

Repair techniques for BUR blisters

Following are criteria for evaluating blisters, as well as hands-on techniques for repairs

by Jim Carlson

During the past 15 years or so, advancements in material technology and application practices have helped eliminate most interply blistering of built-up roof (BUR) membranes. Sufficiently porous ply sheets and other reinforcement fabrics that allow air and hot bitumen gases to escape during application have reduced the potential for building in voids during BUR membrane application.

Type IV fiberglass ply sheets and polyester fabrics specifically made for BUR generally are good reinforcement materials for hot- and cold-applied asphalt BUR membranes, depending on the asphalt type and particular project's design criteria. In general, these materials possess the tensile strength, porosity and other physical characteristics that some of the previous blister-prone organic felts lacked. However, even with sound material engineering, conservative roof design and good craftsmanship during ply sheet application, isolated blisters occasionally occur.

When blisters are discovered, some believe that all of them should be repaired promptly. In addition, many believe that the only repair procedure is to

cut out the voided or unbonded plies and install a patch over the location.

However, some blisters do not need to be cut out—some simply should be reinforced with the appropriate type and number of reinforcing patching plies. Other blisters are best left undisturbed, and, of course, certain blisters should be cut out and the appropriate type and number of patching plies installed.

Inspect, evaluate first

Before prescribing remedies, professionals first should inspect and evaluate blisters for characteristics that signal the need for repair, such as:

- *Weak membrane in the blistered (voided or unbonded) area.* A blister that has weak membrane walls (such as one that consists of one or two

plies) or could rupture easily from foot traffic or heavy snow/icing conditions should be repaired (see Photo 1).

Weak blisters usually are evident with a quick, visual inspection—the blister appears to be vulnerable and capable of rupture. To determine whether a blister is weak, a professional can apply thumb and finger pressure to the blister, simultaneously pressing down on its top and side. The combined pressure will help an experienced person assess whether the blister walls are weak and only made of one or two plies.

When inspecting BUR membranes and prioritizing various areas or locations for repairs, weak blisters should be marked.

By marking blisters with the priority code numbers of "1" (for cut out and repair); "2" (for patch with reinforcing plies); or "3" (monitor), appropriate maintenance has been initiated, and the remedy or repair can be performed.

- *Fatigue cracks or stress lines around the blister's circumference.* A blister that has existed for some time and has undergone extensive thermal movement (i.e., expansion and contraction of the blistered area due to the membrane



Photo 1: Cutting a blistered, organic-reinforced BUR membrane with a straight-blade utility knife in x-shaped fashion.

heating and cooling) will have stress lines or small fatigue cracks around its base. As the blister thermally cycles, the membrane fatigues at the blister's circumference. The stress lines eventually lead to small fractures or fatigue cracks. The fractures and cracks weaken the membrane's integrity and suggest that the blister should be repaired.

If thumb and finger pressure detects that the blistered membrane is firm, has integrity, is not in jeopardy of rupturing, is not in a traffic area and is not full of water, it does not need to be cut out and may be repaired with a reinforcing patch. Integrity means that the blister is durable even if left alone, such as when the blister is composed of three or four well-laminated plies. Such a condition may exist when three or four plies have blistered off the underlying insulation or base sheet. Professionals should remember that once a membrane is cut, all integrity is removed.

■ **Excessive loss of surfacing and evident membrane deterioration.** The blister should be repaired when it has led to excessive loss of surfacing, such as where premature membrane deterioration is evident at the blistered location. This is true for an aggregate-surfaced or granule cap sheet-surfaced BUR membrane. Blisters should be repaired if they have lost aggregate or granules and the exposed membrane has suffered accelerated weathering. This blister type does not always need to be cut out but should receive attention.

■ **Blisters in side or end laps.** When blisters occur at critical locations, such as side or end laps, they should be repaired. Repair is important especially if dimensional cycling (swelling and shrinking)

has begun to shear and separate the lapped seam. If the sheer force has reduced the coverage of the seam's adhered portion, repairs are needed.

■ **Blisters in high-traffic areas.** Blisters that have developed in a portion of the roof experiencing regular foot traffic, such as from rooftop equipment maintenance personnel, should be cut out and repaired.

Monitoring

If inspection and evaluation indicate that the blistered membrane is of sufficient integrity and does not need a patch, it should be monitored. When an isolated blister is to be monitored, especially on roof systems that receive annual or biannual inspections, it should be marked. One way to do this is to outline the blister with spray paint.

Then, during periodic inspections, the blister can be monitored for any changes, such as increase in size, excessive loss of surfacing,

membrane embrittlement or cracking. The preceding characteristics signal the need for repair.

Repairs

If the inspection suggests that the blister(s) should be cut out and patched, the following step-by-step instructions are recommended:

1. **Prepare the surrounding surface.** The area around the blister should be prepared to ensure adhesion of the patching plies to the membrane's surface.

Typically, this means removing debris, aggregate or loose surfacing from the area. If the membrane's surface was flood-coated and has embedded aggregate, the aggregate should be spudded off the surface carefully.

In addition, to achieve a successful tie-off and obtain redundant adhesion to the existing membrane's surface, the patching plies should be sequentially feathered-out well beyond the blistered location. Therefore, it is a good idea to extend the area being prepared at least 18 inches (457 mm) beyond the blister. This gives the craftsmen room to work without getting gravel or other debris back on the location being serviced.

The author prefers using a blunt-nosed spud shovel (rather than a weighted, sharp-bladed spud bar) to

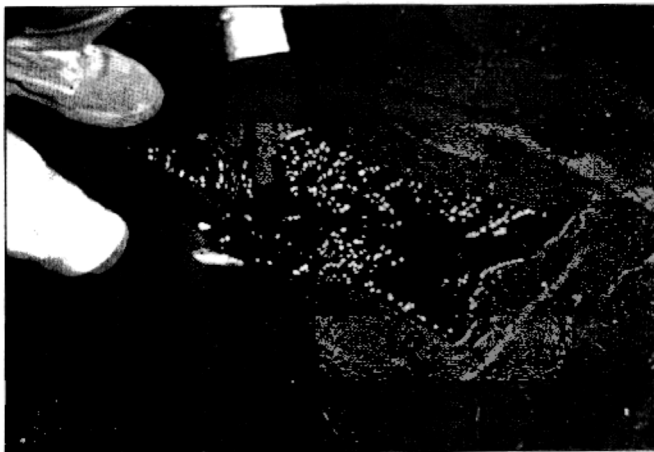


Photo 2: The author uses a hook-blade utility knife (held almost parallel to the roof's surface) to remove all blistered plies.



Photo 3: Setting the first patching ply in solvent-based asphalt roof cement.

spud around blistered locations. A lightweight spud shovel is easier to control at varying angles, while a weighted spud bar can hole or puncture the membrane easily, often making it necessary to install a larger patch.

After spudding, loose aggregate, dirt, dust and bitumen chips should be swept off the surface. A 12-inch- (305-mm-) wide, stiff-bristled push broom works well. For sweeping most surfaces (other than large areas of spudded aggregate or a peeling coating on a BUR membrane), a stiff-bristled house broom held on edge works fine.

2. *Cut an unbonded, blistered membrane with a hook-blade knife.* Once the area surrounding the blister has been prepared and swept, the blister can be cut. The author prefers using a hook-blade utility knife to cut out blisters. A sharp hook blade can be inserted into the blister at its base circumference. Then, the blade's hook portion can be used to guide the knife around the blister's base (see Photo 2).

By holding the blade almost parallel to the roof's surface and following the void around its circumference while employing a pulling pressure against the blade's hook portion, professionals can cut the voided, blistered plies easily from the adjacent, well-adhered membrane.

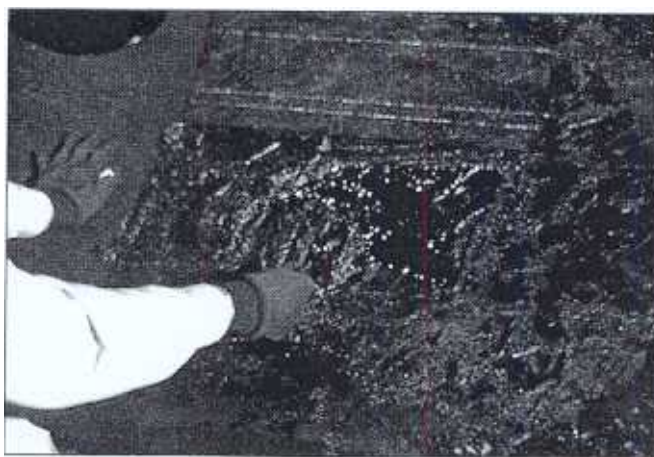


Photo 4: Troweling asphalt roof cement over the first patching ply in preparation for the larger, second patching ply.

With a straight-blade knife, it is easy to get off track and make an incomplete cut around the blister's circumference. An incomplete cut can leave unbonded material at the edge of the previously blistered location.

Then, when a patch is applied over the area, the unbonded material is trapped in a portion of the patch. In time, the interlying, unbonded material can cause a portion of the patch to begin to blister away from the underlying membrane.

For this reason, the author suggests not slicing a blister with an x-shaped cut. Usually, after an x-shaped cut is made, there are four unbonded, triangular-shaped "flaps," or tabs, left attached to the unbonded membrane (see Photo 1). Typically, the

roofing worker lifts these portions of unbonded material, applies bituminous roof cement or hot bitumen under them, and then presses them flat. It can be difficult to install the bituminous cement or hot bitumen all the way back into the far edges of the unbonded tabs. If the cement or bitumen is not

installed all the way back into the voided edges, voids are built into the repair and can result in future blisters.

3. *Prime to promote patch adhesion.* Many believe that priming the surfaces of existing bituminous membranes is critical to achieving patch adhesion; for the most part, this is true. However, successful, quality patches can be installed over certain types of asphalt BUR membranes without priming the existing membrane's surface.

When using hot asphalt as the adhesive and waterproofing for the patching plies, it is critical to prime the membrane's surface, particularly when the existing membrane is aggregate-surfaced and has been spudded. Priming also is critical for some coated, smooth-surfaced membranes—especially if an acrylic or aluminum-pigmented coating was used. With some coated surfaces, it is beneficial to scrub or use a propane-fired, weed-burner-type torch to heat and remove the coating in the location being patched.

But for most well-draining, relatively clean, cap sheet-surfaced asphalt-based membranes and hot asphalt-glazed, smooth-surfaced membranes, priming is not necessary as long as solvent-based asphalt roof cement is used to adhere the patching plies.

When primer is necessary for patch adhesion, it can be applied with a medium-nap roller. However, trying to prime small areas with a roller sometimes can be difficult—the primer tends to be applied too heavily as the tradesman tries to avoid leaving skips or holidays. However, thick primer applications can further break down already weak membranes, such as older, organic-reinforced BUR membranes. And the thicker the primer is applied, the longer it takes to dry.

Another efficient method for priming isolated locations for repair is using a weed sprayer. Primer can



Photo 5: Installing the second patching ply to repair the previously blistered location.

be sprayed relatively quickly, and, therefore, thinner, more consistent applications are possible without skips or holidays. For example, when a light film of primer is deemed best for adhesion to a clean but older membrane (e.g., cap sheet-surfaced membrane), a weed sprayer makes "haze" (light, but even) priming application possible. Haze priming often is all that is needed to prepare an existing asphalt-based membrane's surface for a patch that will be installed with solvent-based asphalt roof cement.

4. *Installation of patching plies.* After the existing membrane has been prepared and blistered plies have been removed, the patching plies can be installed. Typically, patching plies for



Photo 6: Applying the third layer of asphalt roof cement to the repair location.

a hot asphalt BUR membrane consist of Type IV fiberglass ply sheets set in solvent-based asphalt roof cement or hot asphalt (see Photo 3).

However, depending on the conditions and approximate service life

remaining in the existing roof membrane, many different types of patching materials can be used successfully.

Various types of polyester fabrics, set in solvent-based asphalt adhesive or cut-back asphalt, are useful for patching hot asphalt BUR membranes. Also, heavyweight, relatively thick pieces of SBS-modified asphalt base sheet or interply sheet (when set in roof cement) work well for filling a depressed location where

blistered plies have been cut out.

In addition, various grades of APP-modified asphalt membrane material work well for patching blisters in different situations. Using torch-grade, APP-modified bitumen material also

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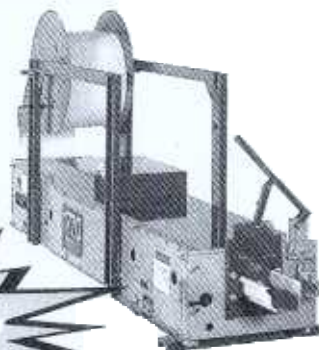
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precludes the use of primer in many situations because torching the existing membrane's surface can prepare it for patch adhesion. When using a polyester, mid-reinforced, commodity grade of APP-modified membrane material for patching, the author suggests employing two sequentially applied plies when blisters consist of more than two plies of ply sheet that have been removed from the existing membrane. This is especially important if the existing BUR membrane is relatively new, made of three or more plies and has substantially more than 10 years of service life remaining.

To further describe the basic patching process, the author will explain a typical scenario for a fiberglass-reinforced, hot asphalt BUR membrane.

In general, the number of patching plies to be installed should be the same as the number of blistered plies removed. However, if removal of the voided plies has left a significant depression in the existing membrane, it is a good idea to set at least one ply (cut to the void's shape) in roof cement to help fill the depression. Then, the actual patching plies can be installed—they should be set in hot asphalt or solvent-based asphalt roof cement so they feather out and extend further onto the prepared membrane surface with each sequentially applied larger ply.

The first patching ply should cover the previously blistered location and extend at least 6 inches (152 mm) beyond the cut-out location (see Photo 3). Then, each succeeding patching ply should extend at least 3 inches (76 mm) beyond the previous ply (see Photos 4, 5 and 6). For most isolated blister repairs, the author prefers using solvent-based asphalt adhesive or asphalt roof cement instead of hot asphalt to adhere patching plies. However, when there are numerous blisters to be repaired and the patching can be performed during warm weather, hot asphalt expedites patching.

A trowel commonly is used for

applying asphalt roof cement, but the author prefers to wear elbow-length, heavy-duty rubber gloves. An appropriately protected, gloved hand can spread greater quantities of asphalt roof cement than a hand-held trowel.

When setting patching plies, they should be rubbed in fully to promote thorough adhesion. Also, using a trowel or back edge of a straight-blade utility knife can help embed the perimeter edges of the top or uppermost patching ply. A straight-blade utility knife held at an angle can be pressed around the last patching ply's perimeter to set the sheet's outer edge down into the roof cement or bitumen, thus "sealing" the exposed perimeter of the patch.

5. *Apply or reset surfacing.* When a granule-surfaced cap sheet membrane is being repaired, the last patching ply should be a cap sheet of a similar granule color. If the existing membrane is aggregate-surfaced, the surfacing that previously was spud off the existing membrane may be re-adhered when the patching materials have set.

Smooth-surfaced existing membranes that have liquid-applied coatings should receive new coatings per the coating manufacturer's instructions. These may dictate a specific waiting or curing period for the fresh bitumen used in or on the patch to set and oxidize before applying the coating.

Reinforcing patch

When it is deemed appropriate to leave minimal blisters intact, but a reinforcing repair is in order, all the steps mentioned previously are applicable except step 2 because the membrane is not cut. Each overlying reinforcing ply installed should be rubbed in thoroughly. With isolated blisters that have integrity and are durable, a knowledgeable roofing professional can design an effective patch of overlying reinforcement to consist of the necessary ply or plies.

For example, if a four-ply,

fiberglass-reinforced, hot asphalt BUR membrane that otherwise is in good shape has an isolated blister near a low-lying area (which occasionally may hold water), a reinforcing patch over a small blister can be beneficial. Polyester is a good reinforcement to use when patching over minimal blisters because of its elongation characteristics.

For instance, if a membrane has been evaluated to have six to eight years of service life remaining, it may be prudent to reinforce the blister with two plies of polyester fabric set in solvent-based asphalt adhesive. As the two plies are installed and the second is extended beyond the first, two separate tie-offs are obtained. Now this blister is reinforced with a patch capable of some elongation that will accommodate the blister's thermal cycling and ensure the minor blistered location will last as long as the surrounding membrane.

Effective inspections

Effectively conducted, periodic inspections by experienced professionals can prolong the life of low-slope membrane roof assemblies when the correct maintenance and repair procedures are prescribed at the appropriate times.

During the inspections, deficient locations, such as blisters, should be examined for possible repair. If the blistered membrane's integrity indicates that the blister need not be repaired, it should be marked and outlined for future monitoring.

If the inspection indicates that repairs might be needed, a close examination is recommended so the appropriate repair can be prescribed. Some blisters should be cut out completely, and the appropriate type and number of repair plies installed to patch the cut membrane. Other blisters, with reasonable integrity in the membrane, can be repaired effectively with a simple reinforcing patch. **[PR]**

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