

**Roof Membranes**

Insulfoam’s insulation and sheathing products can be used as an integral component in virtually any traditional roof membrane system. Customary application techniques and methods are used in order to accommodate the various characteristics and requirements of each.

**Polymer-Based Single Ply Systems**

Single ply roofing membranes are one of the most popular systems due to their flexibility, relatively easy and clean installation, lightweight and competitive price. One key feature is that they are produced in a factory to strict quality-control requirements that minimize the risks that are inherent in traditional built-up roof systems. In addition, these systems can employ light-colored, reflective roof surfaces that reduce energy consumption and potentially permit the use of smaller, less expensive heating and cooling plants.

The most limiting characteristic of these systems is that they are single ply, offering no redundancy, compared to other systems. Care must be taken to avoid damaging the membrane both during installation and once in service.

Single ply membranes are typically categorized as thermoset or thermoplastic materials. This classification is based on

mechanical behavior with respect to the heating and cooling of the membrane, or more accurately, the polymer used to produce the membrane.

**Thermosets**

Thermoset polymers are composed of long-chain molecules that are linked together by small molecules with strong chemical bonds. This trait is often referred to as vulcanization or curing. The polymer network is so rigid that the molecules cannot move with respect to each other, even when heated. These types of materials do not soften or flow when heated, and the seams cannot be heat-welded in the field. They require the use of a sealing tape or adhesive to form a field-seam or lap.

One of the most common polymers used in these membranes is EPDM (ethylene-propylene-diene-monomer). EPDM membranes are known for their long-term weatherability and resistance to stress (caused by the expansion and contraction typically resulting from fluctuations in temperature), ultraviolet light and ozone. The membranes are available in both unreinforced and reinforced systems, the latter of which increases tear resistance. EPDM is available in black or white, with thicknesses that range from 45 mils to 90 mils, and is offered in wide sheets that may be desirable for large projects, as fewer field seams are required.



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Another thermoset material is CSPE (chlorosulfonated polyethylene) also called Hypalon®, which is quite different from EPDM. It is unique in that it starts out as a thermoplastic material, but over time cures into a thermoset. This membrane can be heat-welded as long as the installation takes place prior to excessive aging or curing. CSPE has been promoted for use in harsh environments.

Hypalon® is a registered trademark of DuPont Performance Elastomers.

### Thermoplastics

Thermoplastic materials are made from long-chain molecules that are held together by weak chemical bonds. When heated, the molecules slide past each other, and the material softens or flows. Upon cooling, the molecules are no longer able to slide past each other, and the material hardens. Because of this property, the seams of thermoplastic single ply membranes can be heat- or solvent-welded to form field-seams.

PVC (polyvinyl chloride) and TPO (thermoplastic polyolefins) are two of the most commonly used thermoplastic single ply membranes. These membranes include a reinforcing layer, usually polyester or fiber glass, which provides increased strength and dimensional stability. They are typically offered in white or light colors.

PVC membranes are manufactured from a combination of PVC resin, stabilizers, pigments, fillers, plasticizers, biocides and various additives. The membranes are inherently fire-resistant. Historical problems with these membranes related to the use of chemical plasticizers that ultimately evaporated (causing the membrane to become brittle and/or shrink), and have been discontinued.

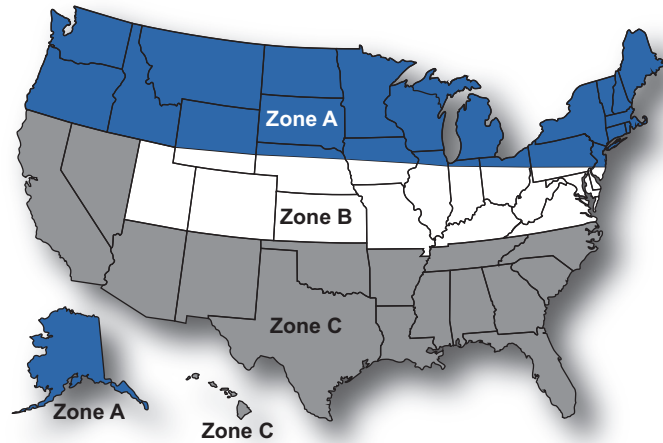
TPOs are another popular thermoplastic choice. These polymers are blends or alloys of polypropylene plastic or polypropylene and EPR (ethylene-propylene rubber) or EPDM. TPO can be installed using a number of traditional methods, the latest of which is a self-adhesive system.

KEE (Ketone Ethylene Ester) membranes, in addition to having the typical properties exhibited by thermoplastic materials, are also inherently chemical-resistant.

PVC, TPO and KEE remain heat-weldable throughout their service life, and simplify repairs and maintenance.

### Black Membrane Applications

Due to the surface temperatures that can be reached on certain un-ballasted black membrane installations, the following chart should be followed when using InsulFoam products with black membranes. Contact the InsulFoam Technical Center or your local InsulFoam representative for additional information.



Zone	Acceptable Insulation Systems
A	<ul style="list-style-type: none"> <li>• R-Tech metallic w/ side up</li> <li>• InsulFoam SP</li> <li>• InsulFoam w/ SecurePly</li> <li>• InsulFoam w/ Cover Board</li> </ul>
B	<ul style="list-style-type: none"> <li>• R-Tech w/ metallic side up</li> <li>• InsulFoam SP</li> <li>• InsulFoam w/ Cover Board</li> </ul>
C	<ul style="list-style-type: none"> <li>• InsulFoam w/ Cover Board</li> </ul>

### Single Ply System Fastening Methods

**Mechanically Fastened** Systems in which the membrane is secured to the deck with screws, plates, bars or other anchoring devices, are referred to as mechanically fastened systems. The fastening method used will typically depend on the type of roof deck. Some applications may require the use of narrower sheets and more fasteners to reduce the likelihood of fastener pull-out.

In areas that are subject to high winds, the fastening system for attaching the membrane is critical. Due to the repetitive movement of the membrane and the resulting forces on the fastening system, the owner may be better served by selecting an alternative system type (e.g. fully adhered).

InsulFoam products are well suited for use with virtually all mechanically fastened single ply systems. These systems meet modeling building code requirements and achieve fire ratings required for most installations.

**Fully Adhered** Fully adhered systems employ a continuous layer of adhesive that firmly bonds the membrane to a substrate (either the deck or insulation). This method requires the cohesive strength of the adhesive bond to the substrate to be capable of holding the roof in place under the design conditions. Though the roofing materials can be somewhat more expensive, the actual installed cost of these systems can be very competitive.

A recent variation on these systems includes membranes that have an integral adhesive built onto the back of the membrane – these are referred to as self-adhered or peel-and-stick systems. The elimination of liquid-adhesive application can provide additional installation savings.

Care must be used in selecting adhesive systems when InsulFoam products are being used. The insulation can be damaged when exposed to petroleum- or solvent-based adhesives or primers. When these materials are used in the system, InsulFoam shall receive a cover board of wood fiber, oriented strand board, gypsum or DensDeck®. Water-based and urethane adhesives have been found to work extremely well when placed directly over InsulFoam. However, fire ratings for these systems are somewhat limited at this time.

**Ballasted** Ballasted single ply systems typically use aggregate (round river-washed rocks), 0.75 to 1.5 inches in diameter, installed between 10 to 12 pounds per square foot. The ballast is applied directly over loosely laid membrane and insulation. While adding ballast to a loosely laid roof is most commonly associated with EPDM, other membranes can also take advantage of this fastening method. The designer must consider both the additional weight of the ballast as well as the probability of the structures exposure to high winds. In high-wind areas, ballast can be lifted from the roof and cause damage to surrounding buildings or individuals. It should be noted that manufacturers of PVC membranes often do not permit the use of ballasted systems with their membranes. As an alternate to aggregate, concrete pavers, which can withstand freeze-thaw cycles, can be applied over a non-woven fleece pad to anchor the membrane. These systems are generally accepted as having the lowest installed cost per square foot, followed by mechanically fastened and fully adhered (excluding self-adhered) systems.

InsulFoam is an ideal insulation for use in ballasted single ply membrane systems, and has been used successfully in these applications for over twenty years.

### Multi-Ply Bituminous Membranes

**Built-Up Roofing Systems** Conventional bituminous built-up roofing (BUR) membranes have been used for over 100 years and represent a notable portion of today's roofing market. The membrane, in essence, is fabricated in place, (not in a factory), and consists of layers of waterproofing bitumen alternating with plies of reinforcing felts, and finished with a protective surfacing. The primary feature of BUR is the redundancy offered by multiple plies. Molten bitumen is typically applied at elevated temperatures. These systems can be used very effectively with InsulFoam; however, the use of cover boards and particular application techniques is required. Refer to the Insulation Specifications section for these application techniques.

InsulFoam products are not to be used with coal tar or coal-tar bitumen membranes.

**Modified Bitumen Roofing Systems** Polymer modification of bitumens has enhanced the properties of classic waterproofing materials used in built-up roofing. Traditional bitu-

men limitations, such as elongation, slippage in hot weather and flexibility in cold weather, have been improved with this innovation. In addition, because the properties of the bitumens were altered, new application techniques were developed. These enhanced bitumens are typically combined with reinforcements or carriers that complement the properties of modified bitumen blend. This results in sheet materials that have exceptional tensile strength, tear resistance and weatherability.

SBS (Styrene-Butadiene-Styrene) modified bitumens have excellent elongation and recovery properties, permitting repetitive exposure to the cyclic stresses caused by the expansion and contraction of underlying decks or substrates. The ability to accommodate these loads minimizes the potential of premature fatigue failure of the membrane. The rubberized blend also results in improved cold-weather performance.

APP (Atactic Polypropylene) modified bitumens use plastic modifiers to improve the properties of the asphalt. These materials are typically referred to as amorphous or atactic polypropylene. The products are ideal for heat weld or propane torch applications, as the blend on the back of the sheet acts as an integral hot-melt adhesive. Often, these products are reinforced with a polyester mat that creates excellent tensile strength and flexibility.

Direct exposure to the elements and ultraviolet light can result in premature aging of modified bitumen blends, and, for that reason, they are often produced with a protective coating of ceramic roofing granules.

### Bituminous System Fastening Methods

**Hot-Asphalt Attachment** Built-up roofing (BUR) and SBS modified bitumen systems utilize hot asphalt to bond the membrane to the underlying substrate. The application temperature of the asphalt ranges from 335 °F to 450 °F. The use of a cover board is required over InsulFoam with the use of BUR or SBS membranes. The cover board can be attached using mechanical fasteners or hot asphalt application techniques. These techniques are described in the Insulation Specifications section of this manual.

**Heat Welding** Heat welding techniques differ depending on the membrane and application.

Heat welding of single ply membranes typically requires the use of a hot-air gun. This tool provides a stream of air that is hot enough to soften the membrane coating. Once the material has softened sufficiently, it will bond to another sheet of the same material, or, in some instances, specially coated metal flashing. This technique is used to seal field-seams, attach perimeter and penetration membrane flashing materials to the roof membrane and attach the membrane to perimeter metal.

Heat welding of modified bitumens can employ either a propane torch or hot-air gun. Both tools are used to soften the modified bitumen blend on the sheets to allow the material to bond to itself at field laps, roof insulation, other roof substrates and properly prepared perimeter metal.



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The lap or bond to the roof substrate is complete once the membrane material has cooled.

**Cold Adhesives** Virtually any of the membranes described in this section can be built or secured to the roof substrate with adhesives. Many alternatives are available, and proper selection largely depends on the roofing components employed in the system.

Organic, solvent-based bonding cements have been used very effectively for many years. Although they work well with some membranes, most solvents in these adhesives can damage InsulFoam products. When these materials are used in systems employing InsulFoam, a cover board must be used to protect the insulation. Care must also be taken in applying the adhesive. Pouring large pools of adhesive on the cover board can penetrate the cover board and damage the insulation. **INSULFOAM WILL NOT ACCEPT, UNDER ANY CIRCUMSTANCES, ANY RESPONSIBILITY FOR DAMAGE TO INSULFOAM INSULATION OR SHEATHING PRODUCTS THAT IS CAUSED BY SOLVENTS FROM ADHESIVES.**

A number of low-solvent, urethane and water-based adhesives are also available for use with InsulFoam insulations. These systems may also require the use of a cover board. Membrane manufacturers typically provide their own brand or specify which adhesive materials are compatible with their membrane. Refer to membrane manufacturers' recommendations.

**Self-Adhered Membranes** Self-adhering membranes are manufactured with an integral adhesive film on the back of the sheet that is covered with a release paper or film. They are similar in design to adhesive bandage strips. These membranes are available from single ply membrane and modified bitumen manufacturers. The sheet is installed by removing the release paper while placing the membrane over the roof insulation or substrate. Depending on the Insulfoam product being used, a cover board may be required.

