



Insurance Institute for Business & Home Safety®

Asphalt-Saturated Felts Used as Roofing Underlayment

Heather Estes

Tanya Brown-Giammanco

January 2017

Summary

Asphalt-saturated felts are commonly used as underlayment for roof systems. There are several standards that specify the mass requirements and other physical and mechanical properties for these products. ASTM International has developed ASTM D226 and ASTM D4869 standards covering specifications for asphalt-saturated organic felts. Underlayments conforming to these ASTM standards must be identified by a label on the packaging of each roll of membrane that contains the product brand, ASTM designation, and type of underlayment. Typical asphalt-saturated felts are found in either a “15 pound (#15)” felt or a “30 pound (#30)” felt. However, labeling can vary and it can be unclear if the products on the market comply with ASTM standards, as described by Martin (2000), who also pointed out that lightweight asphalt felt with no ASTM ratings are the products that are typically stocked by distributors in most regions. Other common labels include: 15/30 ASTM D226-05 TYPE I/2, No. 15/30, 15W/30W, 15#/30#. This paper explains variability in physical property and performance requirements of underlayments that may have a label with a designation of 15 pound or 30 pound, yet do not perform as well as those meeting an ASTM standard (for specific class and type) when protecting against moisture penetration, tearing, and wrinkling. It also focuses on the most predominant organic asphalt-saturated felts, and how to verify code compliance to ensure high-quality products are installed to protect the roof deck.

Specifications of ASTM D226 and ASTM D4869

Asphalt-saturated felts are typically made from organic base fibers and can be installed under roof shingles or other roof covering materials, and act as roof underlayment or a secondary drainage plane. Roof underlayment performs several functions: (1) it protects the sheathing from moisture absorption until shingles or other roof covering can be installed; (2) it provides additional weather protection by preventing the entrance of wind-driven rain below the shingles into the structure; (3) it improves the fire resistance of the roof; and (4) it prevents direct contact between shingles and the resins in the wood sheathing, which may damage the shingles due to chemical incompatibility (Olin et al., 1983). Underlayments are commonly used in low-slope and steep-slope roofing to protect the sheathing from water damage. Although asphalt-saturated felt is not waterproof, it can provide additional protection if the roof cover is removed or damaged (Gromicko, 2015).

Two ASTM standards are commonly used to specify mass requirements for asphalt-saturated felts. ASTM D226 is the Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing and lists two types of felts: Type I, which is a “15 pound felt” (or #15), and Type II, which is referred to as a “30 pound felt” (or #30) (ASTM, 2009). ASTM D4869 is the Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing and lists four types of felts: Type 1 (8 pound felt, but typically labeled as #15 or No. 15), Type II, Type III and Type IV (26 pound felt, but typically labeled as #30 or No. 30) (ASTM, 2011). Table 1 lists the mass requirements that can be found in these ASTM standards.

Table 1. ASTM D4869 and ASTM D226 Mass Requirements for Asphalt Felts

TYPE	ASTM D4869-05 (2011)	ASTM D226-09
Type I	#8 (8 lb/100ft ² min)	#15 (11.5 lb/100ft ² min)
Type II	#13 (13 lb/100ft ² min)	#30 (26 lb/100ft ² min)
Type III	#20 (20 lb/100ft ² min)	
Type IV	#26 (26 lb/100ft ² min)	

While asphalt-saturated felts can help protect the roof system, they have also been known to fail if they are installed improperly, exposed to UV radiation for extended periods of time, or if they have poor composition or lower quality materials. Products that are labeled to comply with ASTM D226 or ASTM D4869 are tested and verified to be higher quality products that offer better roof protection. Furthermore, ASTM D226 Type II and ASTM D4869 Type IV felts have increased protection against water absorption and tearing.

Problems

During IBHS' wind-driven rain testing in 2014, several different types of asphalt-saturated felt were purchased and installed on the roof of a single-story residential house constructed and tested in the IBHS testing laboratory. Although each product was listed as a "#30" felt, one did not comply with ASTM D226 Type II or ASTM D4869 Type IV requirements. This product failed at the ridge after exposure to high winds, exposing the sheathing underneath to wind and water. When physical property measurements were made on the failed felt, they indicated that the product was likely an ASTM D4869 Type II (similar to an ASTM D226 Type I, #15 felt), because of the lower weight measurement. When these lightweight #15 felts are used, they are more susceptible to damage (Fricklas, 1995). Common problems include:

- Water absorption into the roof deck
- Increased wrinkling and damage to asphalt shingles
- Lower wind and tear resistance
- More susceptible to volatile loss and UV damage if roof cover is removed
- Thinner and higher pliability

Many products on the market have a generic label of "#15" or "#30" and do not meet the ASTM standards, meaning they may lack the weight, saturation, and other specified requirements. If a product is not labeled as meeting the ASTM D226 or ASTM D4869 standard, one should assume that the mass requirements in Table 1 will not be true. It is important to specify the desired product standard and type when designing a project and

purchasing materials to avoid confusion and ensure delivery of a high-quality product. If not specified, distributors will generally provide generic, lightweight felts that do not meet the ASTM standards. The labeling of products should be verified prior to installation.

Table 2 compares the heaviest felts found in ASTM D226 Type II (#30) and ASTM D4869 Type IV (#30). Asphalt-saturated felts that conform to ASTM D226 Type II and ASTM D4869 Type IV are stronger than their lighter-weight counterparts. This can be seen with the increased tensile strength (40 lbf/in compared to 30 lbf/in) and decreased pliability (0.75-in. radius compared to 0.50-in. radius). By increasing the strength and decreasing the pliability, the heavier asphalt-saturated felts will have a higher resistance against tearing, wrinkling, and water absorption. Overall, heavier asphalt saturated felts have been found to perform better than their lighter-weight counterparts during high-wind and wind-driven-rain testing.

Table 2. Comparison of ASTM D4869 Type IV Felt to ASTM D226 Type II Felt

PHYSICAL REQUIREMENTS		
PROPERTY	ASTM D4869-05 (2011) TYPE IV	ASTM D226-09 TYPE II
Tensile Strength (Test Method D146)	Machine direction 40 lbf/in. [7kN/m] Cross machine direction 20 lbf/in. [3.5 kN/m]	Machine direction 40 lbf/in. [7kN/m] Cross machine direction 20 lbf/in. [3.5 kN/m]
Tear Strength (Test Method D1922)	0.9 lbf (4 N) for both machine direction and cross machine direction of sheet	N/A
Pliability/Flexibility (Test Method D146)	Pass 0.75-in.-radius (19 mm) mandrel	Pass 0.75-in.-radius (19 mm) mandrel
Loss on Heating/Behavior on Heating (Test Method D146)	6% max. for 5 h at 221°F (105°C)	4% max. for 5 h at 221°F (105°C)
Liquid Water Transmission (Test Method D4869)	Pass 4 h water shower test on a 14° inclined roof	N/A
Dimensional Stability (Test Method F1087)	Max. 1.75% both machine and cross direction from low humidity to high humidity	N/A

DIMENSIONS AND MASSES		
PROPERTY	ASTM D4869-05 (2011) TYPE IV	ASTM D226-09 TYPE II
Thickness	N/A	N/A
Width of Roll	36 in. (914 mm)	36 in. (914 mm)
Area of Roll	216 ft ² (20 m ²)	216 ft ² (20 m ²)
Moisture, Max %. at point of Manufacture	N/A	4.1
Net Mass of Saturated Felt, Min.	26 lb/100 ft ² (1270 g/m ²)	26 lb/100 ft ² (1270 g/m ²)
Mass of Saturant, Min.	15 lb/100 ft ² (732 g/m ²)	15 lb/100 ft ² (732 g/m ²)
Mass of Desaturated Felt, Min.	10 lb/100 ft ² (488 g/m ²)	10 lb/100 ft ² (488 g/m ²)
Ash, Max. %	N/A	10
Saturation, % by wt., Min.	150	N/A
Moisture Min. % by wt. at the Time of Manufacture	2.0	N/A
Saturation Efficiency, % by wt., Min.	70	N/A

Conclusion

Asphalt-saturated felts represent one option that can be used as an additional drainage screen for the roof deck against moisture penetration. There are a variety of products on the market, but not all of them comply with the ASTM standards discussed in the paper. When installing a roof underlayment, care must be taken to ensure the product meets the specifications intended for the project. Typical high-quality asphalt-saturated organic felts are manufactured conforming to either ASTM D226 or ASTM D4869, and more specifically, ASTM D226 Type II or ASTM D4869 Type IV. In regions where hurricanes and high winds are more prevalent and under wood shakes, a heavier felt should be installed over the sheathing to protect the roof deck. Users should beware that unless underlayment products specify compliance with labeling requirements of ASTM D226 or ASTM D4869, a generic “#15” or “#30” label may not necessarily mean that the product meets the desired or required specifications. Products that meet ASTM D226 Type II or ASTM D4869 Type IV have increased tear resistance and tear strength and are expected to perform better. Additionally, for regions that experience hurricanes and/or high winds, IBHS’ FORTIFIED guidelines for sealed roof decks provide even more

resistance to water penetration through the roof decks. Additional information regarding standards, building codes, and IBHS' FORTIFIED program is provided in Appendix A and B. However, even buildings which are not installing a sealed roof deck, and therefore not seeking a FORTIFIED designation, can benefit from the installation of a high-quality underlayment.

References

- 2012 *International Building Code®* (IBC), Chapter 15 - Roof Assemblies and Rooftop Structures International Code Council, Washington, DC.
- 2012 *International Residential Code®* (IRC), Chapter 9 - Roof Assemblies, International Code Council, Washington, DC.
- ASTM International, 2009: ASTM D226 / D226M-09: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing, ASTM International, West Conshohocken, PA.
- ASTM International, 2011: ASTM D4869 / D4869M-11: Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing, ASTM International, West Conshohocken, PA.
- Fricklas, R., J.D. Carlson, and T. Simmons, 1995: "Underlayment for Steep-Slope Roof Construction," p. 10-21. Proceedings of the 11th Conference on Roofing Technology, Gaithersburg, MD.
- Gromicko, N. and K. Shepard, 2015: "Roofing Underlayment Types." InterNACHI. Retrieved from <<http://www.nachi.org/underlayment-types.htm>>. March 10, 2015.
- Holladay, M., 2000: "Choosing a Sheathing Wrap." *Journal of Light Construction*, August, 2000.
- Insurance Institute for Business & Home Safety, 2014: FORTIFIED-Wise Contractor Training Manual. York, PA: Architectural Testing Inc.
- Olin, H.B., J.L. Schmidt, and W.H. Lewis, 1983: "CONSTRUCTION Principles, Materials & Methods". Chicago: The Institute of Financial Education, and Danville, IL: Interstate Printers and Publishers, Inc.

Appendix A. Additional information regarding standards

Underlayment standards and building codes

Underlayments conforming to the following ASTM standards are recognized in the building codes for installation under different types of roof covering. Installation of the

underlayments must comply with Chapter 15 of the *International Building Code*[®] (IBC) or Chapter 9 of the *International Residential Code*[®] (IRC) and the manufacturer's installation instructions. The following list includes the two ASTM standards that have been previously identified for asphalt-saturated felts as well as other underlayments that contain asphalt.

- ASTM D226 Specification for Asphalt Organic Felt Used in Roofing and Waterproofing
- ASTM D4869 Specification for Asphalt-Saturated Organic Underlayment Used in Steep-Slope Roofing
- ASTM D6757 Specification for Underlayment Felt Containing Inorganic Fibers used in Steep-Slope Roofing
- ASTM D2626 Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet used in Roofing
- ASTM D6380 Specification for Asphalt Roll Roofing (Organic Felt)
- ASTM D1970 Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection

While these six standards are recognized in the building codes, asphalt-saturated felts are different from sheet materials that contain asphalt. Organic felts that conform to ASTM D226 and ASTM D4869 are impregnated with asphalt while other products may be comprised or coated with asphalt or modified material.

Appendix B. Code-plus enhancements using IBHS FORTIFIED guidelines

IBHS' FORTIFIED for Safer Living[®] and FORTIFIED Home[™] programs were created to improve the resistance of new and existing homes to natural hazards (IBHS, 2014). These standards require the installation of a qualified sealed roof deck for protection against water intrusion in the event that the roof covering is damaged. A list of qualified sealed roof deck options is provided below. For each option, the materials must be code-compliant, and the use of the correct type of underlayment as specified in each sealed roof deck option must be verified.

1. Cover the entire roof deck with a full layer of self-adhering polymer-modified bitumen membrane meeting the ASTM D1970 standard. It is recommended that the membrane is covered with ASTM D226 Type I (#15) felt before shingles are applied to provide bond break, and to prevent shingles from fusing with the self-adhering membrane.
2. Apply a self-adhering polymer-modified bitumen flashing tape at least 4 in. wide directly to the roof deck to seal the horizontal and vertical joints in the roof deck. Next, apply an ASTM D226 Type II (#30) or an ASTM D4869 Type IV (#30) underlayment over the entire roof. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps at 6 in. on center spacing along all laps and at 12 in. on center in the field, or a more stringent fastener schedule, if required by the manufacturer for high-

- wind installations. Horizontal laps must be a minimum of 2 in. and end laps must be a minimum of 6 in.
3. Apply reinforced synthetic and/or polymeric roof underlayment which has an International Code Council Evaluation Service (ICC–ES) evaluation report as an alternative to ASTM D226 Type I (#15) or ASTM D226 Type II (#30) felt. The synthetic underlayment must have minimum tear strength of 20 lbf in accordance with ASTM D1970 or ASTM D4533. This underlayment must be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps at 6 in. on center spacing along all laps and at 12 in. on center in the field, or a more stringent fastener schedule if required by the manufacturer for high-wind installations. All seams (horizontal and vertical) must be sealed with a compatible adhesive or a compatible 4-in.-wide tape except for steep-slope roofs with a 12/12 roof pitch (45 degrees) or greater, where they do not have to be sealed provided the overlap for horizontal seams is at least 18 in.
 4. If new roof cover is not being installed, or if the building owner prefers, sealing the roof deck can be done from inside the attic using qualified closed-cell foam adhesive to all horizontal roof deck seams and along all sheathing/roof framing member joints. Application must be done by professional applicators.
 5. Two layers of ASTM D226 Type II (#30) or ASTM D4869 Type IV (#30) underlayment shall be installed in a shingle-fashion, lapped 19 in. on horizontal seam, and 6 in. on vertical seams. Fasten underlayment at 6 in. on center along the laps and at 12 in. on center in the field.

The FORTIFIED guidelines or standards represent code-plus construction and require a sealed roof deck.