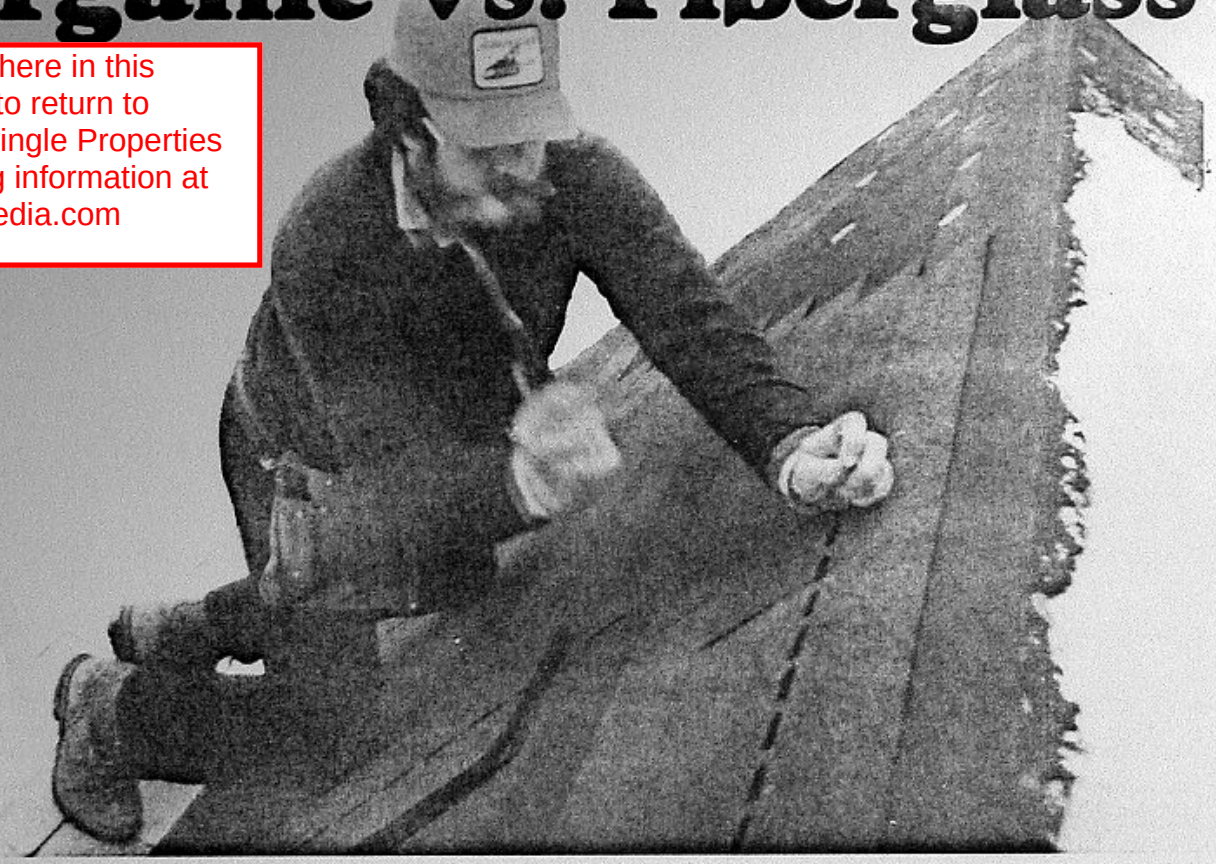
Choosing an Asphalt Shingle: Organic vs. Fiberglass



Reports of premature failures in fiberglass shingles have spawned a host of studies — and a closer look at shingle construction and selection

The most common residential roofing material applied in the U.S. today is fiberglass asphalt shingles. Since they were introduced in the late 1970s, fiberglass shingles have come to dominate the market, accounting for nearly 90% of all shingles installed today. In fact, the original "organic felt" shingles are now hard to find in many areas.

Evaluating the quality of organic shingles has always been pretty straightforward: In general, the heavier the shingle, the longer it will last on the roof. Fiberglass shingles, on the other hand, have a different composition and cannot be easily evaluated based on weight. This has made it more complicated for builders to choose a shingle. And recent reports of some fiberglass shingles failing prematurely have made the choice even tougher.

Anatomy of a Shingle

All asphalt shingles consist of a fiber mat coated with asphalt (see Figure 1, page 13). The fiber mat, which gives the shingle most of its strength, is made either from an organic cellulose material (derived from wood or recycled paper) or from the newer and more popular fiberglass. The organic mats, sometimes called "felt" mats, are similar to ordinary roofing felt. They are saturated with a soft, pure asphalt to form a sturdy, pliable base. Fiberglass mats are much thinner, and are not saturated with asphalt.

Both types of mat are surface-coated on both sides with a layer of hard asphalt that has been "stabilized" with inexpensive mineral fillers, such as finely ground limestone or slate. The filler adds bulk and helps to make the shingles more fire resistant. The top coating of asphalt also holds a layer of small granules of rock, usually colored with a ceramic coating, that protect the asphalt from damaging sunlight. The back surface of the shingle is covered with a fine mineral dust, such as talc, sand, or mica, to keep the shingles from sticking together and from staining each other in the package.

Worth Its Weight?

All of these components add to the weight of a shingle, but only some add strength and durability. Heavier stone, for example, can add weight without increasing shingle life. Similarly, in a high-profile "architectural" shingle, the added weight of the extra layer of stabilized asphalt contributes little to shingle strength unless it's applied to a thicker mat.

Despite this, the quality of organic asphalt shingles can still be reliably judged from their weight — when comparing shingles of the same brand and type. This is because the additional weight of the heavier shingle is mostly accounted for by a thicker mat with more soft asphalt saturant — factors that add strength and durability as well as weight. The pure asphalt typically adds 25 or 30 pounds per square.

But weight is generally not a good basis

BY TED CUSHMAN

Choosing a Shingle Offset

The watershedding characteristics of three-tab asphalt shingles depend to some degree on the pattern used to lay them. The "side lap" or offset — the horizontal distance from the butt end of one shingle to the end of the shingle in the course immediately below it — performs three functions:

- It prevents moisture migration into butt joints and fastener punctures;
- determines how the finished roof looks from the ground; and
- provides an avenue for water runoff.

Straight up. Most builders learned to lay shingles "carpenter style," offsetting every other course of shingles by 6 inches, or for metric shingles, half the width of a tab (see Drawing A). This "straight up" method makes it easy to keep the courses straight, and many customers like the neatly aligned rows of tabs. But it also aligns cutouts and butt joints in every other course. Over time, the granules on the surface of the tab immediately under the cutouts can erode, exposing the underlying asphalt to ultraviolet light. This can accelerate heat aging and wet/dry cycling, and because there's only one tab between the butt joints and a cutout, leaking water can more easily make its way through to the sheathing.

Half pattern. The "half-pattern" method (also called "half-tab" or "sixes") also uses an offset half the width of a tab, but the pattern is stepped (Drawing B). The appearance is similar to the straight up pattern, but the butt joints are better protected from water migration. Unfortunately, the cutouts are still aligned and can erode early.

Four-inch offset. Two other popular methods use offsets of 4 inches and inches to solve the problem of cutout alignment. With a 4-inch offset, tw full courses intervene before cutouts align, and butt joints align every 1 courses (Drawing C). But for low-slope roofs, wet areas, or climates wit severe freeze-thaw cycling, the 4-inch pattern does not provide enough pr tection from horizontal water migration.

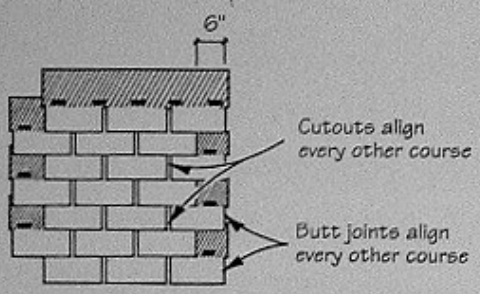
Cutting books with fives. The most popular pattern among roofin specialists is made with a 5-inch offset. Also called "cutting books wit fives" (Drawing D), it works well with metric shingles as well (the of set is actually 5⅝ inches, called "five-plus"). The 5-inch pattern pr vides good side lap protection in wet climates and hides shingle si irregularities better on a large expanse of roof. But its biggest advanta is that both the cutouts and the butt joints align only every eight cour es, so runoff is less likely to cut channels into the shingle granules.

All of these methods are described in the *Residential Asphalt Roofing Ma ual* (ARMA, 6288 Montrose Rd., Rockville, MD 20852; 301/231-9050) an *The NRCA Steep Roofing Manual* (NRCA, One O'Hare Centre, 6250 Riv Rd., Rosemont, IL 60018; 312/318-6722). However, most manufacture specify on the shingle wrapper which method you should use to lay the shingles. In fact, some manufacturers recommend patterns other than one these. The important thing is to check the shingle wrapper for manufactu er's recommendations, and get permission if you plan to deviate from th pattern specified. Otherwise, you will void the shingle warranty.

— *Sal Alfan*

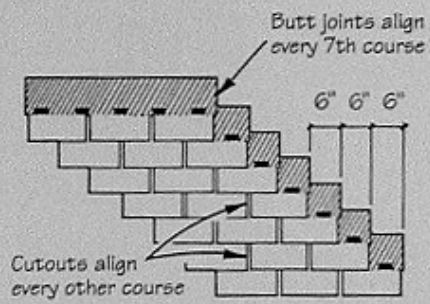
Asphalt Shingle Layout

A. Straight-Up Method



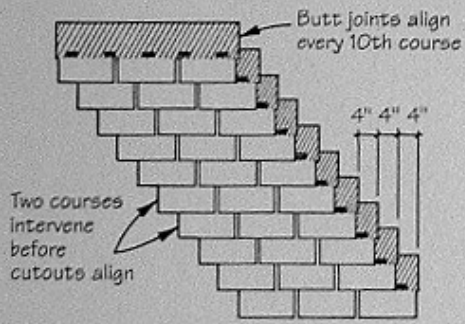
A. *The straight-up method of laying shingles offsets alternating courses 6 inches from a vertical line up the roof (half a tab width for metric shingles). The alignment of butt joints and cutouts in every other course, however, can cause premature weathering of surface granules.*

B. Half-Pattern



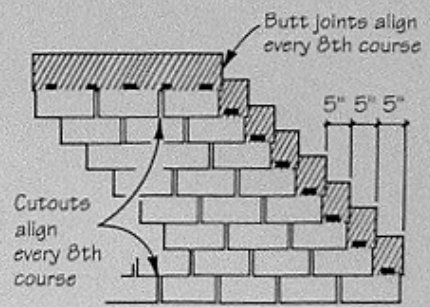
B. *A half pattern (also called half-tab or sixes) staggers each course with a 6-inch offset (half a tab width for metric shingles). Butt joints are better protected from water migrating horizontally, but cutouts still align every other course.*

C. 4-Inch Offset



C. *A 4-inch offset keeps cutouts separated by two courses, and butt joints align every ten courses. But the short side lap doesn't provide enough protection in wet climates, or in areas with severe freeze-thaw cycles.*

D. 5-Inch Offset



D. *A 5-inch offset provides the best all-around protection. Both the cutouts and the butt joints align only every eight courses, so runoff is less likely to cut channels into the shingle granules. It also hides shingle irregularities well.*

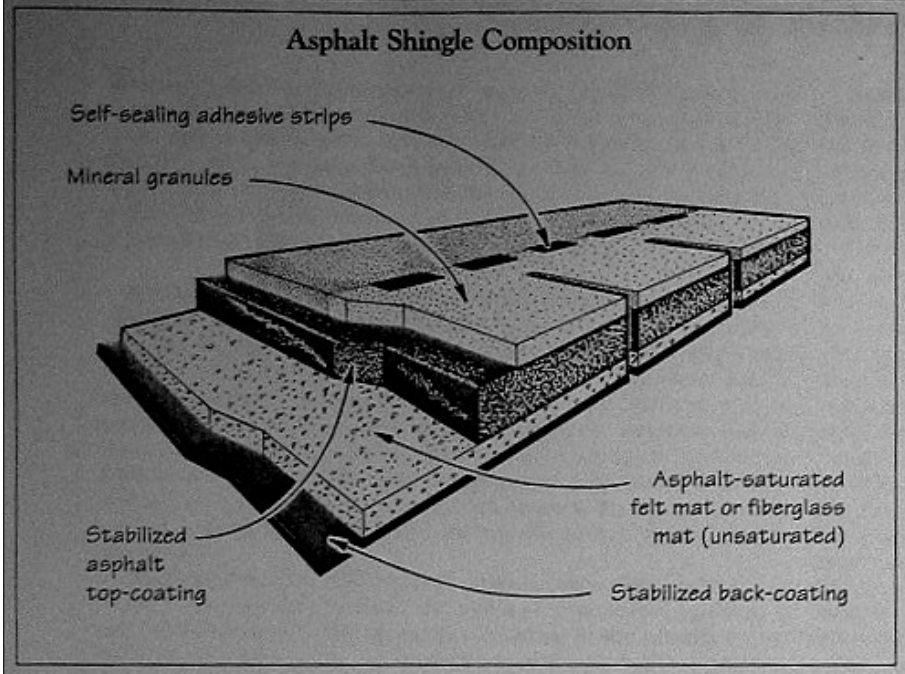


Figure 1. *All asphalt shingles are built around a mat of either organic felt or fiberglass. The organic mats are thicker and are saturated with soft, pliable asphalt. Both types of shingles have a top layer of harder, stabilized asphalt topped with colored stone to protect against UV light. On the bottom, all shingles have a thin coating of asphalt coated with talc, sand, or mica to keep the shingles from sticking together in the package.*

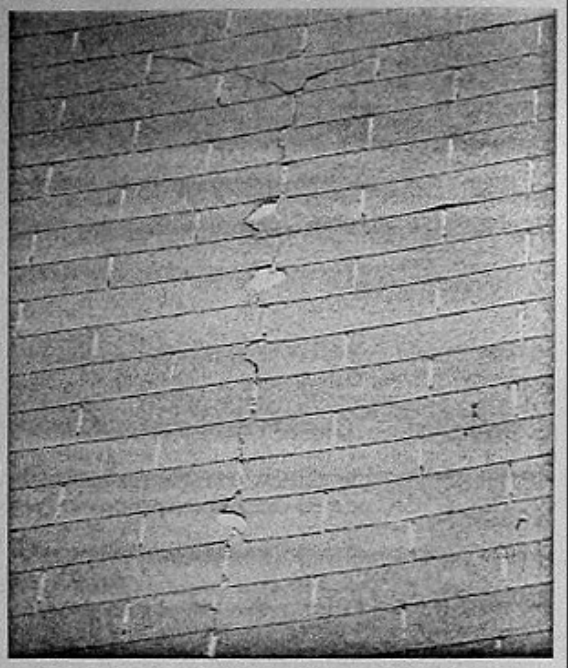


Figure 2. *Fiberglass shingles that fail early usually crack, either vertically up the roof over many courses of shingles, or horizontally and diagonally across tabs.*

for comparison of fiberglass shingles. The additional weight of a heavier fiberglass shingle is accounted for primarily by additional hard, stabilized asphalt — a component that adds weight but not necessarily strength or durability. In fact, if too much mineral filler is used in the hard coating asphalt, it can make the shingle brittle and more likely to crack, despite the added weight.

As for the fiberglass mat, a better mat will make a stronger shingle. But it is the type of binder, strand orientation, and other components of the base material that make a better fiberglass mat, not necessarily the thickness or weight. Also, a heavier fiberglass mat only adds a pound or two per square, so it barely registers anyway.

Warranty Woes

Since you can't use shingle weight as a standard for choosing fiberglass shingles, a lot of roofers look at the manufacturer's warranty to gauge quality. This has traditionally worked for organic shingles, since the heavier, longer-lasting shingles usually carry a longer warranty. But the warranty periods of fiberglass shingles — typically expressed as 20-year, 25-year, and 30-year — do not necessarily correspond with shingle quality. In some cases you are simply paying more for a longer warranty.

The warranties differ from company to company, but none gives the installer full coverage. According to the terms of most warranties, for example, the manufacturer agrees to pay only the depreciated cost of the roofing material, and none of the labor to install it or the cost to dispose of the old shingles, which are two of the biggest expenses for roofers. Also, most shingle warranties aren't transferable when the home is sold. Since the average American homeowner sells after about six years, shingle companies are not liable even if their product doesn't perform as advertised. The builder's reputation, however, is still at risk if the roof fails, no matter who owns the house.

Even though warranties don't necessarily predict shingle life, it's still worth comparing coverage among the different roof manufacturers. Some warranties, like CertainTeed's, include payment of labor costs and provide 100% coverage for the first five years. BPCO, a Canadian manufacturer of organic shingles, provides similar "up front" coverage in a warranty that is transferable to subsequent owners of the home.

Another key to warranty protection is installation: If you want to ensure coverage, you have to install the roofing properly. And for warranty purposes, the "right" way is the way the package says to do it (see "Choosing a Shingle Offset," previous page). Bear in mind, also, that no matter how the shingles are installed, the warranty could be voided if the roof framing, sheathing, or ventilation is determined by the manufacturer to be substandard.

Shingle Failure

In past years, warranties weren't much of a concern because the organic felt shingles usually lasted longer than the 15 or 20 years for which they were guaranteed. Some organic shingles on roofs today have seen 30 years and are still hanging on.

Many roofs with fiberglass shingles, however, aren't faring as well. Several roofing contractor associations have heard complaints from their members that some fiberglass shingles are failing within ten years — and sometimes as early as six months — into the warranty period.

When fiberglass shingles were first introduced, their biggest problem was with blow-offs. Manufacturers responded by improving the adhesive in the shingle sealant strip. The more recent failures usually involve cracking, which can occur vertically up the roof over many courses of shingles, horizontally across tabs, or diagonally (see Figure 2). No one has fully documented how common the problems are, but industry experts feel they are fairly widespread.

The causes are also difficult to pin down, but appear to involve a combination of weak fiberglass mats, thin and inflexible asphalt, and the effects of thermal expansion and contraction. Some shingles crack because they can't adjust to movement in the roof substructure. More commonly, however, cracks are caused by dimensional changes in the shingles themselves as they respond to temperature changes. Shingles expand in the heat and contract in the cold, but because they're pinned to the roof by nails and stuck to each other by their own adhesive strips, the shingles rip themselves apart. Ironically, manufacturers' efforts to solve the blow-off problem by improving seal strip adhesion may have made the cracking problems worse.

Aging is also a factor in early failure. Over time, the volatile elements in the asphalt cook off, reducing the tensile strength and flexibility of the shingles. So roofs that get a lot of sun or are not well ventilated may fail sooner.

According to Don Berg, of the National Roofing Contractors Association's (NRCA) technical department, the cracking is "not limited to one or two brands, or one or two types or qualities of shingle. It has occurred in the commodity-grade and the architect-grade shingles." Berg has received reports of the problem "from generally around the country" but says NRCA "doesn't really have a handle on how widespread it is."

The Midwest Roofing Contractors Association (MRCA), another trade organization, has also received reports from their members of early failure of fiberglass shingles. And the president of Western States Roofing Contractors Association (WSRCA), Don Bosnick of Bosnick Roofing in Tacoma, Wash., says his organization has looked at samples of failed shingles "from Connecticut to California," mostly in the 20-year three-tab type.

The Asphalt Roofing Manufacturers Association (ARMA) is also aware of the problem, and responding in part to WSRCA test results, has recently formed a task force to study it and find solutions. According to Joe Jones, a retired senior technical executive at Owens Corning, who heads the ARMA task force, "The cracking problem occurs in a number of different types of shingles, from a number of different manufacturers, in many parts of the country." Jones emphasizes, however, that the number of homes reporting cracking problem "is miniscule compared with the number of shingles sold."

Shingle Installer's Disclaimer

The roofing contractor and materials supplier have no control over the production quality of shingles or the length of time the manufacturer claims they will last. The manufacturer has the sole liability for these properties of the shingle.

In your case, the name of the manufacturer of the product being applied is _____ and the type of shingle is _____.

Contractor's sole liability is limited to the warranty in the contract. This is in lieu of all other warranties, express or implied.

Figure 3. *WSRCA has distributed this disclaimer to its members so they don't unintentionally warrant the roofing materials they install. Roofers give the disclaimer to homeowners along with the roofing manufacturer's warranty.*

Tear Strength

There is growing evidence that a shingle's tear strength is a good indicator of its resistance to cracking. The American Society of Testing and Materials (ASTM) has a minimum standard for tear strength, included in ASTM D3462. The standard establishes that, using an Elmendorf tear tester, it should take at least 1,700 grams (3¾ pounds) of force to tear a shingle that already has a notch in it. Although the tear test does not directly relate to cracking of shingles, high test results indicate a strong fiber mat. This standard was adopted in 1976 when fiberglass shingles were first introduced, and was based on the *lightest organic shingle* known to have performed acceptably. Most organic felt shingles still available today have tear strengths of over 2,250 grams, and some as high as 3,500 grams.

Compliance with ASTM D3462 is voluntary, and ASTM does not check whether manufacturers who claim their shingles meet the standard actually comply. In fact, many don't. In tear strength tests conducted in early 1992 by two independent laboratories at the request of WSRCA, 22 of 24 fiberglass shingle samples (two each from 12 manufacturers) tested below the 1,700-gram standard.

Underwriters Laboratories recently announced that it would independently check tear test results, so you can start looking for UL certification of ASTM D3462 in a special box on the shingle wrapper. So far, only CertainTeed has received such certification, but a spokesman for UL says several other companies are expected to receive certification soon.

Manufacturers Respond

According to Jones, head of the ARMA task force, most manufacturers have already taken steps to eliminate the cracking. Some have gone to a heavier fiberglass mat; others have changed their asphalt formulation. ARMA has promised test results by June 1993.

San Francisco-based WSRCA is also continuing to work on the problem. WSRCA's Bosnick says the association is looking at several different characteristics of new fiberglass shingles, including tensile strength, flexibility or pliability, and response to thermal shock. In February 1992, WSRCA started a comprehensive testing program on actual shingle samples from failed roofs, hoping to determine exactly why the shingles have cracked. This June, WSRCA plans to release a report describing test procedures and specifications that will tell roofers what tests shingles should undergo and what results shingles should achieve to avoid early failure.

An ASTM subcommittee, which includes representatives from industry and the trades as well as consultants, architects, and academics, has also been trying to develop a new standard. But since ASTM subcommittees make decisions by consensus, new AS standards may be slow in comi

Choosing A Shingle

Until new standards are set enforced, contractors need t careful when choosing a shi One option is to avoid fiberglas use organic felt shingles, which not shown any premature crac problems. Some organic shin have been reported to "blister" "curl," but the problem is n widespread as the cracking of f glass shingles, and rarely resul leaks or blow-offs. Organic shi have higher tear strength, good ibility, and a high resistance to pull-through. They usually cost t than fiberglass shingles, prim because their heavier weight m them more expensive to ship.

If you use fiberglass shingles, sider stepping up to a longer war period. This may reduce the cha of a roofing failure, because the cr ing problem seems to occur m among the 20-year fiberglass shin But you still can't be sure, becaus year and 30-year fiberglass shin have failed prematurely, too.

Also be careful how you guara your work. WSRCA has distribu standard disclaimer to their mem to be given to customers along w copy of the manufacturer's warr (see Figure 3). The disclaimer st that the contractor guarantees workmanship, not the shingles; shingles are covered only by the m ufacturer's warranty. If you say so thing vague to the customer like is a 20-year roof" or "these shin will last 25 years," you may be hel that promise even though the shi warranty doesn't really say that.

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Sources of Supply

Organic Felt Asphalt Shingle Makers

BPCO Inc.
12 Furler St.
Totowa, NJ 07512
800/361-3656

Celotex Corp.*
4010 Boy Scout Blvd.
Tampa, FL 33607
800/331-7451

CertainTeed Corp.*
Roofing Products Group
P.O. Box 860
Valley Forge, PA 19482
215/341-7000

GAF Building Materials Corp.*
Residential Roofing Products
1361 Alps Rd.
Wayne, NJ 07470
201/628-3000

Georgia-Pacific Corp.*
133 Peachtree St. NE
Atlanta, GA 30303
404/521-4000

Globe Building Materials Inc.
2230 Indianapolis Blvd.
Whiting, IN 46394
219/473-4500

IKO Chicago Inc.*
8725 W. Higgins Rd.
Suite 585
Chicago, IL 60631
312/714-9999

Tamko Asphalt Products Inc.*
220 W. Fourth St.
Joplin, MO 64802
800/641-4691

*Also manufactures fiberglass asphalt shingles