

BITUMINOUS LOW-SLOPE ROOF REPAIR:

FIXING THE **BIGGEST** HEADACHES

By Dan White

After the business decisions have been made and the wet insulation and deteriorated deck have been identified, the real challenge of a comprehensive roof restoration—the job of finding and repairing the leaks—can begin.

The following is a guide. Many roof repair methods that have been developed over the centuries. Below is a collection of the most successful techniques and details developed by manufacturers, contractors, and roof design professionals. Here we have focused on the trouble areas—those problems that keep one up at night:

- Insulation and membranes
- Parapet walls and adjoining steep roofs
- Base flashing
- HVAC flashing
- Pitch pans
- Pipe and structural penetrations
- Splits
- Asphalt coating options

(General note: Before applying asphalt-based repair products at any stage, always prime metal and asphaltic surfaces with ASTM D-41 asphalt primer.)

SPOT INSULATION AND MEMBRANE REPLACEMENT

Often, portions of the roof will need to be replaced. Somewhere, a leak is causing wet insulation and rusted decking. Typically, the split allowing the water in will be removed with the rest of the roof membrane and insulation.

Checklist:

1. Install a new membrane at least as strong as the one being removed. One ply of glass mesh does not equal a 4-ply BUR with a 250-gram polyester cap sheet mopped on top.
2. Use like materials to reroof. If the original membrane was a 4-ply BUR, replace it with a 4-ply BUR. It doesn't have to go in hot; a cold modified adhesive may be used, but make sure the tensile strengths and thicknesses are about the same.
3. Feather, feather, and feather in the plies. Start small and work out in increments of four to six inches. Feathering plies is often ignored, but

it provides the insurance needed to seal the new membrane to the old.

4. If using a cold-applied adhesive, use a solid, self-adhered base ply for the first layer to reduce the opportunity for drippage and fumes in the building.

PARAPET WALLS AND ADJOINING STEEP ROOFS

The most common wall materials are:

- Concrete block
- Brick
- Stone
- Cast-in-place concrete
- Precast concrete/tilt wall
- Metal panels
- Shingles



Split in base flashing on concrete block parapet wall.



Three-course base flashing below a stucco parapet wall.

- Stucco
- EIFS

They all have a propensity to leak and are not considered part of the roof membrane, yet the consultant will be called if there is water entering the building at any point above the floor level.

Checklist:

1. Through-wall flashing should be required for all masonry walls: block, brick, and stone. Coated copper has a long and proven field history. Polyester-reinforced bituminous membranes have also been popular. The client will typically not want to pay to restore the adjoining masonry walls, so the designer should write the spec with the through-wall flashing and let the owner be the one to reject this portion of the project. The consultant/designer will have done his/her job of educating the building owner and the contractor as to the importance of properly flashed parapet walls. Now, the designer should help the contractor eliminate wall-related leaks from his warranty responsibility. A surface-mounted flashing on a brick wall will not stop water from migrating behind the sealant. Masonry is porous and should be expected to develop hair-

line cracks. Even exotic sealers applied to the surface will not take the place of a well-designed and properly installed through-wall flashing system.

2. An alternative to a through-wall detail is a saw cut in masonry walls. This is still not a warrantable detail, but a 1-inch groove cut in the mortar joint will slow the flow of surface

water. It will not stop water from leaking through the masonry higher up the wall. If there is a question of where the water is coming in, then water test before any work is done. Even better, charge for water testing before writing the specification.

3. Cast-in-place concrete and tilt walls can be detailed with a cut joint. Most solid concrete walls built in new construction today end up with a surface mount. Even if a cut joint is written in the specification, it will probably be value-engineered away.
4. Metal panels, stucco, EIFS, and shingles must have a flashing that turns up behind the wall finish. If there is not a functioning metal wall flashing, then wall material will need to be cut away, a new metal counter flashing installed, and then new wall material reinstalled over the new metal counter flashing.
5. An adjoining steep-slope roof follows the same principle. Remove the bottom 1 to 3 feet of steep-roof material, flash a minimum of 6 inches onto the low-slope portion and a minimum of 12 inches up the steep-slope portion (2 to 3 feet in cold regions with snow and ice).

BASE FLASHING

Base flashings fail from splits at the bottom or top of the fiber cant and cracks in



Note the wide spudded area at the base of this roof divider.



Splits at an expansion joint. Wall movement was not helped by the expansion-joint cover.

the wrinkles formed from differential deck and wall movement. Punctures are caused by roof traffic, falling ice, dropped tools, and window washers. Slippage from inadequate fastening is another area to look for during the initial inspection.

Checklist:

1. Keep bituminous base flashing between 8-inch and 24-inch heights. Slippage and resultant wrinkling are some of the biggest problems with base flashings. Use materials better suited to vertical applications for heights over 24 inches.
2. For base flashing in good condition, a three-course application with an SBS flashing cement, Neoprene, or urethane material will be adequate. Reinforce with fiberglass or polyester.
3. If there are obvious splits and cracks big enough to stick a pen in, then they may need to be cut out and replaced with a new base- and modified-flashing material. Fasten the top edges 1 inch down from the top of the flashing, 8 inches to 12

inches on center, using a term bar. Use only an SBS-modified flashing cement to apply the modified sheets. High-solvent-based Neoprene is great for surface applications but should never be used as an adhesive between asphalt-based plies.

4. Asphalt-based cements have been a standard for flashing coal-tar BUR membranes, since coal tar's low softening point makes it a poor choice for vertical flashing applications.
5. West-coast base flashings use emulsion-based coatings in combination with light polyester reinforcements, since the thermal shock is much less and a large percentage of the in-place inventory is granule-surfaced cap sheet.
6. Gravel surfaces must be spudded smooth using a combination of machine and hand spudding. This is the hardest skill to find among contractors. Most contractors specializing in bituminous repairs should have a crew that knows the basics of

spudding. Spud the surface early in the morning or even at night when noise is not a factor. Scheduling repair work in the winter months makes surface prep much easier.

HVAC FLASHING

Air conditioning units on the roof are tied with parapet walls as a source of non-membrane roof leaks. For this reason, the specifier should pay special attention to their flashing design. The rooftop units leak, the ductwork leaks, the curbs leak, the supply lines leak, the pitch pans around the wood dunnage leak, and the steel legs that support the larger units leak.

Checklist:

1. For units sitting on curbs, lift the units and reflash the curb. For units sitting on wood, lift the unit enough to recoat under the unit, set new walk-pad strips in flashing cement, and then set new wood dunnage on top of the walk-pad strips.
2. Flash the base curb and counter-flash with a thin, self-adhered sheet.



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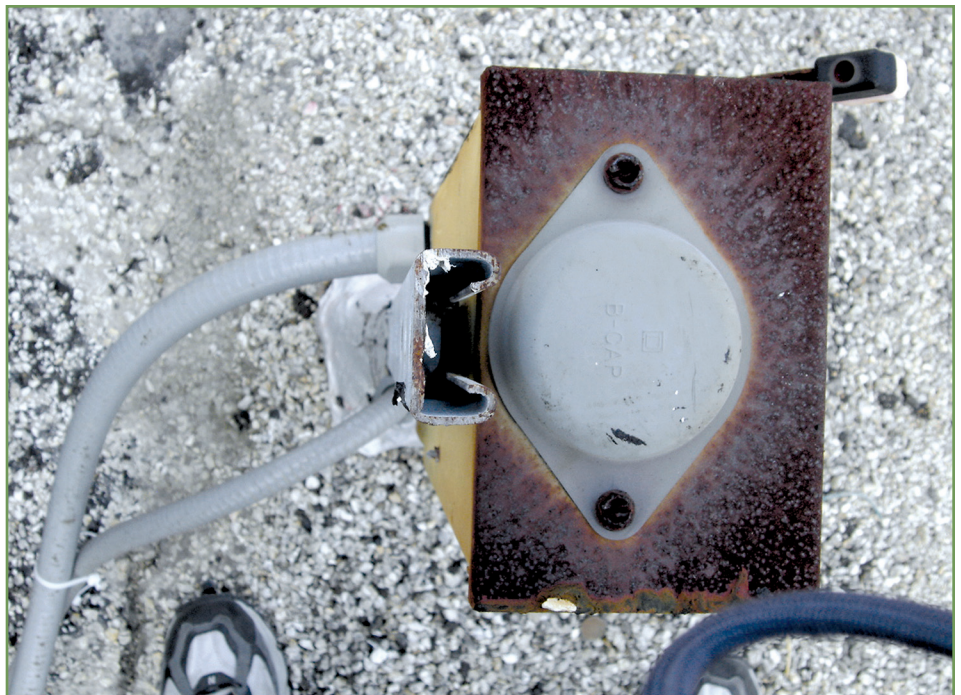
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Metal counterflashing over base flashing repair.

3. If there is enough room left, install metal counterflashing and fasten 8 inches on center.
4. Pitch pans: See section on pitch pans below.
5. Steel support legs: See section on pipe penetrations below.
6. Seal the seams of all ductwork and recoat with an aluminum roof coating to match aluminum-coated base flashing. Water-based coatings may be appropriate for ductwork, and white or grey water-based mastics used to repair metal roofing are ideal for duct repair. If the duct is badly rusted, include replacement in the restoration bid as an extra.
7. Abandoned units need to be taken off the roof and all penetrations roofed over.
8. Install new walk pads around units with regular repair traffic.



Uni-strut support is very difficult to seal.

PITCH PANS

Pitch pans around existing pipe penetrations are very complex. Quality of design can range from galvanized steel filled with plastic cement to a new stainless-steel pitch pan filled with a pitch-pan sealant and then covered with a stainless cap or umbrella. UNI-strut-style supports are very difficult to seal with any type of pitch-pan filler and should be replaced with a solid support of some type—either pipe or angle. Conduit and pipe connections can be a source of leaks and ideally should be designed to enter a box from the side and should be sealed at the pitch-pan level.

Checklist:

1. Clean pipes before filling pitch pans.
 2. If replacing existing pitch pans with new ones, prep existing membrane by spudding (if gravel) or wire brushing (if granule-surfaced cap sheet).
 3. Prime metal base with an ASTM D-41 asphalt primer and let dry.
 4. Mechanically fasten larger pitch pans to wood nailers or to the structural deck to eliminate movement.
 5. Check with the manufacturer of the
- pitch pan filling material and follow its guidelines.
 6. Most asphaltic pitch-pan systems should have the pitch pan sealed with mastic at the membrane level. Then apply a cementitious, quick-set cement, leaving no more than an inch to fill with the cement, Neoprene, or hot asphalt. Pipes can also be sealed with expanding foam to prevent drippage into the building.
 7. Urethane pitch-pan filling systems have widely varying application requirements. Follow the manufacturer's directions to the letter, since the products are generally fast-setting.
 8. It is a good idea to



Challenging multiple pipe pitch-pan detail.

Not your garden variety green roof

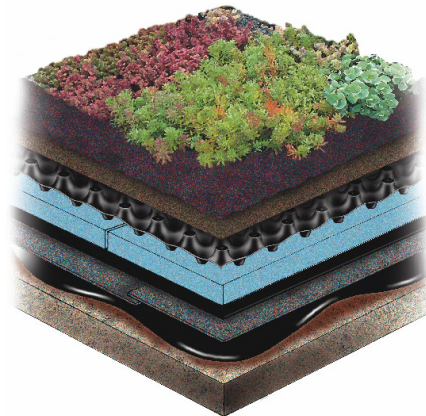


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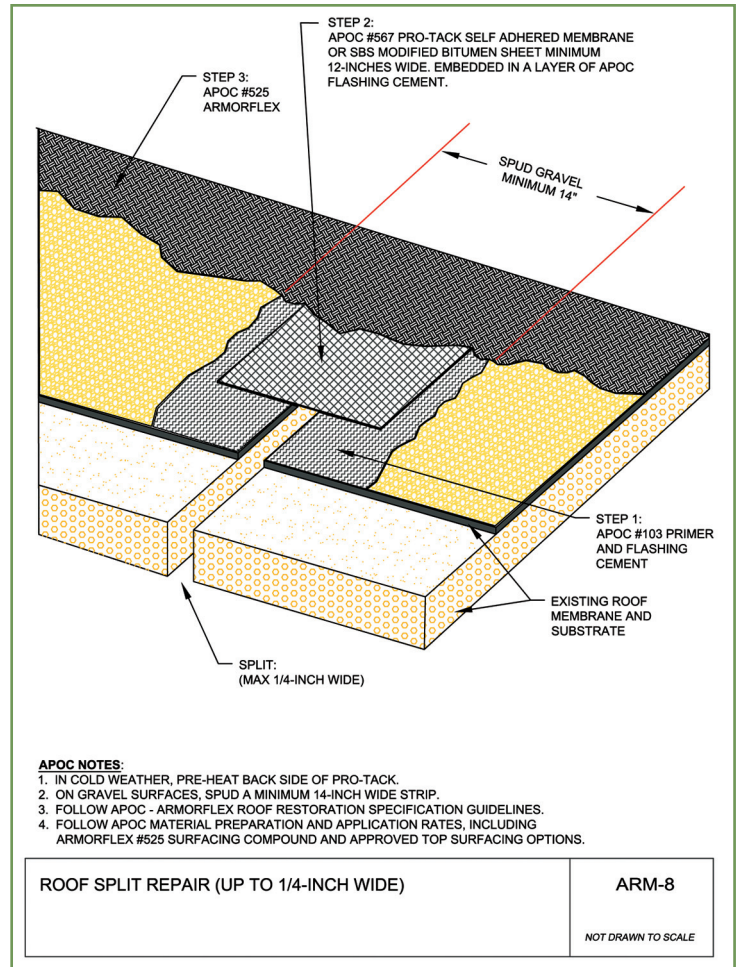
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Exposed split at insulation joint.



Split repair detail.

add slope to the top of a pitch pan with a mastic version of the original self-leveling fill material.

PIPE AND STRUCTURAL PENETRATIONS WITHOUT PITCH PANS

Vent pipes are typically flashed with metal boots. There are a number of polymer-based flashing systems on the market that use polyester to reinforce the base of the pipe. Modified sheet manufacturers have been flashing individual pipes for decades using only torched or hot-applied APP or SBS sheets.

Checklist:

1. Clean the roof surface at the base of the penetration; spud if gravel-surfaced, and wire brush if granule-surfaced.
2. Remove rust and corrosion on the pipe or structural member, and prime with appropriate primer. Check with the manufacturer of the flashing system.
3. Seal pipes at the roof membrane level with expanding foam, quick-set

- concrete, or fast-setting mastic to stop drippage of sealant into the building.
4. Seal penetration with a modified-SBS flashing cement, Neoprene mastic, or urethane flashing system.
5. Optional: add pre-formed or custom metal collars and seal to pipe.

SPLIT REPAIR

This is the most neglected aspect of bituminous roof restoration. Coatings will not fix splits. They will temporarily slow the flow until the split fatigues the unreinforced coating after a matter of months and the leaks start all over again. This is where the consultant can set himself apart from his competition. Become an expert at locating the source of the leak.

- If gravel-surfaced, spud either side of split by hand or machine.
- Prime with asphalt primer; let dry.
- Apply rubber-modified flashing cement.
- Reinforce with one or more polyester reinforcing plies of a minimum of 3-oz weight.

- Optional: Set an SBS-modified sheet in SBS flashing cement (minimum 5-oz weight of polyester).

ASPHALTIC ROOF COATING

A roof coating is not a roof membrane. It is a sacrificial surface layer that adds life to the membrane below. It can also be an energy-saving device if reflectivity is over 50 percent. It can enhance the appearance of a building, since roof coatings come in a wide variety of surface textures and colors.

Permanent logos can be created with different-colored gravel, ceramic granules, and colored coatings.

Checklist:

1. Work with a material manufacturer when selecting a coating. The manufacturer will verify that the restoration system is compatible with the existing roof.
2. Repair materials should be compatible with the coating to be applied. For coal-tar built-up roofs, use a coal-tar-based coating. For asphalt-based built-up roofs, use an



Application of a highly modified bituminous roof coating.

asphalt-based coating.

3. **Weight:** Calculate existing system vs. the design load. A roof with two layers already in place, ponding water, added HVAC units, and materials stored on the roof shouldn't have a gravel surface or pavers installed.
4. **Energy-saving requirements:** California and other states and municipalities require a wide variety of energy-saving modifications, including reflective white roof surfaces.
5. **Warranty:** Educate the building owner so that he or she relies on good design and engineering of the roof rather than the simplistic comparison of warranty duration. Warranties don't keep water out of a building; good repairs do.
6. Coastal locations ideally should have a granule surface or a reflective roof coating applied rather than loose gravel. Hurricane-prone locations are already removing loose gravel and recoating with aluminum coating or granules embedded in the roof coating.
7. Consider the region where the project is located. Emulsion-based systems are popular in the desert Southwest, and solvent-based systems are typically used in rainy or cold regions. Time of year is also critical; temperature, wind, rain, humidity, and dust are all factors that need to be considered and that vary seasonally.
8. Work with contractors who have experience with restorations. A crew

???

BUILDING ENVELOPE KNOWLEDGE ASSESSMENT

Test your knowledge of slate roofing with the following questions developed by Donald E. Bush Sr., RRC, FRCI, PE, chairman of RCI's RRC Examination Development Subcommittee.

1. **Water filling an insulation material's interstices generally replaces air. How much greater is the thermal conductivity of water at above-freezing temperatures when compared to air?**
2. **How much greater is the thermal conductivity of water at subfreezing when compared to the thermal conductivity of air?**
3. **Besides reducing energy costs, insulation also enhances building occupants' comfort. What other three benefits does roof insulation provide?**
4. **What are four basic methods used to limit moisture within a roof assembly?**
5. **Where should a vapor retarder be installed in a roof assembly when a metal roof deck is utilized?**

Answers on page 20

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BUILDING ENVELOPE KNOWLEDGE ASSESSMENT

Answers to questions from page 19:

1. More than 20 times that of air.
2. Nearly 100 times that of air.
3. A. It can prevent condensation on interior surfaces.
B. It furnishes an acceptable substrate for the membrane over steel decks.
C. It stabilizes deck components by reducing their temperature variations and consequent expansion and contraction.
4. A. General ventilation designed to carry interior moisture out on air drafts circulating through a space left under the roof.
B. Vapor retarders, designed as low permeability membranes blocking the passage of water vapor into the roofing systems.
C. The self-drying concept, which relies on heat energy supplied by the spring and summer sun to evaporate winter's accumulated moisture and drive it through the vapor-permeable deck into the building interior.
D. Seal against air leakage.
5. It should be placed on top of a thin layer of insulation (usually 3/4-in perlite) or 1/2-in gypsum board mechanically fastened to the deck. Metal fasteners should not be driven through a vapor retarder.

Reference: *Manual of Low Slope Roof Systems (4th Edition)*



Fully restored roof-pitch pan, power vent, HVAC, skylight, and roof divider.


- trained in the use of a spudding machine is essential for gravel-surface restorations. If the contractor doesn't have a spud bar, he probably isn't a good choice for a gravel-surfaced restoration. Spray experience is necessary if a spray application is selected, and familiarity with the system chosen is also helpful. The system manufacturer can generally provide names of the best contractors in a given area.
9. Don't be afraid to bring in other experts such as structural engineers, HVAC contractors, and industrial hygienists for asbestos questions and fastener representatives to provide pull tests on decks.
 10. Historical restoration is an art. An architect specializing in historic restoration can be brought in to help with flashing designs and adjoining materials that are not considered part of the roof system, such as 200-

year-old columns that cannot be drilled or marred.

CONCLUSION

It is recommended by most manufacturers that a protective coat (either aluminum or white) be applied to the bituminous coating system to reduce surface temperatures, save energy, and add years of life to the roof membranes.

New products are being introduced to the market every year. Try them, test them, and use only those that have been proven to perform.

Put engineering before warranty, proven products over the latest fads, and let the building owner be the one to value-engineer the consultant's quality designs. 

Dan White

Dan White is technical product manager for APOC, a division of Gardner-Gibson. He has over 27 years of experience in the commercial roofing industry, restoring roofs as a contractor, consultant, and manufacturer's representative.

