considered.

The background of the slide is a monochromatic blue image of a tropical beach. In the foreground, the fronds of several palm trees are visible, some hanging down from the top and others on the sides. Below the palm trees, a calm ocean stretches to the horizon. The overall tone is serene and tropical.

Warm Weather Climates



Metal Roof Design Considerations for Warm Weather Climates

#1

**Cool Metal
Roofing System**

#2

**UV Exposure
& Protection**

#3

**Fire
Resistance**

#4

**Tested for
Uplift Resistance,
Hail Resistance,
& Location-
Specific Codes**

#5

**Proximity to
Coastline or
Large Body
of Water**

Consideration #1: Cool Metal Roofing System

One of the first notable design considerations for a property exposed to extreme heat is to ensure that you're installing a cool metal roofing system.



Cool metal roofing is defined as painted or coated metal products that reflect the sun's energy to dissipate heat. Cool roofing ensures that heat is adequately transferred off of the metal's surface so the cooling system doesn't burn up as much energy trying to keep the indoors at a comfortable temperature. According to the Green Building Alliance, installing cool roofing can result in total cooling cost energy savings ranging from 7% to 15%.

Despite the common belief that cool metal roofing is a particular type of metal, the "cool" properties are dependent on the paint system applied during the coating process. The cool metal roofing paint formula (formulated by Sherwin-Williams or another paint supplier) contains innovative solar reflective pigments.

Also, you'll want to verify the metal has the appropriate:

- + **Solar reflectance** – Solar reflectance is the ability of a material to reflect solar energy from its surface back into the atmosphere. Solar reflectance is measured in decimals on a scale from 0 to 1, where 0 would be considered the truest black and 1 would be considered the truest white.
 - + The measurement of solar reflectance is also dependent on a roof's slope. The measurement of solar reflectance is also dependent on a roof's slope.
- + **Emissivity** (also called thermal emittance) – Emissivity measures how efficiently and quickly a surface releases or emits absorbed heat and returns to its normal temperature. Emissivity is determined on a decimal scale from 0 to 1, where a 1 represents the most emissive material possible.
 - + Look for metal coil or panels with a higher emissivity value so the heat can't linger on the surface and transfer indoors.
- + **Solar Reflectance Index (SRI)** – Solar Reflectance Index is a measure of a surface's ability to reflect the sun's solar energy (solar reflectance) and emit heat (emissivity). SRI is measured on a scale from 0 to 100. An SRI value closer to 0 indicates a darker or black surface, and a value closer to 100 indicates a brighter or white surface.
 - + For a building in a hot climate, the higher the SRI, the better.

Consideration #2: UV Exposure Protection

You should consider picking out metal products coated with a special paint that withstands UV exposure if installing a metal roof in a warm location. In the United States, this is a common design concern in Florida, California, Texas, and other states where the sun shines for most of the year.

Unfortunately, the reality is that there will be some level of fading to expect on a metal roof, especially if it's consistently exposed to the sun and high temperatures. However, that doesn't mean the metal's paint system's fading or degradation has to be excessive.

You'll want to ensure that you're choosing or specifying metal with one of the following paint finishes, which we explained in full detail in chapter two:

- + **Polyvinylidene fluoride (PVDF)** – PVDF resins are the best protective coatings available to stand up to extreme temperatures, sun exposure, oxygen, humidity, and even pollution particles. Coils coated in this resin are most likely to have the most extended chalk and fade warranties (typically up to 30 years). Still, they are slightly more expensive due to superior durability.
- + **Silicone-modified polyester (SMP)** – SMP coatings are a step below PVDF in terms of quality and warranty options. SMPs are a great option to defend against extreme weather (including UV exposure) while still carrying long paint warranty options. However, SMP warranties often have a lesser chalk and fade rating than the PVDF.

One of the best ways to see how the manufacturer expects the paint system to last, especially when exposed to UV, is to read the warranty documents thoroughly. This includes all of the inclusions, exclusions, and other special conditions. Most reputable manufacturers make their paint specifications available so you can see how the coatings performed when tested in extreme weather conditions (i.e., accelerated weather testing).

Consideration #3: Fire Resistance

In regions where hot and dry weather conditions can create a concern for fires, installing a fire and combustion-resistant roofing material is critical. Recently, there have been wildfires ravaging California and its surrounding regions, which is why more and more manufacturers are emphasizing the production of fire-resistant building materials. Installing fire-rated building materials can help to prevent buildings from catching fire and spreading the fire to other structures.

Regarding standing seam metal roofing, you'll want to look for metal that is tested according to the UL 790 standard and achieves a rating of Class A (the best fire rating).

Earning a Class A rating means that:

“

Roof coverings are effective against severe fire test exposures. Under such exposures, roof coverings of this class afford a high degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

— Underwriters Laboratories Inc. (UL)



Consideration #4: Tested for Uplift Resistance, Hail Resistance, & Location-Specific Codes

Going along with the fire resistance is the need for a standing seam roof system that is tested to stand up to weathering events that can wreak havoc on a roofing system. This can include wind (hurricanes, tropical storms, tornadoes, etc.), hail, and rain (wind-driven rain) in hot weather environments. Plus, you might even live in a state, county, or municipality that must adhere to region-specific codes and testing requirements.

Let's dive a little deeper into some extreme weather events and the testing standards to look for if your project is located in a region where it may occur:

- + Wind & Wind Uplift Testing (UL 580 & UL 1897)
- + Hail & Impact Resistance Testing (UL 2218)
- + Rain & Water Intrusion Testing (ASTM E1646) / Wind-Driven Rain Testing (TAS 100)
- + Special Codes, Testing, Requirements Based on Location





Wind & Wind Uplift Testing (UL 580 & UL 1897)

For properties where hurricanes, tornados, and other strong wind events are a threat, you're going to want to choose a standing seam metal roofing assembly tested according to UL 580. This standard tests the uplift wind resistance of a metal roofing system, including the panels, accessories (clips, underlayment, and fasteners), and structural support frame. The test applies positive and negative pressure (PSF) and is a pass or fail test done in three UL 580 sequences and then turns into a UL 1897 if it can go beyond Class 90 and tests until the system fails:

- + UL 580 Class 30
- + UL 580 Class 60
- + UL 580 Class 90 (best/highest UL 580 test rating) — must be met to achieve a UL 90 rating based on the UL 580 test
- + UL 1897 test (maintains a positive pressure and increases in negative pressure usually in increments of 15 PSF until the system fails)



Hail & Impact Resistance Testing (UL 2218)

For areas where hail is a concern, including Texas and the Great Plains, always ensure the roof system you're installing adheres to the UL 2218 industry guideline. This test exists to measure a metal panel's resistance to puncturing or failing when it comes into contact with items, such as hail or other small debris.

The final rating is on a scale from Class 1 to 4, with Class 4 being the toughest and least likely to fail when in contact with objects.



Rain & Water Intrusion Testing (ASTM E1646) & Wind-Driven Rain Testing (TAS 100)

ASTM E1646: In warmer regions that receive significant rainfall, such as the Southeastern U.S., you'll want to pick a panel system with a passing ASTM E1646 water penetration rating. After the pre-determined air pressure is reached, water is sprayed on the panels for 15 minutes. The amount of ponded water is determined, and then the amount of water infiltration through the tested panel is measured. This is a pass or fail test where any water intrusion in the system will result in failure.

TAS 100: The less common rain-related test standard is TAS 100, which measures how a roof system holds up in wind and wind-driven rain conditions. TAS 100 is a region-specific test that will vary heavily from project to project. Check with the local building codes to see if this test is a requirement.



Special Codes, Testing, & Requirements Based on Location

It's also critical to remember that many cities, regions, and states have specific building codes based on the location's weather patterns. This means that the roof or wall system you design with must adhere to these regulations and requirements. Some of the most common location-specific regulators include:

- + Florida Building Code (FBC)
 - + Additionally, verify if your project is in a High Velocity Hurricane Zone (HVHZ), which is built into the Florida building code. Other states have similar codes and test protocols that fall under another name, so it's best to check state building codes or consult with a licensed contractor.
- + Miami-Dade County building codes
- + Texas Department of Insurance (TDI)
- + International Code Council Evaluation Services (ICC-ES)

Consideration #5: Proximity to Coastline or Large Body of Water

One other consideration that often comes into play for warm weather environments is the property's proximity to water, especially a coastline or saltwater environment. It's recommended that all properties within a certain distance of a coast that contains saltwater use an engineered aluminum roof system (plus the proper accessories) and NOT a Galvalume system. Aluminum can better resist corrosion and rusting from saltwater, and still comes with a substantial paint warranty.

At Sheffield Metals, we recommend using an aluminum system:

- + Within 1500 feet of a coastline with breaking surf.
- + Within 800 feet of a coastline with a large bay.
- + Within 400 feet of a coastline with a marsh.



A blue-tinted photograph of a winter landscape. In the foreground, there is a frozen body of water, possibly a lake or a wide river, with a smooth, icy surface. To the left, a large, snow-laden tree branch hangs over the water. In the background, a dense forest of snow-covered trees stands under a pale, overcast sky. The entire scene is bathed in a monochromatic blue light, creating a cold and serene atmosphere.

Cold Weather Climates



Metal Roof Design Considerations for Cold Weather Climates

#1

Snow Shedding & Retention Systems

#2

Ice Dam Prevention

#3

Underlayments Designed for Cold Weather

#4

Proper Structural Support

#5

Proximity to Coastline or Body of Water

Consideration #1: Snow Shedding & Retention Systems

Snow is easily one of the most significant concerns for properties in regions where cold weather is typical.

When it comes to snow build-up on a roof, the number one main concern is the safety of the people inhabiting, entering, and leaving the building. Plus, you want to minimize any damage that falling snow can inflict on the property below, including windows, doors, cars, plants, etc.

This is why it's critical to design the roof system with the appropriate snow shedding or retention system. According to snow retention manufacturer S-51, using a metal roof snow guard helps to retain the snow on the top of the roof and allows it to slowly leave the roof in small amounts or as melted water. Such systems are specifically designed to prevent catastrophic events from happening if the snow comes off the roof like an avalanche.

In regions with the threat of snow build-up, always make sure to design the roof with a steeper slope that allows for snow retention over walkways, doorways, garages, and any other areas accessible to people or property that can be damaged.

There are various snow retention systems to choose from that match the design of a roof and are warranted. Plus, snow retention and shedding systems can be installed without ever penetrating the roof's surface, which is always recommended for standing seam metal roof systems.



Consideration #2: Ice Dam Prevention

Another cause for concern in cold environments is the potential for ice dams to form on the roof's eave. Luckily, one of the benefits of choosing a standing seam metal roof for your project is that it significantly reduces the likelihood of ice damming from occurring.

Metal roofs, especially the lines of a standing seam metal roof, allow water to flow freely off the roof's surface, which can help stop the formation of ice dams. Plus, with the proper ventilation for the whole roof system, you can avoid the formation of ice dams altogether in some cases.

Additionally, if ice damming is a concern, always make sure to install an ice and water shield type of underlayment beneath the panels. This will help to prevent water from entering the structure.

What Is an Ice Dam & How Does it Occur?

The attic is a collector of heat, which warms the roof and can help to melt snow off the surface. However, because the eave doesn't have any attic space beneath it, it stays colder than the rest of the roof. As the snow begins to melt off the roof because of the warm attic, it freezes to ice at the cold eave. This creates an ice dam that builds up and prevents water from shedding off of the roof.

When the water has nowhere else to go, it just sits on the roof and often finds its way into the structure. Ice damming is common with asphalt shingles because the backed-up water is forced to flow underneath the shingle(s) and into the property.



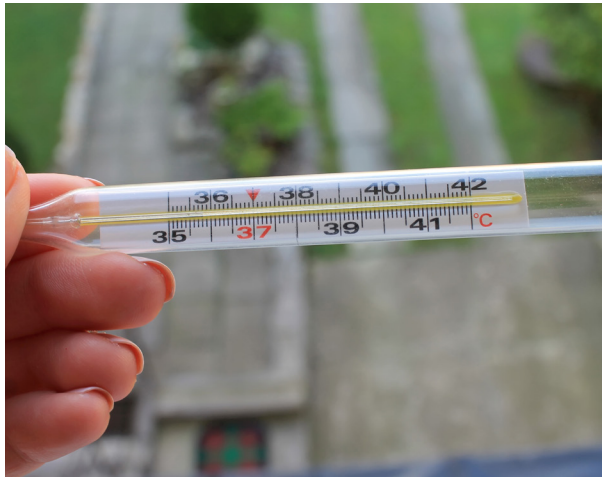
Consideration #3: Underlayments Designed for Cold Weather



Ice & Water Shield Underlayment

First and foremost, we recommend using a full ice and water shield underlayment, a waterproof membrane product that protects vulnerable areas on a roof from water and ice damage. Such regions include eaves, valleys, hips, penetration points, and any other spot on the roof susceptible to water or ice intrusion.

If you're going to use a synthetic underlayment, the roof pitch needs to be a 3/12 or more. Even so, we recommend using an ice and water shield in conjunction with the synthetic at the vulnerable areas mentioned above.



Temperature Restrictions

Many underlayments have a minimum outside and surface temperature that it needs to be for them to be correctly installed. For example, ice and water shield products have a peel-and-stick adhesive backing that runs the risk of not adhering to the roof deck if installed at a temperature below 40 degrees.

Always verify the minimum installation temperature and any other temperature restrictions that can influence your underlayment choices.



Slope & Substrate Requirements

No matter the environment, it's important to always check the minimum slope requirement for the underlayment you specify. Some underlayments, ice and water shield included, might not go to as low of a slope as you would think. It's critical to check the manufacturer's instructions and follow them accordingly.

The same goes for ensuring that you can use the underlayment on your project's specific roof deck substrate. Most underlayments can be installed over plywood or OSB decking, but not all are suitable for metal decking (B-deck), concrete, etc.

Consideration #4: Proper Structural Support

Another essential safety measure to consider when it comes to roofing snow build-up in colder regions involves the proper structural support underneath the standing seam metal roof.

It's often easy to forget that snow is water, and water is heavy. So when you're designing the building for the roof to go on, always make sure that the property has an adequate snow load capacity so it can handle the weight of snow and water.

This is especially true if you have a snow retention system that keeps the snow on the roof so it can safely run off over time. Our best recommendation is to involve a structural engineer who can look at the plans and ensure that the structure can withstand the weight.



Consideration #5: Proximity to Coastline or Body of Water

As discussed in the hot weather metal roofing concerns, the same principles apply to coastal properties in cold weather environments. Any property within these coastal distances should install an engineered aluminum roof system (plus the proper accessories) and NOT a Galvalume system:

- + Within **1,500 feet** of a coastline with a breaking surf.
- + Within **800 feet** of a coastline with a large bay.
- + Within **400 feet** of a coastline with a marsh.





Final Thoughts on Weather & Metal Roofing

It's safe to say that weather can significantly affect how you design your projects that have a standing seam metal panel system. But, if you know what to look for based on the location and weather patterns, you'll be well-equipped to design a long-lasting metal roof that will make you and your client happy.

Remember to always consider:

- + Local or state-specific codes and testing requirements.
- + Special environmental concerns (UV, fires, water, ice, etc.).
- + Proximity to an ocean, sea, or saltwater coast.
- + How a design can affect the safety of humans (especially from shedding snow).

Chapter Four

What Is Low or Steep-Slope Metal Roofing? Characteristics, Limitations, & Profiles

Choosing the wrong standing seam metal roof profile for your project's slope can be detrimental to the system. Discover what is considered low and steep-slope, why choosing the right profile matters, and what profiles we recommend for each slope.



INTRODUCTION

The next critical design factor that will affect your standing seam metal roofing product choices is the slope of the roof.

You might be asking yourself how slope can make that much of a difference in a design. But it does matter and is a critical component that determines how well a roof will perform.

Ahead, we'll discuss:

- + What is considered a low-slope roof.
- + What is considered a steep-slope roof.
- + How to measure roof slope.
- + Hydrostatic vs. hydrokinetic roof systems.
- + Why choosing the right profile matters.
- + Our profile recommendations for low and steep slope roofs.



What Is Considered a Low-Slope Roof?

A low-slope roof is defined in the industry as a roof that has a pitch equal to 3/12 or less. At Sheffield Metals, we also recognize low slope as 3/12 and below. Determining which panel is the right choice for the slope on your project will depend on the manufacturer's minimum slope factor for that specific panel profile.

Testing of Low-Slope Metal Roofing Systems

Low-slope and steep-slope roofing systems have different industry standard testing requirements. Low-slope metal roof systems are tested to ASTM E2140 standards, a water penetration test evaluating the resistance of roof panels' vertical seams.

During this test, the roof panel system is completely submerged under six inches of water for approximately six hours. Static water pressure is then applied to the outside face of the roof panel, which tests the roof's ability as a water barrier. This method is intended to evaluate the water barrier (not water-shedding) of roof systems with a pitch below 3/12.



What Is Considered a Steep-Slope Roof?

The most common industry standard for what is considered steep slope is any roofing structure that is above a 3/12 pitch. Keep in mind that some manufacturers might use a different number as their definition of a steep slope, but above a 3/12 tends to be the most widely recognized. At Sheffield Metals, we also consider anything above a 3/12 as a steep sloping structure.

Testing of Steep-Slope Metal Roofing Systems

Steep-slope metal roofing systems are tested to meet ASTM E1646 standards, which determines the system's resistance to water penetration under uniform positive static air pressure differences.

ASTM E1646 exists to simulate what rain would do to a steep-slope roof system and how well it can shed water in a similar weather event. During the test, there is a little bit of water back-up on the roof system, then static air pressure is applied to see if any of this water penetrates the roof. If any water leaks through, it constitutes a failure.

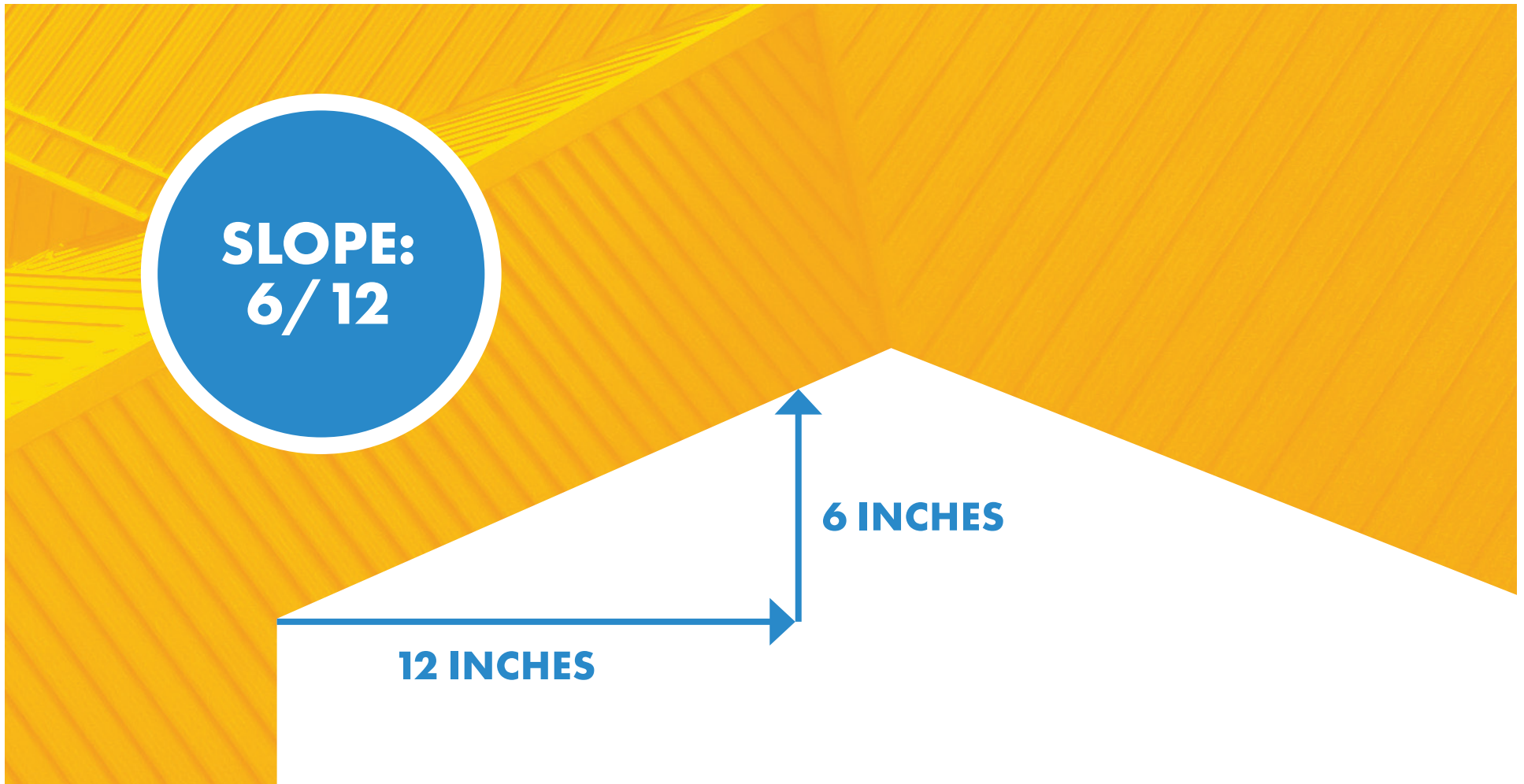
So, you know that if a profile passes the ASTM E1646 test, it's a good indicator that it will work well for a steep-slope roofing application.



How to Measure the Slope of a Roof

If you're unsure of what the slope of a roof structure is, it's relatively easy to measure. To determine the roof pitch, you'll need to measure how many inches the roof rises over every 12-inch run.

Using a measuring device, move inward on the flat roof plane (parallel to the ground) 12 inches. Once you reach 12 inches, mark it, and then measure how far the roof rises perpendicular to the ground. For example, if the roof rose 6 inches for every 12 inches, the roof pitch is 6/12.



Standard Roof Pitches & Slopes



1:12



2:12



3:12



4:12



5:12



6:12



7:12



8:12



9:12



10:12



11:12



12:12



13:12



14:12



15:12



16:12



17:12



18:12

Hydrokinetic vs. Hydrostatic Roof Systems

When researching low and steep slope roofs, you might come across the terms “hydrokinetic” and “hydrostatic” to describe a roof system. Here are the definitions of these two terms:



HYDROKINETIC

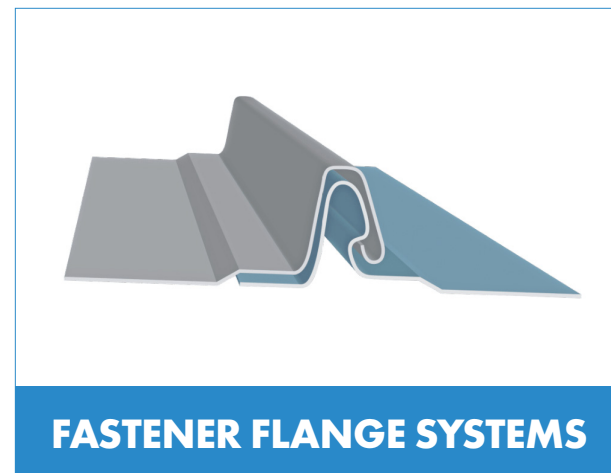
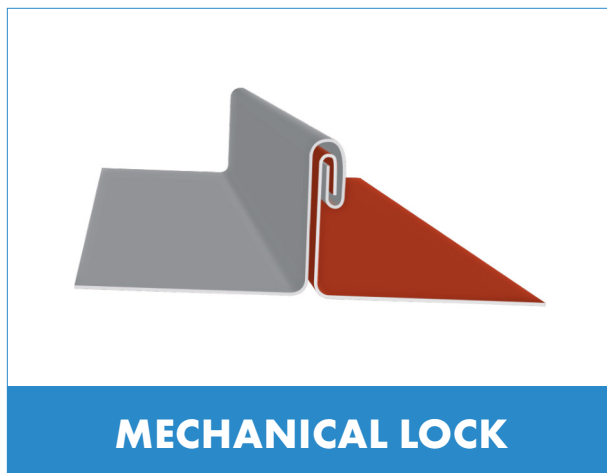
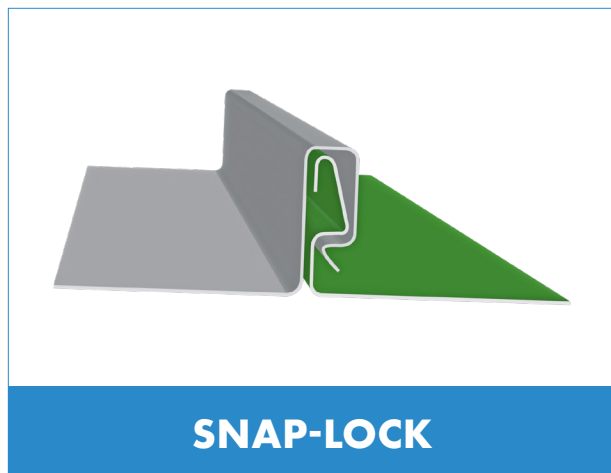
When a roof system is hydrokinetic, it means that water is quickly shedding off the roof plane. Hydrokinetic systems are typically any roof pitch above a 3/12, making it a steep-slope roof.

HYDROSTATIC

Hydrostatic roof systems refer to panel systems that are 3/12 or less, which are designed to hold water and drain slower. Hydrostatic systems have a higher potential to become submerged, which is why it's critical to have better protection against water intrusion. That's why we recommend sealant in the seams and an ice and water shield synthetic underlayment for low-slope systems under a 2/12 pitch.

Why Choosing the Right Profile Based on Slope Matters

Many different standing seam roof profiles look similar to one another on the surface, such as:



However, they are not all suitable for every slope situation. So why does choosing the right profile based on the slope make a difference?

With a roof system, you obviously want the “look” you’re going for, but it’s all about shedding water and making sure the profile chosen doesn’t get overrun with water that has nowhere to drain. As you probably guessed, lower-sloped systems don’t shed water as quickly as a steep-slope roof. This means that low-slope roofs are more susceptible to leaking due to water backing up or not shedding from the roofing system fast enough, particularly in a driving rainstorm. Springing a leak is the number one metal roofing problem that can cause significant damage and lead to high repair costs. That’s why it’s critical to choose a profile where the seam provides the extra weather-tightness required in a lower slope system.

On top of choosing the right profile, we want to reiterate the importance of picking the proper underlayment to go along with the profile. One of the best choices for low-slope roofs is a self-adhering high-temperature/ice and water shield synthetic underlayment. This is especially true when compared to using a mechanically attached synthetic or asphalt felt paper underlayment in a low-slope system. A self-adhering ice and water shield synthetic underlayment will ensure that if water does somehow pass through the roof panels, it will not leak through into the property.



Best Profiles for Low-Slope Applications

The best profiles to use for low-slope projects will be mechanically-locked metal roof systems. Mechanically seamed panels are rollformed with specific edges that line up with each other. Once the two panels are engaged, a hand or robotic seamer is used to bend the edges and lock the panels together.

There are two different versions of mechanical seams:

- + Single-lock (one fold, 90-degree seam)
- + Double-lock (two folds, 180-degree seam)

Best Profiles for Low-Slope Applications (continued)



For low-slope systems, double-lock mechanically seamed profiles are going to provide the most protection and extra weather-tightness. Plus, there is less of a chance for panels to come unseamed, which is important in low-slope situations and in locations where freezing and thawing (and therefore expansion and contraction) take place. For example, snap-lock profiles are more susceptible to disengaging due to thermal movement of built-up snow and ice.

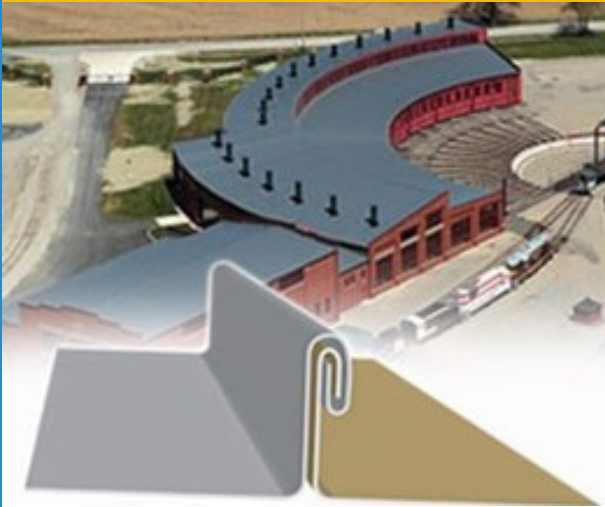
Surprisingly, a lot of the decision comes down to aesthetics. If you're designing a metal roof and it's a low-slope structure, you should go with a mechanical lock profile.

Keep in mind that because a mechanically locked system requires seaming, it might not look as clean as a snap-lock profile. However, a mechanical profile will perform better, which is more important. For reference, an entirely mechanically seamed roof is going to be on the higher price end because it's a labor-intensive installation process.

Luckily, low-sloped roofs are often not visible from the ground, so you might not notice the slight imperfections of a mechanical system. Or, if you have a roof with multiple both low and steep slopes, you can also consider using two different profiles.

Let's go through a few examples of low-slope profile options on the next page.

#1: Sheffield Metals 2.0" Mechanical Seam



- + Panel Type: Standing seam
- + Panel Seam: Mechanical
- + Panel Width: 18" (steel) | 16" (aluminum)
- + Seam Height: 2.0"
- + Panel Material: 22 to 24-gauge min steel | .040 aluminum
- + Panel Surface: Smooth | Embossed optional
- + Panel Clip: Required per engineering
- + Minimum Slope: .5/12 for steel (based on project conditions and in-seam sealant application) | 2/12 for aluminum
- + Substrate: Open framing, plywood, b-deck, b-deck w/ ISO

#2: Sheffield Metals 1.5" Mechanical Seam



- + Panel Type: Standing seam
- + Panel Seam: Mechanical
- + Panel Width: 16"
- + Seam Height: 1.5"
- + Panel Material: 22 to 24-gauge min steel | .032 to .040 aluminum
- + Panel Surface: Smooth | Embossed optional
- + Panel Clip: Required per engineering
- + Minimum Slope: 2/12 | 1/12 (steel only – based on project conditions and in-seam sealant application)
- + Substrate: Plywood, b-deck, b-deck w/ ISO



Best Profiles for Steep-Slope Applications

Unlike low-slope roof systems, steep-slope standing seam metal roofs have more options available to choose from, including both snap-lock and mechanically seamed profiles:

- + Snap-lock profiles are panels that have been carefully rollformed with a male and female leg that snap together and do not require hand or mechanical seaming during installation.
- + Mechanically seamed profiles are rollformed with specific edges that line up with each other. Once the two panels are engaged, a hand or mechanical seamer is used to bend the edges and lock the panels together. Mechanically seamed profiles are either single-lock (one fold – 90-degree seam) or double-lock (two folds – 180-degree seam).

Best Profiles for Steep-Slope Applications (continued)

There are a couple of considerations to know when choosing between a snap-lock or mechanically seamed profile for your steep-slope project:

#1

We recommend that snap-lock metal roofing systems be used for anything ranging from a 3/12 pitch to about a 7/12 pitch. Luckily, most roofing structures fall somewhere between a pitch of 4/12 and 9/12.

#2

Since there's less of a concern for pooling or standing water with steep-slope roofs because it's a hydrokinetic roof system, installing a mechanically seamed system might be an added unnecessary expense. Mechanically seamed profiles cost more because the installers have to align the panel legs and then seam them together, which is a more labor-intensive process than a simple snap-lock profile.

#3

With the addition of a labor-intensive installation, there is also the potential for more nicks, dents, and scratches to your system. Remember, steep-slope roofs are likely to be more visible from the ground than a low-slope roof. So just keep in mind that there could be some more noticeable aesthetic issues.

#4

Another consideration to remember is that snap-lock profiles are more susceptible to disengaging due to thermal movement of built-up snow and ice. So, if your project is in a region where snow and temperature fluctuations occur, it might make more sense to go with a mechanically seamed profile. This will make it less likely to separate at the seam from thermal movement.



#1: Sheffield Metals 1.5" SnapLock 550

- + Panel Type: Standing seam
- + Panel Seam: Snap-lock
- + Panel Width: 19" (steel)
| 15" (aluminum)
- + Seam Height: 1.5"
- + Panel Material: 22 to 24-gauge min steel
| .032 to .040 aluminum
- + Panel Surface: Smooth
| Embossed optional
- + Panel Clip:
Required per engineering
- + Minimum Slope: 2/12
- + Substrate: Plywood (steel)
| Plywood, b-deck, b-deck with ISO (aluminum)



#2: Sheffield Metals 1.75" SnapLock

- + Panel Type: Standing seam
- + Panel Seam: Snap-lock
- + Panel Width: 18" (steel)
| 16" (aluminum)
- + Seam Height: 1.75"
- + Panel Material: 22 to 24-gauge min steel
| .040 aluminum
- + Panel Surface: Smooth
| Embossed optional
- + Panel Clip:
Required per engineering
- + Minimum Slope: 2/12
- + Substrate: Plywood, b-deck, b-deck w/ ISO



#3: Sheffield Metals 1.5" Mechanical Seam

- + Panel Type: Standing seam
- + Panel Seam: Mechanical
- + Panel Width: 16"
- + Seam Height: 1.5"
- + Panel Material: 22 to 24-gauge min steel
| .032 to .040 aluminum
- + Panel Surface: Smooth
| Embossed optional
- + Panel Clip:
Required per engineering
- + Minimum Slope: 2/12
| 1/12 (steel only – based on project conditions and in-seam sealant application)
- + Substrate: Plywood, b-deck, b-deck w/ ISO



#4: Sheffield Metals 2.0" Mechanical Seam

- + Panel Type: Standing seam
- + Panel Seam: Mechanical
- + Panel Width: 18" (steel)
| 16" (aluminum)
- + Seam Height: 2.0"
- + Panel Material: 22 to 24-gauge min steel
| .040 aluminum
- + Panel Surface: Smooth
| Embossed optional
- + Panel Clip:
Required per engineering
- + Minimum Slope: .5/12 for steel (based on project conditions and in-seam sealant application)
| 2/12 for aluminum
- + Substrate: Open framing, plywood, b-deck, b-deck w/ ISO

Final Thoughts on Slope Considerations

The bottom line is that you want to specify a standing seam metal roof profile that will provide the most protection for the project.

As it applies to slope, this means:

- + For a low-slope roof, your best bet will be to use some variation of a mechanically seamed metal roof system, specifically a double-lock profile.
- + For a steep-slope roof, you have more profile options to choose from, including most variations of mechanically seamed or snap-lock profiles.

Finally, to ensure your project is providing the best protection, always make a point to also verify that the profile you're specifying is an engineered standing seam metal roofing system.



Chapter Five

What Is Cool Metal Roofing? Reflectance, Emissivity, SRI, & Cost Savings

The introduction of cool metal roofing products opened the door for the use of more sustainable building materials in projects. Discover what cool metal roofing is, how it saves on energy consumption, and how it relates to SRI and emissivity.



INTRODUCTION

As the emphasis on conservation and sustainability dramatically increased over the past 15 to 20 years, so has demand for cool metal roofing products.

You might be asking yourself several questions, such as:

- + What exactly is cool metal roofing?
- + What is used to measure the “coolness” of a roof or wall panel?
- + How does it help reduce energy consumption?

These are all valid questions that deserve a thorough explanation, especially because we know how important it is to have sustainable roofing products for architects to specify, contractors to install, and property owners to benefit from.





What Is Cool Metal Roofing?

Cool metal roofing is defined as painted or coated metal products that reflect the sun's energy to dissipate heat. Cool roofs help to reduce the heat that is transferred into the building, which can result in total cooling cost energy savings ranging from 7% to 15%, according to the Green Building Alliance.

In fact, cool metal roofing doesn't have anything to do with the metal substrate itself – it's solely dependent on the paint or coating system that is applied to the substrate during the manufacturing process. The cool metal roofing paint formula (formulated by Sherwin-Williams or another paint supplier) contains innovative solar reflective pigments, which is the key differentiator.

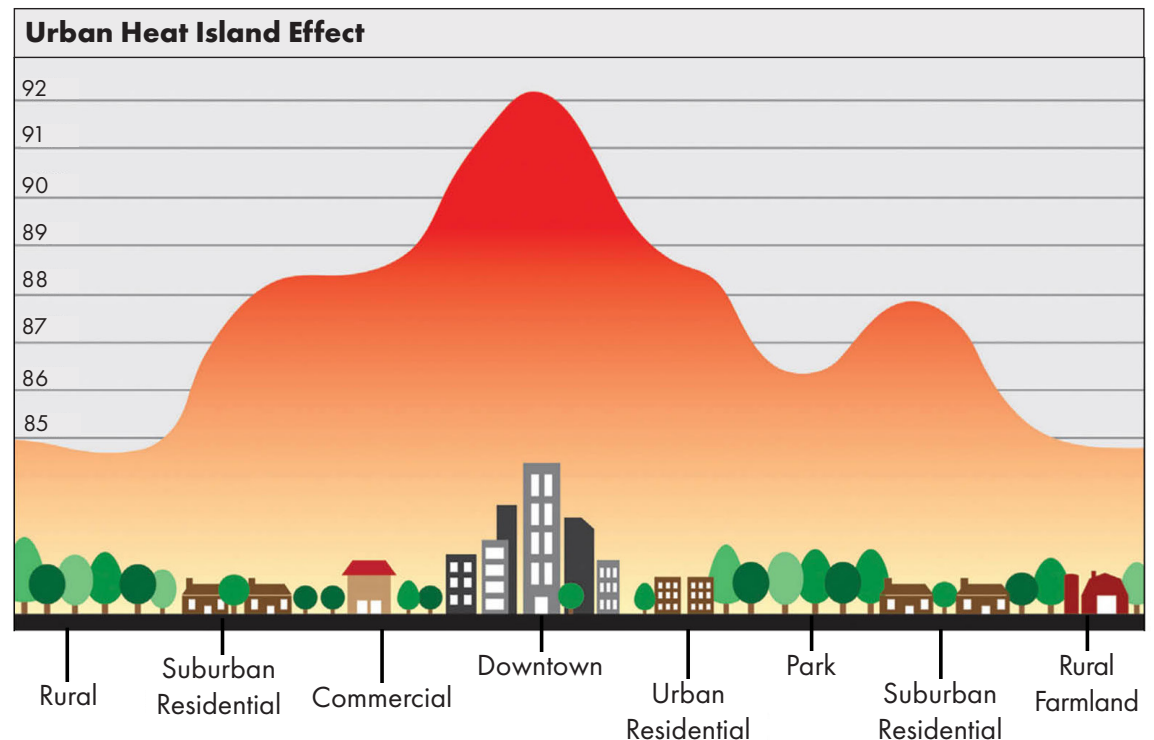
The Benefits of Cool Metal Roofing

Cool metal roofing has many benefits beyond savings on energy costs. It's commonly specified because it helps to reduce the urban heat island effect, which is defined as: "Built up areas that are hotter than nearby rural areas. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution/greenhouse gas emissions, heat-related illness and mortality, and water quality."

Many urban areas have buildings and infrastructure made of concrete, which is why cities are sometimes referred to as "concrete jungles." The problem with concrete is that it absorbs heat and retains that warmth for more extended periods and therefore keeps its surroundings warmer than places without as much concrete.

Beyond the heat island effect, cool roofing can help reduce the electricity demand, which reduces potential power outages and blackouts. The push for building materials that reduced energy consumption, including cool roofing, was made a priority in response to the 2003 Northeast U.S. blackout.

In conjunction with lower energy consumption, cool roofing can help reduce "power plant emissions, including carbon dioxide, sulfur dioxide, nitrous oxides, and mercury, by reducing cooling energy use in buildings," according to the U.S. Department of Energy.



Measurements of Cool Roofing: Solar Reflectance, Emissivity, & SRI

When designing a property with a more eco-friendly, cool metal roof or wall system, several measurement terms come up, including:

- + Solar reflectance
- + Emissivity (also called thermal emittance)
- + Solar Reflectance Index (SRI)

In the early to mid-2000s, legislation and regulations were established to reinforce sustainability and combat increasing problematic energy consumption. That's how the three terms listed above came into prominence, as these measurements are how cool roofing is determined.



Solar Reflectance: Definition & Uses

Solar reflectance is the ability of a material to reflect solar energy from its surface back into the atmosphere. Solar reflectance is measured in decimals on a scale from 0 to 1, where 0 would be considered the truest black and 1 would be considered the truest white.

For a roof system to be considered ENERGY STAR® compliant, which is a common requirement for most buildings and structures, there are specific solar reflectance ratings that the metal coil must fall into. Side note: As it applies to designing a metal roof, measuring the solar reflectance is divided up into two categories: Low-slope roofing and steep-slope roofing applications.

ENERGY STAR® Program Requirements for Roof Products

	Initial Solar Reflectance	Solar Reflectance After 3 Years
Low Slope Roofing (2:12 and lower)	Greater than or equal to 0.65	Greater than or equal to 0.50
Steep Slope Roofing (Above 2:12)	Greater than or equal to 0.25	Greater than or equal to 0.15





Emissivity (Thermal Emittance): Definition & Uses

Emissivity is a measure of how efficiently and quickly a surface releases (or emits) absorbed heat and returns to its normal temperature. Emissivity is determined on a decimal scale from 0 to 1, where a 1 represents the most efficiently emissive material possible. In essence, the higher the number, the better it will be at cooling itself.

There are varying levels of emissivity levels cited throughout the industry as the minimum for cool metal roofing and can range anywhere from 0.70 to 0.85. At Sheffield Metals, we follow ENERGY STAR's emissivity requirement for both low-slope and steep-slope roofing applications, which is greater than or equal to 0.75.



Solar Reflectance Index (SRI): Definition & Uses

Solar Reflectance Index is a measure of a surface's ability to reflect the sun's solar energy (solar reflectance) and emit heat (emissivity). SRI is measured on a scale from 0 to 100. An SRI value closer to 0 indicates a darker or black surface and a value closer to 100 indicated a brighter or white surface.

SRI is a little more complicated to define because it's measured using a complex formula that includes more than just the solar reflectance and emissivity values (image to the right).

However, to make it easier, the Lawrence Berkeley National Laboratory created a [downloadable SRI calculator](#) where you can input the solar reflectance and emissivity values, and it will calculate it for you.

SRI Formula⁹

α = solar absorptance = 1 – solar reflectance,
 I = solar flux, $\text{W}\cdot\text{m}^{-2}$,
 ϵ = thermal emissivity,
 σ = Stefan Boltzmann constant, $5.66961 \times 10^{-8} \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-4}$,
 T_s = steady-state surface temperature, K,
 T_{sky} = sky temperature, K,
 h_c = convective coefficient, $\text{W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$, and
 T_a = air temperature, K.

$$T_s = 309.07 + \frac{(1066.07\alpha - 31.98\epsilon)}{(6.78\epsilon + h_c)} - \frac{(890.94\alpha^2 + 2153.86\alpha\epsilon)}{(6.78\epsilon + h_c)^2}$$

$$SRI = 100 \frac{T_b - T_s}{T_b - T_w}$$

Solar Reflectance Index (SRI): Definition & Uses (continued)

One of the more critical measures of building sustainability is referred to as LEED, the Leadership in Energy and Environmental Design. LEED is a building rating system available for nearly all building and home projects that provides the framework for businesses, contractors, and property owners to follow to be recognized as sustainable. SRI values are used in determining if a building material is LEED compliant.

Minimum SRI for Cool Roof Materials in LEED v4

	Initial SRI Value	SRI Value After 3 Years
Low Slope Roofing (2:12 and lower)	Greater than or equal to 82	Greater than or equal to 64
Steep Slope Roofing (Above 2:12)	Greater than or equal to 39	Greater than or equal to 32



Cool Metal Roofing & Cost Savings

Nowadays, cool roofing is similarly priced to non-cool metal roofing. In addition to metal's versatility, strength, and longevity as roof and wall systems, this little to no price discrepancy means that cool roofing is getting specified and installed more frequently in architectural projects.

As far as energy cost savings go, the best way to illustrate how a cool metal roof can benefit the property owner and, by extension, the greater good is to explain how the solar reflectance level can reduce energy costs.

According to the Lawrence Berkeley National Laboratory:

- + For every 1% increment in roof reflectance, the surface temperature of the metal roof decreases 1 degree Fahrenheit.
- + For every 10% increase in roof reflectance, heating or cooling costs drop 2 cents per square foot per year.

Keep in mind, these numbers will vary based on location and utility costs, but still offers a good representation of how cool metal roofing with a high solar reflectance can help a consumer save on their energy bills.



Factors to Keep in Mind About Cool Metal Roofing



Metal Sheet & Coil Colors & Finishes

Colors: SMI's paint colors Solar White and Medium Bronze are both cool metal coils and sheets (COOLR®), but have very different SRI values. Solar White has an SRI of 82, while Medium Bronze has an SRI of 31. In essence, Solar White will be noticeably cooler to the touch and will offer more energy savings for the end-user. However, Medium Bronze will still offer savings over non-cool roofing, but it will just be on a smaller scale.

Finishes: The specific type of finish also factors into the SRI measurements of cool roofing as well. For example, high-gloss finishes tend to have a higher solar reflectance and SRI than low-gloss or matte finishes.



Varying Environments

Heat, cold, dry, rainy, or otherwise: Cool metal roofing is beneficial in all environments. However, some locations will experience more a significant percentage of cost savings than others. Specifically, cool roofing will be most efficient in saving on energy costs in hotter climates, as the metal panels will reflect and emit more heat in these environments.



Roof Slope

As we mentioned above, roofing slope plays heavily into the compliance requirements for both ENERGY STAR and LEED v4. Low-slope roofs face the sun on a more consistent and extended period of time than steep-slope roofs because they're flatter, which is why the reflectance and SRI values must be higher to withstand the longer duration of heat from the sun.



As long as the metal sheet and coil are categorized as cool roofing by the manufacturer, you can expect it to have energy-saving characteristics. That being said, some colors and finishes can increase and decrease the effectiveness.

Final Thoughts on Cool Metal Roofing

Cool metal roofing continues to rise to prominence as a sustainable and cost-saving building material to use on commercial, architectural, residential, agricultural, and government properties.

Best of all, cool roofing is:

- + High in solar reflectance, emissivity, and SRI values.
- + Helpful in pushing utility cost savings on to the property owner.
- + Useful in reducing the urban heat island effect and overall energy consumption.
- + Readily available, cost-effective, and easy to specify.



Chapter Six

Review of the Common Warranty Types for Metal Roof & Wall Systems

Warranties are a key component of any metal roof or wall system, especially on larger architectural projects designed to stand the test of time. Learn more about the most common three warranty types before you specify.



INTRODUCTION

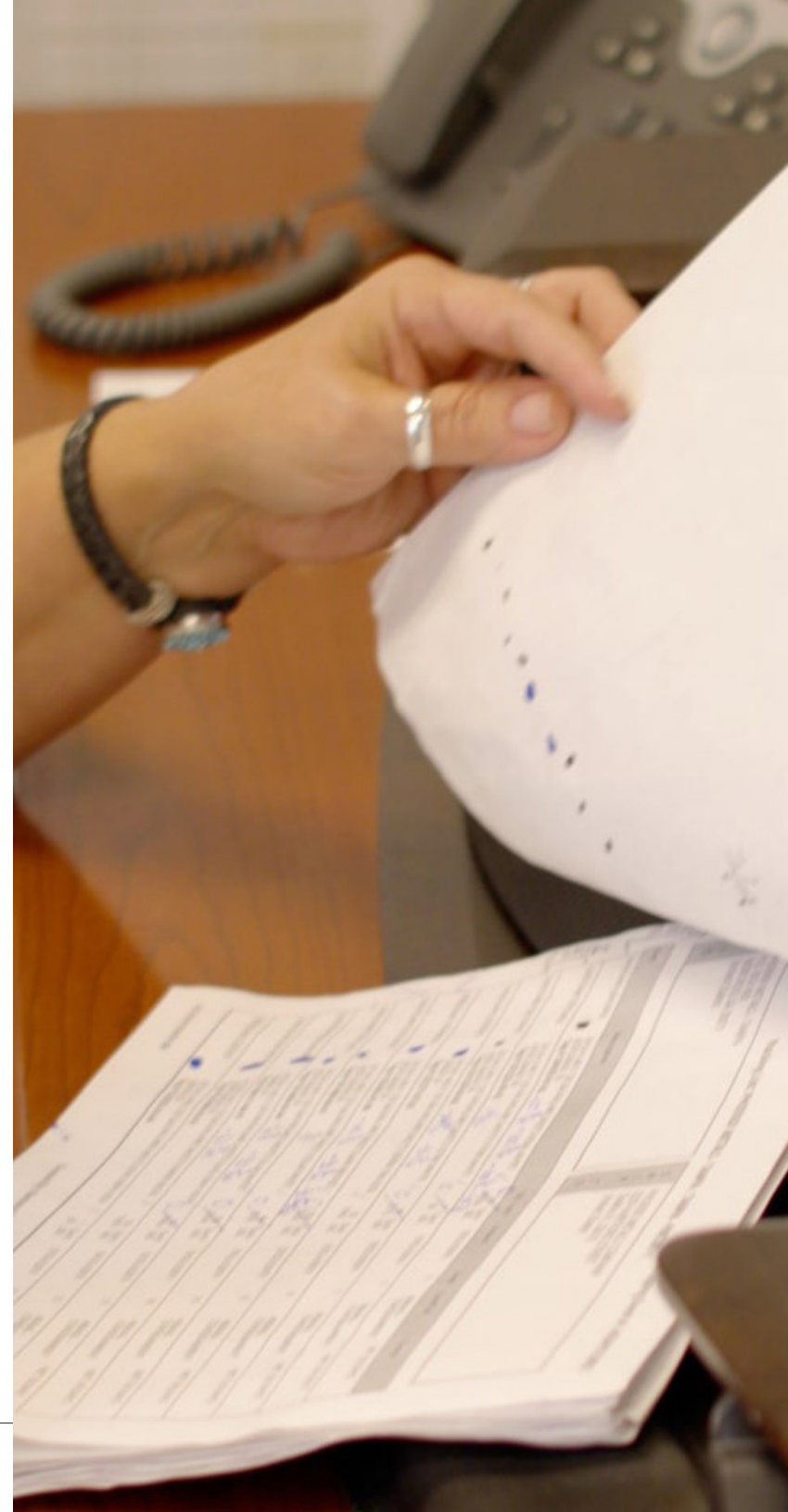
The option to apply for or purchase warranties is a critical component of specifying or buying a metal roof or wall on an architectural project.

Warranties act as a key selling point and provide reassurance that the roof or wall system will stand the test of time and won't degrade due to manufacturer or installation issues.

That being said, how familiar are you with the various types of warranties, inclusions, exclusions, and warranty considerations?

In this final chapter, we'll dive deeper into the three most common warranties for architectural metals, including:

- + Substrate
- + Paint
- + Weathertight





Substrate Warranties for Metal Roofs

A substrate warranty is a guarantee that the base metal (that a paint system is applied to) will not corrode due to rupture, fail structurally, or perforate within the specified terms when exposed to normal atmospheric conditions.

Galvalume® Substrate Warranties

One of the most common substrate warranties comes on Galvalume® sheet and coil products. While the duration and terms will vary from manufacturer to manufacturer, a typical Galvalume substrate warranty can range anywhere from 15 to 25.5 years.

When you're looking at the substrate warranties on Galvalume products, there might be more than one because of the different ways a coil can be coated or uncoated. For example, there is often a painted Galvalume substrate warranty, which may also be called "AZ50." There is also often an unpainted (or acrylic-coated) Galvalume substrate warranty, which may also be referred to as "AZ55."



“Galvalume sheet is made to meet ASTM Specification A792. This specification covers a number of requirements, including coating weight. AZ50 and AZ55 are the English unit coating weight designations indicating that, respectively, 0.50 ounces per square foot (AZ50) and 0.55 ounces per square foot (AZ55) of the aluminum-zinc alloy coating have been applied to both sides of the Galvalume sheet.”

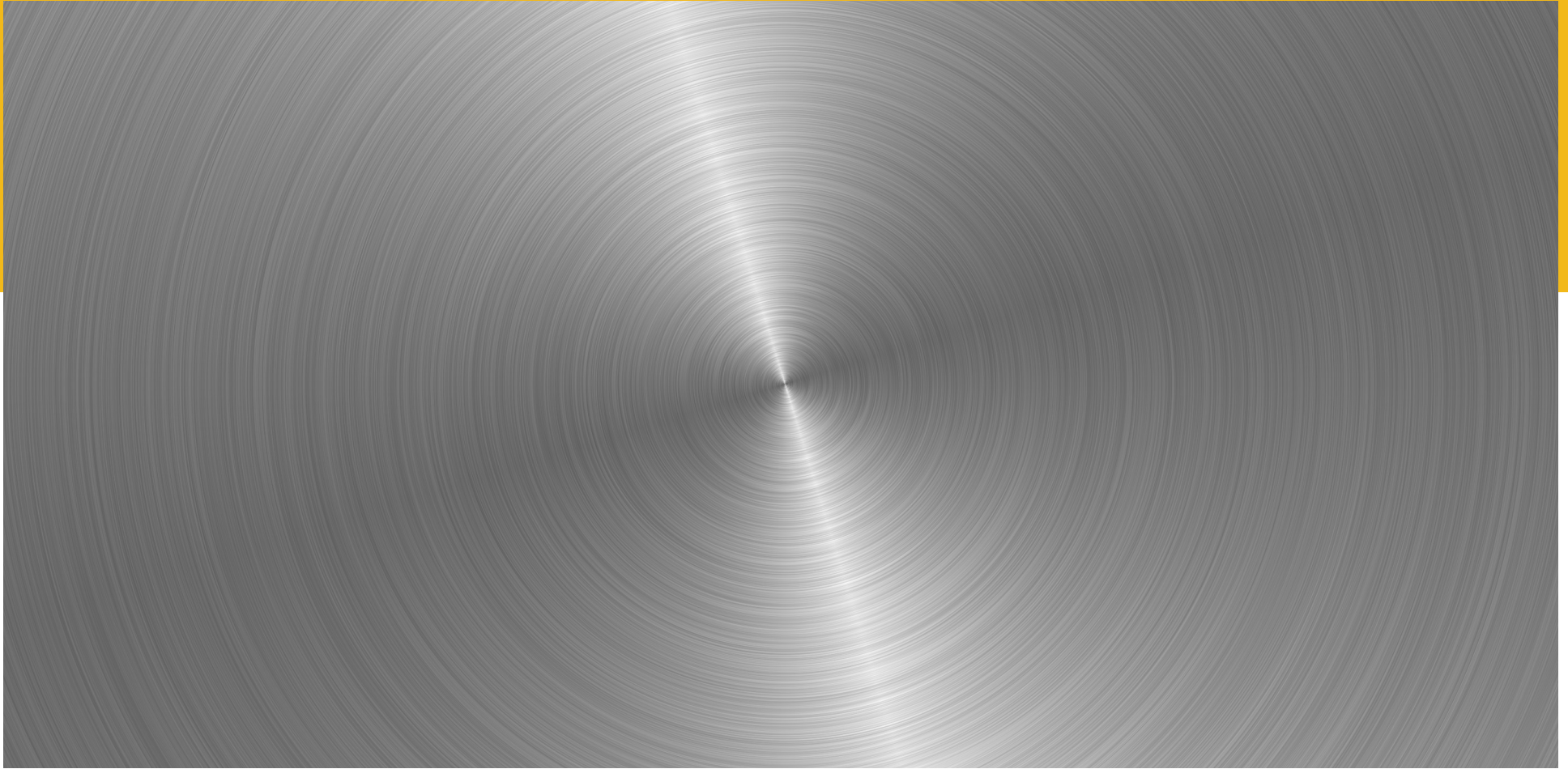
— *steelroofing.com*

Common Situations NOT Covered by a Galvalume® Substrate Warranty

- + Areas subjected to constant spraying of either salt or freshwater. Most importantly, coastline areas with marine exposure within the following distances:
 - + Coastline with breaking surf within 1500 feet.
 - + Coastline with large bay within 800 feet.
 - + Coastline with marsh within 400 feet.
- + Areas subject to fallout exposure to corrosive chemicals, ash, fumes, cement dust, animal waste, or its decomposition by-products, fallout from copper, lead, nickel/silver mining, refining operations, and carbon black.
- + Buildings where animals are confined (manure from the animals breaks down into ammonia gas over time and then reacts with the Galvalume coating).
- + Conditions where corrosive fumes or condensation are generated or released indoors.
- + Areas subject to water run-off from lead or copper flashing, or piping or areas in contact with lead, copper, or lumber.
- + Mechanical, chemical, or other damage sustained during shipment, storage, forming, fabrication, etc.
- + Failure to provide free drainage of water and failure to remove debris from overlaps and all other surfaces of the sheets or panels.
- + Improper rollforming, bending, scouring, or cleaning procedures.
- + Slopes of roof or sections of the roof flatter than 1:15.

While this list is not all-encompassing, it does outline some common situations that a Galvalume substrate warranty doesn't cover. Therefore, it's critical to read every inclusion and exclusion outlined in the warranty provided by the manufacturer.





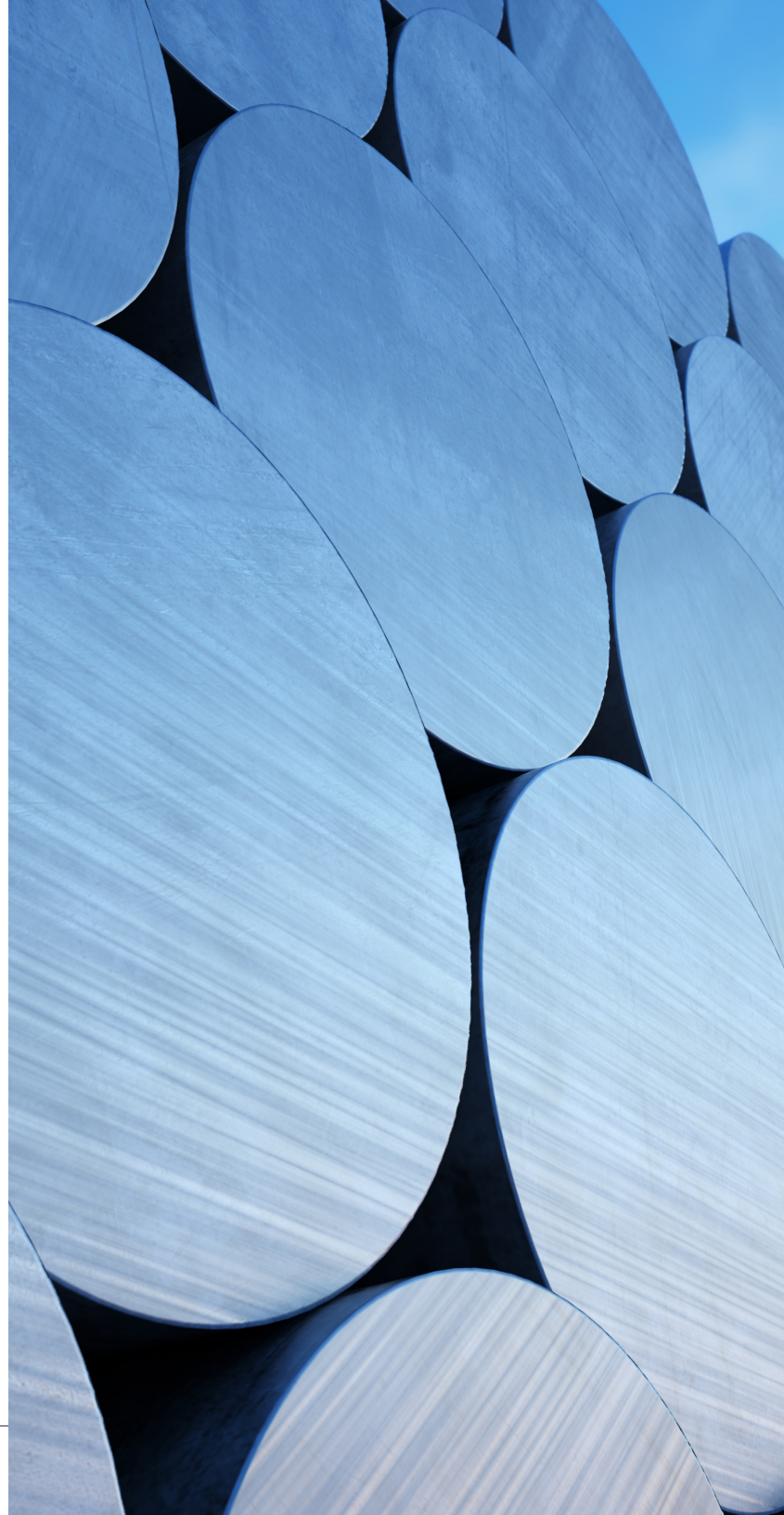
Aluminum Substrate Warranties

You'll also see manufacturers offer substrate warranties on painted aluminum products, which are better suited for saltwater environments than Galvalume products. They also often have a shorter term than Galvalume warranties and can come with a duration of about 20.5 years or less.

Common Situations NOT Covered by an Aluminum Substrate Warranty

- + Areas subject to fallout exposure to corrosive chemicals, ash, fumes, cement dust, animal waste, or its decomposition by-products, fallout from copper, lead, nickel or silver mining, refining operations and carbon black.
- + Conditions and circumstances where corrosive fumes or condensation are generated or released inside the building.
- + Areas subject to water run-off from lead or copper flashing or piping or areas in contact with lead, copper, or lumber.
- + Mechanical, chemical, and other damage sustained during shipment, storage, forming, fabrication, during or after erection.
- + Slopes of roof or sections of the roof flatter than ¼:12.
- + Deterioration to the panels caused directly or indirectly by panel contact with fasteners.
- + Failure to perform an annual fresh tap water rinse on pre-painted aluminum located within one mile of a seacoast, saltwater, brackish water, etc.

Again, while this list is not all-encompassing, it does outline some common situations that an aluminum substrate warranty doesn't cover. It's critical to read every inclusion and exclusion outlined in the warranty provided by the manufacturer.





Paint Warranties for Metal Roofing Systems

A paint warranty is a guarantee from a manufacturer and paint supplier that the paint system applied to the metal substrate will not degrade to a certain degree within a specific time frame. As an architect or design professional, it's important to understand the different elements a paint warranty consists of, including how to apply, duration of the warranty, environment exclusions, etc., so you can clearly communicate this information to clients.

What Does a Paint Warranty Cover?



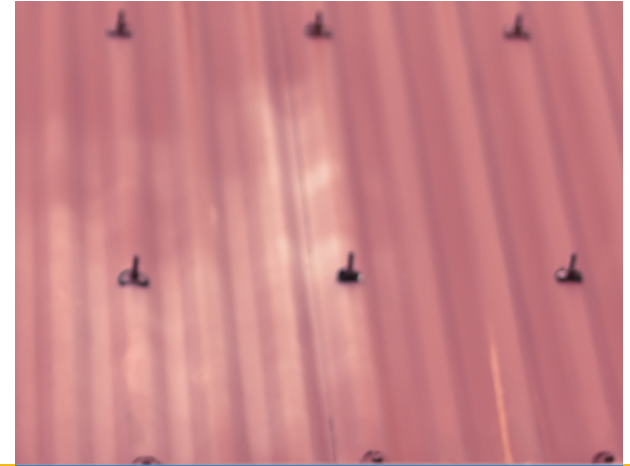
Cracking, Flaking, or Peeling

To the extent that is visible on ordinary outdoor visual observance (this portion specifically refers to paint adhesion).



Chalking

Defined as a resin system degradation and loss of adhesion on the paint's surface that results in a white coating. Most warranties ensure the metal roof or wall system will exceed a specified chalking number (roof and wall panels normally have different specified numbers because the roof will have significantly more UV exposure than walls). Often times, if you swipe the surface with your finger, you will be able to see the chalky residue on your skin.



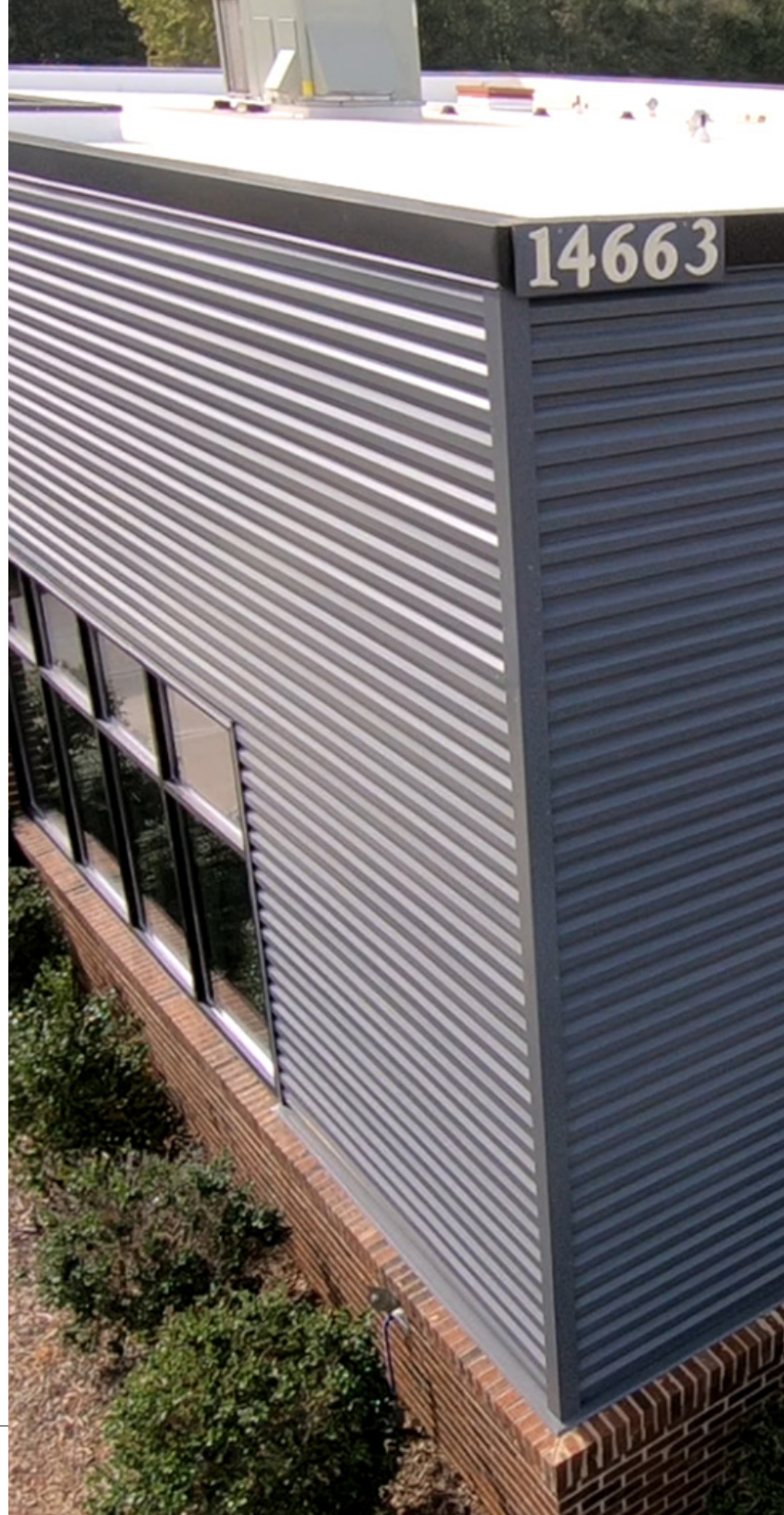
Color Fade

Occurs when the paint's pigment breaks down and alters the color, exceeding a specified ASTM D-2244 Hunter Delta E (DE) unit. The amount of fade is determined on a number scale by comparing a sample to the baseline color, and every paint warranty should specify the allotted amount of change in Hunter units over a certain length of time. For example, maybe you've seen a building where various sides of the structure slightly differ in color. This is often because one section gets more UV exposure and therefore fades at a faster rate.

What Does a Paint Warranty NOT Cover?

This section outlines the circumstances that would not warrant a replacement of the metal roofing (this list is not all-encompassing; please read the warranty for specific exclusions and inclusions):

- + Fire, deliberate damage, wind damage, or improper handling by installers.
- + Foreign substances or chemicals present in the environment and inside of the structure.
- + After-the-fact additions to a roof that may affect the chemical make-up, such as adhered solar panels, snow guards, etc.
- + Liquid or solid material submersion.
- + Altered or sculpted beyond what it was intended for.
- + Stored or installed in a way that allows for poor air circulation.
- + Exposure to animals or animal waste.
- + Complimentary roof products, fasteners, or penetrations that could cause a galvanic reaction and ruin the finish or corrode the metal.
- + Using non-standard industry installation details.
- + Using details that do not allow for moisture to run off or evaporate.





Paint Warranty Considerations

#1

Type of
Paint System

#2

Warranty
Length

#3

Environment

#4

Weathering
Factors

Paint Warranty Considerations (continued)



Type of Paint System

For most architectural applications, Kynar 500® (owned by Arkema) or Hylar 5000®, also known as polyvinylidene fluoride (PVDF), paint systems are considered the best, while silicone-modified polyester (SMP) systems are second, and plain polyester is a distant third. However, SMP carries a “longer” advertised warranty. However, it tends to come down to the big bold print up top being marketing and the fine print in the body of the warranty being the substance that needs paid attention to.

- + When it comes to SMP and the widely promoted 40-year warranty, this is just for film adhesion. The chalk and fade coverages for these same SMP warranties are usually less than that of PVDF.
- + PVDF paint warranties last 20 to 40 years for film adhesion, depending on the manufacturer. The “color warranty” for chalking and fading on the same warranty is generally offered for only 10 to 30 years and depends on the paint color.
- + Polyester warranties vary dramatically depending on the quality and generally do not exceed 20 years for adhesion and 10 years for color.

Warranty Length

Keep an eye on the time frames expressed throughout a paint warranty, as they may change depending on the circumstances. For example, on the same exact warranty, chalking may only be covered up to 20 years, fading for 30 years, and adhesion for 40 years. This is normal in the roofing industry because some resins, colors, and paint systems are warranted differently as the material ages, which is often thoroughly explained in the warranty document.

Paint Warranty Considerations (continued)



Environment

One of the best questions you can ask is: Is the product I'm specifying warrantable in my project's environment?

As discussed, steel (Galvalume) usually is not warranted within specified distances from a coast. If you find yourself in this situation, consult with the manufacturer to help you find the best product for your design. Other environmental conditions can impact the ability to get a paint warranty, such as buildings that contain livestock, water treatment facilities, pools, etc.

Weathering Factors

Some colors will inherently fade faster than others; a dark color will remain "darker" longer in Northern Ohio than it will in South Florida. For example, red will fade quicker than beige because brighter colors tend to fade faster than earth tones. The most significant advantage PVDF has over SMP paint systems is that it will hold the color integrity longer. The bottom line is that the metal roof or wall system will fade over time because of weathering and UV exposure, but how much will depend on the type of paint system.

Weathertight Warranties for Metal Roofing Systems

A weathertight warranty is a guarantee from the installer and roofing manufacturer that the roof installed on a commercial structure will remain weathertight for the duration of the warranty. First and foremost, weathertight warranties protect the investment made by the property owner for the roof or wall system. This type of warranty says that if a leak develops in the roofing system due to defects in the material provided, manufacturing defects, ordinary wear and tear by the elements, or the installation contractor's workmanship, then the manufacturer or installer is financially responsible for all repairs needed to return the roof to a weathertight condition.

These warranties also assure the property owner that the metal roof system is installed to the proven standards and details specified and approved by the metal roof manufacturer.

Weathertight warranties are standard in the metal construction industry, especially in spec-driven or architecturally designed projects. These warranties are also known throughout the industry as weathertightness warranties or water-tight warranties. In addition to roofing systems, weathertight warranties can be purchased for metal wall systems.

The Importance of a Weathertight Warranty

It's no secret that metal is a more expensive, premium roofing choice, which means it's also going to be more costly to repair if it fails. Spending the extra money on a weathertight warranty to protect that investment is likely going to be worth it for your clients in the long run.

Most importantly, having that weathertight warranty ensures that what's on the inside of the property is protected. Whether it's a school filled with kids, an apartment building that houses multiple families, a shopping complex filled with merchandise, or a bank filled with money—the people and items on the inside rely on the protection that a metal roof or wall can provide. That's why it's critical to specify a weathertight warranty in your commercial projects.





Common Weathertight Warranty Types

- + **Side Lap Warranties** – A side lap warranty covers the panel seams and not the flashing zones. These warranties tend to instill some false confidence for property owners. You can ask for a side lap warranty, but it would also be good to ask for a workmanship warranty or something similar, because, in general, most leaks occur in flashing zones more frequently than they do in the field or seam of a standing seam metal roofing system.
- + **Level-Type Warranties** – Some warranties have varying levels of coverage, whether it's a variable timeframe or what products and areas are covered. Just make sure to read the warranty being offered to ensure it provides the desired coverage.
- + **Pro-Rated Warranties** – With a pro-rated warranty, the property owner may incur some of the costs of repair or replacement. This essentially means that the manufacturer will pay for the part or aspect of the system that failed.
- + **Limited Weathertight Warranties** – Limited weathertight warranties cover repairs up to the dollar amount paid for the cost of the metal roof materials and installation. For example, if the original roof costs \$30,000 for both the materials and the installation, the manufacturer would cover up to \$30,000 worth of repairs through the specified timeframe. This is not limited or capped by a single issue if multiple events occur in the duration of the warranty.
- + **No-Dollar Limit Weathertight Warranties** – No dollar limit weathertight warranties do not come with a dollar limit on liability. If the repairs for an affected roof or wall exceed that of the cost of the materials and installation, then it will still be covered. For example, if the original material and installation cost was \$30,000, and it costs \$36,000 to fix or replace the roof, the manufacturer will cover the full \$36,000 cost.

Final Thoughts on Metal Roofing Warranties

Warranties are a hot topic in the metal construction industry.

The best thing you can do as an architect or design professional is to ensure you know the available warranties, communicate the various options, and correctly specify or choose the products with the best warranty.

Remember:

- + Read the fine print on each warranty, specifically the inclusions and exclusions.
- + Know the environment your project is in and if it could affect the warranty coverage.
- + Ensure the paperwork is correctly filed according to the manufacturer's timeline.
- + When in doubt, call the manufacturer of the metal to ask warranty-related questions.

