

Specifying SPF Roofing Systems

Is a spray polyurethane foam system right for your next roofing project? Find out now.

By Mason Knowles

SAMPLE

In today's buildings industry, there is a growing desire to provide owners with durable, long-lasting roofing systems that combine high energy performance with low maintenance costs. From that desire, a renewed interest in SPF roofing systems has risen. SPF roofing systems have been around for more than 40 years; however, there is still a significant lack of knowledge among many roofing professionals on how to specify, install, or maintain these systems.

What is spray polyurethane foam roofing?

Spray polyurethane foam (SPF) roofing consists of an application of specifically designed foam covered with an elastomeric coating (typically acrylic, silicone, or polyurethane) or aggregate covering to protect the foam from ultraviolet rays. Specialized equipment mixes two liquid components at the spray gun that applies the SPF to a prepared substrate. The mixed liquid expands many times its original volume in a mat-

ter of seconds, forming a rigid foam plastic that chemically bonds to the surface to which it is sprayed. Spraying the foam in ½-inch to 1½-inch lifts allows the applicator to reach the desired thickness to fill in low areas, build up slope, and provide insulation.

SPF has a closed-cell structure that makes it water resistant. It must, however, be protected by elastomeric coatings or other coverings (such as aggregate) to prevent ultraviolet-induced surface degradation. Such coverings can also be used for other purposes, including inhibiting moisture vapor transmission, enhancing the aesthetics of the system, increasing the impact and abrasion resistance of the system, and achieving flammability and code requirements.

What type of life should I expect from a SPF roof?

In 1996 and 2003, the National Roofing Foundation commissioned Dr. Rene Dupuis of Structural Research Inc. to conduct research on SPF roofing systems in six different climate zones in the United States. Based on surveys of over 300 SPF roofing systems, Dupuis concluded that SPF roofs have an effective service life of more than 30 years. The research also shows that the physical properties of the foam change very little with age. This indicates that the life expectancy of a SPF roof system

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Applying elastomeric coating to SPF protects the foam from UV rays.

Mechanical damage from wind-driven debris typically does not cause leaks in SPF roofing systems and can be repaired with a compatible sealant. This Pensacola, FL, roof survived a direct hit from Hurricane Ivan.



PHOTO COURTESY OF REBE SMITH, RICOWI WIND INVESTIGATION STUDY



PHOTO FROM SFA ACCREDITATION COURSE 101-R



After direct hits from two severe hurricanes (Francis and Jeane) in Southern Florida, this SPF roof shows no damage from the storms.

depends primarily on the original application and long-term maintenance.

SPF roofing systems should be inspected semi-annually and after events that could cause mechanical damage, such as hail storms, tornados, and hurricanes. Small (less than 4-inch in diameter) cracks, gouges, or punctures can be repaired with an elastomeric sealant compatible with the SPF system. To repair more extensive damage, remove the damaged foam and reapply additional SPF and coating.

SPF roofing systems typically are recoated at regularly scheduled intervals to extend the life of the system. According to Dupuis' research, SPF roofing systems currently average 15 years between recoating cycles.

Where is SPF used?

SPF roofing systems have good adhesion to a variety of substrates, including metal, wood, concrete, and built-up roofing (BUR). Since SPF adds little weight to existing roof coverings and can build slope to fill in low areas, these systems are used frequently as a recover roofing system. Caution should be used when specifying any recover roofing system. The existing roof covering and roof deck assembly should be thoroughly evaluated to verify that it can be a good substrate for SPF roofing systems.

Hail and wind-driven missiles (such as tree limbs, broken roof tile, metal flashing, etc.) can damage the SPF roofing system. However, this type of damage typically does not cause leaks and can be repaired later without compromising the long-term performance of the system. SPF roofing systems also excel when the following conditions exist:

- Additional insulation is required.
- There are severe temperatures.
- The roof substrate has numerous penetrations.
- The roof deck is an unusual configuration.
- The roof is in an area where high winds are likely to occur.
- Lightweight materials are required.



- Slope must be added to provide positive drainage. Because of the energy-saving characteristics and low maintenance costs of SPF roof systems, these roofs are suited to companies or organizations that own their own buildings and must pay their own energy and maintenance costs.

What are the limitations of SPF roofing systems?

Warning: Knowledge and experience are required. A relatively small crew can install large SPF roofing systems, but it requires a high degree of technical knowledge and experience. Years ago, there were fewer trained contractors and less training available. Today, many courses are available from suppliers and from the Spray Polyurethane Foam Alliance (SPFA) to shorten the learning curve.

When incorrectly installed, SPF roofing systems often exhibit interlaminar blistering of the SPF layers. Foam blisters most often occur by trying to stretch the application window, improper substrate preparation, or equipment problems.

Environmental conditions. The SPF roofing systems, like most roofing systems, must be installed under suitable envi-



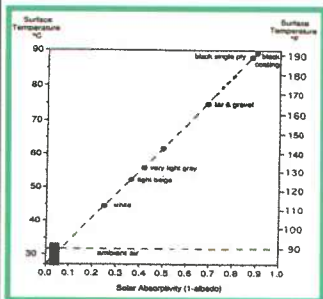
Above: Blisters on a SPF roof are typically caused by thin foam passes and/or moisture or contaminants on substrate. Left: Mechanical damage typically does not cause leaks in SPF roofing systems and can be repaired with a compatible sealant.

ronmental conditions. The SPF applicator should not proceed with substrate temperature below the manufacturer's recommendations or humidity within 5 degrees of dewpoint. In addition, SPF and the protective coating should not be applied when there is ice, frost, surface moisture, or visible dampness present on the surface to be covered. Barriers may be required if wind conditions can affect the foam quality or create overspray problems.

Since applicator knowledge and experience is important

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SOLAR ABSORBTIVITY



Solar Absorbtivity vs. Surface Temperature of Horizontal Surfaces: paints, roofing materials, roadways and cities, adjusted to noon on a clear, windless summer day in Austin, TX.

to the successful installation of a SPF roof, it is important to thoroughly investigate past performance when selecting a SPF contractor. Fortunately, the United States has high-quality foam contractors in every geographic region. (For more information on selecting a SPF roofing contractor, read *Selecting a SPF Roofing Contractor*, page 58.)

Overspray potential. SPF is spray-applied and is very lightweight. While the overspray outside of the zone of application typically does not pose a health hazard, it can stick to many surfaces from great distances away. Building owners and contractors should have an overspray protection plan in place before starting a project.

Fumes. Some coatings can emit strong odors while curing. Curing may occur very quickly or over many hours. When installing a SPF roofing system, air-handling units should be turned off and covered if occupants are in the building. They should remain covered until the SPF is sprayed and the coating can cure.

Cost. SPF roofing systems vary widely in cost depending on the foam thickness required, the type and thickness of the coating or covering, the degree of substrate preparation, availability of contractors in a specific region, and other factors. As with other roofing systems, there are high-end and low-end SPF roofing systems. In 2004, Michelsen Technologies performed a life-cycle analysis for SPF roofing systems in five climate areas of the United States. The study concluded that the average SPF roofing system in those areas cost between 15- and 50-percent less to install and maintain than conventional membrane systems over a 30-year time frame. The study reported costs based on 6-year, 10-year, and 15-year recoat schedules.

Are SPF roofing systems sustainable?

At the 1996 Sustainable Low-Slope Roofing Seminar, Oak Ridge National Laboratories described sustainable or green roofing systems as "roofing systems that have a long life, low maintenance, save energy, add durability to buildings, control moisture in buildings, and contribute very little to the waste stream."

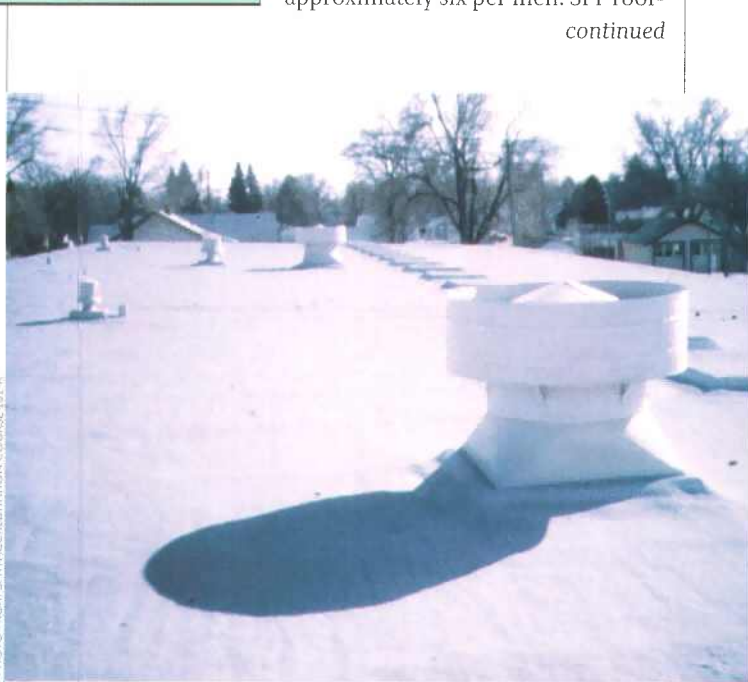
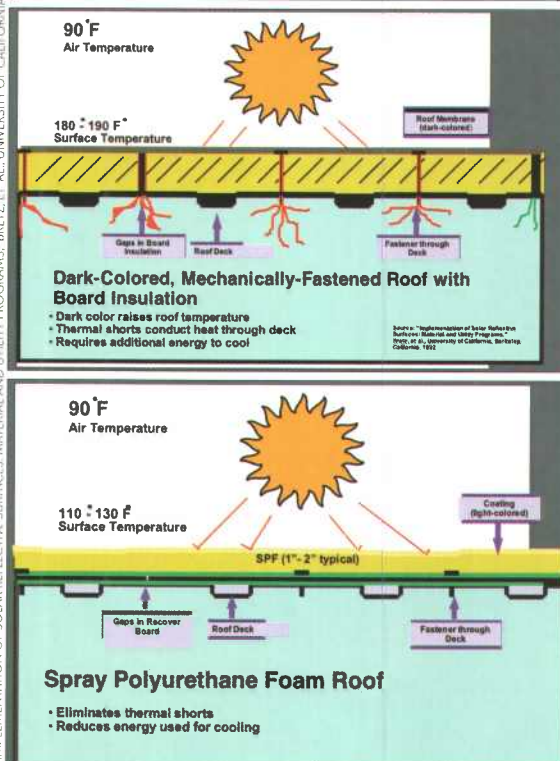
SPF roofing systems comply with every criteria of this definition. SPF roofing systems greatly reduce tear-offs in

many re-roofing projects, which also decreases the amount of materials entering the waste stream. In addition, the SPF systems used today do not contain any ozone-depleting chemicals, and the energy-saving characteristics can save considerable amounts of fossil fuel and CO₂ production, which affects global warming. SPF roofing systems also arrive on the jobsite in 55-gallon drums that create the foam plastic, which expands 30-times its original volume on-site. This saves greatly on fuel used for transportation. And, as reported earlier, SPF roofing systems add durability in severe weather events, such as hurricanes, and last more than 30 years with proper installation and maintenance.

The energy-saving characteristics of SPF have been widely reported by institutions such as Texas A&M and companies like Ford Motor Co., but deserve some explanation. SPF roofing systems are applied above the roof deck. These systems eliminate thermal bridging by providing a continuous layer of insulation over existing thermal bridges in the roof deck and/or assembly. SPF has a very high aged R-value of approximately six per inch. SPF roof-

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IMPLEMENTATION OF SOLAR REFLECTIVE SURFACES: MATERIAL AND UTILITY PROGRAMS; BRETZ, ET AL. UNIVERSITY OF CALIFORNIA, BERKELEY, 1992



SPF roofing is frequently covered with a light-colored reflective coating.

PHOTO FROM SPF ACCREDITATION COURSE 101-18



SPF can be applied to a variety of surfaces, including metal decks.

ing systems typically are coated with light-colored, reflective coatings.

What are some other advantages?

Reduced construction debris is one. Oak Ridge National Laboratories reported, "The need for multiple roofs makes roofing one of the largest contributors of solid waste." According to a 1999 survey by the National Roofing Contractors Association (NRCA), more than 68.5 percent of the \$11.3-billion low-slope re-roofing market includes tear-off and replacement of the existing roof membrane.

SPF roofing systems have excellent adhesion to a variety of substrates, including BUR, modified bitumen, concrete, wood, asphalt shingles, clay tile, and metal. Since SPF adds little weight and can be applied in various thicknesses to add

slope and fill in low areas, SPF roofing systems are often used as a recover system over existing roofs without tear-off. Therefore, the application of SPF roofing systems over existing roof coverings greatly reduces the amount of construction debris in landfills.

What is the ideal climate for installation of SPF systems?

Although SPF is installed very successfully in all 50 states throughout the country, the perfect climate would be warm and dry with little wind.

In northern climates, cold substrate temperatures restrict the use of the materials in winter months. In hot, humid climates, high winds and humidity have to be considered. In hot, dry climates, special formulas are used to handle the extreme hot weather. It is the contractor's responsibility to know under what conditions they can spray and when to stop.

In conclusion, SPF systems can provide long-lasting and durable roofing solutions while contributing to a lower environmental impact. However, to be assured of a quality application, a building owner or owner representative should do their homework to understand the roofing system and hire a responsible contractor. **B**

Mason Knowles is executive director of Fairfax, VA-based Spray Polyurethane Foam Alliance (www.sprayfoam.org).

Selecting a SPF Roofing Contractor

The following tips can help:

- **Contact suppliers** for a list of contractors in your area. Should the manufacturer only provide you with a couple of names, keep them handy. There is probably a good reason for the limited recommendations. Also, if more than one manufacturer recommends the same contractor, it's usually a good sign.
- **Contact related trade groups** (such as the Spray Polyurethane Foam Alliance [SPFA] or National Roofing Contractors Association) for contractors in your area. Ask contractors if they participate in educational programs such as SPFA's Accreditation Program.
- **Obtain recommendations** from friends and associates. (Be sure to compare apples to apples. Hiring a great commercial roofer for a small residential project may be a mistake.)
- **Interview the contractor** to determine if the company has the qualities and experience you desire. Some questions to ask your

prospective contractor include: What type of roofing system do you install? What type of roofing system do you prefer? How long have you installed the systems? What is your specialty? What is your preference for my particular roof? What regions do you cover? Do you have offices or personnel in those regions? How many crews do you have? Have you ever declared bankruptcy; if so, what were the conditions? Who will perform the work? How are they trained? What certifications, approvals, licenses, or awards does the company have? How does your company address site safety and regulatory compliance? What associations does your company belong to? What is the average length of the roof project of my type? How soon can you schedule the work? What warranties are available? Do you provide maintenance services (including inspections)? How do you handle complaints or call-backs? How

do you verify quality?

- **Check references.** Most contractors will provide a list of references on projects similar to yours. Be sure to check out enough to get a good understanding of the contractor's relative performance and customer service. A few helpful questions to ask include: Were you happy with the overall project? Was the contractor reliable, informative, helpful, on time, etc? Were there any misunderstandings? Did the project start and end according to estimates? Do you consider the roof a good investment? How old is the roof? Were there any complaints or problems; if so, did the contractor address your concerns satisfactorily?

The information you collect can assist not only in finding the right contractor, but in evaluating pricing differences. With a little effort, you should be able to find a contractor you can trust to do a great job.