



## SPFA-107

# Spray Polyurethane Foam Roofing Blisters: Causes, Types, Prevention and Repair

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## ABOUT SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

Founded in 1987, the Spray Polyurethane Foam Alliance (SPFA) is the voice, and educational and technical resource, for the spray polyurethane foam industry. A 501(c)6 trade association, the alliance is composed of contractors, manufacturers, and distributors of polyurethane foam, related equipment, and protective coatings; and who provide inspections, surface preparations, and other services. The organization supports the best practices and the growth of the industry through a number of core initiatives, which include educational programs and events, the SPFA Professional Installer Certification Program, technical literature and guidelines, legislative advocacy, research, and networking opportunities. For more information, please use the contact information and links provided in this document.

## DISCLAIMER

**This document was developed to aid building construction and design professionals in choosing spray-applied polyurethane foam systems. The information provided herein, based on current customs and practices of the trade, is offered in good faith and believed to be true to the best of SPFA’s knowledge and belief.**

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## DOCUMENT HISTORY

Date	Sections Modified	Description of Changes
July 2004		
August 2015	All	Administrative changes
January 2021	Cover and Header	New SPFA Logo

## ROOFING COMMITTEE

### Mission Statement

The mission of the Roofing Committee is to provide a wide range of technical service to the SPF (spray polyurethane foam) industry such as, but not limited to:

- (1) Review existing documents and serve as a clearing house to ensure the “Continuity of Value” of technical information published by SPFA and others concerning roofing system products and services to the SPF industry;
- (2) Review, research, develop, and issue documents concerning new products, systems and services for SPF roofing applications; and
- (3) To identify, explore, develop, and communicate an understanding of roofing technical issues facing to the SPF industry.

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## Part 1 – General

Although blisters are sometimes not aesthetically pleasing, they should not be removed and/or repaired unless it appears that their presence will adversely affect the water tightness of the sprayed polyurethane foam (SPF) system. This also applies to blisters in built-in and single-ply membrane systems. The unnecessary repair of blisters in an SPF roofing system can lead to leaks and premature roof problems. Most industry warranties do not cover SPF blisters, as they generally cover only the water tightness of the polyurethane foam/coating system. (Please refer to the specific warranty document for more detailed information.)

Those blisters that are likely to lead to leaks at a later date must be repaired in the recommended manner. This document examines the types of SPF blisters, and reviews their causes, methods to prevent their formation, and recommended repair methods.

## Part 2 – Types of Blisters

The following four types of SPF blisters are most frequently encountered:

**Type A. Interlaminar–Top Lift:** A separation between the top layer or lift of the SPF and the lift beneath it. These are generally small in size, typically 50–300mm (2 inch–1 foot) in diameter. They are easily broken when touched or stepped on. Typically they often show separation of the top layer of SPF with a thickness range of 3 mm–9 mm (1/8 inch–3/8 inch).

**Type B. Interlaminar–Intermediate Lift:** A separation or delamination between layers or lifts of polyurethane foam that are not the top lift. This type of blister is somewhat larger than Type A, usually ranging in size from 150 mm–1,000 mm (6 inches to several feet) in diameter with a thickness of 25–75 mm (1–3 inches). In some cases, a Type B blister could be up to 9 square meters (one roofing square) or larger. These blisters are somewhat less flexible and not easily broken. Test cuts show delamination between layers other than at the top two layers.

**Type C. Substrate Bond Line:** These blisters are about a meter (several feet) in diameter or larger, but readily observed by visual inspection. They are rigid and usually detectable by movement when walking on the surface of the roof. These blisters reflect a loss of adhesion of the sprayed polyurethane to the substrate.

**Type D. Intra-Substrate:** Similar to Type C, as they are very rigid and not readily detectable by visual inspection. These types of blisters are often large (9 square meters [one roofing square] or larger) and located between felts or other components of the original roof.

## Part 3 – Causes of Blisters

The following four causes of blisters are most frequently encountered:

### (1) Type A. Interlaminar–Top Lift

- Generally moisture, oil, grease, or other contaminants on the previous layer of SPF.
- Substrate moisture sources. Moisture may be introduced into the spray application through perspiration, moisture in the air feed of the spray equipment, dew or rain during spraying, or condensate draining onto the SPF.
- Foam or coating overspray on the substrate.
- Polyurethane foam lifts applied less than 13mm (1/2 inch) thickness.
- Spraying over incompletely cured polyurethane foam.
- Spray applying the last lift of polyurethane foam over UV-degraded polyurethane foam without suitable preparation. SPF will not properly adhere to SPF that has degraded because of prolonged exposure to sunlight or UV radiation. It is an industry standard that the full thickness of SPF be applied the same day.
- Applying SPF in temperatures below those that are recommended by the SPF manufacturer.

### (2) Type B. Interlaminar–Intermediate Lift Blisters

- Generally moisture, oil, grease, or other contaminants on the previously sprayed layer of SPF.
- Moisture sources. Moisture may be introduced into the spray application through perspiration, moisture in the air feed of the spray equipment, dew or rain during spraying, or condensation draining onto the SPF.
- Foam or coating overspray on the previous lift.
- Polyurethane foam lifts applied less than 13 mm (1/2 inch) thickness.
- Spraying over incompletely cured polyurethane foam.
- Spraying the last lift of polyurethane foam over UV-degraded polyurethane foam without suitable preparation. SPF will not properly adhere to SPF that has degraded because of prolonged exposure to sunlight or UV radiation. It is an industry standard that the full thickness of SPF be applied the same day.
- Using polyurethane foam that is not the proper reactivity for the ambient conditions can cause blisters to form at lift tie-ins.
- Applying SPF in temperatures below those that are recommended for that system.

### (3) Type C. Substrate Bond Line

- Generally moisture, oil, grease, or other contaminants on the substrate.
- Substrate moisture sources. Moisture may be introduced to the spray application through perspiration, moisture in the air feed of the spray equipment, dew or rain during spraying, or condensation draining onto the SPF.
- Applying SPF in temperature below those that are recommended by the SPF manufacturer.

### (4) Type D. Intra-Substrate

- These blisters occur between layers in the original roof system.

- Poor adhesion between felts, between felts and insulation, or between insulation and deck.

## Part 4 – Prevention Methods

The following preventative measures are recommended for each of the various type blisters:

### (1) Type A. Interlaminar –Top Lift Blisters

- a. Apply foam in lifts of 13mm (1/2 inch) or greater. Apply the full thickness of polyurethane foam in any specific area on the same day.
- b. Elimination of moisture:
  - i. Keep perspiration and moisture from other sources off the substrate.
  - ii. Ensure that the substrate is dry by allowing sufficient time for the sun to dry the surface or by using mechanical blowers. Surface moisture can be detected by the use of moisture sensitive paper.
  - iii. Prevent moisture in the compressor or airlines, for example, by installing a moisture separator or trap between the compressor and spray equipment. The desiccant in the trap will change color on contact with moisture and should be inspected on a regular basis.
  - iv. Apply polyurethane foam within the temperature ranges and relative humidity recommended by the manufacturer.
- c. When applying polyurethane foam, aim the spray gun nearly perpendicular to the surface to keep overspray to a minimum.
- d. Ensure that the polyurethane foam from a previous lift has had time to thoroughly cure, especially at the edges of the lift line. This condition is more likely to occur in cool weather.
- e. If weather conditions prevent the final thickness from being applied during one day's operation, prepare the surface in conformity with the manufacturer's recommendations.
- f. Maintain equipment to minimize off-ratio application.

### (2) Type B. Interlaminar–Intermediate Blisters

- a. Same as for Type A, Interlaminar–Top Lift Blisters.

### (3) Type C. Substrate Bond Line Blisters

- a. Remove loose gravel, dust, oil film, moisture, soft mastic, and other contaminants prior to the application of the SPF.
- b. Inspect or test the roof assembly for the presence of moisture.
- c. Rust and poorly adhered coating should be removed from metal substrates.
- d. In certain cases, the use of a primer after cleaning may improve adhesion. Use of a primer should not be considered to be a substitute for cleaning. The primer must be cured prior to application of SPF.

### (4) Type D. Intra-Substrate Blisters

- a. Inspect substrates for adhesion between felts, insulation, and deck. Take test cuts. Areas of loose felts, blister, buckles, wrinkles, and fishmouths shall be removed and/or fastened. If necessary, fasten the top felt to the deck using approved

mechanical fasteners.

## Part 5 – Blister Repair Considerations

The desirability and/or necessity to repair sprayed polyurethane foam blisters will largely depend on the type of blister. All Type A blisters should be repaired promptly because they are very flexible and easily broken when stepped on. Type B blisters, while generally larger than Type A blisters, are less flexible and less likely to be broken when stepped on. Type B blisters should be repaired only when it appears that foot traffic or other use of the area would probably lead to a rupture of that blister at a later date. Type C and D blisters, although they may be fairly large in size, are usually very rigid and thus do not require repair.

- (1) As a general rule before repairing or during the repairing operation, adequate test cuts (core or slit samples) should be taken to determine the exact extent of the problem. Foam beyond the actual area of an individual blister may need to be removed in order to prevent reoccurrence. The surfaces adjacent to the cut should be prepared and cleaned.
- (2) If a number of blisters are found clustered in one area, it is recommended that you remove the top lift or top two lifts in the area rather than attempting to repair individual blisters. Take sample cuts or cores to determine the adhesion adjacent to the blisters. If poor adhesion is found, remove the entire area.
- (3) Cutting out and filling blisters with coating is not an acceptable procedure. This type of procedure will result in either a depression in the surface, which will hold water, or an unacceptable thickness of coating, which may itself blister.
- (4) Replacement SPF should be installed so that the originally specified density and compressive strength are maintained. Many commercial “froth packs” and pour foams will not give satisfactory results.
- (5) After a blister has been opened or an SPF layer has been removed, , the lower layer should be inspected for degradation or moisture. No repair should be made to a degraded or moist surface. Instead, dry the surface and remove the degraded area before proceeding with repairs.
- (6) Apply coating to the proper thickness to repaired areas. Two or more coats should be used. The final dry mil thickness on repaired areas should be the same as originally specified.
- (7) Small blisters less than 100 mm (4 inches) in diameter and less than 25 mm (1 inch) deep can be repaired with a compatible sealant when the sealant is: a) not installed in a greater thickness than is recommended by the manufacturer for proper cure, and b) is installed to ensure that the final surface is higher than the surrounding area so that water will not pond in the repair area. The sealant used should be as recommended by the coatings’ manufacturer; the area to be repaired should be clean and dry; and the edges should be beveled to ensure proper adhesion. In some cases, SPF plugs can be used with sealant to make these small repairs.
- (8) On larger blisters that will require reapplication of the SPF:
  - a. Cut out the blistered area. Taper the existing SPF edge at a 45° angle.
  - b. Apply the polyurethane foam and coatings at the proper thickness in accordance with the original specification and the accepted application procedures.



- (9) Type C or D Blisters--- One method of repair is to install mechanical fasteners with 75 mm (3 inch) diameter plates. Fasteners must be a type suitable for the particular type of deck and of the proper length. Caulk over all mechanical fasteners with caulking recommended by the coating manufacturer.