Felts & Underlayments

New Product Developments Solve Old Problems

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(Editor’s Note: Mark C. Strait has been active in the roofing and construction industry for over 20 years with a specific focus on the pitched roofing market. Strait has spent a decade in research and the collection of information on various pitched roof, material, ventilation, and energy related applications both nationally and internationally.)

“Tar Paper” felt materials have been used for decades as the base sheet underlayments for a number of pitched roof applications. Type 15 and Type 30 Asphalt Saturated Organic Felt (Felt) were originally developed for ASTM designated built-up roof systems. Although not originally designed for pitched roof applications, Type 15 and 30 felts are readily available. As a result, type 30 felt has been used as underlayment under metal, asphalt shingles, as shake liner for cedar shakes, slate, and has become the accepted minimum under concrete and clay roof tile. Although widely used, these felt materials are associated with numerous drawbacks that can diminish the integrity of pitched roof systems.

Recently, a new generation of novel synthetic polyolefin roof underlayment materials have become available that provide a significant improvement over standard felts. Designed specifically for pitched roof applications, these new synthetic polyolefin materials offer optimum levels of tensile strength, light weight and improved handling characteristics. The focus of this article is to review the challenges associated with organic felt materials currently in use and examine the benefits of synthetic alternatives.

The primary application for which Felt was originally designed for is “built-up” roofing where the product was designed for application with hot asphalt as in a flat roof system. Either capped with a mineral cap sheet or flooded with asphalt and covered with gravel to protect the felt underlayment barrier of the roof system from UV exposure and direct contact with moisture.

In the pitched roof environment, however, felt is exposed to moisture (ambient humidity, precipitation, etc.) and UV radiation. Felt readily absorbs moisture, which causes physical expansion. A drawback of this expansion phenomenon is that the material will buckle and wrinkle after it is applied. Anyone that has installed felt and come back the next day can attest to the wrinkling and buckling that occurs from even the slightest amount of moisture in the air. This condition will also occur after installation where moisture from inside the structure is generated from various sources such as cooking, showers, industrial processes, etc. If the structure is not properly ventilated, this inside moisture can enter the attic and be absorbed from the bottom side of the felt underlayment.

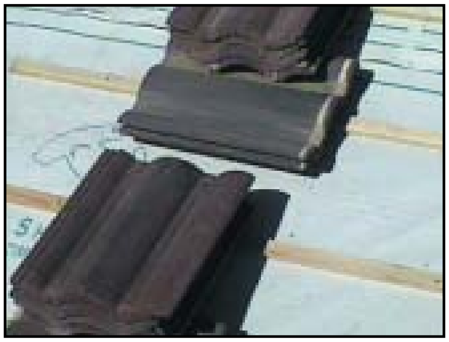
In the later stages of the felt decomposition process, the felt acts as a support for mold and fungus growth depending upon the level of moisture present over prolonged periods. The buckling that occurs whether prior to or after asphalt composition shingles have been installed can create a bumpy or uneven appearance. The buckling and wrinkling condition causes felt to load up on the fasteners causing tears or elongation of the felt at the fastener, which can compromise the integrity of the roof system. Because felt is susceptible to moisture from exposure before and after the primary roof covering has been installed, these problems continue to confound roof installers and building owners, especially in humid climates.

Because felt has no natural protection from UV, it will deteriorate when left exposed to direct solar radiation. Type 30 felt that has been left exposed to the sun for two to three months prior to the installation of concrete or clay tile will exhibit loss in ductility (flexibility) resulting in a dried out and brittle underlayment which is susceptible to cracking.

What seems to be the best path forward is to replace felt underlayment material that was clearly never designed for the applications into which it is currently used, with materials that are designed for steep pitch roof applications. To review the design criteria, consideration of the environment into which this material will be used and the various applications is necessary.

- The underlayment material needs to be thermally stable within the range of temperature before and after installation of the primary roofing material (PRM).
- High tensile strength. Resistance to wind during underlayment installation and prior to installation of PRM.
- Slip resistance in wet and dry conditions for the installer during installation process.
- Resistance to UV exposure prior to installation of PRM.
- Resistance to degradation from moisture before and after installation of PRM.
- Long-term moisture protection to complement the PRM. A key component of an integrated roof system.
- Ease of use to the installer in transport, handling and installation.
- Insulating property for energy savings.
- Environmentally sensitive manufacturer and recyclability.
- Cost effective to contractor, builder and property owner. Long-term value.

The replacement of the existing asphalt saturated organic felts has



begun. The European market has already been through this evolution of adopting new polymeric roof underlayments, although, in many cases, their application procedures and the PRM used are different than those used in the United States.

SBS (styrene butadiene styrene) modified glass base sheets are an improvement although they still fall short of meeting the performance requirements of the pitched roof market. While SBS exhibits excellent resistance to moisture absorption, it is not as mechanically robust in terms of tensile strength, abrasion resistance or slip resistance (when hot). Plastic cap fasteners are generally required to improve integrity of the SBS installation. In addition, as of this writing, there are no published specifications for UV resistance for SBS underlayments.

Engineered roofing underlayments designed to meet requirements for specific applications show great promise for the future. For example, the underlayment used under asphalt shingles does not necessarily need to meet the same criteria for clay or concrete roof tile. Tile underlayments are subject to exposure to a much

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higher volume of water than a composition shingle underlayment as the shingle is the primary waterproofing element within that roof system. Metal roofing may require an underlayment that can resist deterioration and reduced thermal bridging due to exposure from temperature extremes. In addition metal roofs may require a slip-sheet for proper installation. Abrasion resistance is more important for a direct-deck tile or natural slate installation than that of metal roofing or composition shingle.

Among the most favorable engineered synthetic underlayments available today are those developed from polyolefin composition. Normally, a woven polyolefin material is coated on either one or both sides with a polymer coating. The polymer composition of the woven material and coating are normally a variation or combination of polyethylene or polypropylene. These polymeric materials are not laminated or otherwise combined with paper or asphalt, which results in greatly improved characteristics for various roofing applications. Physical properties of engineered underlayments includes:

- *Inert.* Won't absorb moisture or breakdown when exposed to harsh outdoor elements or chemicals. Will not dry out or rot. Greatly improved UV resistance.
- *High tensile strength*, far superior to standard felt and SBS underlayments. Plastic caps are not needed for installation. "Tear off" from high wind is virtually eliminated.
- *Remains flexible* and easy to handle in cold temperatures yet will not expand, stretch or become slippery in hot conditions.
- *Lightweight.* Up to five times lighter that type 30 felt. Provides improved coverage (via larger dimensional rolls are available), and safety for installer. Less expensive to ship and transport.
- *Slip-resistant.* Some polymeric underlayments are available with "slip resistant" chemical coatings while other designs have woven tex-

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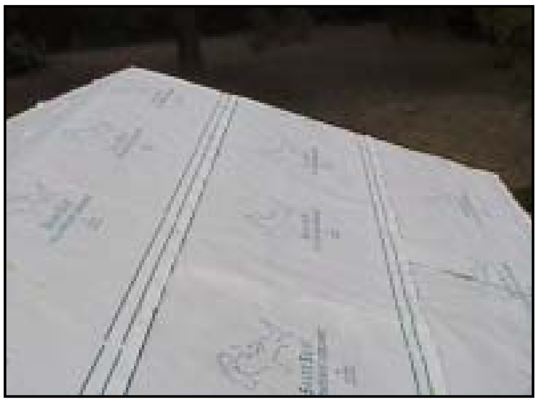
tures that do not require coatings for slip resistance and improved recyclability.

- *Can be produced* in a variety of dimensions depending upon the manufacturer's capability. For example 54" wide rolls are available (compared to 36" wide rolls for standard felt).
- *Available with foam laminated* layer to provide improved insulation value and cushion for stacking concrete and clay tiles during installation. Useful for metal roof applications to guard against thermal bridging.

When considering the efficacy of new polymeric materials for use as a roof underlayment for steep pitched roofs, it is important to consider the original application that the material was designed for. Was the polymer material designed for the environment into which it will be used? Not all polymer materials used for a specific application in one industry may be appropriate in the pitched roof environment. The up side seems to be that manufactures are trying to produce new roof underlayments with the end in mind.



In conclusion, while tar paper organic felts and SBS modified underlayments have become the industry standard as universal "one size fits all" roof underlayment base sheets, it is clear that they are not the optimum choice. Requirements of the various roof applications (concrete tile, metal, composition shingle, etc.) indicate the need for a variety of underlayments that are designed to optimize the integrity of the individual roof system applications. Engineered polyolefin underlayments offer value added features that meet, or in most specifications, exceed the current and code compliance requirements of integrated pitched roof systems.