What Home Inspectors Need to Know About SLATE ROOFS

Joseph Jenkins

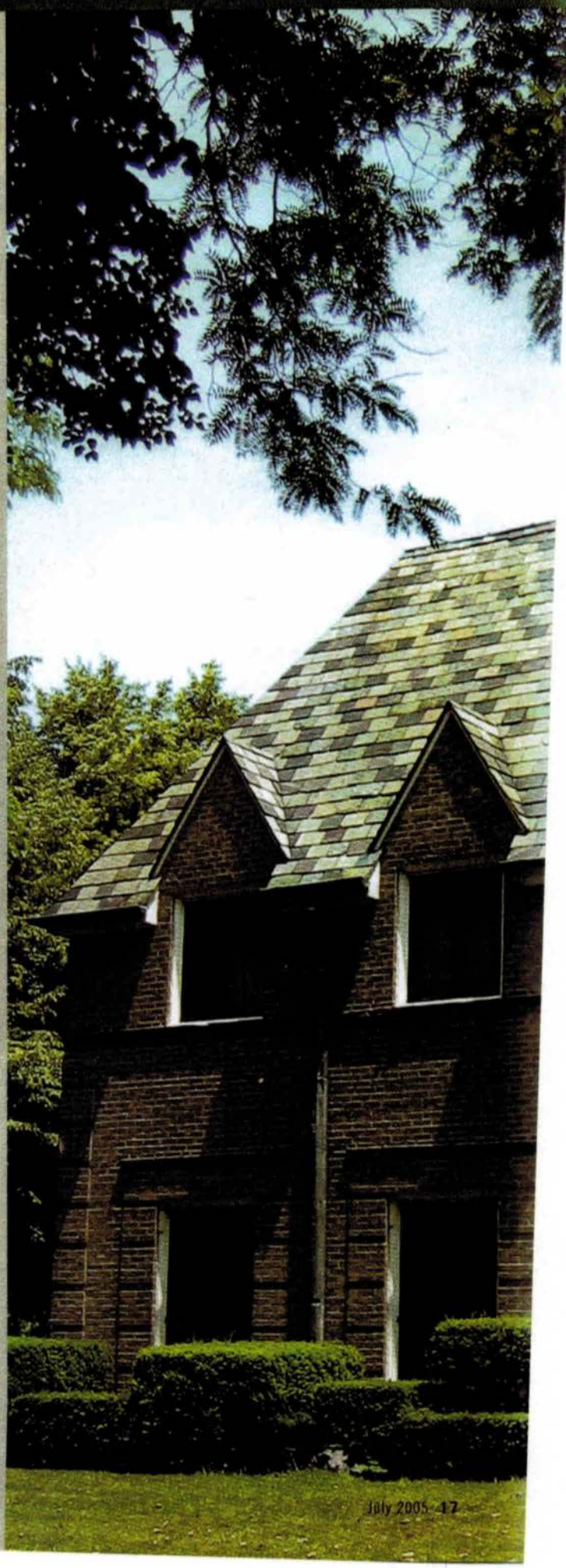
Although most home inspectors will work their entire career without ever inspecting a slate roof, those who are called on to do so have an opportunity to help protect and preserve one of our nation's most overlooked architectural treasures. Many existing slate roofs in the United States are more than a century old, and may continue to function well for another century.

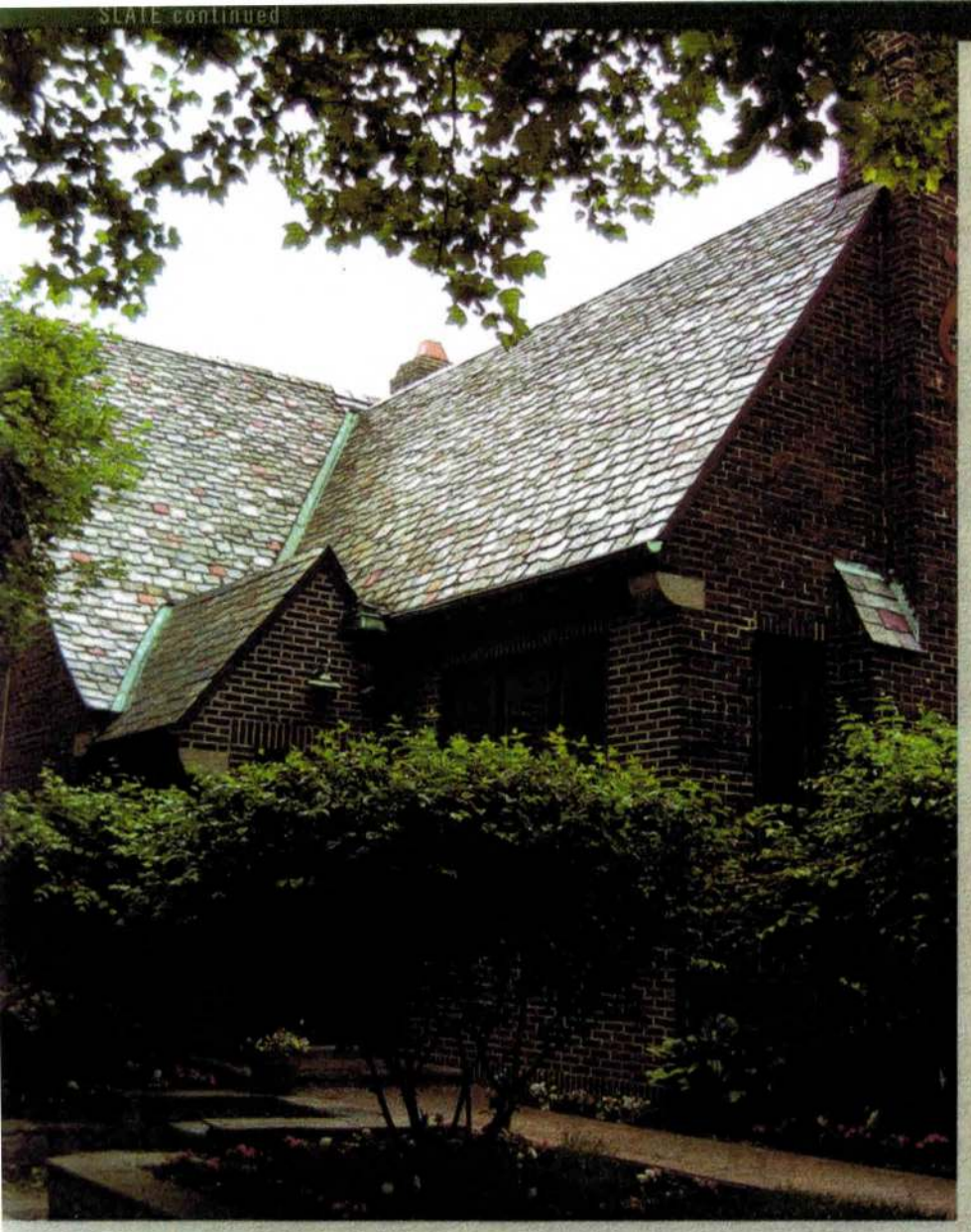
With a basic understanding of this highly specialized roofing system that dates back hundreds of years, home inspectors can provide their customers with information on the current condition of a slate roof, its life expectancy and, if necessary, the potential for restoration.

A standard slate roof installation is a model of simplicity. It is comprised of thin, flat, usually rectangular slabs of stone overlapping in such a manner as to be water tight and to stay water tight for a century or two. The stones, or slates, are fastened to a wood roof deck with nails. Those three components: stone, wood and fasteners, are all that are needed for a successful slate roof system that will keep a structure dry for centuries.

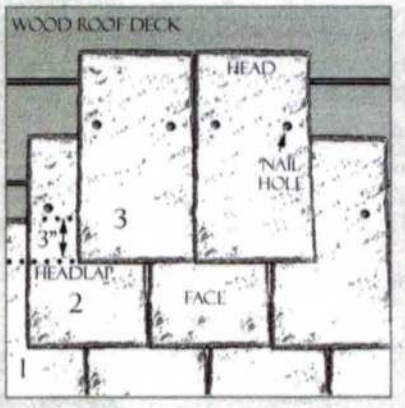
There are many variations of slating styles: side-lapped slate, graduated slate, diamond pattern, random widths, staggered butts, but the "standard pattern" was used for the majority of slate roofs in the United States. ▸▸▸

Editor's note: This article presents an overview of a complex subject and is not intended to prepare someone to inspect slate roofs. Just as differences exist between slate quarried in different regions, one finds regional differences in techniques used to install and repair slate roofs. Readers with questions about materials, techniques or a specific slate roof are invited to post queries at www.slateroofcentral.com.





In a standard slating pattern, each slate is the same length and width (although shapes may vary). Each slate is fastened to the roof with two nails along a chalk line that marks the top edge of the slate course, and each slate overlaps two courses below it. The standard headlap is three inches, but it can range from two to four inches. Without this headlap, the roof would leak like a sieve. Less headlap can lead to leakage, depending on the slope of the roof, however, two-inch headlap is not uncommon on older roofs with adequate slope *(see illustration at right)*.



Standard slate installation pattern, showing overlap, headlap, placement of nail holes, "face" and "head" of the slate. Course #3 overlaps course #1 by three inches. This is called the "headlap."

What goes wrong with slate roofs?

Typically, problems with a slate roof can be traced to one of four factors.

- All slate is stone, but not all slate is the same.
- Flashings fail.
- People walking on slate roofs damage them.
- Bad workmanship plagues many.

All slate is stone, but not all slate is the same

Slate is wrestled from the earth in heavy slabs and worked into individual shingles largely by hand. The fact that slate roofs are rock roofs is the main reason why they last so long. Nevertheless, stone is a natural material and may have invisible fractures or other imperfections that can cause slates to eventually break and come off the roof.

Some slate varieties are softer than others and do not last as long as the harder (S1) types. Softer S2 or S3 slates become flaky and crumbly when they reach the end of their effective lives, which could be as soon as 55 years, but more likely around 80-100 years. These "soft slate" roofs cannot be saved or restored, but can be replaced with new or salvaged slates. Harder slates, such as most Vermont, Peach Bottom, Buckingham or Monson slates, could conceivably last centuries on a properly maintained roof.

It is imperative that people who own, inspect or work on slate roofs are able to identify the slate on the roof in question, its type, origin, longevity, characteristics and qualities. If it can't be identified by sight, a slate sample or photo can be sent to someone who knows slate. Presently, in the U.S., roofing slate is still being quarried in Virginia, Pennsylvania, New York and Vermont. A century ago, there were hundreds more slate quarries than there are today, including in Maine and Georgia. The differences in appearance and quality between the slates from the

various quarry areas are sometimes striking, so knowledge of the history of slate quarries is useful for people who work with traditional slate roofs. Older homes in the U.S. are likely to have one or more of the following types of slate on them:

- Vermont "sea green," unfading green, mottled green and purple, gray/black, purple;
- New York red;
- Pennsylvania Bangor black, Chapman black, various other black slates from the Lehigh-Northampton slate region;
- Pennsylvania/Maryland Peach Bottom black;
- Georgia gray/black;
- Maine black; and
- Virginia black slate.

When flashings fail

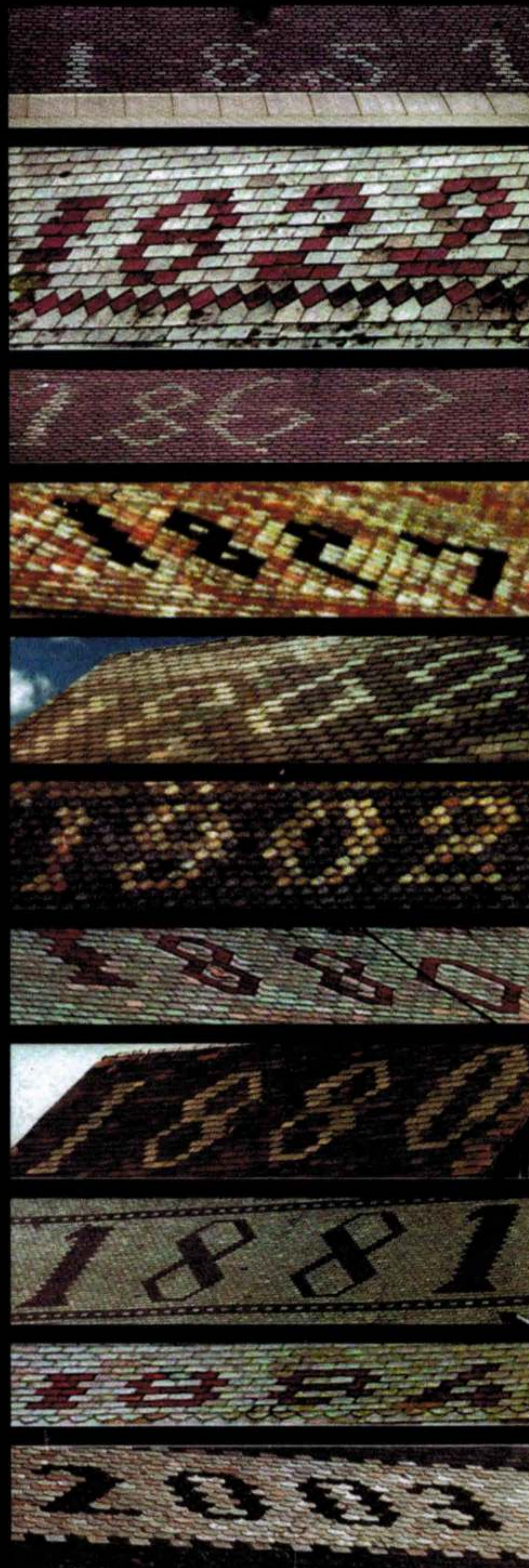
Even if a roof is made of long-lasting slate, the metal flashings can wear out and leak before the slate wears out. Flashings are sheet metal joints installed between the various planes of a roof to prevent water entry, such as in the valleys, along dormer walls and around roof penetrations such as chimneys. Older flashings are often made from terne-▶▶▶

Photos

Opposite page and preceding pages:* *Homes with slates roofs in Chicago.

Below:* *A new slate roof installed by the author is made with a variety of new and salvaged slates, clearly illustrating the striking contrasts in color and shade between common types of roofing slate. What you can't see is the longevity of each type of slate. Half of the slates on that roof are already 100 years old. The other half are new. It is likely this roof will last a century—well into 2100.* *Photo courtesy of the author.

Right:* *Dates inscribed on existing house and barn slate roofs. These are roofs that are still functioning well, some after 150 years or more. The 2003 date was installed by the author.* *Photos courtesy of the author except 1822 roof, courtesy of Steve Taran, Jr.



coated steel, which is steel coated with a lead/tin combination, also erroneously (but commonly) called "tin." Terne-coated steel must be painted regularly to avoid corrosion. Copper flashings (either plain copper or lead-coated) were used primarily on institutions and upscale residences; sometimes, sheet lead flashings were used on older buildings, especially around plumbing vent pipes. The "tin" flashings can last 90 years or longer if kept painted. Copper flashings, ironically, because they are typically not painted, will begin to corrode, pit and leak in about 60 to 70 years in areas of high wear, such as valleys. For this reason, older copper flashings should be painted in order to extend their effective lives.

When flashings begin to fail on a slate roof made of sound, hard slates, only the flashings should be replaced, not the entire roof. This is routine work for slate roof restoration professionals.

When repairing or restoring a slate roof, individual slates are removed from the roof in order to expose the existing flashings, which can then be removed and replaced. The removed slates are put back in their original positions, and the repaired roof will look much the same as it did before the repair, except with new flashings. The sign of a good repair is one that is invisible to the layperson.

Box gutter linings, or "built-in" gutters, are another common problem on old slate roofs because the metal deteriorates and leaks. They, like valleys and any other flashings, can be replaced without removing and replacing the entire roof.

People don't realize that walking on slate roofs damages them

Experienced slaters work on slate roofs using hook ladders, which keep their weight off the slate while allowing them to safely cling to a safe work platform. It is not proper to work on slate roofs by using ropes. Walking on a slate roof will definitely crack slates, which can later, after a freeze/thaw cycle or other environmental pressure, break apart. Today, when inexperienced roofers install new slate roofs, dozens and even hundreds of slates can break off the roof within five years due to careless foot traffic during the installation. Fortunately, broken slates can routinely be replaced; however, this should not be necessary.

Bad workmanship plagues many a slate roof

One of the most serious problems facing older slate roofs today, and a cause of many leaks, is not natural attrition, flashing failures, broken slates or global slate failures. It is, put plainly, bad work. There are many unqualified persons attempting to repair slate roofs. In the author's own slate roof restoration business, fully half of the work done involves the removal and replacement of faulty repair work. Slate roof owners pay good money to have their roofs abused, then they have to pay more good money to have them repaired correctly. Abused roofs include the ones that are walked on by installers, the ones that are face-nailed, tarred, repaired with non-matching slates, coated, or reflashed incorrectly (*see photo below*).

It is improper to tar or coat the surfaces of slate roofs, or to use surface tar for repairs. Not only is this unsightly, but it doesn't stop leaks permanently, and it ruins the slates. Applying coatings to slate roofs creates problems that cannot be easily reversed.

Furthermore, roofing contractors who have little or no expertise in slate roofs will advise a roof owner to replace a slate roof that may have many decades of life still remaining. A roof owner will listen to bad advice when it is the only advice that can be found. All these factors combined can make a roof owner, in frustration, want to forever remove her slate roof no matter how much longer it will last if properly repaired.

There is no need for roofing contractors, home inspectors or homeowners to remain uninformed about slate roofs. The Internet offers how-to information, message boards, source lists, contractors, consulting services, organizations, books and periodicals. Furthermore, in recent years, several trade organizations have sprung up, such as the ▸▸▸

Photos: Bad repairs can be found on almost any old slate roof. Some constitute "hidden leaks," such as #1 below, where a nail has been driven into the top of the slot, caulked, then the caulk has worn off leaving an almost invisible hole in the roof. A bib flashing would have prevented this problem and will still solve the problem if inserted at this time. #2 illustrates the same problem, this time with roof cement rather than caulk. #3 shows "face nails" that have been tarred over — these are guaranteed leaks. #4 illustrates two obvious errors: wrong type of replacement slate and exposed roof cement. #5 is another example of a multiple error — face nails, wrong type of slate and wrong shape of slate. All of the above can be removed and the roof properly repaired.

Photos courtesy of the author.

The general rule is, "If the slate is still good, the roof should be repaired or restored."

National Slate Association (slateassociation.org) and the Slate Roofing Contractors Association of North America (slateroofers.org)

The extraordinary life expectancy of slate

One of the extraordinary characteristics of slate roofs is that they can be taken apart and put back together. Broken slates, worn flashings, rotted sheathing boards, or any element of the roof can be removed and replaced without the need to replace the entire roof. Because of this unusual maintenance characteristic, slate roofs can be made to last as long as the slate itself will last.

The first photo on the right shows a bell tower on a church that has been poorly repaired with roof cement, unfortunately a common sight on old slate roofs. The second photo on the right shows how a mess like that can be cleaned up and restored with new copper in one day by a professional slater and helper. The photo at the bottom illustrates a similar situation—valleys that were tarred repeatedly until the roof looked beyond hope (and, of course, still leaked). Nevertheless, one day's work by a professional slater, working alone, cleaned up the roof, giving it an almost miraculous new lease on life. Such is the art of slate roof restoration.

A lay person or a home inspector may look at either of the situations shown in these photos and be immediately convinced that the roof is shot and must be replaced. When a slate roof professional looks at the tarred mess, he sees a common sight that can be routinely repaired because he understands that any part of a slate roof can be removed, repaired or replaced.

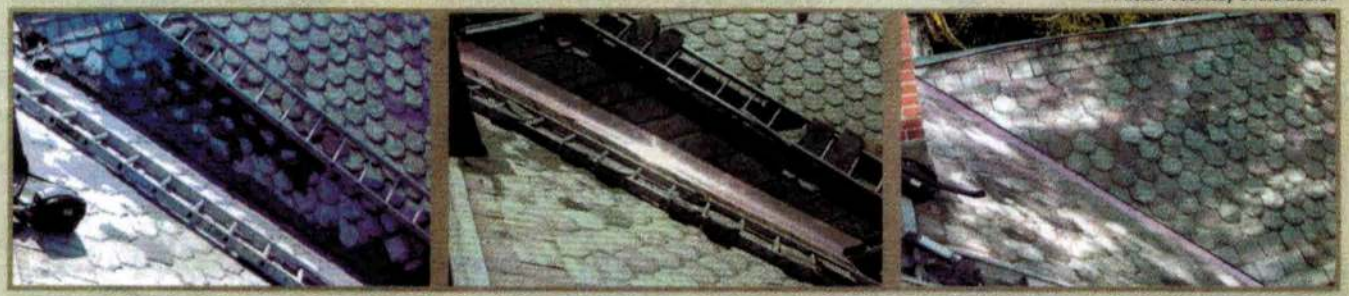
The general rule is, "If the slate is still good, the roof should be repaired or restored." The slate is still good if the exposed surface is smooth, free of pervasive delamination, flaking or other signs of obvious deterioration, no matter how old. If in doubt about the quality of the slate, get an expert opinion, or go to slateroofcentral.com and post a query on the public message board.

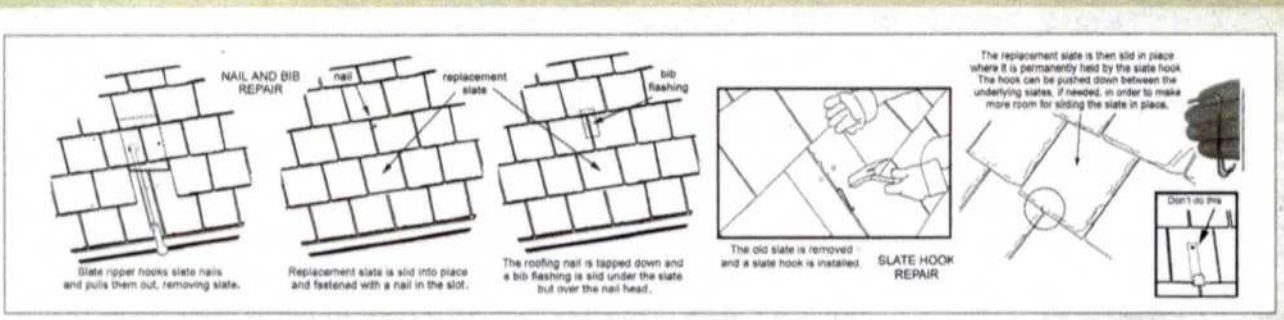
When slates are broken or missing

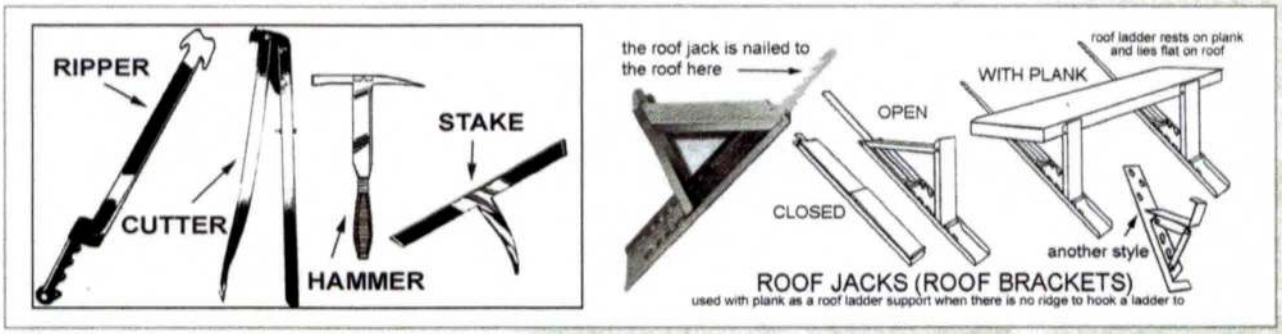
It is not uncommon for a century-old slate roof to have 50 or more slates fail from simple attrition. Slate is a natural stone and some may contain faults or hairline cracks and may eventually break here and there on the roof. A typical 20 square roof (2,000 square feet), with a typical 10"x 20" slate, will have about 3,400 slates. If 50 of them fail after a century, then the failure rate of the roof is 1.5 percent over 100 years— or a 98.5 percent success rate over a century. Yet, one missing slate is all it takes to create a leak. Fortunately, the repair is simple when done by a professional slater.

Faulty slates are removed and replaced with slates as close as possible to the same size, shape and color as the originals. Replacement slates must never be fastened in place with visible straps or exposed nails (known as "face-nails"). There are two generally accepted methods of ▸▸▸

Photos courtesy of the author







fastening replacement slates into place: the nail and bib method or the slate hook (*see illustration above, top*).

The nail and bib method is perhaps the most widely used. The broken slate is removed with a slate ripper; the replacement slate is anchored with a nail in the slot between the overlying slates, then a "bib" flashing is slid under the overlying slates and over the nail head. Often bent slightly to fit in place by friction, the bib can be composed of aluminum, copper, or other non-corrodible metal, but stainless steel or other shiny and reflective metals that would be visible from the ground on a sunny day should not be used. Copper or brown-painted aluminum (coilstock) blends nicely into the roof.

A slate hook is a hard wire hook made of galvanized steel, copper or stainless steel, approximately three inches long. A small exposed loop hooks the replacement slate in place. This is one instance when an exposed repair device is acceptable because the tiny hook is almost invisible from the ground. Stainless steel hooks are stronger than copper hooks. Slate hooks are preferable to the nail and bib on new slate roofs, especially for repairs in the field of the roof.

Using straphangers to repair the roof should be avoided; they're unsightly and they deface the roof.

The tool required for removing slates from a roof is the slate ripper—a sword-like object that slides up under the slate and yanks out the two nails that hold it in place. You never want to cut the nail because the piece of nail left under the slate will interfere with sliding the replacement slate into place.

A slate hammer, another important slate roofing tool, has a hole punch at one end used to punch nail holes in slates. New slates can be hard and brittle and require some practice for easy punching with a slate hammer. Standard thickness slates (3/16" to 1/4") are readily cut with a simple hand-held device, a slate cutter *(see illustration above)*.

Myths, rumors, misconceptions

Misconceptions about slate roofs are common, frequently related to nail failure, the purpose of felt, and differences between natural and fake slates.

Know your nails

Nails are often said to be the cause of slate roof failure. Nails will corrode on an older slate roof, but this is most likely under two general conditions: 1) the nails were of poor quality when initially installed, and/or 2) the slate has reached the end of its life and moisture is now penetrating the roof, thereby corroding the nails.

Originally, in Wales, slate roofs were installed with wooden pegs driven through a hole in the top center of the slate. The slate/peg combination was then hung over a horizontal lath on the roof—no nails were used. The weight of the slates overlapping each other held the roofing in place.

In the U.S., field slates are nailed in place with two nails situated about a third of the way down from the top of the slate, along the outside edges. The slates are nailed into the roof boards, also called roof "sheathing" or "decking," which is often one-inch thick lumber. Slate can also be nailed into horizontal wooden strips called "slating lath" or "battens," usually 1x2 or 1x3 inch lumber. Lath roofs are common in Wales, England and Europe, so immigrants from those countries often copied their traditional styles of slate installation once they arrived here in the U.S. Traditional Scottish roofs use solid boarding, as is more common in the U.S.

Most of the older slate roofs in America are nailed with hot-dipped galvanized roofing nails, although many institutional and upscale residential roofs are nailed with copper slating nails. Some older slate roofs are nailed with square-cut iron nails. The author has seen many a hot-dipped or cut-steel nail that has ▶▶▶

been on a slate roof for 100 years and is still in quite serviceable condition. The exceptions are as mentioned above: poor nails to begin with (not hot-dipped or copper), or a roof on its last legs due to slate deterioration.

It should be added that slates are not nailed tightly to the roof. They are loosely nailed to the roof deck, or some say "hung" on the roof. This is to prevent strain by the nails against the slates themselves and to prevent damage to the slates when hammering them in place.

Felt is temporary

The need for felt underlayment on slate roofs is a myth. The most common underlayment on older slate roofs is a single layer of 30-pound felt. It is used to prevent the roof from leaking during installation. Once the slate is installed, if you could magically yank the felt paper out from under it, it wouldn't make any difference—the felt is a temporary covering and is severely punctured and obsolete once the slates are in place. After about 75 years, the felt deteriorates almost to a powder underneath the slates. This is not a cause for concern. Many slate roofs in the U.S. have been installed with no felt underlayment whatsoever and they do not leak. This is true for virtually all barn roofs, where leaking during installation was not a concern so no felt was used when the roof was installed. These roofs do not leak. The felt underlayment is only essential during installation on a structure where rainwater can damage the interior. Telling someone to replace a roof because the felt is worn out is bad advice.

Identifying fakes

Fake "slates" should be avoided. They do not function like natural stone and will not have the longevity, although they can still be as pricey as natural slate. How can you tell the difference? It's obvious to slate professionals, but to an untrained eye, some fake slate may look like the real thing from a distance. However, no two natural slates are exactly alike. Manufactured artificial substitutes, on the other hand, will show a lot of uniformity from piece to piece.

Protect and preserve

Just because a roof is old doesn't mean its time is up. Slate roofs are unique in this sense. Even though an American slate roof is 120 years old already, that doesn't mean it won't live to see its 200th birthday. Well-informed home inspectors can help our communities, as well as the slate roofing industry, by protecting and preserving one of our nation's most overlooked architectural treasures—slate roofs. ■

Joseph Jenkins has been in the preservation trades since 1968 and directs a corporation in northwestern Pennsylvania that provides national slate roof consulting services, slate and tile roof contracting services, slate roofing publications and slate roofing tools and supplies. He has personally worked on more than a thousand slate roofs, many a century old. Jenkins authored and self-published The Slate Roof Bible, which has been recognized in four national book award competitions and received the National Roofing Contractors Association Gold Circle Award. Jenkins is on the Board of Directors of the National Slate Association (slateassociation.org), and he recently founded the Slate Roofing Contractors Association of North America (slateroofers.org). For information on slate roof installation, slate and tile roof repair, industry contacts, sources of materials, slate roofing tools and a message board on slate, tile and asbestos roofing, visit his Web site www.slateroofcentral.com. For information about his books and publications, visit www.joseph-jenkins.com.

5 TIPS for Home Inspectors

1. Identify the slate.

Read "How to identify your slate" at www.slateroofcentral.com. You cannot do this with binoculars on a rainy day. Wet slate does not look the same as dry slate. The single most important detail of a slate roof inspection is the type of slate. Until you determine the type of slate, you can't do much else. Also, find out how old the roof is. Most slate roofs were installed when the building was erected. If the slate is still good, the roof is repairable.

Photos at right:
1) a 70-year-old Vermont unfading green slate; 2) 110-year-old Pennsylvania black slate (a harder variety); 3) 90-year-old Vermont purple slate; 4) 100-year-old Buckingham, Virginia, slate; 5) a mix of sea green slate (also known as semi-weathering green), Buckingham, and NY red slate; 6) Chapman (PA) slate with its characteristic diagonal striations.

2. Look at the flashings, including the chimney flashings, valleys, ridges, hip metal, plumbing vent pipes, step flashings on dormers and any other flashings.

Are they tarred over? If so, they were probably leaking and likely still are. Are they pitted? If so, they need to be replaced. If they're just rusty, a coat of paint may cure them — for now. If the slate is good, faulty flashings can and should be maintained, repaired or replaced.

3. Look for any bad, old repairs.

They will almost certainly be there. They include tar patches, metal patches, slates of the wrong color, shape, size or type, facenails and exposed straps. These can all be erased and the roof put back in order if the slate is still good.

4. If you have to get on the roof, don't walk on it.

Use a hook ladder or other appropriate means of access.

5. If in doubt, do additional research.

Read the *Slate Roof Bible*, search the Web or get an opinion directly from a slate roof professional.

Help protect and preserve slate roofs. ■