



SATURN

RESOURCE MANAGEMENT

3.6.5 Spray Foam Insulation Materials

SWS Details: 4.0103.5 Accessible Attic - SPF on Attic Floor; 4.0102.1 SPF Roof Insulation - Unvented Roof Deck; 4.0102.2 SPF Roof Insulation - Vented Roof Deck; 4.0104.5 Knee Wall - SPF With No Existing Insulation; 4.0104.6 Knee Wall - SPF With Existing Insulation; 4.0302.4 SPF with Rigid Barrier; 4.0202.6 SPF Insulation Installation in Closed Cavities; 4.0301.5 SPF in Open Joisted Cavities

Spray Polyurethane Foam (SPF) is combustible and creates toxic smoke. Foam insulation usually requires covering with a thermal barrier or an ignition barrier, discussed in [“Special Safety Precautions for Spray Foam” on page 116](#). SPF comes in two formulations: closed-cell and open-cell. Both are described below.

Spray foam is an insect-friendly material that can aid termites and carpenter ants in establishing a colony in wood structures. Mitigate all sources of ground water before installing foam near a foundation. When foam is installed on the outside of foundations, the surrounding soil should be treated with a termiticide if necessary. Inside a crawl space, foam must never provide a direct link from the ground to wood materials. The International Residential Code (IRC) forbids foam below grade in “very heavy” termite-colonized areas. [See also “Liquid Foam Air Sealant” on page 101](#).

Caution: Two-part foam is hazardous to installers and building occupants. Installers must wear special personal protective equipment and ventilate spaces during installation to avoid lung, skin, and eye damage. SPF can harm occupants who breathe the toxic vapors during installation. SPF requires precise mixing of the two components at specific temperature ranges. Improperly mixed or installed spray foam can emit vapors for months or years resulting in long-term respiratory hazards. [See “Special Safety Precautions for Spray Foam” on page 116](#).

Closed-Cell Spray Polyurethane Foam

Closed-cell polyurethane spray foam (SPF) is an air barrier and a vapor barrier and is the most expensive insulation discussed here. Closed-cell SPF is a good value when space is limited, where an air or vapor retarder is needed, or where its structural strength and durability are needed.

Spray foam professionals install closed-cell SPF from two 55-gallon containers through hoses and a nozzle that mix the material. The closed-cell foam installs at approximately 2 pcf density

and achieves an R-value of 6 or more per inch. However, roofing applications call for a density near 3 pcf.

Closed-cell polyurethane foam is also packaged in smaller containers in the following products.

- One-part high-expanding foam for air sealing.
- One-part low-expanding foam for air sealing.
- Two-part high-expanding foam for air sealing and insulation of surfaces.

Open-Cell Polyurethane Spray Foam and Injectable Foam

Polyurethane open-cell foam is installed at between 0.5 pcf to 1.0 pcf and achieves an R-value of around 3.7 per inch to 4.7 per inch depending on density.

These open-cell formulations are injected into a hole, one inch or smaller, through an injection nozzle and not a fill tube. (The plastic fill tube would clog and isn't cleanable.) The open-cell foam can subject a wall cavity to some pressure, so evaluate wall-cladding strength before injecting it.

Open-cell foam can absorb both water vapor and liquid water. Open-cell foam can hold moisture and become a medium for mold growth. We recommend that contractors don't install low-density spray foam in the following locations.

- Underside of roof decking
- Underside of floor decking above crawl spaces
- Crawl space walls

3.6.6 Special Safety Precautions for Spray Foam

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Two-part foam is hazardous to installers and building occupants. SPF can harm occupants who breathe the toxic vapors during installation. SPF requires precise mixing of the two components at specific temperature ranges. Improperly mixed or installed spray foam can emit vapors for months or years resulting in long-term respiratory hazards.

Installers must wear special personal protective equipment and ventilate spaces during installation to avoid lung, skin, and eye damage.

Consider essential these precautions for spraying foam safely.

1. Ask the occupants to leave while you spray foam for as long as a day. Power ventilate the area during installation and for at least 24 hours afterwards.
2. When spraying low-pressure polyurethane foam — either 1-part or 2-part — use a respirator cartridge designed to filter organic vapors, and ventilate the area where you're spraying the foam.
3. You must complete training, including safety training, before spraying high-pressure 2-part foam.
4. When spraying high-pressure polyurethane foam from a truck-mounted machine, use a supplied-air, positive-pressure respirator, and ventilate the area.

3.6.7 Fire Protection for Foam Insulation

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Plastic foam is the generic term used by the IRC for both rigid and spray foams. Plastic foams are combustible, and create toxic smoke when they burn.

The following fire-safety and durability issues are particularly important to installing foam insulation.

- Foam insulation requires a thermal barrier covering of at least half-inch drywall when installed in a living space.
- Foam may require an ignition barrier when installed in attics or crawl spaces or it may not.
- A *thermal barrier* is a material, usually drywall, that protects combustible materials behind it from heat and flame creating a fire.
- An *ignition barrier* is designed to delay the ignition of the material it protects. Ignition barriers include plywood, galvanized steel, damp-spray fiberglass, and intumescent paint. Intumescent paint is a proprietary latex coating designed to delay the ignition of foam insulation in a fire.

The IRC requires a thermal barrier (half-inch drywall) for spray foam in all living areas and storage areas. Instead of a thermal barrier, installers may use an ignition barrier (1.5 inches of fibrous insulation or intumescent paint) to cover foam in attics and crawl spaces that aren't used for storage.

Fire protection requirements vary among foam formulations, according to the amount and type of fire retardant. Foam insulations generally fit into one of two classifications.

- Class I or Class A; ≤ 25 flame spread
- Class II or Class B; flame spread 26-75

If a foam product has a flame spread of 25 or less (Class I), it may require no thermal barrier or ignition barrier. If a foam product has a flame spread of more than 25, further testing may qualify it for exemption from the thermal barrier or ignition barrier requirements of the IRC.

Code jurisdictions and individual building officials vary in their interpretation of the IRC depending on these three factors.

1. Foam manufacturer's fire-testing reports.
2. The possibility that residents might use an attic or unoccupied basement for storage or even living space.
3. The possibility that no one may ever enter the space again except for maintenance.

Expanded Polystyrene (EPS) Foam Board

EPS foam board, sometimes called beadboard, is the most inexpensive of the foam insulations. EPS varies in density from 1 to 2 pcf with R-values per inch of 3.9 to 4.7, increasing with greater density. EPS is packaged in a wide variety of products by local manufacturers. Products include structural insulated panels (SIPS), tapered flat-roof insulation, EPS bonded to drywall, and EPS embedded with fastening strips.

EPS is flammable and produces toxic smoke when burned. EPS has a low maximum operating temperature (160 degrees F) — a concern for using EPS under dark-colored roofing or siding. EPS shrinks in some high-temperature installations.

EPS is very moisture resistant and its vapor permeability is similar to masonry materials, which makes EPS a good insulation for masonry walls.

Dense EPS (2 pcf) is appropriate for use on flat roofs and below grade. Dense EPS is also more dimensionally stable and less likely to shrink. Use weatherproof coverings to prevent degradation by ultraviolet light and freezing and thawing at ground level.

Extruded Polystyrene (XPS) Foam Board

XPS is produced by only a few manufacturers and is popular for below-grade applications. XPS is more expensive than EPS and has an R-value of 5.0 per inch. XPS may be the most moisture-resistant of the foam boards.

XPS is flammable and produces toxic smoke when burned. XPS must be covered by a thermal barrier when installed in living spaces. XPS has a low maximum operating temperature (160 degrees F) that is a concern for using XPS under shingles or dark-colored siding. XPS has shrunk in some installations. Use weatherproof coverings to prevent degradation by ultraviolet light and freezing and thawing at ground level.

Polyisocyanurate (PIC) Foam Board

PIC board has the highest R-value per inch (R-6 or a little more) of any common foam board. PIC is packaged with a vapor permeable facing or an aluminum-foil (vapor barrier) facing. PIC is expensive but worth the cost when the thickness of insulation is limited.

PIC is combustible and produces toxic smoke during a fire. However some products have fire retardants that allow installation in attics and crawl spaces without a thermal barrier or ignition barrier.

PIC has a low maximum operating temperature (<200 degrees F) that may be a concern for using PIC under dark-colored roofing or siding. Use the high-density (3 pcf) PIC board for low-sloping roof insulation.

Polystyrene Beads

Polystyrene (EPS) beads can be poured or blown into cavities. The cavities must be airtight or the beads escape, making an annoying mess. EPS beads have an R-value between 2.2 and 2.5 per inch. Beads work well for filling hollow masonry walls.

Vermiculite and Perlite

These expanded minerals are pour-able and used when a non-combustible insulation or high temperature insulation is needed. R-value per inch is between 2.0 and 2.7 per inch. These products are good for insulation around single-wall chimney liners to prevent condensation in the liner. Existing vermiculite may contain asbestos, and it must not be disturbed by anyone except a licensed asbestos abatement specialist.

3.7 INSULATION SAFETY AND DURABILITY