

Student Material Book

InterNACHI “Inspecting Slate Roofs” online video course

[www.nachi.org/inspecting-slate-roofs-online-video-course.htm](http://www.nachi.org/inspecting-slate-roofs-online-video-course.htm)

9,800 words

70-minute video

One 12-question quiz

30-question final exam

## **“Inspecting Slate Roofs” video course**



Welcome to the InterNACHI video course on inspecting slate roofs. I’m your instructor, Kenton Shepard.

This course is designed to help you recognize and identify defects and damage, to determine the sources of those problems as often as possible, and to make good recommendations.

The sections on inspecting for damage from wind and hail were developed with the cooperation of members of the insurance and roofing industries.

We’ll cover the different types of slate their performance characteristics. Along with slate roofing, we’ll cover related components like underlayment, flashing and fasteners.

You’ll learn the general, industry-accepted methods for installation, where to look for defects, how to recognize them, how to determine how serious they are, and how to tell when slate roofs are at or near the end of their useful lives.

Although we’ll use common terminology throughout this course, you should keep in mind that different names for the same things are sometimes used in different parts of North America.

Which terms you choose are not as important as making sure that you explain conditions clearly and in a way that will be understood.

Slate is a natural stone formed 450 to 650 million years ago by the accumulation of marine sediment, mostly clay and sand. These materials became buried and were transformed by heat and pressure into a stone that splits evenly and consistently into tiles.

## **PROPERTIES OF SLATE**

### **Slate formation**

Slate tiles are made from stone mined in quarries. This is the Greenstone Slate Quarry in Poultney, Vermont.



Slabs of slate are trucked from the quarry to the mill.



The slabs are then cut to rough size using a saw with a diamond blade. The slate in the bin is waste.



After they're cut, the blocks are split by hand using a hammer and chisel.



Only the best stone will spit evenly and consistently into tiles thin enough for roofing slate.





After splitting the tiles... at this point called “chips” ... are trimmed to size.



Slates are not trimmed to size with a diamond blade. Instead, the edges are broken in a manner that leaves a rough, beveled edge typical of roofing slates.



Holes are then punched from the back side for fastener installation.





Finally, slates are loaded onto pallets to be trucked to the jobsite.



The conditions under which slate forms are typical of those that formed the Appalachian Mountains, so most slate quarries in North America are near the Appalachians... in Pennsylvania, New York, Vermont, Maine and the parts of Canada bordering these states. The Appalachian deposit is famous for producing high-quality slate.

Slate deposits are often very large, underlying multiple state with quarries located on different parts of the deposit. Slate from different quarries has unique characteristics. The differences in color, density and durability are the result of the differences in the mineral types and their proportions.

In other words, the properties of slate are determined by its chemical make-up, and the different types and magnitudes of forces that acted upon the slate as it was being formed.

One concern with slate is its color fastness. The term “color fastness” refers to the long-term stability of the slate color. Slate is classified as “fading” or “unfading” according to its color stability. Fading slates may change to a different color, may fade to a new shade of the same color, or may develop a streaked appearance. Change may be from less than 10% to more than 90%.

Slates designated as “unfading” will maintain their original color for many years. Color permanence is not an indication of slate durability, although the general color can be an indicator since it can help determine which quarry the slate came from. Darker slates sometimes have a high percentage of carbon, which can be less durable.





Some colors are specific to certain areas and others are found more widely. Here are some examples of slate colors from different quarries. These are slate samples. If they were actual roofing tiles you'd see nail holes.



- The above image is of an unfading mottled green and purple from Vermont.





- This image above is an unfading red from New York.



- Royal purple.





- This is an image of a variegated purple piece of slate. These slates are all from Vermont.



- Here is a semi-weathering grey piece of slate.





- This image above is an unfading green piece of slate.



Unfading grey piece of slate.





Unfading green piece of slate.

Differences can be subtle, as you can see when we compare the unfading grey to the unfading green.

And the mottle grey-black to the Vermont black. Although these slates might look very similar, they could have very different lifespans.

### **Ribbon slates**

As you can see, the differences can be subtle. It takes experience to identify slate by sight with confidence.

Slates which have dark bands- usually brown or red- across their faces are called “ribbon” slates. There is some disagreement among contractors about whether or not ribbon slate will suffer a reduced lifespan. The dark bands often contain a higher percentage of carbon or unstable minerals that may weather more quickly than the rest of the tile.

Ribbon slates are usually used for interior applications. If you see them installed as roof tile, you should mention in your inspection report that the tiles installed appeared to be ribbon slates, that their use as roof tile is controversial and explain the possibility that they may fail before similar non-ribbon slate tiles would.



Identifying ribbon slates takes a lot of knowledge and skills that many inspectors will not have.



The ribbon slates in the picture above are about 80 years old.

### **Density**

The density of slate has a strong effect on its durability. Slate which was exposed to higher pressure and temperatures will be denser. Higher density makes slate less porous and less likely to absorb moisture, and moisture absorption is a major contributor to slate weathering and deterioration, although not in the way that you might think. I'll talk more about this shortly.

### **Slate grades**

Slate is graded S1, S2 or S3 according to ASTM standards, with S1 being the highest grade.

Slate grade S1 has a minimum lifespan of over 75 years.

S2 is rated for 40 to 75 years.

S3 is rated for 20 to 40 years.

Slate can be grade tested by a laboratory for compliance with ASTM standards, but this won't tell the remaining lifespan with any real accuracy. Slate rated S1 may last from 75 years to 200 years or more.

### **Grading standards**

ASTM C-406 is the standard used to grade slate. It consists of three separate test types:

- C121 Water absorption;
- C217 Weather resistance, and
- C120 Flexure testing.

Complete grade testing requires about 20 samples for each slate being tested, so testing is seldom done on typical residences.

Almost all slate installed on new roofs in North America is rated S1.

### **Slate lifespan**

The lifespan of slate is directly tied to its quality. Lifespans can vary from less than 60 years for some types of Pennsylvania SoftVein, to more than 200 years for Pennsylvania Peach Bottom. Different quarries that produce the same color or type of slate can be located on different parts of a slate deposit. The slate they produce can look very similar but have different qualities and different service lives.

And, slate quality varies not only among different quarries, but can vary within a single quarry.





Here you see light grey Pennsylvania slate with a lifespan of around 60 years. Notice the scaling, widespread efflorescence and smooth texture compared to the three Vermont slate tiles that have been used for repairs. The missing slate was also a repair slate, held in place by a strap around the butt. Sliding snow straightened the strap and pulled the slate out of place.



Different layers can be of different quality, so as mining in a pit progresses, in addition to changing color, the quality of the slate can change.

You will not likely be able to identify the type of slate on a roof or estimate its remaining service life by looking at it.

Although the slate may be very durable, the lifespan of a slate roof is limited by its weakest component. The slate may be of a type known to last 200 years, but if the fasteners or crucial underlayment fail after 50 years, then the lifespan of that slate roof is only 50 years.

### **Foreign slate**

In addition to being quarried in the US, slate is imported into North America from a variety of sources.

Purple and grey-black Welsh slate was imported into cities along the eastern seaboard, mostly prior to 1840. It generally has an extremely long service life and may still be seen on roofs.

Large amounts of inexpensive slate have been imported from China starting in the 1980s. It comes in a HUGE range of colors and quality, although this example is common.





Looking closely, you can see that this slate has cleaved less evenly than our other samples. The different minerals show up as different colors, and you can see that they're not very uniform across the face of the tile. The dark area in the upper left quarter is likely to have a high carbon content and to eventually appear as a mineral occlusion, failing sooner than the other portions of the tile.

It's generally brittle, so it's more easily broken than North American slates. It may also be soft and colors may be unstable.

Although they may be seen anywhere, In the US, Chinese slates are most common in California, in the southern US and in states along the eastern seaboard.

Performance problems with Chinese slate are more common in northern areas where snow and ice cause a freeze-thaw cycle that can cause delamination.

People sometimes insist on having these slates installed on roofs even after being told that they will be damaged by frost.

Inexpensive slate with similar properties also comes from India and Brazil. Low-quality, black Spanish slate has been sold in US since the 1980s. It often has oxidizing iron pyrite that appears as rust stains. Spain does produce some very high-quality slate, but very little of it is sold in North America.



It’s common to see these imported slates installed in home interiors, but if you see them on a roof, especially in a cold climate, look carefully for mineral occlusions, color fading, delamination and broken slates.

## **SLATE STYLES**



### **Standard**

Standard slate roofs are the most common. That is... standard size as opposed to custom-made.

Standard slates are ¼-inch (0.64 cm) thick (plus or minus 1/16-inch). They vary in length and width no more than 1/8-inch and they have a relatively smooth face.

In the past, Standard slate tiles were available in up to 30 different sizes. Roofs with standard slates should look flat, even and uniform.

It’s not unusual to see slate tiles with large gaps between them on older utility buildings.

### **Textural**

Textural slate is from 3/16 to 3/8-inch thick. With individual tiles, texture and thickness

may vary.



Roofs with textural slate may still look uniform, but coarser texture and greater thickness with the resulting stronger shadow lines tend to give them more character. Textural slates can be manufactured with the same variations as standard slates.

### **Intermingled**

Intermingled thickness roofs use at least three distinct variations in slate thickness; for example, one home might use  $\frac{1}{4}$ ,  $\frac{3}{8}$  and  $\frac{1}{2}$ -inch slates.





In intermingled slate roofs, look to see that excessive differences in slate thickness is not preventing slates from lying flat. Intermingled roofs may have a cobbled appearance and may have more thin slates than thick ones.





Although you see some broken corners, the majority of this roof is actually in good shape, with the exception of this area.

Although it looks like a different roof, one that's at or near the end of its useful life. This is an area of the roof you just saw that has been damaged by from ice falling from an upper roof.

### **Heavy slate**

A heavy slate roof uses slates at least 3/8-inch thick. Thicker slates may be specified, but the thickest slates included in the order can't exceed the minimum thickness by more than 1/8 inch.

This means that if the order specified 1/2-inch minimum thickness, the slates might vary from 1/2-inch to 5/8-inch.



In heavy slate roofs, slates up to 1-inch are not unusual and these slates will be heavy and rough. Slates this size may require heavier framing than usual, and you should be looking for signs of failure such as rafter sagging or cracking of interior or exterior wall coverings. Heavy slates seldom have cut butts.

### **Graduated**

Graduated slate roofs were usually installed on large institutional structures or churches.

Slates graduate in size, thickness and exposure with the largest, thickest tiles laid along the eaves graduating to the smallest, thinnest near the ridge.





### **Salvaged**

Salvaged slates are slates which have been re-used and you may see them used as a repair. Salvaged slates are good choices for repair because they've had a chance to weather. New slates may have aging characteristics different from the existing slates and may weather differently or fail to change color at the same rate or in the same manner as the rest of the roof.





The thicker slates shown here are unfading green and grey. All the other slates are semi-weathering grey-green, which changes appearance randomly as it weathers. All the semi-weathering grey-green slates were the same color when they were new. If you were to break open these slates, they'd be the same color inside. Over time, they “tan out” to various degrees. It's unpredictable. If the installer pulls slates straight off the pallet and installs them without first sorting them so that they'll blend well after they weather, the result could be groups of similarly colored slates in various portions of the roof. It's much more desirable to intentionally sort slates so that the color scheme is random and uniform across the roof.

### **Special order**

Special order slate roofs may use slates which are longer or wider than usual, are of a special color or cut, or which have special fastening requirements.

Examples of special order requirements might be lengths over 24 inches or widths over 14 inches.

### **MANUFACTURING VARIATIONS**

Depending on the style of the slates installed, you may see variations that are the result of the manufacturing process.

## **Length**



Typical slate length is from 10 inches to 24 inches. The length of the slate determines the amount of exposure and affects the cost in a couple of different ways. Shorter lengths mean more slates per square, which increases the labor cost for installation, but longer slates are more difficult to make, which increases their cost.

## **Width**

Slates are available in single or random width. Single width slates are all the same width, typically from half the slate length to 14 inches, although you may see exceptions. Single-width slate should be obvious immediately; vertical joints will align in every other course.

Random width slates will vary in width, but in looking at a roof most will be about 2/3 of the slate length. A smaller percentage will be of larger widths. If you’re looking at a roof with many joints that don’t align at alternate courses, it’s probably random width.

## **Staggered butts**

If you’re looking at a roof in which the slate butts don’t align in clean, horizontal lines, but instead jog up and down at each slate, then you’re looking at a staggered butt installation. These roofs require slates of two different lengths. The tops of all slates in



each course must align for the slates to lie properly.



Keeping the tops of the slates aligned allows the installer to keep the headlaps the same size. If slates were the same length and moved up or down to achieve this effect, the headlaps would vary .

### **Cut butts**

Cut butt slates are those that have been cut to a specific shape, like diamond, hexagonal or scalloped. Like cut shingles, cut slates are more expensive than those left rectangular, and it's not unusual to see them installed in a band or pattern across a roof.



Speaking of cuts, Let's talk with Terry Smiley about what you can tell about a slate roof by looking at the way slates are cut. (See the video.)

## **SLATE DURABILITY**

Slate durability depends on four primary factors; weathering, fabrication, installation and maintenance.

### **Weathering**

“Weathering” of slate tiles, just like for the other roof-covering materials we’ve discussed, is really the slow process of natural deterioration of materials exposed to the elements.

A slate tile is composed of layers called “cleavage planes” because it’s along these planes that slate naturally splits or “cleaves”. When you look at the face of a slate tile, you’re looking at a cleavage plane.

Weathering in slate is really two factors:

1. The gradual delamination of the different cleavage planes.
2. The slate becomes increasingly porous as minerals dissolve from repeated moisture cycles.

### **Occlusions**





Mineral impurities can cause deterioration in slates.



Impurities may be uniform throughout one or more tiles, or may appear in pockets called mineral “occlusions” as Terry mentioned.





### **Delamination**



Delamination is caused by the reaction of certain minerals to long-term moisture cycles. Over time, these minerals expand, causing layers to separate along cleavage planes.

Because tiles are most likely to absorb moisture along their edges, delamination is often most obvious along the tile edges. As slate gets older, paper thin flakes of slate separate from the surface, and the interior of the slate becomes increasingly soft and spongy as the



inner layers also begin to delaminate.

Tiles with mineral occlusions may show deterioration anywhere on the tile. Slate with more stable minerals and which is denser will last the longest. As layers delaminate, they provide an avenue for moisture to be absorbed into the shingle interior. “Rot” is not an appropriate word to describe slate deterioration, since rot is caused by decay fungi that don’t affect slate, but the softening, crumbling effects of slate deteriorated by moisture are similar to wood rot.

The chemical and physical changes common to aging slate increase its moisture absorption properties and reduce its strength and toughness. This general weakening leaves slate tile more vulnerable to breakage, cracking and corner chipping. The increase of moisture absorption may not actually cause leaks, but it can hold moisture against the wood sheathing, causing wood decay, which can go undetected for a long time, so in homes with older slate, you should check the condition of the roof sheathing.

### **Efflorescence**

UV and moisture also cause lime and other mineral salts in slate to break down. This causes slate to become more porous and these minerals are eventually deposited as white powder on the surface of the slate.



There is some disagreement about the degree to which visible efflorescence indicates failure of slate tiles, but there is general agreement that widespread efflorescence



indicates a long-term moisture problem that may be serious.

### **Contributing factors**

Factors that typically affect other roofing types, like thermal expansion, the freeze/thaw cycle and UV deterioration, have a smaller effect on slate tiles. Older slate roofs, which have been generally weakened will be more affected by these elements than newer ones. Southern exposures are less important to the deterioration of slate roofs than with other types of roofs. More important are the directions from which storms approach, since it’s long-term, moisture-related chemical changes that deteriorate slate.

### **SLATE FABRICATION**

Although problems related to fabrication can affect slate roofs, fabrication techniques vary among quarries. This makes it difficult to recognize defects related to fabrication or manufacturing methods.

Clues to the quality of fabrication include the size and location of nail holes and grain orientation. We’ll cover this shortly.



The mineral grains should be oriented along the length of the tiles.

The mineral grains should be oriented along the length of the tiles. You can see that in the less expensive Pennsylvania tile that the grain orientation varies.



And the same on this roof

## **INSTALLATION**

### **Slope limitations**

Slate installed on roof with a pitch of less than 4:12 should have a built-up roof installed beneath it. Slate installed on a roof of less than 4:12 with conventional underlayment is a poor installation.

### **Framing and substrate**

The weight of a slate roof is measured in thousands of pounds per square instead of hundreds of pounds like most roof-covering materials. A slate roof can weigh up to 8000 pounds per square although 3500 pounds is typically considered heavy. It's important to inspect the framing and sheathing from inside the attic. Check rafters for sagging. Sheathing can be either spaced boards, battens or panels, like OSB or plywood, but it should be 3/4" minimum. The 1/2" sheathing used on most roofs may result in broken slates. Check any areas where you see evidence of past leakage for advanced decay.

### **Underlayment**

As you already know, felt underlayment is not permanent and deteriorates as it loses volatile oils over time. This is less of a problem with asphalt shingles, since the lifespan of the shingles and felt are likely to be fairly similar.

Because slate roofs can have a much longer lifespan, it's more likely that the underlayment will deteriorate long before the slate. The quality of the slate tile installation becomes much more important in preventing leaks in roofs with deteriorated underlayment. When inspecting older homes, you should be sure to mention this in your



inspection report, even if you don’t see signs of leakage during the inspection.

### **Interlayment**

One method used to save money during installation is interlayment of slate. Using this method, the slate exposure is increased substantially in order to save money by using fewer slates. Under normal circumstances this would increase the risk of leakage dramatically. In an effort to reduce that risk a layer of felt is installed as interlayment between each course of slates.

Once the felt has deteriorated, which will probably be long before the slate, the roof will be much more likely to leak, and repair will involve removal and re-installation of the slate roof. If it’s re-installed with a proper exposure, there won’t be enough slates and then the problem will be to find matching slates. It’s a very good idea to alert your client to this condition.



This radiused valley is a high-quality installation. Since the valley is round and the slates are flat some gap is natural. To help prevent moisture intrusion from wind-driven rain, valley slates are installed with interlayment that is a course of felt underlayment about four layers thick is installed between courses, with the felt covering the upper portions of the slate, but held high enough that no felt is left directly exposed to weather. You can



see the interlayment where a slate is missing about halfway up the valley.

In this particular roof, originally installed in 1928, the felt interlayment has deteriorated. Because the roof is otherwise in excellent condition, the recommendation is that the valley slates be removed and replaced with new interlayment, by a qualified contractor.

### **Colors**

When slate arrives on a jobsite, pallets may contain slates of slightly different colors. In order to blend well, slate from different pallets may need to be blended. Let’s listen to Terry Smiley talk about that in the video. (See the video.)

### **Starter Course**



Like with other overlapping roof-covering materials, the first course of slate, the starter course should be doubled. In the starter course the underlying slates are installed chamfer down and should rest on a cant strip installed at the roof edge.



All other field slates are installed with the chamfer facing up. The chamfer is created when the slate is cut.

The main purpose of the cant strip is to elevate the starter course onto the same plane as slates on the rest of the roof. If the roof lacks a cant strip, check for cracked slates in the starter course. The secondary purpose is to prevent water from pooling behind a section of raised fascia or wood strip.

Slates should overhang the roof edges by 1 ½ to 2 inches. The overhang should be adequate to protect the framing from runoff, but not so long that it causes runoff to overshoot the gutter.

### **Field slates**

Slates that cover the main part of the roof are called “field” slates. Other types of slates would be hip and ridge “cap” slates and valley slates, cut to meet at the valleys. Lets listen to Terry talk about inspecting field slates. (See the video.)

### **Fastening**





You should check a representative number of slates for the fastening method. When it comes to nailing practices, slate installation is different from other roofing materials.



In North America, nailing is the most common fastening method although you may see hooks used, especially for repairs, but sometimes entire roofs are installed with hooks.





Slate has also been hung from wires.

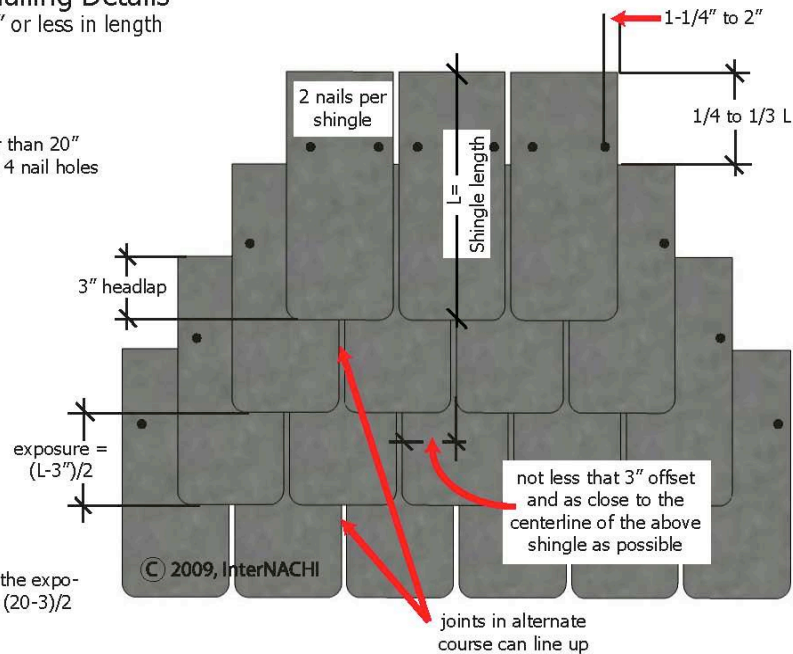


During the manufacturing process, nail holes are punched from the back of each tile.

### Slates - Nailing Details for slates 20" or less in length

**Note:**  
slates longer than 20"  
usually have 4 nail holes

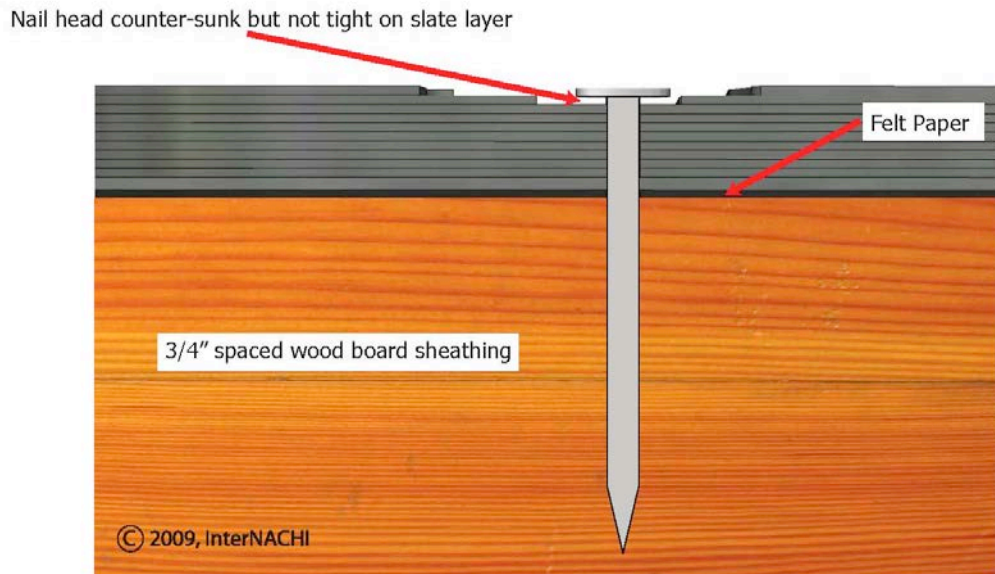
**For example:**  
On a 20" slate the expo-  
sure should be  $(20-3)/2$   
or about 8.5"



This method causes a small blowout in the face of each tile, which provides a counter-sink for the nails holding the tile in place.

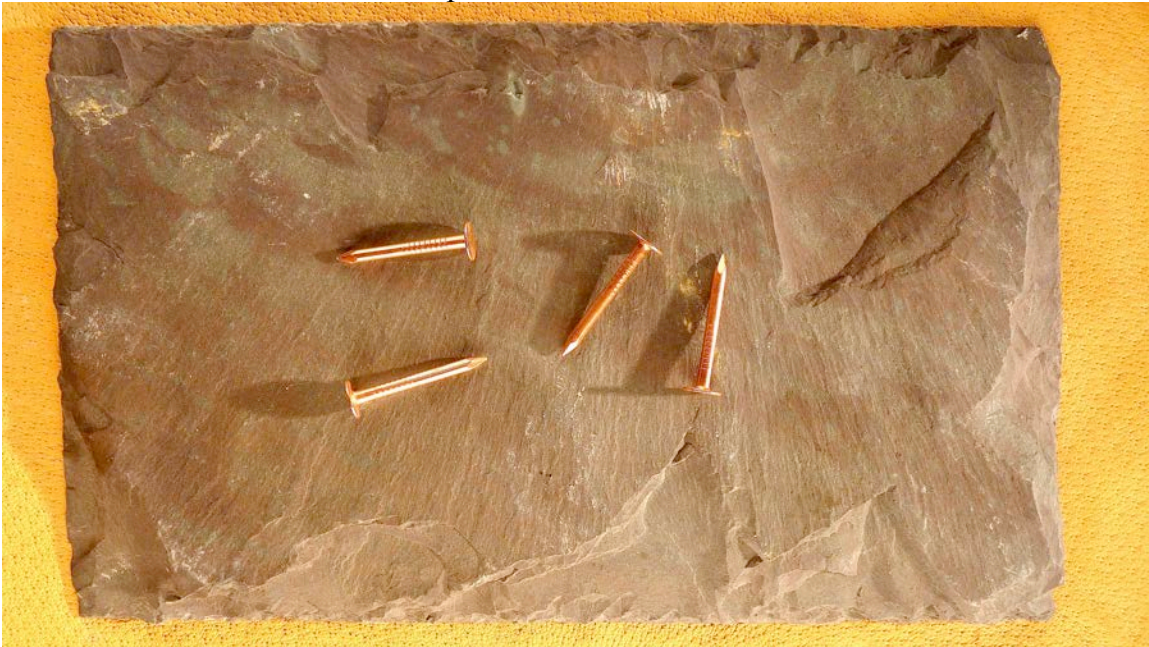
Nail holes are usually punched 1 1/4" to 2" in from each edge and about a quarter of the length of the tile down from the top. Holes punched too low or too far from the edges of the tiles may cause leaks. Most slates will have two holes although slates thicker than 1 inch should have 2 additional holes located 2 inches above the 2 original holes.





Nails are driven so that the slates hang from the nail shanks instead of being held in place by pressure from the nail heads. Nails driven too tightly can crack slate tiles as the substrate expands from moisture absorption.

Nails which are incompletely driven may damage the overlying shingle and increase the chances that wind-driven rain will penetrate the roof.



Acceptable nails are copper, stainless steel and hot-dipped galvanized.





Copper nails are the most desirable, followed by stainless steel. Hot-dipped galvanized steel the least desirable. Electro-plated galvanized nails are a defective installation.



This structure was built in the mid-1800s. The roof is original and slates were about 150 years old when these photographs were taken.





Aside from a few broken tiles, the slate is still in good condition. Although the fasteners holding field slates were still performing well, fasteners at the rake were beginning to fail.



If you see evidence of leakage in slate roof tiles but don’t see missing or damaged tiles, check the nail hole locations and nailing methods.



If you see slates broken in line with the fasteners, they may not have countersinks or may have been nailed too tightly. Nails left protruding can wear right through the overlying slate.

Fasteners may fail before the slate does. If you see many repairs or displaced tiles, check the condition of nails over representative portions of the roof, especially on homes approaching 70 years of age. If many fasteners are failing, it can be a real problem. The slates may be salvageable, but if they’re less than 1/4-inch, they are probably not salvageable.

It may be difficult to find a contractor who is competent or willing to try salvaging the slates. Depending on the condition of the slate, it may not be possible or cost-effective, so fastener condition can be very important.

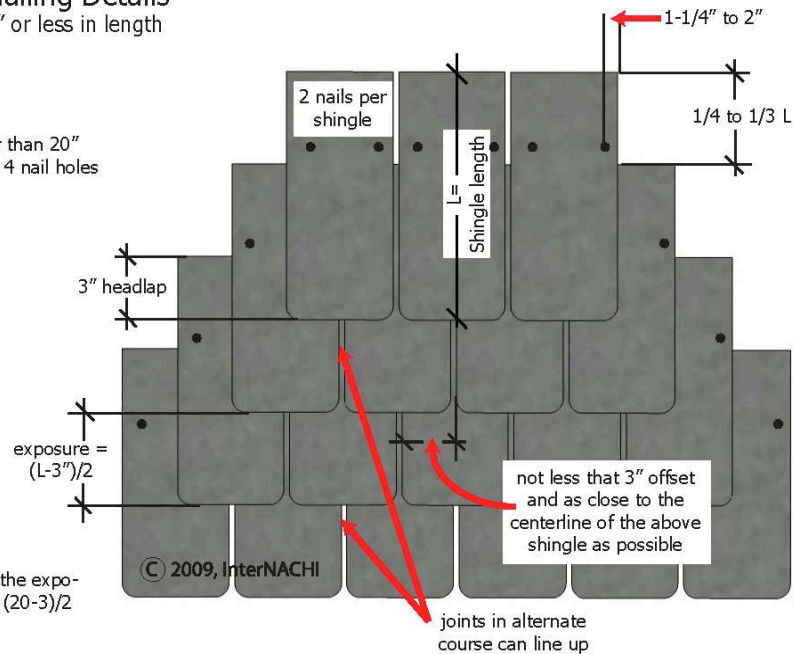
### **Sidelaps**



### Slates - Nailing Details for slates 20" or less in length

**Note:**  
slates longer than 20"  
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**For example:**  
On a 20" slate the expo-  
sure should be  $(20-3)/2$   
or about 8.5"



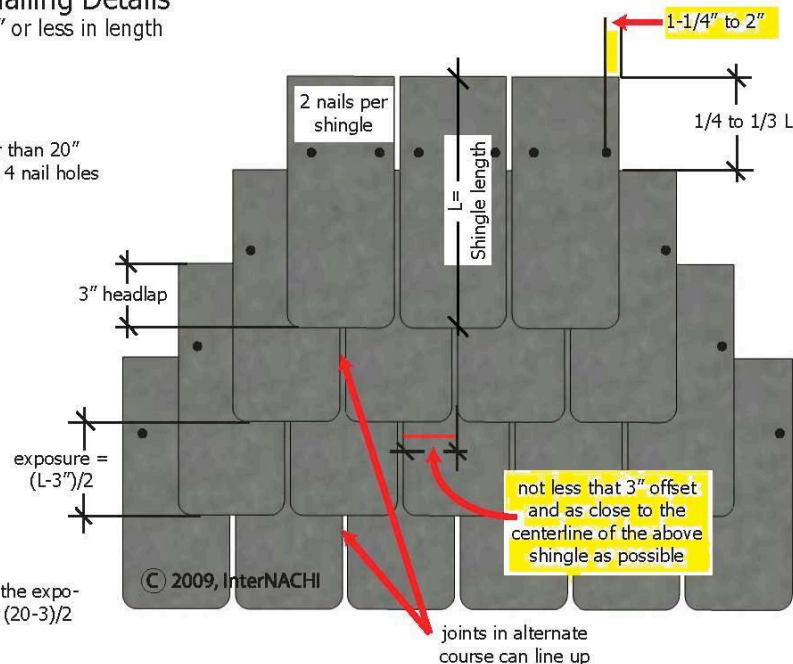
"Sidelap" is the term used to describe the separation between vertical joints in adjacent courses. The minimum sidelap between slate edges is 3 inches. Slates should also have a minimum sidelap from centerline of nail holes of 1 and 1/2 to 2 inches. Ideally, vertical joints should center on slates in the adjoining courses.

### Headlap/exposure

### Slates - Nailing Details for slates 20" or less in length

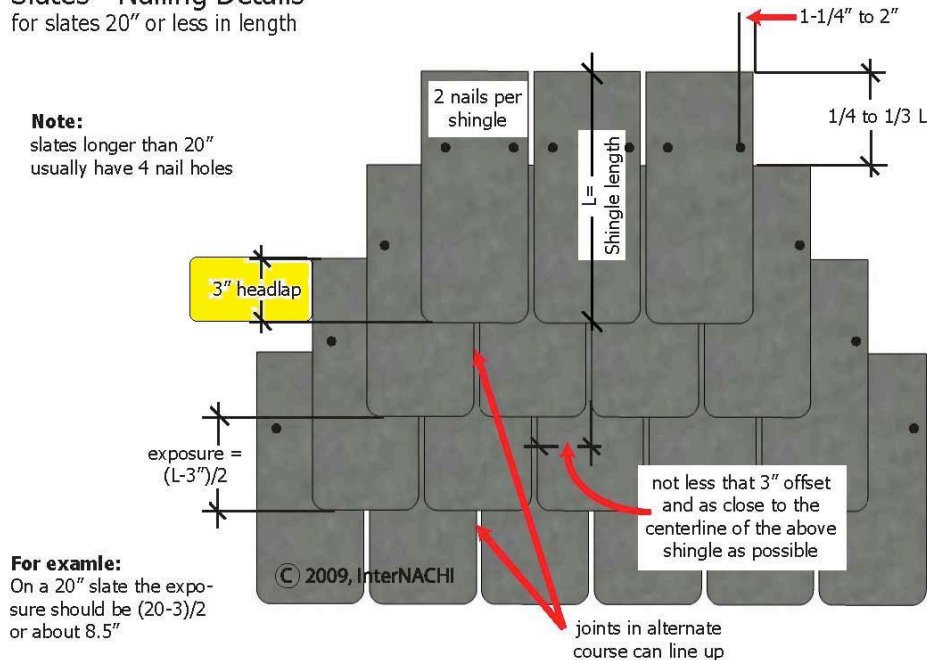
**Note:**  
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On a 20" slate the expo-  
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The "headlap" is the amount by which alternate courses overlap, as you can see in this illustration.

#### Slates - Nailing Details for slates 20" or less in length



The formula for slate tile exposure is based on half the shingle length. 3-inch is the standard minimum headlap, so the exposure for a 20-inch slate would be 20 minus 3 = 17, divided by 2 = 8 ½ inches. So the exposure for a 20-inch slate is 8 ½ inches.

If the roof is less than 6&12, the headlap should be a minimum of 4-inches.  
The exposure would be 20 minus 4 = 16. 16 divided by 2 = an 8-inch exposure.

If the roof is steeper than 20&12, the headlap can be reduced to 2-inches  
The exposure would be 20 minus 2 = 18. 18 divided by 2 = a 9-inch exposure.  
These are modern headlap minimums and will vary some. In areas in which snow is not an issue it may be common to find 2-inch headlaps, especially on older homes.

#### Gable slates

At gable ends, slates should also overhang the roof edge by about 1 ½ to 2 inches. This means that the pre-punched nail hole nearest the roof edge will be too close to the edge. The roofer should punch another hole, which will be about 1 and ½ inches in from the roof edge once the slate is in place. You should check that gable slates are securely fastened.

The methods used to install hips and valleys will give you a good idea of the level of expertise of the installer. A variety of methods can be used, and some require more expertise than others. An assessment of the installer's level of expertise is helpful because there will be some parts of the system which will be hidden from view. If the visible

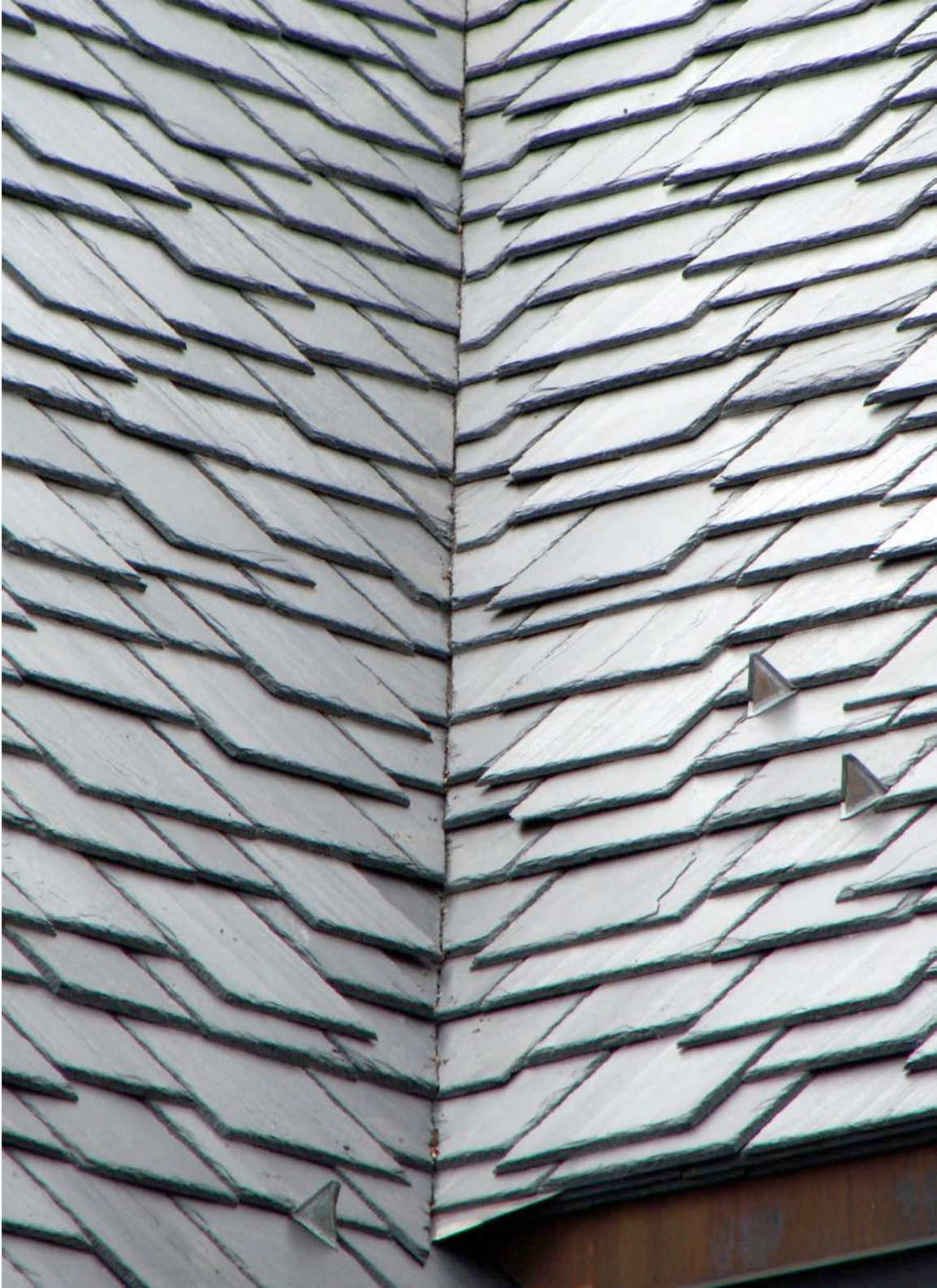


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work is done well, there’s a good chance that hidden work is also done well. If the visible work is poor, the chances of the hidden work being done well are also poor.

## **Valleys**



You may see both open and closed valleys. Closed valleys are not closed in the sense that the slate forms a continuous moisture barrier across the valley, but only in the sense that there is no gap down the center of the valley. Beneath the slate, the valley should be lined



with heavy-duty underlayment or metal.



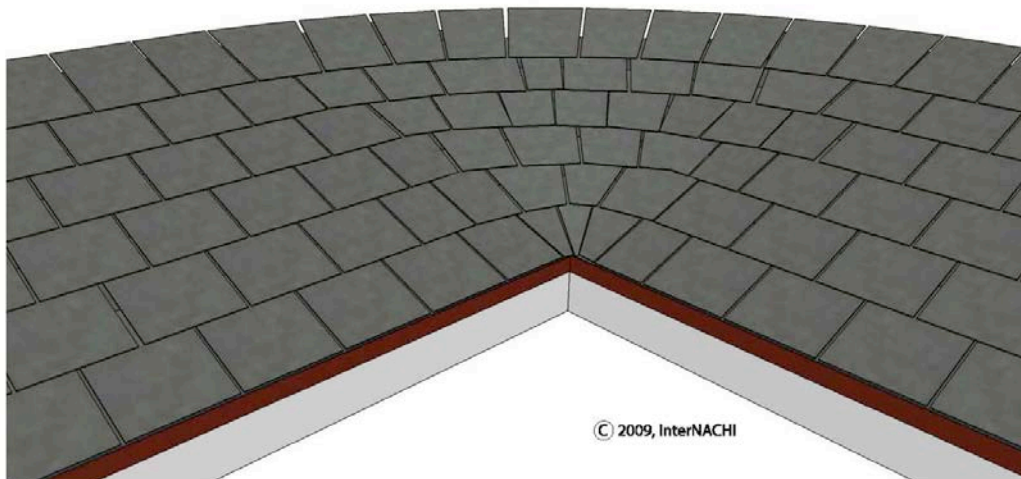
Metal valleys are preferable. The preferred alternative to continuous flashing is to use short sections of flashing that are installed with each course. This is simply another form of step-flashing. Here are some tips on inspecting valleys.

Open valleys should be installed with a taper, so that they’re wider at the bottom than at the top, which helps keep them clear of debris. Valleys that don’t taper are not defective. It is a quality issue and taper is desirable.

Field slates which meet with the valley- called “valley slates”- will need to be cut to the angle of the valley. These cuts should be chamfered and the chamfer should face up, just like the rest of the slates. Again, this is a quality issue.

Before the valley slates are fastened they’ll each need an additional hole punched to avoid nailing through the valley metal (heavy slates should have two extra holes). These holes should be punched above an existing nail hole, not in the center of the slate. If they’re in the center of the slate they’ll align too closely with the vertical joint in the course above, increasing the potential for leaks.

Slate - Canoe Valley



**Note:**

A Canoe valley is a valley in which the slate is laid using a radial pattern that progresses from a minimal radius at the eaves to a larger radius at the mid-point in the valley and back to a minimal point at the peak. No flashing is exposed in this application. These are extremely difficult to install and not be done by unqualified laborers.

In the past, valleys were occasionally built rounded, but these are rare and require a great deal of expertise to install correctly.





If you see a rounded valley you won't confirm proper installation, just look for signs of leakage.

## Hips

Generally, there are two different methods for dealing with hip conditions when installing slate, capped hips and mitered hips, and of course there are variations on those two, and we won't go into all those. We want you have a basic understanding of what you're looking at and to know where to look for defects

#### Slate - Saddle Hip



**Note:**

A hip in which the cap slate is installed over the finished slate roof on either side creating a saddled effect. This is the most common hip application used.

Capped hips, also called “saddle hips” are similar to cap shingles on a wood roof. Two slates will form a cap, which extends out over the field slates on each roof slope. Unlike wood cap shingles, cap slates don’t fasten to each other but to nailers fastened to the sheathing along each side of the hip.

Capped hips should have a waterproof base membrane installed over the nailers. As cap slates are installed, they sometimes have step-flashing installed between each course. Sometimes, waterproof membrane is used as step flashing. Let’s hear what master slate installer Terry Smiley has to say about cap installation.





Mitered hips have no cap slates, instead, slates that meet at the hip are in the same plane as the field slates. They’re cut to fit where they meet at the hip.

### **Ridge Slate**

Ridge slate is the course which covers the ridge, also called the finish course. There are also two methods for completing the finish course; the saddle ridge method and the strip ridge method.

In both methods, two horizontal nailers are fastened to sheathing on each side of the peak. The lower nailer provides nailing for the last course of field slates, and the upper nailer provides backing for the ridge cap slates.

### **Saddle ridge**

The saddle ridge method uses cap slates that lap each other and look similar to asphalt shingle ridge caps. This is the most common ridge detail.

### **Strip ridge**



The strip ridge method looks as though field slates continue on to meet at the ridge and looks similar to a mitered hip.



This is what it looks like installed on the roof.



### **Metal ridge**



You may also see ridges capped with metal like this roof with a copper ridge cap.

### **FLASHING**

High quality slate will typically outlast flashing. Flashing is almost always the first component to fail on a slate roof. 70 years is generally considered the maximum lifespan for flashing, so when you inspect homes approaching this age or older, look at the general condition of the flashing, especially if you see temporary repairs like mastic or caulk. If 25% or more of the slate will be disturbed in replacing flashing, it may be more cost effective to remove and replace the entire roof.



In addition to the hips and valleys you just heard about, slate roofs need flashing at the usual places... penetrations, sidewalls and headwalls, changes in pitch and roof edges. Combustion and plumbing vents should be flashed so that runoff stays on top of the slate. Sidewalls should be flashed using step-flashing. Modern requirements are 4” minimum both up the wall and under the slate, but older homes may not meet modern requirements. If flashing looks like it’s been keeping moisture out of the roof system, then it’s been doing its job.

You’ll often see copper flashing installed with slate. 16-gauge copper has been a standard gauge, and it typically lasts about 70 years although this will vary with the environment in which it’s installed.

Copper flashing should be installed using copper fasteners. If galvanized steel fasteners are used, galvanic corrosion will corrode the steel, causing fasteners to fail prematurely.

## **SLATE MAINTENANCE**

### **Contractor qualifications**

Slate roofs require maintenance just like all the rest of the roof-covering materials. Damaged or missing slates should be replaced by a qualified contractor, and “qualified” is a key word here. As slate roofs become increasingly rare, so do the contractors qualified to work on them. Any time you make a recommendation that a roof- or any



other part of the home- be evaluated or repaired by a contractor, put the word “qualified” in front of the word, ”contractor”.

That way if your client takes low bid on work and the contractor makes a mess of it, it’ll be difficult for them to include you in the lawsuit because they didn’t follow your recommendation and hire a qualified contractor.

## Repairs



If you see hooks or copper tabs holding tiles in place in small areas of a slate roof, it’s usually a sign of repairs.



Look closely to see if those repairs were made properly.





Repair slates should match the existing and the spaces between them should be uniform.







Broken slates are removed by hooking the nails with a slate ripper and either cutting or pulling them.





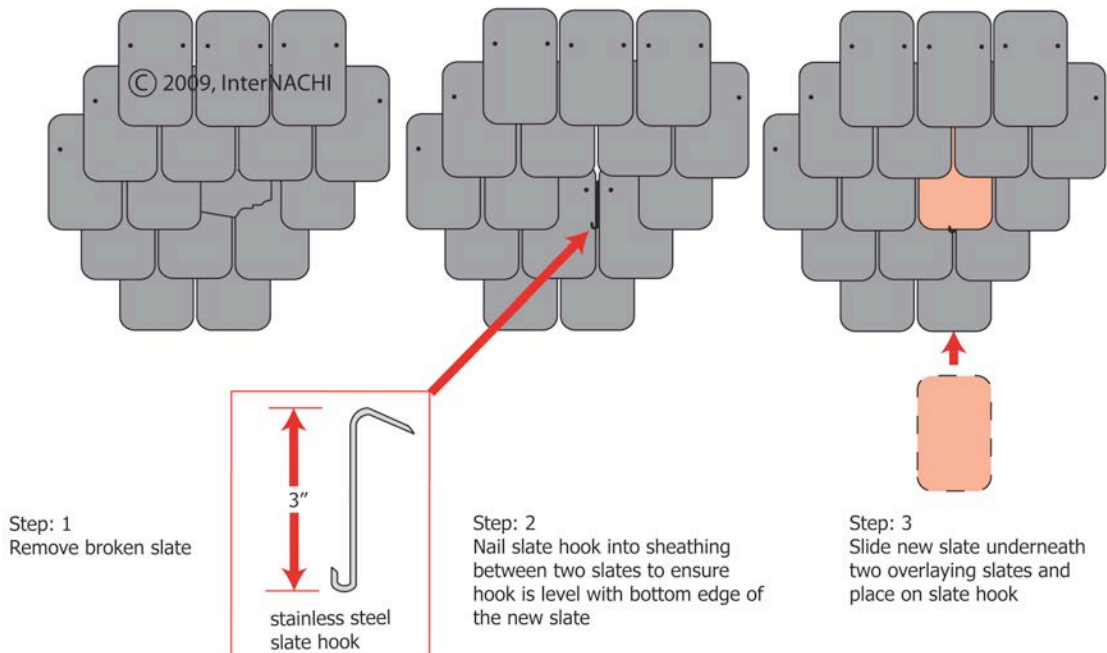
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he ripper slides beneath the broken slate to hook the nail shafts, not the heads.

## Repairs

### Slate Repair: Use of Slate Hook



Look for evidence of repairs. Slate roofs may be repaired using several different methods. Hooks may be used to hold new slates in place.



Here's what they look like installed on a roof.



You may see copper strips installed between slates. Replacement slates are nailed between existing slates and the nail heads then covered with copper strips.





You may also see copper tabs used for repairs. Tabs are nailed into place and then bent up around the butt of the replacement slate to hold it in place.



If you see tar, roof mastic or asphalt shingles installed over slate as a repair method, that's a defective repair.

### **Broken Slate**

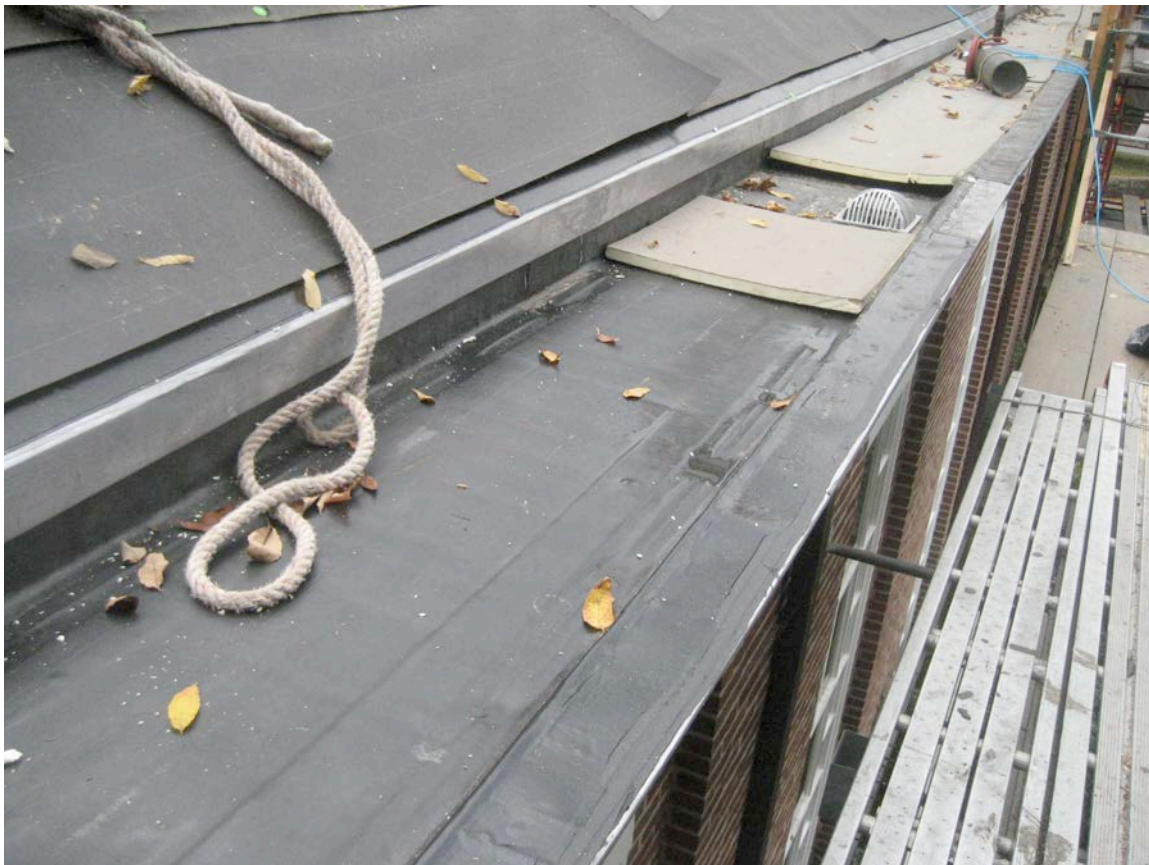


You may find gutters built into the roof. Because slate is fragile, these gutters are often walked in.

If you see an unusually high number of slates broken along the eaves, check to see if a cant strip was installed. Poorly-supported slates can be broken by snow sliding off the roof.

Look for broken field slates including missing corners.

### **Gutters**



You may find gutters built into the roof. Because slate is fragile, these gutters are often walked in or used to hold tools. The lining may be fragile. Tools with sharp edges, corners, or points, like a drill bit, can easily damage linings like the EPDM lining of this gutter. Also, because they're hidden, maintenance is often neglected. Do your best to get a look at these gutters.

During the early 1900's downspouts for these built-in gutters were sometimes routed to home plumbing. If you find leaks in older homes in which the roof appears to be in good condition, check to see if the gutters are still connected to the home plumbing waste pipes.

## **Cleaning slate**

Whether slate can be cleaned depends on the source of the stain. Here are some common sources:

- Tree sap can be removed using a diluted, non-acid based masonry cleaner and a rag.
- Moss can be scraped and the stain removed using the same methods used for tree sap. Moss usually indicates a moisture problem and slate may be damaged beneath the moss. During your inspection, scrape off some moss and check the condition of the underlying slate. Look for efflorescence and delamination.
- Concrete, paint and oil do not remove well and efforts may make staining worse.
- Some dark slates installed in cities may develop a greenish tint.

## **SLATE ROOF DESIGN**

Design problems affecting slate roofs are generally the same as those affecting roofs with other roof-covering materials installed. Steeply-pitched roofs will help extend the lifespan of the slate by shedding runoff more quickly. Runoff should have a clear path to the roof’s edge.

Attic and rafter bay ventilation can be an issue with slate. Temperatures and relative humidity levels should be equal on both sides of the slate. If moisture originating inside the home is not adequately vented to the exterior, it may cause chemical reactions in the underside of the slate tile, which accelerate deterioration. This can appear as efflorescence (white powdery deposits) on the underside of the tile.

## **SNOW GUARDS**

Snow sliding off the roof can be dangerous, and avalanche preventers, also called “snow guards” should be installed in areas where this is a possibility. Look for these typical problems:

- a. Guards are attached to slates instead of sheathing. This will eventually result in loose or lost slates.
- b. Guards are sometimes placed too far apart in an effort to save money. Guards can bend, break or pull out if they’re over-spaced. When they bend, the strap may damage the slate above.

These snow guards were retrofit instead of being installed at the time the slate was laid. The part of the strap beneath the slate is slotted and designed to hook an existing fastener. You can see the same model snow guard here with the label outlined in red.

Wire snow guards are weak and on a roof like this one should have been installed across the entire roof.



d. 1 You may see pipes installed as snow guards. When this is the case, pay attention to how they’re attached to the roof. The preferred method is a bracket that replaces an entire slate. When a snow guard like the one in the upper right is installed, the slate... or tile, in this case... will have to be cut. This condition creates an avenue for moisture intrusion, so when you see this condition, look for this condition.

The trick in evaluating snow guards is being able to determine if they’re spaced properly. Since you would have to get this information from the manufacturer and the fasteners are often hidden from view, confirming proper installation of snow guards will exceed the scope of your inspection. Look to see if they are installed where they’re needed, and that they appear to be secure.

## **INSPECTING SLATE**

### **Walking slate roofs**

Do not walk on slate roofs. They’re slippery and dangerous, and they’re fragile and expensive to repair. It’s often difficult to tell the condition of the slate and old slate can be soft and crumbly. You can go thorough the roof and you can go over the edge. Don’t walk slate roofs. It is that simple.

### **Common causes of damage**

A number of things can cause slate to break. Here are some of the common causes:

- Contractors walking the roof can damage it.
- Falling trees or tree limbs can damage slate.
- Thrown rocks or hard balls can cause damage.
- Ice or snow falling from an upper roof onto a lower one can break slate.
- Leaning ladders against the roof edge can break tile edges.
- Poorly-designed or installed snow guards can cause damage.
- Improperly installed roof penetrations of various types can damage slate roofs.

Keep these sources in mind as you look at slate roofs.

### **Leaking slate roofs**

In looking at moisture on roofs there are two general rules:

- Water always moves downhill. Steeper slopes will move water off the roof more quickly and reduce the chance of developing leaks.
- Water always takes the path of least resistance. Water will run more quickly across smooth surfaces and roof components or debris that hamper its progress will slow it down, increasing the chance of developing leaks. Look for anything that blocks or impedes the water’s path of travel off the roof. Chimneys placed at the base of valleys are not uncommon.

Just like with other roof-covering materials, there is often more than one way to install slate roofs correctly. When you inspect the installation, you’ll be looking to see if slates and flashing are installed using a method, which will keep moisture from penetrating the roof and in a way that will not cause premature failure.

These are all areas you should look at closely during an inspection.

- Roof penetrations should be flashed in a manner that will prevent leaks.
- Slates should have at least a 3-inch headlap. Installations that depend on interlaid underlayment to prevent leaks have a high chance of premature failure.
- Ridges, hips and valleys should have slates that fit together tightly. In high quality installations, each pair of cap slates will have been cut from the same tile so that the color and grain match.
- Headwalls should have flashing which is installed behind the exterior wall-covering material and which over laps slates in the top course.
- Sidewalls should have step-flashing in which each piece laps over the slate in the course below and is overlapped by the slate in the course above. Changes in pitch should have flashing installed.
- Roof edges should have edge metal installed, although it’s not required by most building codes.
- Ice dams can be a problem in cold climates. Improving attic insulation can help. Sometimes slates over the eaves are removed and replaced with metal roofing.

If the roof appears to be in good condition, leaks may also be from masonry. If through-wall flashing has not been installed, heavy rains may cause moisture to migrate through masonry.

Repairs are evidence of past problems, and it’s common for underlayment to be torn during repairs, so look for signs of leakage below any repairs you find.

It’s likely that the roof leaked before the repair was made, so stained materials should be tested with a moisture meter for elevated moisture levels.

If there’s been no recent rain or snow in the area, the stain may be dry even if the roof still leaks, so if you find normal moisture levels when you test, you should mention in your inspection report that you tested, but the results may be inconclusive because the weather was dry during the days or weeks before the test.

## **Insects**

It’s not unusual for insects or bats to live in a slate roof, especially roofs with heavy slate. Insects may sting and bats can transmit rabies, so be careful.

## **Chattering**



Slates hung on steep roofs may rattle in the wind. This noise is called “chattering”. If you see a condition with this potential, it’s a good idea to mention it to your client.

### **Chattering**

Slates hung on steep roofs may rattle in the wind. This noise is called “chattering”.

This concludes the section on stone slate. Please take a few minutes to complete the section quiz before continuing with composite slate.

## **HAIL DAMAGE to SLATE ROOFS**

Slate roofs may be punctured, cracked or broken by hail. Any of these conditions could be functional damage.

Because slate is a sedimentary stone composed of layers, hail damage may appear as a slate with a portion of layers missing in an area. This condition would be considered functional damage only if it were severe.

Slate becomes soft and brittle as it ages and old slate is more likely to suffer damage than newer slate. As slate ages and deteriorates, less and less impact energy will be required for hail to damage it.

## **WIND DAMAGE to SLATE ROOFS**

Slate tiles are heavy and low-profile, so if they have suffered wind damage either it was a very strong wind or the slates or their fasteners were deteriorated. Slates are typically hung from nails rather than nailed down securely.

This means that slates can move around a little bit. On roofs with very steep slopes, wind may cause slates to bang against each other, creating a sound called “chatter”. Chatter may damage badly deteriorated slates.

Slate can suffer both direct and indirect wind damage. An example of direct damage is when wind is able to blow off a ridge cap slate. An example of indirect damage is if that cap slate were blown into an adjacent roof slope and damaged slates there.

## **COMPOSITE SLATE**



You should be sure that you’re looking at real slate. A number of companies produce artificial slate tiles, which are cast using a mold made from stone slate. The industry term is “composite slate”. Composite slate from different manufacturers will have different installation and maintenance requirements and different wear characteristics both from each other and from natural slate.

From a distance, composite slate can be mistaken for real stone.

Here are some examples of composite slate. The clue to recognizing composite slates is the straight outside edges of the tiles. Stone slate will have rough edges.





Some composites, especially those made from recycled plastic, require the installer pre-bend each tile before it's installed. If the installer fails to pre-bend the tile, this is what the result can look like.



Composite slate can be identified easily by looking at the under side, which will not be

cast to look like slate.

These particular slates are from Global Manufacturing and are made from recycled materials. The advantages to composites are that they’re much lighter than slate, have a class 4 impact rating- which the highest rating- and can be installed over a standard felt underlayment using pneumatic guns.

Composite slates have been made from many different materials:

- Recycled plastic
- thermoplastic olefin, also called TPO
- rubber
- fiber-reinforced cement
- extruded concrete
- clay
- limestone
- slate particles

## **Warranties**

Although composite slates often have a 50-year limited warranty, manufacturers have not always been in business that long. A few have been in business for over 20 years. Many have entered the business but only lasted a few years due to numerous warranty claims.

When composite slates fail, it’s likely to be in one of the following ways:

### **Failed coatings**

At least one company uses a coating to color their slates, and there have been some coating failures. Most manufacturers mix the pigments with the material so that the color goes clear through the tile.

### **Curling**

A few of the thinner slates will curl if they’re not pre-bent when they’re installed. Unless they’re hollow, these can often be corrected using a double-sided tape.

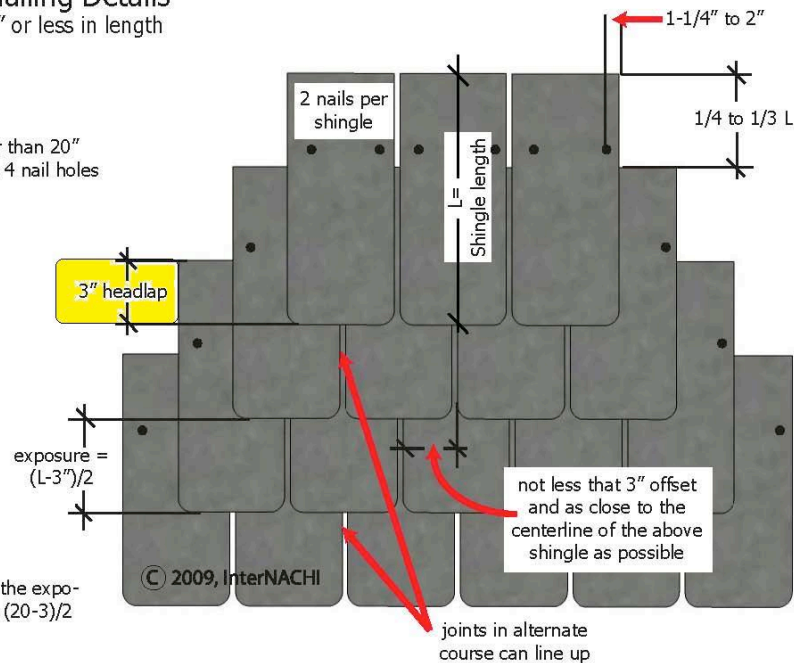
### **Inadequate headlap**

Leaking is often caused by improper installation.



### Slates - Nailing Details for slates 20" or less in length

**Note:**  
slates longer than 20"  
usually have 4 nail holes



**For example:**  
On a 20" slate the exposure should be  $(20-3)/2$  or about 8.5"

The headlap with composites is generally the same as with stone slate... 3 inches. You may see 2-inch headlaps on roofs steeper than 12 and 12, but any slope less than that should have a 3-inch headlap.

### Excessive brittleness

Quite a few companies that failed because their products became excessively brittle over time. After a while they just cracked and fell apart.

### Look before you walk!

It's crucial that you examine these roofs carefully before you try to walk them. These types of failed roofs are impossible to walk safely and without causing damage. From a window or a deck or a ladder, check out composite slates closely before you step on them.

Some types of solid polymer-based composites can be walked as long as the sun is shining on them, but they get very slippery as soon as the sun goes down. These tiles are typically smoother and stiffer than rubber composites that are safer to walk.

### CREDITS:

Derek, Product Sources Group, 303-280-9595  
1600 Huron, Broomfield, SO

Gib McIntee, Canadian slate testing consultant

Student Material Book  
InterNACHI “Inspecting Slate Roofs” online video course

Slate samples from Evergreen Slate 518-642-2530  
Box 248, 68 E. Potter Ave.  
Granville, NY 12832

New England Slate, Chris Smid, 802-287-2295  
363 VT Rt. 30 S.  
Poultney, VT 05764

Russ Watsky, National Slate Association