



**Spray Polyurethane Foam
Blisters**

THEIR CAUSES, TYPES,
PREVENTION AND REPAIR

Spray Polyurethane Foam Alliance
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Sprayed Polyurethane Foam Blisters Their Causes, Types, Prevention & Repair

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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 a sprayed polyurethane foam 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. In this document we will examine the types of SPF blisters, their causes, methods to prevent their formation and recommended repair methods.

Part 2- Types of Blisters

The four-(4) types of SPF blisters that are most frequently encountered are as follows:

Type A. ---Interlaminar- Top Lift: A separation between the top layer or lift of SPF and the lift beneath it. These are generally small in size, typically 50mm – 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 to 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, ranging in size usually from 150 mm to 1000 mm (6 inches to several feet) in diameter with a thickness of 25-75 mm (1-3 inches). In some cases 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 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. (Note: add tank blisters)

Type D. --- Intra-Substrate: Similar to Type C, as they are very rigid and not readily detectable by visual inspection. These type 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

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 due to prolonged exposure to sunlight or UV radiation. It is industry that the full thickness of SPF be applied the same day.
- Applying SPF in temperatures below that are recommended by the SPF manufacturer.

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
- 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 due to prolonged exposure to sunlight or UV radiation. It is industry standard that the full thickness of SPF be applied the same day.
- Using polyurethane foam, which is not the proper reactivity for the ambient conditions, can cause blisters to form at lift tie in's.
- Applying SPF in temperatures below that recommended for that system could also cause blisters

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 that recommended by the SPF manufacturer.

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

Recommended preventative measure for each of the various type blisters are as follow:

Type A.---Interlaminar – Top Lift Blisters

1. Apply foam in lifts of 13mm (1/2 inch) or greater. Apply the full thickness of polyurethane foam in any specific area the same day.
2. Elimination of moisture:
 - a. Keep perspiration and moisture from other sources off the substrate.
 - b. Insure 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.
 - c. Prevent moisture in compressor or airlines. Installing a moisture separator or trap between the compressor and spray equipment can do this. The desiccant in the trap will change color upon contact with moisture and should be inspected on a regular basis.
 - d. Apply polyurethane foam within the temperature ranges and relative humidity recommended by the manufacturer.
3. When applying polyurethane foam, aim spray gun nearly perpendicular to the surface to keep overspray to a minimum.
4. Insure 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.
5. 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.
6. Maintain equipment to minimize off ratio application.

Type B---Interlaminar – Intermediate Blisters

1. Same as for Type A.

Type C---Substrate Bond Line Blisters

1. Remove loose gravel, dust, oil film, moisture, soft mastic and other contaminants prior to application of the SPF
2. Inspect or test to determine if moisture is present within the roof assembly.
3. Rust and poorly adhered coating should be removed from metal substrates.
4. 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. Primer must be cured prior to application of SPF.

Type D--- Intra-Substrate Blisters

1. 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 top felt to 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, because they are very flexible and easily broken when stepped on, should be promptly repaired. Type B blister, while generally larger than Type A blisters, are less flexible and less likely to be broken when stepped on. These type 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. It may be necessary to remove foam beyond the actual area of an individual blister in order to prevent reoccurrence. The surface area 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 entire area.
3. It is not an acceptable procedure to cut out blisters and fill with coating. Such a 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 as to have the originally specified density and compressive strength. Many commercial “froth packs” and pour foams will not give satisfactory results.
5. After opening a blister or removing a SPF layer, the lower layer should be inspected for degradation or moisture. No repair procedure should be attempted to a degraded or moist surface. Dry surface and remove degraded area before proceeding to repair.
6. Apply coating to proper thickness to repaired areas. Two or more coats should be used. Final dry mil thickness on repaired areas should be the same as originally specified.
7. Small blisters less than 100 mm(4”) in diameter and less than 25 mm (1”) 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, b) is installed so as to insure the final surface is higher than the surrounding area so that water will not pond on the repair area. The sealant used should be as recommended by the coatings’ manufacturer and the area to be repaired should be clean, dry and the edges beveled to assure 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 blistered area. Taper existing SPF edge at a 45° angle.
 - b. Apply polyurethane foam and coatings at proper thickness in accordance with original specification and 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.

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