EPDM System's Long-Term Performance Reveals Important Lessons

FEBRUARY 1, 2021 BY LOUISA HART LEAVE A COMMENT

The Firestone RubberGard EPDM roof system on the headquarters of Albo Manufacturing in West Bend, Wisconsin was installed in October of 1980. Photos: Firestone Building Products

For most of us, turning 40 is something of a milestone. Maybe a time for a party, some soul-searching and usually a lot of brave talk about how 40 is the new 30. Regardless, we have crossed into undeniable middle age.

When a roof turns 40, still healthy and well-functioning, that's an accomplishment of a different sort, putting that roof out front in a league of its own. In October, 1980 — yes, 40 years ago — in West Bend, Wisconsin, a team of installers put the finishing touches on the first Firestone RubberGard EPDM roof. That 45-millimeter, 7,900 square feet of membrane is still protecting the headquarters of Albo Manufacturing today, and has continuously done so for the last 40 years. Kurt Mueller, now the president of Albo, was 22 when his dad decided to try out the new type of roofing membrane.

Why would someone agree to be the first in line to try out a new product, especially one that represented a major investment for a small independent job shop? "He was good buddies with the contractor," Mueller says as he explains his dad's decision. The contractor "gave my father his word that the roof would perform, and that, I believe, is what swayed my father." For the contractor and his employees, the lure of installing the roof without having to use hot asphalt was also a plus.

The roof at the Albo job shop is a testament to the durability of EPDM. While results may vary, this 40-year old has withstood the extremes of the harsh Northern Wisconsin: tornadoes, thunderstorms with winds up to 60 miles per hour, almost two feet of snow, and temperatures that plunged to 20 degrees below zero in the winter and rose to a scorching 100 degrees plus in the summer.

The roof at the Albo Manufacturing headquarters is still going strong four decades later, serving as a testament to the durability of EPDM.

Other than congratulating the owner for his savvy decision-making, why should we be talking about this durable roof? Is it a "one-off" or a sample of what might be expected from an EPDM membrane? Here's why the 40-year performance of an EPDM roof is increasingly relevant today: we are facing new challenges now as we look for ways to protect our buildings from extreme weather events. While there may be debate about the cause, indisputable global statistics confirm the increasing frequency of more extreme weather: intense tornado outbreaks, record-setting heat, catastrophic wildfires, heavy downpours, longer droughts, and more frequent and more powerful hurricanes. This roof teaches us important lessons from its 40-year performance, and helps to inform decision-making moving forward.

In a highly competitive marketplace, the manufacturers of EPDM — Firestone Building Products as well as Carlisle SynTec Systems, and Johns Manville — have joined to create the EPDM Roofing Association (ERA), and invest in the science that delivers the data behind record-setting roofs like the facility in West Bend. This effort, in turn, has led to a generation of improvements that deliver a product based on 21st century science.

For instance, while ERA has numerous examples of the durability of EPDM from case studies, it was important to the association to investigate the science behind the longevity of their product. To that end, in a landmark aging study, ERA examined five roof systems with 28 to 32 years of in-field service, and concluded that all of the systems examined were still performing as intended. In fact, the study found that all of the samples were essentially performing “like new” with physical characteristic properties above or just below the minimum characteristics of newly manufactured 45-millimeter EPDM membrane. The roofs were first inspected in the field to get a good sense of their condition, and then samples were sent to a testing facility for the roofing industry. The laboratory testing examined five critical performance characteristics of the EPDM membrane.

The Elongation Test Results showed that four of the five roof samples exceeded the minimum characteristics for aged EPDM, and one exceeded the minimum for new EPDM. For Tensile Strength, all five samples exceeded the minimum standard. For Thickness XD (Cross Direction), three samples exceeded the manufacturer minimum, while the other two missed by one-thousandth of an inch. For Thickness MD (Machine Direction), three achieved or exceeded the minimum, while one missed by one one-thousandth of an inch and another by four one-thousandths of an inch. For Factory Seam Strength, it was only possible to test two of the samples, but both easily surpassed manufacturers’ minimums.

Overall, ERA has conducted four studies on EPDM that validate the long-term performance of the EPDM membrane. “The first field studies of EPDM were done in the late 1980s, and we are finding a pattern,” says Thomas W. Hutchinson AIA, FRCI, RRC and Principal, Hutchinson Design Group, Ltd., Barrington, Illinois. “The pattern is that these roofs can really last a long time. By using today’s advanced design techniques and proper roof maintenance, it is reasonable to expect that an EPDM roof will approach or exceed 40 years of service.”

Given the recent challenges of increasingly cataclysmic weather events, this durability and longevity is one important aspect of the contribution that EPDM can make to a resilient roofing system. Additionally, EPDM has excellent hail resistance, remaining flexible and pliable so that it can absorb the impact from hail without fracturing. The membrane is also very dimensionally stable when exposed to significant changes in temperature and EPDM is the only commercially available membrane that performs in an unreinforced state, making it very forgiving to large amounts of movement without damage and potentially more cycles before fatiguing. Seaming technology has constantly improved over the last 40 years, and has brought about innovations such as double-sided tape and factory applied tape. Sixty millimeter and 90-millimeter membrane has been introduced, offering enhanced puncture resistance.

These improvements to EPDM over the last four decades add up to increasingly sustainable and resilient construction. During a time when resilient structures are essential to a recovering economy, the value of updated EPDM is more evident than ever to the building owner. Kurt Mueller up in West Bend is grateful that his father’s roof continues to provide shelter for his small business. For anyone making a decision about a roofing membrane today, it’s important to know that the 21st century product, with increased strength and multiple improvements, is not your father’s EPDM.

For more information about EPDM as part of a resilient roofing system, consult ERA’s 2020 Resilience Report (http://epdmtheresilientroof.org.)

About the author: *Louisa Hart is the director of communications for the Washington-based EPDM Roofing Association (ERA). For more information, visit www.epdmroofs.org.*

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The Best Sealants For Metal Buildings

DECEMBER 3, 2020 BY MIGUEL PENA LEAVE A COMMENT

Butyl tapes come in various widths and thicknesses to match panel manufacturers’

Sealants represent a relatively small cost in metal construction, but the price to pay if the right sealant and proper application methods aren’t used could be substantial. Sealants used in metal construction are not easily repaired or replaced without potential damage to panels or other parts. When the wrong sealant is used for a metal roof, the overall roof itself could fail. To avoid sealant failure and achieve a long service life on any metal building’s roof or wall component, professionals need a firm understanding of

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requirements. Photo: MCA

the sealant options available and the application guidelines to follow.

The Metal Construction Association (MCA) has released an important new Technical Bulletin, “Best Practices: Metal Building Sealant Types and Application Guidelines.” The document details the benefits, features, and limitations of the most commonly used sealants in metal construction: butyl, polyurethane, and silicone, as well as the most effective procedures for utilization.

Sealant Failure and the Consequences

When sealants fail, metal roof panels can often be damaged severely enough in order to require replacement. Incorrect sealant application, inadequate surface preparation, and early or excessive joint movement can also result in a cracked sealant. That can be expensive and labor intensive.

Removing the ridge cover of a roof that was at least 34 years old at the time reveals properly applied butyl copolymer sealant with retention of all proper performance characteristics. Photo: Rob Haddock

Sealant Options

Butyl, polyurethane, and silicone are three of the most commonly used sealants for metal roofing. When properly applied, they can all provide long life and should accommodate normal movement through the design of the joint itself.

The chart in Figure 1 compares the products’ characteristics and limitations.

Sealant Type	Butyl	Polyurethane	Silicone
Ability To Work With Substrates	Works well with a wide variety of substrates	Only use polyurethane sealants designed specifically for metal and confirmed not to initiate or accelerate corrosion.	Only use silicone sealants designed specifically for metal and confirmed not to initiate or accelerate corrosion.
Temperature Use Range	- 40°F to + 200°F	- 40°F to + 200°F	- 40°F to + 400°F
Life Expectancy (according to manufacturers)	25+ years	A minimum of 10-15 years and in some cases more than 20 years	20+ years
Flexibility and Joint Movement	Generally non-curing, non-skinning, and remains flexible and tacky for the life of the product.	Excellent joint movement properties. Elongation properties reaching as high as 600%.	Joint movement properties with elongation properties reaching +100/-50%. Pre-cured silicone membrane movement can exceed 200%.
Limitations	Butyl sealants become softer in excessive heat and harder in extreme cold. Do not paint non-skinning butyl sealants. Painting a butyl sealant will create a skin and cause the tape to lose elasticity over time.	Some metal coatings may require a pretreatment or primer prior to sealant application to promote adhesion or avoid damage to the metal coating. Product should be allowed to cure prior to applying other sealants in the vicinity, otherwise a negative chemical reaction could occur during the curing process.	Use only silicone sealants designed for metal construction with neutral cure.
Standardized Tests For Comparison	ASTM C765 , ASTM C771, ASTM C782, ASTM C907, ASTM C908, EPA METHOD 24	ASTM C794, ASTM D412, ASTM C639, ASTM D3278, AAMA 800, EPA METHOD 24	ASTM D412, ASTM C794, ASTM C639, ASTM D624, ASTM C920

Best Practices

Just as important as using the right sealant is applying the sealant properly. Best practices include:

· **Use only what is needed.** Although it may appear harmless to add more sealant than required, this can cause issues of separation and buckling of the connection and expansion joints long after the sealant has been installed. Follow manufacturer instructions carefully.

· **Set it on site.** Sealants should be applied at the building construction site, at the moment required to continue construction. Doing so ahead of time can lead to deformed, damaged, or contaminated sealants. (Note: Some manufacturers design and engineer sealants to be pre-applied to substrates at the time of production.)

· **Dry + Clean = Success.** A dry surface is required for sealants to adhere properly. Inspect surfaces for liquid or frozen moisture before applying the sealant. Even a small amount of moisture could compromise the performance of the sealant over the life of the material joint or lead to mold and mildew that may further compromise any sealant over time. Likewise, ensuring the surface is clean and free of any residue or dust or debris is also important.

· **Set your standards.** Standardized test results are preferable to manufacturer data to determine the fitness of a particular sealant type. ASTM, UL, and AAMA are internationally recognized standards that generally require third party independent laboratory testing. Frequently, there are regional and local test standards that must be completed to show the sealant material meets the project performance requirements.

Sealants are an excellent example of the old saying, "Everything counts in large amounts." When sealant fails, roofing can become damaged to the point of requiring an expensive replacement.

The full technical bulletin is available at www.metalconstruction.org.

About the author: *Miguel Pena is the Vice President of GSSI Sealants, Inc., a manufacturer of premiere butyl rubber sealants for the metal building industry. GSSI Sealants has been a member of the Metal Construction Association for more than a decade.*

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A Roofing Contractor's Guide to Completing Successful Public Sector Projects

DECEMBER 1, 2020 BY JOHN A. D'ANNUNZIO LEAVE A COMMENT

In uncertain times, public sector projects can provide an equitable source of work for low-slope commercial roofing contractors. The primary advantage of public sector projects is that they are well-promoted, bid-based projects, which eliminates the need for substantial contractor marketing and sales activities. The projects are readily available and, in most cases, the budget has already been approved and the money allocated prior to solicitation of bids. Public sector projects are typically available throughout economic downturns, as the government often uses these types of projects to ignite the economy.

Following are some guidelines that roofing contractors can implement to increase the odds of being successful on bidding and executing public sector projects.

Check the Qualifications

The primary disadvantage of public projects is that the bid process is open to all contractors, which increases the competition. Some projects may have dozens of bidding contractors, some of which may not be primarily roofing contractors. Because these projects are financed with government funds, the process is designed to allow equal opportunity, but in an attempt to keep inexperienced and unqualified contractors from project selection, several qualifications may be set in place. For instance, the project requirements may include a list of references for similar projects completed over a specified timeframe. Contractors must also have proper insurance coverage. Another way to eliminate inexperienced contractors from these public projects is by requiring long-term material manufacturer warranties. These warranties are only provided to trained and certified contractors who are experienced with specific material applications.

Best practice is to review specific project requirements to ensure that your company can meet them prior to placing a bid. On project bids with numerous and specific qualifications, an experienced administrative staff can pay big dividends by providing all of the necessary qualification documents with the bid package.

Success Begins at the Bidding Stage

Most public projects are obtained through the low-bid process, which means the contractor that submits the lowest price is awarded the project. This can also mean that the contractor who makes the biggest mistake receives the project. Public projects often require bid bonds to ensure the contractor completes the project at the bid price, no matter the circumstances. I know of one case where the contractor's estimator failed to include material costs with the company's bid. The contractor was still required to complete the project, which meant incurring a substantial loss. To try to reduce his loss, the contractor instructed his crew to "cut corners" in application methods. Ultimately, the quality of the work suffered, and the project turned out to be a failure for all participants.

To avoid errors in the bidding process, the contractor should entrust these projects to well-trained and experienced estimators. The estimators should have vast knowledge of the roof material and application methods for the specified systems. Estimators should also have experience with the application crew — primarily the foreman — so that they can accurately price the labor. I knew a roofing superintendent that often criticized one of his company's estimators because he felt that the estimator always bid projects with unrealistic production rates. If the crew does not meet the estimated project schedule, then the contractor loses money. Remember the sarcastic words of Herbert Hoover in describing construction estimators: "A man can complete more work with a pencil than they can with a shovel." Best practice is to allow the estimators to perform their due diligence before placing a bid, because pricing mistakes in this early stage will compound over the life of the project — often at the contractor's sole expense.

The entire bid should be thoroughly reviewed prior to submittal. This review should be completed by someone other than the estimator. For this function, successful companies typically use a management group that may include other estimators, project managers, and field superintendents. The review should include labor, materials, size of project, and all items that could impact the project — such as logistics, setup areas, work schedules, number of penetrations, and existing material removal. Proper bid review can eliminate potential project losses.

Proper Execution of the Plan

Due to the highly competitive nature of public project bids, the estimated profit margin can be minimal. Errors in application methods or production rates could quickly turn a profitable project into a loss. A best practice to avoid such a loss would be to organize an on-site conference with the estimator, field superintendent, and project foreman to discuss all potential problems on the project.

Once the plan is agreed upon by all parties, it is the responsibility of the foreman to properly and effectively execute the plan. The most productive crews are the most organized ones. I have found that crews that are segmented to perform multiple tasks at one time are the most productive. For instance, in many cases roof removal, layout and attachment of insulation, and layout and attachment of membrane can be completed simultaneously if the crew is properly staffed and the work is staggered. This leaves the last half of the day for detail work — the least productive of all tasks.

Material Knowledge

Public projects are intensely competed for by material manufacturers. It is not uncommon for several different systems to be used on projects within the same public sector. Once specified, it may be difficult to submit material alternatives, so the contractor should be experienced in the specified material application. Therefore, the contractor's crew should be experienced in proper roofing application methods of the selected roof system material.

Best practice is to make certain that the project is staffed with a crew that has applied the same materials on several similar projects. Inexperienced applicators will be less productive and can cost the contractor money.

Communication With Project Participants

"Nobody wins unless everybody wins." I have started every pre-construction conference I conducted over the past thirty years with this phrase. Simply stated, this means that all project participants will share in a project's success; but more importantly, all participants will be accountable in the case of a project's failure. Just think: when was the last time a lawyer only listed one party to a lawsuit?

The communication between the contractor and the project designer (i.e., architect, engineer, consultant) is particularly important. There should be no misinterpretation between design requirements and application. Building a good working relationship with these groups may also be a good source of recommendations for further projects. Several design and construction management companies specialize in public projects, and if a contractor performs well for them, they might have opportunities to complete more projects.

Be on the Lookout for Extras

Public projects are bid at very tight profit margins. In an effort to make more money on a project, many contractors look for opportunities to complete extra work during the course of the project. Because roofs have many unforeseen conditions (e.g., deck repair, deck removal, drain conditions, wood nailer deterioration, metal displacement or deterioration, etc.) contractors are required to provide unit costs. Make certain that the unit costs provided allow for profit.

I know of contractors that review design documents prior to the bid process in an effort to identify potential project extras. This practice could make a project more profitable.

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5 Considerations for Resilient Zinc Roofing in Coastal Applications

SEPTEMBER 30, 2020 BY CHARLES "CHIP" MCGOWAN   LEAVE A COMMENT

Non-corrosive, non-combustible and self-healing, zinc's long-lasting performance has been demonstrated its resilience in coastal environmental for more than 200 years. Pictured here is the Nordisches Aquarellmuseum, Skärhamn, Sweden. Photos: RHEINZINK

For centuries, zinc roofing materials have proven reliable in Europe's marine environments and other extreme climates. In recent decades, the enduring qualities of zinc have gained interest and use in North America. Here are five aspects to consider when working with zinc in coastal roofing applications.

1. Natural Material

Zinc is an abundant natural resource. Based on known ore reserves, the world's zinc supply is estimated in excess of 200 million tons and expected to last approximately 700 years.

Zinc's inherent metallic properties allow the material to deliver non-corrosive, self-healing, low-maintenance and long-lasting performance. No paint, varnish or sealants are required, and its run-off is non-staining and non-toxic.

In North America, ASTM B69-16, "Standards Specification for Rolled Zinc," is the primary reference document for both Type 1 and Type 2 alloys and their expected characteristics. Rolled zinc is efficiently produced by alloying Special High-Grade, 99.995 percent pure zinc with very small quantities of copper, titanium and aluminum. The zinc alloy composition determines whether the metal will tend toward a blue-gray or graphite-gray coloration.

2. Dynamic Appearance

A time-proven, dependable material, zinc roofing products complement both contemporary and traditional architectural styles, and foster a connection to their surrounding natural environment.

Zinc can be fabricated to fit almost any slope, curve or linear run, as well as perforated and fashioned into ornamental accents.

Untreated, architectural-grade zinc is bright, shiny and light reflective. Over time, a natural matte patina develops, creating a dynamic appearance as the material ages. A patina's formation is a process of the gradual growing together of zinc carbonate "freckles." The rate of its formation is related to the slope of the surface. The patina will form slower on a vertical wall surface than on a slightly pitched roof. The patination speed varies between six months and five years or more, depending on climatic conditions. The more exposure to wetting and drying cycles, the quicker the patina will develop.

Specific to coastal communities, the natural patina will appear lighter when used in marine locations where the air contains chlorides (salt). Deposits will not be as visible on lighter blue-gray zinc.

Some manufacturers offer pre-weathered zinc material that accelerates the patina formation under controlled conditions. Factory-finished options also are available to achieve an initial, uniform aesthetic.

3. Product Versatility and Variety

A soft, lightweight metal, zinc can be fabricated to fit almost any slope, curve or linear run, as well as perforated and fashioned into ornamental accents. Zinc roofing products can be installed on low sloped, steep sloped, flat and mansard roofs, and used for hip and ridge caps, drip edges, alleys, step flashing, dormers, cupolas, parapets and more.

Seam profiles can be customized to the project’s requirements. For example:

During their many years of use, zinc roofs do not rot, rust or need repainting, and its runoff is non-staining and non-toxic.

· Double-lock and single-lock seam joints between roof panels stand 1 inch or 1.5 inches up from the draining plane. A raised seam height can emphasize the roof as a design element and have a functional purpose in coastal climates with snow.

· Vertical standing seam profiles with mechanical lock connections are the most common zinc roofs.

· Flat seam profiles rely on gravity and at least a 4:12 slope to maintain weathertightness.

· Low-profile zinc shingles and interlocking or overlapping tiles applied parallel to the eave present another familiar aesthetic. They involve a technically easier installation method than vertical joints and always are applied as a “dry-joint” roof system without solder or sealant. Tiles can be small. They provide good wind resistance, but cannot provide the same level of weather protection as a vertical seam.

· For vertical seam profiles, vertical joints are attached to one vertical side joint, overlapped and closed on the opposite side. The soft metal simplifies the task of hand-seaming or power-seaming zinc panels. Long panel lengths can make this design more vulnerable to oil-canning (panel waviness), panel disengagement and wind uplift. Accommodating longer panels, taller seams and those with added capillary breaks offer better water and wind resistance, critical in many coastal applications.

4. Resilient Results

Installed properly, zinc roofing systems will resist corrosion, air and water infiltration, and withstand high winds reaching up to 150 mph. In marine environments that are susceptible to fires, zinc also offers a noncombustible solution.

Common installation considerations and cautions include:

· Zinc roof profiles should be applied as a ventilated dry-joint cladding or a “rainscreen” roof strategy, not as the primary waterproof barrier. This design alternative allows for pressure equalization, backside drying and moisture escape.

· Above-sheathing ventilation mats must be a requirement of every zinc roof assembly. Use an 8 to 10 mm structured underlayment comprised of entangled nylon wire to elevate the zinc roof panel, creating a capillary break with a 0.95 cm airspace to help keep the underside of the profile dry. Do not accept a substitution of this air space and capillary break with a backside paint coating or other barrier strategy.

As zinc ages and weathers, a natural patina develops to create a dynamic appearance.

· Self-adhered high-temperature roof underlayments are recommended. Synthetic felts may be utilized on steep pitch roofs in combination with self-adhered high-temperature underlayments at vulnerable roof conditions and roof penetrations.

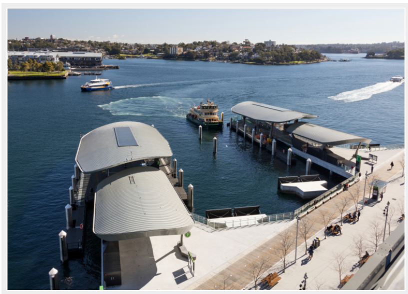
· Red rosin paper, conventional felt and any other moisture-holding material should be prohibited in every zinc application and related specification.

· To facilitate moisture drainage from the vented space, the roof panel usually should have a soft bend past the drip edge (cleat). This open hook promotes water drainage from the end pocket formed by the panel hook. Zinc profile end folds also should be "soft" with the raw zinc edge parallel to the ground and not closed tight.

· Excessive use of sealants can plug weep holes, limit airflow, trap moisture, create adverse reactions or restrict the metal's movement. For any proposed use of tube or tape sealants within laps or other concealed applications, first consult the zinc manufacturer.

5. Sustainability and Longevity

The sustainable benefits of architectural zinc products support criteria for several green building programs including BREEAM certification, the Green Globes system, the U.S. Green Building Council's LEED rating system, and the Cradle to Cradle Products Innovation Institute.



Important to coastal environments, zinc roofing systems can withstand high winds reaching up to 150 mph. Pictured here is a marina in Sydney, Australia.

Products that have earned Cradle to Cradle certification demonstrate their product's material does not release any toxic substances during usage, deconstruction and recycling; that it retains its original properties without loss of performance; and that can be re-used as a new item of at least equal value. This is known as upcycling; whereas downcycling results in recycling material to become inferior products, and non-recyclable products will be sent to a landfill. More than 90 percent of zinc-containing products are recycled at the end of their lifecycle.

During their many years of use, zinc roofs do not rot, rust or need repainting. They require very little maintenance. For aesthetic reasons, it is recommended to clean the surface of the material with clean water (not seawater) at least twice a year in maritime climate zones, depending on local conditions. Follow the manufacturer's cleaning instructions. If the metal is scratched, scuffed or fingerprinted, zinc will heal itself by re-patinating. With time and exposure to wetting and drying cycles, the former blemish will patinate and blend to match.

The resilient performance and natural beauty of zinc has been demonstrated for more than 200 years in marine environments and coastal communities. Collaboration between roofing contractors and zinc manufacturers will help ensure a roof that provides long-lasting functionality and appearance, achieving the best results for the building owner.

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Focused on Proper Residential Attic Ventilation, Roofing Contractors Documented These Mistakes

AUGUST 1, 2020 BY PAUL SCELSI LEAVE A COMMENT

Since 1998 our best practices in residential attic ventilation seminars have featured the real-world situations roofing contractors are seeing. Here we cover a handful of attic ventilation mistakes contractors found in the field. (Note: Some photos show multiple mistakes but were chosen to highlight one.)

Problem: Bagged Wind Turbines Suffocate the Attic Airflow

Solution: Unbag the wind turbines.

It's impossible for a covered attic exhaust vent to work if it's smothered under a bag. Attic ventilation is supposed to provide year-round benefits, fighting heat buildup in the

Photo: Jake Jacobson, SF5 Construction, LLC, Little Elm, Texas

warmer weather and moisture buildup in the colder weather. It's sometimes forgotten (and maybe never known) that occupants of a house generate water vapor daily through activities such as cooking, cleaning, bathing, breathing, etc. It amounts to 2-4 gallons per day for the average family of four. That warm, moist air can make its way into the colder attic in the winter months, where it can condense and cause trouble as water droplets and frost.

Problem: Bath Fan Ductwork Terminating in the Attic Damages Roof

Solution: Run the bath fan ductwork either vertically through the roof or out the side gable wall.

Even a perfectly balanced attic ventilation system cannot handle the quantity of moisture dumped into the attic by the bath fan. It overwhelms the system. That moisture should be vented directly to the outdoors without any pitstops into the attic. In the home pictured here, Trevor Atwell found three bathroom fans venting directly into the attic. He also found a lot of rotted sheathing.

Photo: Trevor Atwell, Atwell Exterior Services, LLC, Greenville, North Carolina

Problem: Painted Soffit Vents Result in Reduced Intake Airflow

Solution: Buy pre-painted soffits, or paint them more carefully, or replace them with new vents.

Photo: Daniel White, Roof Life of Oregon, Tigard, Oregon

Soffit vents have a specified amount of Net Free Area (airflow capability) when they are manufactured. For example, 9 square inches of NFA per linear foot. That amount, by the way, would balance nicely with a ridge vent (exhaust vent) that is capable of 18 square inches of Net Free Area per linear foot (9 NFA at the soffit on the left of the ridge vent + 9 NFA at the soffit on the ridge of the ridge vent = 18 NFA at the peak of the roof). But the airflow capability of the soffit is reduced if the vent openings become clogged or blocked because of a careless paint job. While house exterior colors are important, don't sacrifice attic ventilation performance. It's possible to have both a nicely painted soffit and it's full, intended net free area (airflow capability).

Problem: Two Rows of Box Vents = One Path of Inefficient Airflow

Solution: Always keep attic exhaust vents in one row.

Let's cut to the chase. If it takes two rows of attic exhaust vents to meet the attic's exhaust ventilation needs, it's time to find another category of exhaust (maybe horizontal ridge vent; or diagonal hip ridge vent; or a combination of horizontal and diagonal ridge vent; or a power fan). But when attic exhaust vents are aligned in two rows, the primary path of the airflow will be from one row to the next because air will allows follow the path of least resistance seeking the closest exit point from its entry point. The intake vents in the soffit or low on the roof's edge are supposed to be the intake vents. The pictured scenario here is producing inefficient attic airflow and could cause one row of box vents to ingest weather.

Photo: Daniel White, Roof Life of Oregon, Tigard, Oregon

Problem: Mixed Types of Attic Exhaust Vents = Problematic Airflow

Solution: Only use one type of attic exhaust vent on the same roof above a common attic.

Daniel White, Roof Life of Oregon, Tigard, Oregon

Regardless what combination of two or more different types of attic exhaust vents either the homeowner demands (we've heard the stories) or a well-intended but misguided roofing contractor recommends (it's happening), do not mix two different types of attic exhaust vents on the same roof above a common attic. Pictured here are wind turbines with ridge vents; box vents with ridge vents; solar powered fans with box vents; and traditional electric power fans with ridge vents. Now shown is the all-time classic: Gable-end louvers with any other type of attic exhaust.

When attic exhaust types are mixed, it short-circuits the airflow system because air always follows the path of least resistance. The air is looking for the easiest, least difficult exit path. That path is inevitably the distance between the two types of attic exhaust vents because they are closest to each other. That means the airflow will be concentrated in that area of the attic; which leaves significant areas of the attic incorrectly vented. The intake vents low on the roof's edge or in the soffit/overhang have been pretty much bypassed. Furthermore, if one of the exhaust vents is suddenly an intake vent, does than mean it's ingesting weather along with the air? You do not want to find out.

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New Restrictions May Affect Products Contractors Commonly Stock and Install

MAY 27, 2020 BY JUSTIN KOSCHER AND STEPHEN WIERONIEY LEAVE A COMMENT

The roofing industry is familiar with changes brought on decades ago by international treaties that limited and then banned the use of products containing substances with measurable ozone depletion potential (ODP) — a relative measure of a substance's contribution to the degradation of the ozone layer. The global effort to reduce emissions of ODP substances required manufacturers in the United States and Canada to phase out the use of CFCs and HCFCs in various products (example: polyisocyanurate insulation) and replace them with non-ODP alternatives. In certain instances, ODP substances were replaced by alternatives that had measurably high contributions to global warming, measured as global warming potential (GWP).

Today, under renewed efforts to combat the climate change impacts associated with the manufacture and use of products from insulation to refrigeration, U.S. state governments as well as the Government of Canada have implemented restrictions on the use of products containing certain high-GWP substances. For the roofing industry, familiar products that can contain high-GWP substances include foam adhesives, spray polyurethane foam (SPF), and extruded polystyrene (XPS) foam. In jurisdictions that restrict the use of high-GWP substances, contractors should be aware of the potential impacts that these new restrictions may have on products they commonly stock and install.

U.S and Canada: Development of HFC Policies

The effort to restrict the use of HFCs in formulations used by building material manufacturers (as well as other sectors) started in the mid-2010s as the U.S. Environmental Protection Agency (EPA) developed regulations under the Clean Air Act's Significant New Alternatives Policy (SNAP) program. EPA banned the use of HFCs in the affected roofing products, as well as other common end uses, by issuing SNAP Rule 20 in 2015 and Rule 21 in 2016. However, both rules were challenged and partially vacated by the U.S. Court of Appeals – D.C. Circuit.

As a result of the Court's decision on SNAP Rules 20 and 21, there is no federal requirement for manufacturers to transition away from HFC-based formulations for roofing products. Instead, states are leading the transition to the use of low-GWP blowing agent substitutes to formulate roofing products. The states have organized the U.S. Climate Alliance to coordinate on a broad set of climate related issues – including restricting the use of HFCs. (Information on the U.S. Climate Alliance is available at http://www.usclimatealliance.org/.) The Alliance has developed a model rule to guide the development of HFC restrictions at the state the level. This model rule has helped states move quickly to adopt rules to restrict HFC uses.

For example, California, New Jersey, Vermont, and Washington have enacted legislation similar to what the EPA originally promulgated prohibiting the use of HFC substances in roofing products, such as foam insulation and foam adhesives and sealants. As of mid-March, at least 10 other states are considering legislation or regulations to restrict the use of HFCs.

For the Canadian roofing market, Environment and Climate Change Canada have enacted nation-wide restrictions on the use of HFC substances. As of January 1, 2021, no plastic or rigid foam product can use an HFC substance or HFC blend with a GWP greater than 150. The effect of these restrictions is that manufacturers using common HFCs will need to reformulate with new technologies or blends.

Which Products Are Impacted?

Certain roofing products like foam adhesives, one-component foam sealants, and insulation are formulated using blowing agent technologies. Blowing agents provide the final product with specific physical properties such as thermal performance or are necessary to facilitate the application process for the product. A good example of the benefits that blowing agent technologies provide is closed-cell foam insulation. In closed-cell insulation products, the blowing agents are retained within the cell structure to provide increased and long-term thermal performance.

However, different products use various technologies and not all products will be impacted by the restrictions described above. For example, polyisocyanurate insulation is manufactured with pentane (or pentane blends) as its blowing agent. Pentane is a non-ODP, low-GWP substance. Therefore, polyisocyanurate insulation is not impacted by the restrictions and roofing contractors should not expect to see changes in these products as a result of any HFC regulations. (More information on polyisocyanurate insulation products is available at ~~https://www.polyiso.org/page/Low-GWPBlowingAgentSolution~~.)

Spray polyurethane foam (SPF) roofing insulation is typically manufactured with HFC blends. Most SPF manufacturers have introduced new, low-GWP formulations using HFO technologies in the past several years. Roofing contractors working in states that prohibit the use of HFC-based products will need to be familiar with the available HFO-based SPF products. Similarly, low-rise foam adhesives and other foam products and sealants will be subject to the same restrictions as HFCs. (More information on spray polyurethane foam products is available at https://www.whysprayfoam.org/.)

Another common building insulation product impacted by the HFC regulations is XPS insulation, which is traditionally manufactured with HFCs. Projects that specify XPS insulation and are located within a jurisdiction that prohibits the use of HFC-based foam products will need to consult with product manufacturers to discuss the availability of low-GWP options.

How Should Roofing Contractors Prepare?

The HFC regulations generally ban the use, sale, and installation of products that do not comply with the HFC restrictions as well as the ability to place such products into commerce. These restrictions essentially require manufacturers and product distributors to sell low-GWP formulations and require roofing contractors to ensure they are using and installing compliant products. In certain circumstances, the regulations have required some manufacturers to reformulate HFC-based products to low-GWP technology.

Roofing contractors should learn to identify products that utilize low-GWP technologies in order to ensure they are stocking and installing compliant roofing products in states with active restrictions. This will require roofing contractors to determine the answers to questions including: Where is the product being installed, and does the jurisdiction have HFC restrictions? Does the product contain HFCs? And, if yes, when was the product manufactured?

1. Install Low-GWP Products. Compliant roofing products are already available. These products include polyisocyanurate insulation as well as SPF roofing and insulation that is formulated with low-GWP technologies like HFOs. Other product manufacturers are still transitioning their product portfolios to low-GWP formulations. For the next several years, there may be SPF or foam adhesive and sealant products available in the marketplace that contain HFCs. For these products, roofing contractors should determine how to differentiate between low-GWP and HFC formulations. Product may be branded as “low-GWP” and some products will carry labels stating the product is compliant with state HFC restrictions.

2. Check Date of Manufacture. Thus far, each state with effective restrictions has included sell-through provisions that allow product manufactured prior to the restriction date to remain in commerce until they are used. Roofing contractors may still have products that use an HFC-based formulation in their supply chain. Roofing contractors that are planning to install these products in states with active restrictions should determine when the products were manufactured to ensure they can be used and installed.

3. Do Not “Import” Non-Compliant Product. Roofing contractors should closely track HFC restrictions in neighboring states. Roofing contractors that conduct business in multiple states should ensure they do not “import” non-compliant products that contain HFCs into states where their import and use is restricted.

The regulatory landscape is changing quickly. Currently, 10 states have pending legislation or regulation. The most practical recommendation for roofing contractors is to engage with their product suppliers to ensure they are aware of restrictions in the areas they conduct business.

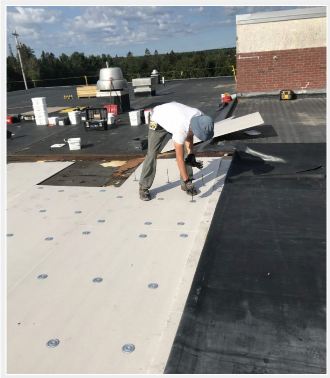
About the authors: *Justin Koscher is the president of the Polyisocyanurate Insulation Manufacturers Association (PIMA), a trade association that serves as the voice of the rigid polyisocyanurate insulation industry and a proactive advocate for safe, cost-effective, sustainable and energy-efficient construction. Stephen Wieroniey is the director at the American Chemistry Council’s Center for the Polyurethanes Industry. In his role at CPI, he also serves as the director of the Spray Foam Coalition.*

FILED UNDER: FEATURES, TECH POINT TAGGED WITH: GLOBAL WARMING POTENTIAL, HCFC, SPF, U.S. CLIMATE ALLIANCE

Coated Glass Facers Bring New Performance Advantages to Polyiso Insulation

MARCH 25, 2020 BY MARCIN PAZERA, PH.D. LEAVE A COMMENT

Rigid polyisocyanurate (polyiso) insulation board is one of the most widely-used insulation products on the market today and is manufactured in various forms for use in wall, roof, and other building construction applications. The different types, classes, and grades of polyiso insulation board are defined by the classification system in



Photos: Owens Corning

ASTM C1289 “Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board” and may be classified by the type of facer or facing material used to manufacture the products.

Polyiso is a thermoset, closed-cell, rigid foam plastic insulation that is manufactured in board form (typically 4-foot-by-4-foot or 4-foot-by-8-foot sizes). Through a continuous lamination process, liquid raw materials that make up the foam formulation are mixed and in a rapid chemical reaction form a rigid and thermally stable polymeric structure. During manufacture, the facers or facing materials enable the manufacturing process by containing the viscous foam mixture as it is poured and cured into the rigid polyiso core.

After manufacture, facers or facing materials perform a number of key functions for the installation and use of polyiso products. At the jobsite, the specific type of facer or facing material can determine the insulation product’s compatibility with various substrates, which is an important consideration where installed as part of an adhered roof system. Once installed in a roof system, the facer or facing material can influence water absorption and water vapor transmission, which can be important characteristics in building envelope applications. In wall applications, polyiso may be used as a drainage plane to shed bulk water and with taped joints between adjacent boards can form both effective water resistive barrier and air barrier component. Facer or facing materials can positively contribute to the fire performance of the product and assembly, reduce air movement through the system, or provide for radiative properties. Finally, it should be noted that the same facer material is typically used on both sides of the polyiso board; however, different facer types may be used to meet specific project design and performance needs.

Facer Types

The three most common types of polyiso facers are aluminum foil, glass fiber reinforced cellulosic felt, and coated polymer-bonded glass fiber mat. The ASTM C1289 Standard contains classifications and descriptions for each facer type:

- **Aluminum Foil Facer (FF)** is composed of aluminum foil that may be plain, coated and/or laminated to a supporting substrate.
- **Glass Fiber Reinforced Cellulosic Felt Facer (GRF)** is composed of a cellulosic fiber felt containing glass fibers.
- **Coated Polymer-Bonded Glass Fiber Mat Facer (CGF)** is composed of a fibrous glass mat bonded with organic polymer binders and coated with organic polymer, clay, or other inorganic substances.

Polyiso products as shown in Table 1 may also be manufactured with other facer types or facing materials such as uncoated polymer-bonded glass fiber mat (AGF), perlite insulation board, cellulosic fiber insulation, oriented strand board (OSB), plywood, and glass mat faced gypsum board. Depending on the particular project requirements, a certain facer type may offer specific benefits and the most attractive option for that application.

Coated Polymer-Bonded Glass Fiber Mat Facer

Coated polymer-bonded glass fiber mat facer (coated glass facer or CGF) is used in polyiso insulation products installed as part the building enclosure, including roof insulation, high-density cover board, and wall insulation products. Coated glass facers consist of multi-layer construction and a coating to impart a versatile weather resistant outer layer. CGF facers offer dimensional stability and resistance to water absorption. The glass fibers in the mat provide tensile strength and moisture resistance characteristics, making the mats an ideal solution for other product applications that require high levels of performance link flooring products, underlayments, asphalt shingles, roof membranes, ceiling tile, and other construction products (i.e., glass reinforced panels and industrial applications).

Table 1. Polyiso Insulation Product Classifications.

ASTM C1289 Classification		Facer or Facing Material		Compressive Strength	Notes
Type	Class	Side 1	Side 2		
I	1	FF both sides		16 psi	
I	2	FF both sides		16 psi	
II	1	GRF both sides		Grade 1: 16 psi	
II	1	CGF both sides		Grade 2: 20 psi	
II	2	AGF both sides		Grade 3: 25 psi	
II	3	GRF both sides		NOTE: All grades apply to Type II Class 1, 2, or 3	
II	4	CGF or AGF both sides		Grade 1: 80 psi Grade 2: 110 psi Grade 3: 140 psi	2
III	n/a	Perlite Board	GRF, CGF or AGF	16 psi	1
IV	n/a	Wood Fiber Board	GRF, CGF or AGF	16 psi	1
V	n/a	Orented Strand Board (OSB) or Plywood	GRF, CGF or AGF	16 psi	1
VII	n/a	Glass Mat - Faced Gypsum Board	GRF, CGF or AGF	16 psi	1

Notes to Table:

1. Orientation of the facer side shall be in accordance with manufacturer instructions for the specific application.
2. Available in maximum ½" thickness.

The CGF Manufacturing Process

For polyiso products, the CGF consists of a non-woven glass fiber mat as the substrate. The glass fibers that make up the mat are formed when minerals are batched together, melted in a large furnace, and extruded into strands through fine orifices in bushing plates. The fibers are mechanically drawn, cooled, and treated to impart the required handling and physical properties for the desired performance.

For non-woven applications, the fibers are chopped to the required length and sent to the mat forming line. The non-woven glass fiber mats (typically produced by a wet laid process on an inclined wire former) are impregnated with a synthetic water-based binder such as acrylic, urea formaldehyde, or renewable organic binders. The impregnated web is dried and cured in a direct gas-heated belt dryer. To produce the final coated glass facer, the rolled mat is coated with a mineral-filled latex coating to seal the mat. The coated mat is rewound and packaged according to individual product and customer specifications. After inspection, the mats are slit and wound in-line on cardboard cores in a turret winder.

The rolls of CGF are delivered to polyiso manufacturers where they are loaded into laminators to become the top and/or bottom facers of the finished polyiso insulation boards.

CGF and Polyiso Performance Benefits

Coated glass facers do more than hold the polyiso together as it cures; they add certain performance characteristics that can enhance the effectiveness of the final polyiso product. CGF as a material is noted for offering the following benefits for polyiso insulation:

- Mold resistance
- Enhanced fire performance
- Excellent strength and durability
- High moisture resistance
- Excellent dimensional stability
- Resistance to delamination
- A reduction in knit line appearance

Since every type of polyiso product has its unique advantages and uses, choosing the right facer for the right application can have long-term impacts on the entire system's performance and resilience. For example, some moisture is always present in our environment. CGF can provide added resistance to moisture absorption for polyiso products and help improve the performance and durability of the overall roof system.

Polyiso insulation products offer:

- A high R-value per inch compared to other insulation products.
- A certified LTTR value (roofing products).
- The performance to meet today's code required R-values while minimizing assembly thickness, and material and labor requirements.
- Excellent performance in fire tests.
- Ease of use and peace of mind, as polyiso products are designed for use in an expansive assortment of tested, approved, and code-compliant assemblies.
- As a thermoset plastic, stability over a large temperature range (-100°F to +250°F) and can be used as a component in roof systems utilizing hot asphalt.
- Versatility as a multi-attribute weather barrier product.
- A continuous insulation solution to minimize heat loss through thermal bridges.

In summary, the combination of polyiso insulation and coated glass facers provide building owners and contractors with a solution that can meet thermal, moisture, and durability considerations. A wide variety of CGF polyiso products are available for specific applications in roofing or wall construction. Consult with a polyiso manufacturer for guidance on design and technical information for various insulation systems. Further information can be found at www.polyiso.org, the website of the Polyisocyanurate Insulation Manufacturers Association (PIMA), along with updated Environmental Product Declarations (EPDs), and technical bulletins for polyiso applications.

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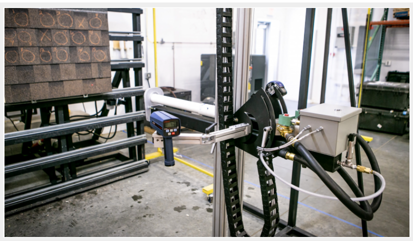
New Test Protocol Provides Deeper Insight Into Performance of IR Shingles Against Hail

JANUARY 29, 2020 BY DR. TANYA BROWN-GIAMMANCO   LEAVE A COMMENT



Hail impact testing takes place at the IBHS Research Center in Richburg, South Carolina. Manufactured hailstones are launched using a hail cannon designed to create an impact with the same kinetic energy as naturally occurring hail. Photos: Insurance Institute for Business & Home Safety

Consumers deserve to have confidence that shingles labeled as impact resistant live up to their resilient expectations. The Insurance Institute for Business & Home Safety (IBHS) has dedicated years to collecting data and identifying unprecedented insights into the performance of impact resistant-labeled shingles.

IBHS is a non-profit, scientific research organization funded by the property insurance industry as a tangible demonstration of its commitment to resilience. Charged with advancing building science, influencing residential and commercial construction and creating more resilient communities, IBHS recreates real-world severe weather conditions to test buildings and building components, including asphalt shingles.

Background

Hail poses a threat to roofs across the country. It routinely causes more than $10 billion in insured losses each year according to a 2017 WillisRe study, and those losses have been growing. Yet, hail is not well accounted for in typical construction processes because hail-resistant products are not typically required by building codes.

There are three impact modes possible when hailstones hit shingles. Hailstones can bounce off the shingle cleanly, shatter into many pieces, or turn to slush leaving a residue behind on the shingle.

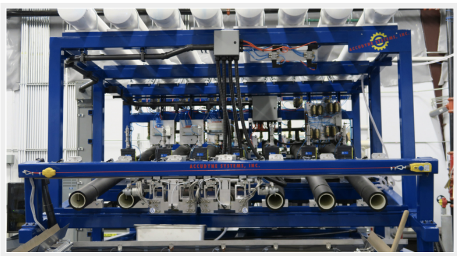
Impact-resistant (IR) asphalt shingles are marketed to consumers to perform better in hailstorms. Currently, those products are tested according to Underwriter’s Lab UL 2218 test or FM Approvals FM 4473 test, which use steel balls and pure water ice balls, respectively. They are based on diameter to kinetic energy relationships from the 1930s, and both tests launch projectiles at the roofing products and assume the damage severity is directly tied to the kinetic energy of the projectile. These tests evaluate products on a pass or fail basis using human evaluation to judge whether a crack has occurred, and in the case of the UL test, the damage is viewed from the backside —

the side of a shingle a homeowner, roofer or insurance adjuster can't see. Neither test, however, accurately replicates both the type and severity of damage found on rooftops after hailstorms.

Missing in the development of these test standards was an understanding of the material properties of natural hail. Historical studies had quantitative data on mass, diameter, and density, but qualitatively described the strength or hardness of hailstones. There were no quantitative hailstone strength data from which to base a laboratory test.

Filling a Knowledge Gap

IBHS began laying the foundation for what would become the IBHS Impact Resistance Test Protocol for Asphalt Shingles by collecting quantitative data on hailstone properties to expand understanding of the phenomenon itself in 2012. Researchers in the field have followed severe thunderstorms and collected hailstones to measure their mass, diameters, and strength. These data provided a deeper understanding of the kinetic energy with which hailstones fall, their mass to diameter relationship, and the strength of the hail itself.



IBHS partnered with Accudyne Inc to design the hail machine to manufacture hailstones in the laboratory to mimic the properties of natural hailstones.

After collecting thousands of data points, IBHS was able to fill the gap in the fundamental properties of hail that would affect damage. The data revealed that natural hail is slightly stronger than pure ice and current test methods overestimate the mass, fall speed and impact energy of hail. This was a significant breakthrough in hail science.

Recreating Hail in the Lab

Armed with these new insights, IBHS researchers could begin to replicate the properties of natural hail and achieve the right impact energies in the laboratory to develop a new test for impact resistance that would produce damage representative of natural hailstorms. Seltzer water was initially used to create the density observed in natural hail. Later, IBHS and Accudyne Systems Inc. developed and patented a hail machine to mass-produce manufactured hailstones for testing. The hail machine allows researchers to configure the density and strength of hailstones to mimic the variety that occurs in natural hail.

Variations in strength and density led to the identification of three impact modes, or types of impacts, that occur when manufactured hailstones are launched at asphalt shingles. The hailstones may result in a "hard bounce" off the shingle remaining nearly intact, a "hard shatter" with the hailstone fracturing into numerous small pieces leaving no ice residue behind, or a "soft" impact where the hailstone turns to "slush" on the surface of the shingle.

Figure 1. Hail causes three distinct types of damage to shingles. Hail can deform a shingle with dents, dislodge the protective granules on the surface of the shingle, and cause cracks or tears that breach the material.

The hard impacts typically caused granule loss and deformed the shingles, leaving dents and creating breaches. The soft, slushy impacts produced a larger area of granule loss, but left less noticeable deformations. These damages are reflective of damages observed on real roofs after hailstorms and may diminish a shingle's water-shedding capabilities. Deformations to shingles can allow water to penetrate and get into the roof, which may damage the interior of a home. Loss of granules on shingles exposes the asphalt to UV radiation, which can cause them to become more brittle and prone to further damage and shorten the service life of the roof.

The Test Protocol

The IBHS Impact Resistance Test Protocol for Asphalt Shingles uses a hail cannon to launch 1.5- and 2-inch manufactured hailstones at roofing test panels. Unlike existing test methods, IBHS requires the shingles be purchased from distribution channels as a roofer or contractor would purchase the product.

The test panel follows the UL 2218 method with a 3-foot by 3-foot frame with a middle structural member

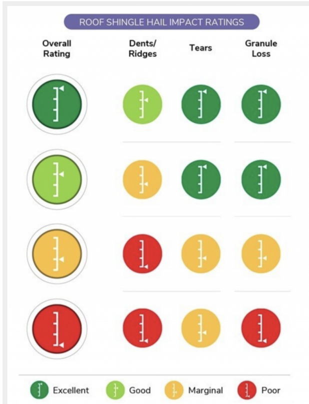


Figure 2. An example of the Roof Shingle Hail Impact Ratings chart found ibhs.org. Each product recieves an overall rating in addition to a rating by damage type ranging from excellent to poor performance.

to simulate the presence of a roof truss. The panel has a plywood roof deck and underlayment. Shingles are installed according to each manufacturer's instructions. Impacts are focused on the main portion of the shingles avoiding edges, joints, corners, the outer frame and the middle structural member.

When testing three-tab shingles, 20 impacts per hailstone size are required. When testing architectural shingles, 40 impacts per size are required — 20 on the single layer portion of the product and 20 on the multiple layer portion of the product. For each hailstone size, an equal number of hard and soft impacts are required. However, some variation is allowed between hard shatter and hard bounce.

Damage Assessment and Ratings

As part of the new test protocol, IBHS needed an objective tool to assess damages and improve upon the human judged pass/fail ratings of the existing test methods. IBHS partnered with Nemesis Inc. to create a cloud computing tool to measure the volume of deformations and the area of granule loss. The application runs on a computer or mobile device and uses at least 13 photos to generate gridded 3D data of the impacts. The 3D mesh allows the application to precisely measure deformations, including both the depth of dents and the height of the ridge surrounding each dent, as well as granule loss individually and in patches. The quantitative data allows for the severity of the damage to be evaluated, rather than treating all damage as equal. The third mode of damage, breach, is assessed by expert judgement to visually determine the severity level.

The damage severities for each of the 20 impacts for three-tab shingles or 40 impacts for architectural shingles are used to calculate the overall performance evaluation rating of a product for a given test size. IBHS publicly released results of the initial testing in June 2019. The published ratings provide the overall performance evaluation rating in addition to performance ratings by damage category.

The initial release included eight of the most widely-sold IR shingle products on the market. As part of the release, IBHS committed to retest the products every two years and to test new products introduced to the marketplace within six months of release. In October 2019, IBHS issued an update to the performance evaluation ratings, adding three newly released products to the list.

Summary

The IBHS Test Protocol differentiates the performance of widely-sold IR shingles currently on the market by replicating the properties of natural hailstones and providing a quantitative evaluation of performance. Moving beyond pass/fail testing provides more detailed performance information for consumers looking to purchase a better performing product, roofers looking to sell a better product and manufacturers who wish to improve their products.

As hail-related losses continue to rise, the IBHS Impact Resistance Test Protocol for Asphalt Shingles and its ability to more effectively determine which shingles may be more resilient to hail will help raise the level of performance and arm consumers in hail-prone regions with more information when selecting a roofing product.

To view the latest shingle performance ratings, visit www.ibhs.org/hail/shingle-performance-ratings.

About the author: *Dr. Tanya Brown-Giammanco is the Managing Director of Research at the Insurance Institute for Business & Home Safety (IBHS) and has overseen the IBHS hail program since its inception in 2010. For more information on hail research, please visit ibhs.org.*

FILED UNDER: FEATURES, TECH POINT TAGGED WITH: HAIL, IBHS, IR SHINGLES, TEST

FEMA's New Mitigation Program Could Mean Good News for the Construction Industry

NOVEMBER 21, 2019 BY LOUISA HART LEAVE A COMMENT

Photo: EPDM Roofing Association (ERA)

It's hard to find bipartisan agreement on anything in Washington these days. But the Disaster Recovery and Reform Act (DRRA) sailed through the Senate and was signed by President Trump two days later, on October 5, 2018. At the time the bill was signed, FEMA Administrator Brock Long said, "We'll never be able to eliminate all risks, but this enables us to take action now so that individuals and communities will be better positioned to recover more quickly when disasters do occur."

FEMA had put forward the ideas contained in the new law in its draft National Mitigation Investment Strategy released earlier in 2018. According to the FEMA draft, the final investment strategy was to be grounded in three fundamental principles:

1. Catalyze private and nonprofit sector mitigation investments and innovation;
2. Improve collaboration between the federal government and state, local, tribal and territorial governments, respecting local expertise in mitigation investing; and
3. Make informed decisions based on data including lifetime costs and risks.

The investment strategy's overarching goal, according to FEMA, would be to improve the coordination and effectiveness of "mitigation investments," defined as risk management actions taken to avoid, reduce, or transfer risks from natural hazards, including severe weather. The final DRRA legislation closely adhered to this plan.

Since the DRRA passed more than a year ago, the folks at FEMA, who will administer the provisions of the bill, have been figuring out how to get the millions of dollars authorized by the new legislation to the people who could make good use of that money. But one thing is for sure: when the money starts to flow, it could be very good news for the construction industry in general and roofers in particular.

Simply put, the new legislation marks a clear change in the federal approach to dealing with the damage caused by increasingly frequent natural and man-made disasters. As 2019 draws to a close, the United States has been buffeted by firestorms, hail, drought, tornadoes, and Hurricanes Michael and Florence. While the damage is still being totaled, it will run into the billions. The not-so-subtle message in the DRRA from FEMA: the agency is telling us not to expect to be bailed out by the federal government and instead is putting their money into helping people prepare for these disasters. In other words, FEMA wants to change the focus from response to resilience, and break the cycle of what they are calling "disaster damage, reconstruction, and repeated damage."

How did this change in approach come about? Clearly the current approach is unsustainable. Waiting until a structure is damaged by a cataclysmic event and then rebuilding it to the same standards has only resulted in more damaged structures. The DRRR legislation itself authorizes the creation of the National Public Infrastructure Pre-Disaster Mitigation fund, using a percentage of what might have been spent on disaster relief. FEMA is still crossing the T's and dotting the I's on its new plan to channel money through the states for individual projects, now called the Building Resilient Infrastructure and Communities (or BRIC) Program.

Why is it taking more than a year for FEMA to put the BRIC program into place? As with all things in Washington, especially when they deal with money and how it will be spent, this is a complex process. The ink was barely dry on the president's signature when FEMA solicited input on how to structure the new program, and help states find their way through the red tape to actually secure funding. The call for input was distributed far and wide through webinars, regional and state workshops and national conferences.

As of mid-summer, FEMA received more that 5,000 comments. Clearly a lot of people are watching this program very carefully. FEMA is expected to have the details of the new program worked out by early 2020. At the same time, it will offer technical support that will describe how to apply for the available funds.

Prepare for Changes Now

For many in the construction industry, and for roofers specifically, the time to prepare for the availability of the new funds is now. The Insurance Institute for Business and Home Safety (IBHS) is a research facility supported by the insurance industry that evaluates residential and commercial construction materials under extreme conditions.

As the president of IBHS recently noted, “The roof is your first line of defense against anything Mother Nature inflicts… and during a bad storm your roof endures fierce pressure from wind, rain, and flying debris.” Now, instead of being in a reactive, unpredictable cycle of cleaning up after natural disasters, roofers can plan to incorporate resilience into their roofing systems and, hopefully, access some of the new federal money to support their efforts, or the efforts of their customers.

Resilience — the ability of a structure to withstand devastating natural and man-made disasters and rebound quickly to normal operating functions — is an idea whose time has come. Prior to passage of the DRRA 46, industry groups urged FEMA “to support the inclusion of enhanced building codes and greater federal funding for resilient construction in the pending legislation.” Since then, industry organizations including BOMA, EESI, the AIA have devoted resources to clarifying what is meant by resilience and how the construction industry can respond to the related challenges.

Among the roofing industry, the EPDM Roofing Association (ERA) has created a microsite (http://epdmtheresilientroof.org) to serve as a resource for builders. The association has also issued an annual report called “Building Resilience: The Roofing Perspective.” The report, which will be updated yearly, contains specific guidance on creating a resilient roofing system, and includes science-based data on the resilient qualities of EPDM roofing membrane.

FEMA is poised to issue the specifics of the BRIC program that will set out a pathway to access federal funds. The roofing industry has the tools it needs to take advantage of this new mitigation-based federal approach to disaster management. The convergence of these two powerful forces should mean more business for roofers, and a more resilient built environment across the country.

About the Author: *Louisa Hart is the director of communications for the Washington-based EPDM Roofing Association (ERA). For more information, visit www.epdmroofs.org.*

FILED UNDER: FEATURES, TECH POINT TAGGED WITH: DISASTER RECOVERY AND REFORM ACT, DRRA, FEMA, MITIGATION PROGRAM

Tapered Insulation Can Prevent Ponding on Low-Slope Roofs

SEPTEMBER 27, 2019 BY MARCIN PAZERA, PH.D. LEAVE A COMMENT

The primary and most important function of a roof membrane in a low-slope roof system is to provide weatherproofing by keeping the rainwater from entering the roof assembly. Ponding water poses the greatest risk to a roofing membrane, since it not only shortens its service life, but can lead to more serious life safety concerns when loads and deflections exceed the designed conditions. This could lead to a roof collapse. From an aesthetics standpoint, areas on roofs with a prevalence for ponding are susceptible to unsightly bacterial and algae growth as well as accumulation of dirt. Given the large footprint of low-slope roofs on typical commercial buildings, managing rainwater timely and effectively is an important design consideration in new roof design as well as roof replacements on existing buildings. In addition, the model building codes include requirements for minimum drainage slope and identify ponding instability as a design consideration for rain loads.

Tapered insulation systems are an integral part of roof system design and can help reduce or eliminate the amount of ponding water on the roof when the roof deck does not provide adequate slope to drain. The popularity of tapered insulation has grown as more designers and roofing professionals understand the importance of positive drainage in good roofing practice. Because of its wide use in low-slope roofing application, tapered polyiso insulation systems offer a number of benefits in addition to providing positive drainage: high R-value, versatility and customization to accommodate project-by-project complexity as well as ease of installation. This article highlights the key considerations for tapered insulation systems.

Slope and Drainage Requirements in Building Codes

The model building codes require that commercial roofs be sloped to achieve a positive drainage of rainwater to drains, scuppers, and gutters. The term “positive roof drainage” is defined in the 2018 International Building Code (IBC) as “the drainage condition in which consideration has been made for all loading deflection of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.” The 2018 IBC indicates a minimum design 1/4:12 units slope requirement for membrane roof systems, and minimum slope of 1/8 inch per foot for coal tar pitch roofs. New construction must comply with the minimum slope requirements in IBC Section 1507. Roof replacement or roof re-cover applications of existing low-slope roof coverings that provide positive roof drainage are exempt from the minimum prescriptive1/4:12 units slope requirement.

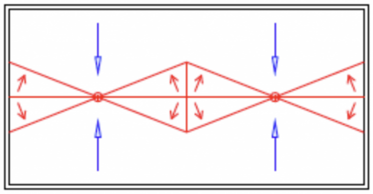


Figure 1a. Two-way tapered insulation system.

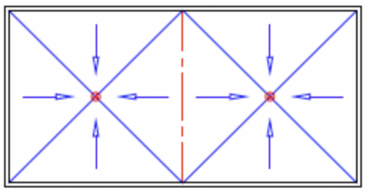


Figure 1b. Four-way tapered insulation system.

Roof drains are part of an approved storm drainage system and function to divert water off and away from the building. Roof drainage systems in new construction must comply with provisions in Section 1502 of the 2018 IBC and Section 1106 and 1108 of the International Plumbing Code (IPC) for primary and secondary (emergency overflow) drains or scuppers. Roof replacement and re-cover applications on existing low-slope roofs that provide positive roof drainage are exempt from requirements for secondary drains or scuppers. It is important to note that secondary drainage systems or scuppers in place on existing buildings cannot be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with the IBC.

When reviewing the options available for achieving the required slope in a roof system, designers have a number of choices. According to the National Roofing Contractors Association (NRCA) (see “The NRCA Roofing Manual: Membrane Roof Systems: 2019”) the slope can be achieved by: sloping the structural framing or deck; designing a tapered insulation system; using an insulating fill that can be sloped to drain; properly designing the location of roof drains, scuppers and gutters; or a combination of the above.

Design Considerations For Tapered Insulation Systems

Proper design and installation are critical to the effective performance of tapered polyiso insulation systems, and this is true for any product or system. Tapered polyiso is manufactured in 4-foot-by-4-foot or 4-foot-by-8-foot panels that change thicknesses over the 4-foot distance from the low edge to the high edge on the opposing sides of the panel. The standard slopes for tapered insulation are 1/8 inch, 1/4 inch and 1/2 inch per foot to accommodate specific project requirements. However, tapered insulation panels with slopes as low as 1/16 inch and other alternative slopes (3/16 inch and 3/8 inch per foot) can be specially ordered to accommodate unique field conditions. The minimum manufactured thickness of tapered polyiso insulation board at its low edge is 1/2 inch and the maximum thickness at the high edge is 4-1/2 inches.

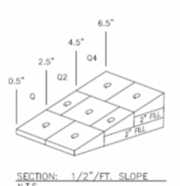


FIGURE 2a. Cross sections of a one panel repeat tapered insulation systems.

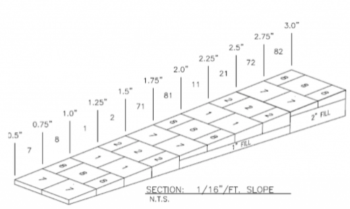


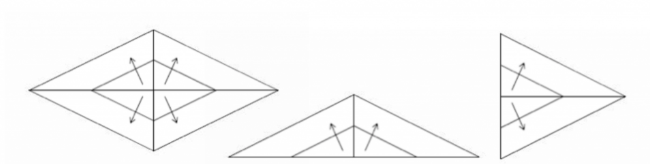
FIGURE 2b. Cross-sections of a four panel repeat tapered insulation system.

The design of the tapered insulation system will be governed by the footprint and complexity of the roof under consideration, slope of the roof deck, presence and configuration of roof drains (primary and secondary), scuppers, gutter or drip edges. In addition, roof structures, height of parapet walls, expansion joints, curbs and through-wall flashings and any other elements that may obstruct water management also needs to be considered in the design phase. The tapered insulation system will be lowest at internal drains, scuppers, gutters and drip edges, and will slope upwards away from these features.

Keeping in mind that the primary goal of a tapered insulation system is to most effectively move water to the specified drainage points. A two-way (two directional slope) or four-way (four directional slope) system are the most common designs. A two-way tapered insulation system is commonly used on roofs where multiple drains are in straight lines. In this scenario, there is a continuous low-point between the drains and it often extends to the parapet walls. Crickets are installed in between the drains and between the building or parapet walls and the drains. (See Figure 1a.)

A four-way tapered insulation system is the most effective way to move water off the roof, and this approach is highly recommended by industry professionals. In this scenario with a drain located in the center, water is drained from the higher perimeter edges on all four sides. (See Figure 1b.) Variations of two-way and four-way systems exist to accommodate complexities in the field. In addition to two-way and four-way systems, one directional slope and three directional slope tapered systems can be used to effectively move water to gutters, drip edges and scuppers.

Keeping in mind that a tapered system is more expensive than a roof system constructed with standard flat insulation only, the tapered design is often a target for "value engineering." Value engineering can compromise the drainage intent of the design professional, architect or roof consultant for the purpose of lowering the installed cost of the roof system. Value engineering may change the specified slope or redesign the configuration of the tapered panels. In the end, the building owner may pay for a tapered insulation system that does not effectively drain water from the roof as intended by the original design. This will likely result in higher long-term costs for roof maintenance and premature roof system failure.


FIGURES 3a, 3b. A diamond-shaped cricket (left) and two half-diamond cricket configurations.

A typical tapered insulation system will incorporate flat polyiso board stock (referred to as "fill panels" or "tapered fill panels") beneath continuing, repeating tapered panels. The tapered panels can be a single panel (or "one panel repeat") system, meaning that the taper is provided by a single repeating panel in conjunction with fill panels. (See Figure 2a.) Non-typical designs can feature up to an eight-panel (or "eight panel repeat") system with eight tapered panels making up the sloped section prior to incorporating the first fill panels. An example of "four panel repeat" system with 1-inch and 2-inch fill panels and 1/16 inch per foot slope is provided in Figure 2b.

Finally, crickets are an integral part of a tapered insulation system and are commonly used in two-way systems. Crickets can divert water toward drains and away from curbs, perimeter walls, and roof valleys. The two factors that must be considered in the design and installation of crickets are slope and configuration. The general "rule of thumb" is that for a full diamond cricket the total width should be between 1/3 to 1/2 of the total width. The wider the design of the cricket, the more you utilize the slope in the field of the roof, which improves the drainage efficiency.

Crickets typically have diamond or half-diamond shapes. (See Figures 3a and 3b.) However, kite-shaped and snub nose crickets can also be configured to accommodate specific roof designs. To keep water from remaining on the cricket surface, the design needs to have a sufficient slope (generally, twice the slope in the adjacent field of the roof). NRCA provides guidance regarding cricket geometry (see "The NRCA Roofing Manual: Membrane Roof Systems: 2019").

Tapered insulation systems offer a cost-effective solution to achieving positive slope and improved drainage in new roof systems and roof replacement applications. An adequate rainwater management strategy that includes both proper drainage and elimination of ponding water is critical to the long-term performance and durability of a roof system. In addition, proper design, detailing, and installation of products must be an integral part of a tapered roof system design. For more information, consult with a polyiso insulation manufacturer who provide guidance, design assistance, and technical information regarding tapered insulation systems. In addition, the Polyisocyanurate Insulation Manufacturers Association (PIMA) publishes technical bulletins to help navigate the process of designing a tapered system. PIMA's Technical Bulletin

#108 on Tapered Insulation Systems can be found at
~~www.polyiso.org/resource/resmgr/Tech_Bulletins/tb108_Mar2017.pdf~~.

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