UNDERLAYMENT COMBINATIONS FOR STORMY WEATHER

By Steve Ratcliff

Whether the outer covering consists of shingles, tiles, metal, or another material, it is only one part of a residential roofing system. Other components to consider for any given climate and building design are the underlayment, sheathing, insulation, vapor barrier, ventilation, and so on.

This paper reviews current trends in the development of underlayment products for steep-slope residential and commercial roofing systems, especially those that offer protection against storm conditions. Typical underlayments ideally suited for use under shingles, tiles, and metal are described below.

A ROOF FOR ALL CLIMATES

Asphalt shingles dominate the steep-slope residential roofing marketplace because their performance-to-cost ratio is unsurpassed by metal or tile. They are easy for the contractor to apply, can be adapted for use in practically any climate, and look great, too. Asphalt-shingle products do not become too brittle in the cold or too soft in the heat. They resist sunlight, heat, cold, water, and ice. See the Asphalt Roofing Manufacturers' Association's (ARMA) *Asphalt Roofing Residential Manual* for more information about asphalt shingles.[1] Major historical developments in shingles were the introduction of fiberglass mat reinforcement as an alternative to traditional organic felts; the development of laminated shingles as an alternative to three-tab shingles; and, in recent years, the growing popularity of polymer-modified asphaltic shingles for impact resistance, as well as those designed to withstand high winds.

To achieve high wind resistance, the sealant that holds overlapping tabs together is more important than the thickness and weight of the shingle. Most manufacturers also require a six-nailing pattern for fastening wind-resistant shingles. Nailing placement is important to improve adhesion between the shingles and could vary, depending on the specific shingle product. Some shingles rely on interlocking tabs for wind protection. The new wind-resistance classification system adopted by many building codes is relatively simple and easy to use. One needs to know the wind zone of the building and the wind classification of the proposed shingle.

BENEATH THE SHINGLES

For shingle roofs, there are several options for the underlayment. The traditional choice is a 15- or 30-pound asphalt-saturated organic felt. The next step up in quality is to use an asphalt-saturated organic felt or synthetic underlayment for the main areas of the roof and a self-adhering modified bitumen product for the critical areas of the roof.[2] As an alternative to traditional felt, an asphalt-saturated, high-performance polyester underlayment handles the same as a traditional felt but offers the advantages of a synthetic underlayment such as lightness and watertightness (*Figure 1*).

It is a testament to the weather resistance of asphalt shingles that asphalt-saturated organic felt is commonly specified under asphalt-shingle roofing; however, as the distinction between the primary roof and the watertight secondary covering becomes more pronounced, there has been a growing trend in some parts of the country toward the use of self-adhering underlayment as a secondary water barrier under shingles (*Figure 2*).

Arguments are being advanced for totally covering the roof beneath asphalt shingles with a premium self-adhering underlayment. The choice of underlayment also may be dictated by the roofing contractor. Many roofing contractors report that a premium underlayment is less expensive to

Figure 1 — EasyLay® asphalt-saturated high performance polyester handles the same as traditional felt, yet offers the advantages of a synthetic felt.

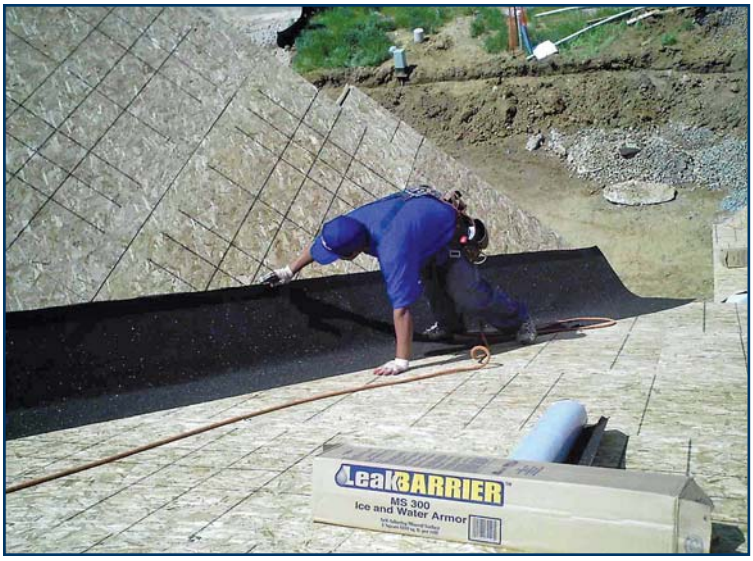


Figure 2 – LeakBarrier® MS300 Ice and Water Armor is highly effective in critical roofing areas such as valleys, ridges, coping joints, chimneys, vents, dormers, skylights, and low-slope sections.

install because of labor savings.

One caveat is that a self-adhering underlayment installed over the entire roof deck can prevent proper air flow and act as a vapor retarder. Ventilation, moisture control, and proper vapor-retarder placement (relative to the insulation) must be considered to avoid potential problems. Depending on building structure, insulation, and climate, complex calculations may be required to properly design a roof system so that moisture is prevented from accumulating. Guidelines are given in the *NRCA Steep-Slope Roofing Manual, Fifth Edition.*[3]

BENEATH THE TILES

The choice of underlayment for a tile application is a different story than for shingle applications. Most tile roofs are watertight. Interlocking tiles block any water from penetrating the primary roof. Nonetheless, the secondary water barrier in a tile application also needs to be watertight because occasional physical damage to the tiles could expose the interior of the home to water damage. The underlayment plays an essential role in preventing water migration into the structure until repairs can be made. In this manner, the primary roof and secondary water barrier together can last for decades, while they may be ineffective when used alone.

One commonly employed underlayment for tile applications is a glass fiber reinforced material with high-strength polyester facer and specially formulated self-adhesive compound on the bottom surface. This underlayment is especially popular in hot climates because it can withstand temperatures up to 260°F (*Figure 3*).

The smooth top surface and high-temperature resistance are also desirable for metal roofing applications, so this type of underlayment is commonly designated as a "metal and tile" underlayment.

The polyester surface not only provides excellent walkability and tear resistance but also protects against ultraviolet radiation. In fact, this type of underlayment could be left exposed for up to 120 days, an important consideration during periods when

Figure 3 – The PS200HT self-adhering underlayment has fiberglass reinforcement and high temperature resistance. It is suitable for metal, tile, or shingle applications.

tiles and labor are in short supply such as after a hurricane.

Several other options are available for tile applications, depending on the climate zone and local codes. Roofers in Florida have conventionally used tried-and-true hot-mopped 90-pound, mineral-surfaced roll roofing complying with ASTM D6380 as an underlayment beneath tile roofs. Hot mopping 90# to the deck provides an excellent last line of defense against hurricanes. For those who prefer not to hot-mop asphalt, a self-adhering underlayment with a mineral surface has been developed for use in Florida and has been approved by the Florida Building Commission and Miami-Dade County as an alternative to hot-mopped 90#.

For regions with less severe heat and wind conditions, there is more flexibility in the selection of the tile underlayment. For example, nailable, asphalt-saturated, high performance polyester felt is popular in drier climates such as California, yet would not be suitable for use in Florida.

Also, some contractors prefer a mineral-surfaced self-adhering underlayment rather than a smooth-surfaced underlayment. A mineral-surfaced underlayment could be used in a tile application but would not be acceptable in a metal application due to the potential for abrasion of the metal surface by contact with mineral granules. Conversely, a tile roofing application requires high strength to withstand the concentrated stresses of the tiles without tearing; thus, a nonreinforced underlayment that may be an excellent choice in a metal application would not be suitable for this application.

Figure 4 — Metal panels are being installed over PS200HT self-adhering underlayment, which provides a smooth surface and resistance to high temperatures.

MEMBRANES FOR METAL

As mentioned, both metal and tile applications typically employ a watertight secondary barrier. The metal or tile protects the underlayment from ultraviolet radiation (UV) and physical damage; meanwhile, the underlayment protects against leaks. The two key attributes of a metal roofing underlayment are a nonabrasive, antiskid surface and tolerance of high temperatures. Beyond those requirements, metal roofing projects are each distinct, with contractors and specifiers having specific preferences for underlayment. Hence, as with tile applications, there are several underlayment options for metal roofing applications.

Figure 5 — LeakBarrier PS200MU Ice and Water Armor is a self-adhesive, glass fiber-reinforced, modified bituminous underlayment especially for metal roofing. It helps protect a building's deck or internal structure against leaks caused by ice and water damming and wind-driven rain.

Some self-adhering metal roofing underlayment products are made with specially engineered hybrid polymer formulation to withstand the high temperatures often reached beneath a metal roof (*Figure 4*).

Metal has a relatively high thermal expansion coefficient compared to deck materials, so a metal roof tends to move relative to the underlayment. A mineral surface underlayment would scratch the metal whenever the roof temperature changed from low to high (metal expands) or high to low (metal contracts). So a smooth upper surface is an essential attribute of a metal roof underlayment. Yet the surface must also offer good walkability; it cannot be too smooth or it will be difficult for the roofer to safely install. Polyester fabric or polyolefinic film is nonabrasive and offers excellent walkability. Glass fiber-reinforced underlayments are available with either of these surfaces, depending on the preference of the contractor and the specific needs of the project.

Self-adhering underlayment for use beneath metal roofing is commonly made with glass fiber reinforcement, which imparts high dimensional stability to the product (*Figure 5*). Another option is to use an underlayment with no reinforcement. One premium self-adhering underlayment on the market is available with a 40-mil thickness (i.e., 0.040 in or 1 mm) and no reinforcement. It has an upper surface of cross-laminated polyethylene-based film.

Most of the self-adhering underlayment products have a split-back release film that peels off for easy installation and handling. Depending on the application and climate, metal roofers could also choose a synthetic underlayment or a nailable, high-performance polyester (HPP), asphalt-saturated underlayment that is tear-resistant, lightweight, and skid-resistant. This underlayment provides sure footing during installation and lies flat—two important advantages compared to synthetic felt. It allows up to 180 days of exposure but handles the same as traditional asphalt-saturated felt.

Each metal roof underlayment has distinct handling and performance characteristics with regard to walkability, temperature resistance, and strength. The final choice comes down to application, climate, and contractor preference. More choices mean that the underlayment can be better matched to the application.

CODE-RELATED DECISIONS

In 2007, the state of Florida enacted a building code requirement that self-adhering underlayment be installed along with all new and replacement roofing. Some of those rules were revised in 2008, such that self-adhering underlayment is now optional rather than mandatory. Nonetheless, based on their experience with self-adhering underlayment in Florida, many consultants and contractors are willing to go on record in stating that a secondary water barrier makes sense for any building, regardless of its climate zone.[4]

Contractors are recommending self-adhering underlayment because it is easy to install and reduces their liability. Meanwhile, homeowners have become aware of these products and are demanding the extra protection of a self-adhering underlayment, and insurance companies are providing incentives to encourage their use.

The experience in Florida has implications for secondary water barriers in many climate zones. While most of the nation is not at high risk for hurricane damage, severe storms and other weather events that damage primary roof coverings also result in consequential damage, so a secondary water barrier is a good idea for any building.

Another code driving the demand for premium underlayment products is the International Building Code (IBC), which mandates self-adhering underlayment for new construction in certain climates. The International Residential Code (IRC) recommends the use of a self-adhering modified bitumen sheet in areas where the average daily temperature in January is 25°F (-4°C) or lower.

SECONDARY WATER BARRIERS

The decision to use self-adhering underlayment goes beyond code requirements. The extra cost for these premium membranes is cheap in comparison to the damage that could be incurred through a compromised roof. These membranes create an effective barrier against water intrusion typically caused by snow, ice, and water buildup; melting and freezing; and expansion and contraction of shingles and other roof coverings.

High winds, hail, heavy rain, snow loads, ice dams, and other naturally occurring hazards can defeat even top-quality roof coverings and building designs. Premium self-adhering underlayment is highly effective in critical roofing areas such as valleys, ridges, coping-joints, chimneys, vents, dormers, skylights, and low-slope sections.

Buildings in many regions of the country are subject to development of ice dams as a consequence of frequent freeze-thaw cycles. In these regions, temperatures rise above freezing during the day, allowing some snow to melt and flow to the valleys and eaves of roofing systems, and that same water freezes overnight. The resulting ice dams are disastrous to the shingles, roof decks, insulations, and eventually the inside walls of a home.

Faulty design is often to blame for ice dams. Older homes may lack proper ventilation (soffits) to prevent the heat inside the home from melting the snow on the roof. When a warm roof melts the snow, the

water runs down and ponds at the colder eaves, where it refreezes. Some building experts recommend attic ventilation; others swear by soffit-to-ridge ventilation, which allows cold air to circulate just under the roof and attics to be sealed. If the roof could be kept below freezing temperatures, so the theory says, then ice damming could be eliminated or at least mitigated. Thawing can occur due to sunlight as well as heat transfer from inside the home.

Special design considerations may apply to buildings located in regions with cold winter weather and high altitudes such as the Rocky Mountains and Appalachian Mountains.[5] Ice dam formation can occur due to building heat loss and solar radiation. For cold climates, proper ventilation is often preferred over heavily insulated systems to prevent ice dams. At high altitudes, roof ice-melt systems address ice dam formation due to solar radiation. In cold and high-altitude regions, some form of roof ice-melt system such as heat tracing or heated metal systems is almost always required. Vapor retarders must be carefully designed and installed. Also, depending on the roof pitch and roof type, various snow-retention devices may be needed.

The use of a premium underlayment offers a partial solution to ice damming. The extra protection afforded by the use of a secondary water barrier won't prevent the formation of ice dams, which can still damage the primary roof, but it will help prevent leaks when ice dams do occur.

A NEW BEST PRACTICE

For commercial and residential steep-sloped roofing applications, self-adhering underlayment is emerging as a new best practice in many applications. As outlined in this article, there are many brands of self-adhering underlayments readily available. Installation does not require much more labor than conventional felts, but these tough, thick membranes provide far more protection.

The secondary water barrier gives building owners and homeowners the best protection for their money. They benefit from a good waterproof membrane beneath the primary roof. Damage or defects in the primary roof will not affect the main structure, because the underlayment protects the building.

Whether a hurricane, tornado, storm, or whatever act of God damages the primary roof, the self-adhering underlayment will protect the building unless the deck itself is removed.

REFERENCES

1. *Asphalt Roofing Residential Manual*, The Asphalt Roofing Manufacturers Association Design and Application Methods, 2006.
2. Steve Ratcliff, "The Extra Protection Every Roof Needs," *Roofing Contractor*, August 2002.
3. *NRCA Steep-Slope Roofing Manual, Fifth Edition*, National Roofing Contractors Association, 2009.
4. Steve Ratcliff, "Keeping Water Out," *Professional Roofing*, February 2009.
5. Steve Bunn, "Roof Design Considerations in Cold and High Altitude Regions," *Interface*, February 2003.

Steve A. Ratcliff

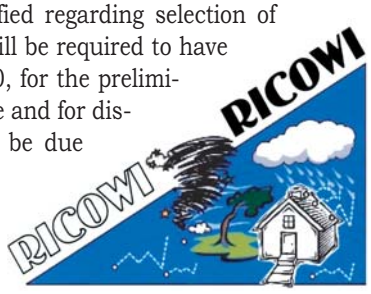
Following several years of manufacturing, marketing, and management experience at Justin Industries, Allied Chemical Corporation, George K. Baum & Company, and Honeywell, Steve Ratcliff assumed responsibility for a single roofing product during the 1990s and built a $60 million roofing system business with a national brand identity. As VP and general manager of Honeywell's eRoofing Venture in 2000, he was involved in several e-business initiatives. Joining privately held Tarco as a partner in 2001, he launched a new business segment and was promoted to president and CEO in 2003. A residential roofing products manufacturer with headquarters in Little Rock, AR, Tarco is the largest company in its segment in North America. Ratcliff's education includes an undergraduate degree in marketing from Henderson State University and an MBA from the Duke University Fuqua School of Business.

RICOWI Call for Presentations

The Roofing Industry Committee on Weather Issues (RICOWI) is currently seeking speakers for its 2011 Spring Educational Seminar on April 18, 2011, in Reno, NV. Eight 45-minute educational sessions will be chosen.

Submission forms with abstracts should be submitted no later than Nov. 15, 2010, to the RICOWI offices. The RICOWI Meetings and Education Committee will review the abstracts, and authors will be notified regarding selection of abstracts by Nov. 30. Once accepted, authors will be required to have bios and finalized abstracts in by Dec. 05, 2010, for the preliminary agenda publication on the RICOWI Web site and for distribution. All presentations and handouts will be due from presenters no later than Feb. 28, 2011.

Questions may be referred to Executive Director Joan Cook at 330-671-4569 or jcook@ricowi.com.



Half of Ten Largest Global Contractors Are Chinese Firms

On the Top 225 Global Contractors list, published yearly by *ENR* magazine, there are 170 firms with over $1 billion each in contracting revenue. Of the top ten firms, five are Chinese, two are French, one German, one U.S. (Bechtel), and one Spanish.

— ENR