

Shedding Light on Skylights

New options in glazing, sizes and flashing systems can have you scratching your head when trying to choose the right skylight

by Roe A. Osborn

After 10 years my wife and I had almost gotten used to the dark, windowless crypt that served as our bathroom. There wasn't enough money in our original budget for a bathroom skylight, so we added it to our wish list, somewhere in between a new microwave and a garage. But after finding the right skylight at a sale, we moved the project up the list.

Using an old table lamp without a shade for light, I cut the hole in the ceiling and did the necessary framing alterations in the dim and dusty roof cav-

ity. Then, on a steamy July morning, I stripped the roof shingles back and blasted through the sheathing, plunge-cutting with my sidewinder.

When I lifted out the rectangle of sheathing, a blast of air from inside the house blew sawdust everywhere. The change in the bathroom was dramatic. Even without the chase closed in, the bathroom went from dreary to cheery as sunlight flooded in. A refreshing, gentle breeze wafted through the room as the natural convection currents inside the house kicked in.



Skylights for different purposes. Skylights on the outside of this house punctuate the various roof planes. Inside, they serve a variety of functions, from kitchen light and ventilation, to ventilation and added views for a second-floor bedroom, to concentrated light and solar gain in the sunroom.

To vent or not to vent—Besides letting in light, our bathroom skylight was a way to get rid of excess moisture. One of the first things skylight buyers should consider is where the skylight will be going and if it will be needed for ventilation (photo facing page). If the skylight is going into a kitchen or a bathroom as ours was, a venting skylight is a wise choice. Even with exhaust fans and range hoods, a skylight can provide a quick alternate escape route for the excess moisture and warm air that these areas are likely to encounter (top photo).

Nearly every residential-skylight manufacturer offers the choice between skylights that open to provide ventilation and skylights that are fixed, or non-opening. Bart Mosser, vice president of Wasco (26 Pioneer Ave., Sanford, Maine 04073; 800-388-0293), told me that Wasco's fixed residential skylights typically outsell their operating skylights almost 3-to-1, probably because operating skylights almost always carry a bigger price tag. The venting version of their E-Class 22-in. by 46-in. skylight lists for \$477 compared with \$277 for the fixed.

Skylights in high-moisture areas such as bathrooms and kitchens are more likely to suffer condensation than skylights in other areas. Because venting skylights open to allow moist air to escape, they are best-suited for these high-moisture areas. If the condensation is heavy enough, it can run down the glass, over the skylight frame and down the skylight chase, damaging everything in its path.

Many manufacturers include condensation gutters on their skylights to catch and to collect condensation as it runs off the glass. If you are putting a skylight in an area likely to see a lot of moisture, make sure the skylight you choose has these gutters.

Still not convinced that you need a venting skylight? The folks at Velux-America Inc. (P. O. Box 5001, Greenwood, S. C. 29648-5001; 800-283-2831) have come up with a compromise. Their FSF skylight has a ventilation flap at the top of a fixed skylight (bottom photo). The flap opens into a channel to the outside that allows air circulation even in bad weather. The FSF skylight adds only about \$30 to the cost of their FS fixed skylight of comparable size and glazing, a reasonable price for convenient ventilation. Velux, however, still recommends fully venting skylights for use in kitchens or bathrooms.

Motor-driven skylights open and close at the press of a button—If a skylight is being installed in a living space inside the geometry of the roof, such as a finished attic space, and you have easy access for opening the skylight, you may opt for one that closes with a latch and pushes open. Other skylights crank open and shut like awning windows. Push-open skylights open wider than their crank-out cousins and usually pivot for easy cleaning of either side.

If your skylight is going in a less accessible spot—say, in a cathedral ceiling high above the floor—then the crank-out variety is probably a better option. Many crank-out skylights also pivot for cleaning, but the opening mechanism has to be disconnected from the sash beforehand, not an easy feat when the skylight is out of reach. Instead of a handle, many crank-open skylights are equipped either with a socket or a small, fixed loop that lets you operate the skylight with a telescoping crank handle from the floor below.

Most skylight companies offer an optional motor that opens or closes the skylight at the push of a button either from a switch on the wall or a remote control. A lot of these motors look pretty ugly, like large boxes stuck on the skylight trim as an afterthought.

The slickest-looking mechanical skylight opener belongs to Roto's Sunrise II skylights (Roto Frank of America, P. O. Box 599, Chester, Conn. 06412; 800-243-0893). Roto houses the entire mechanical works in an aluminum extrusion that is wood-veneered to match the skylight trim. The aluminum extrusion conceals both the crank mechanism and the optional motor, and the extrusion can be removed easily for access and



A skylight expands a bathroom. The splayed chase for this skylight not only lets in more light but also makes the bathroom feel roomier. Even though the bathroom is equipped with a powerful exhaust fan, an open skylight can provide a quick escape route for the warm, moist air from the shower and the spa.



Fixed skylight with ventilation. Velux's FSF skylight does not open, but a ventilation flap at the top lets warm air out and cool air in through a screened channel. Photo courtesy of Velux-America.



A rain sensor waits for rain. When even a single drop of rain hits this small circuit board, it instantly signals the skylight motor to close the skylight and keep out the rain. Photo courtesy of Velux-America.

maintenance. Motorizing any of Roto's Sunrise II model skylights adds \$95 to the price.

The mechanisms that hold crank-out skylights open fall into two categories. One variety has metal arms that swing, or scissor, out to open the skylight. Both Velux and Andersen (100 4th Ave. N., Bayport, Minn. 55003-1096; 8004264261) use this type of apparatus, similar to the opening mechanisms for awning and casement windows.

The second and most popular system among skylight companies opens the skylight with a chain that uncoils and stiffens as the crank handle is turned. The chains are made either of metal or of plastic, and manufacturers using this system brag that their skylights open farther than those using the stiff-arm mechanisms.

Smart skylights close when it starts to rain—When people give me a hard time about being bald, one of my standard comebacks is that you have to be bald to appreciate fully a ride in a convertible. Another advantage to being follicularly challenged is that I'm usually the first to feel raindrops. Some of the contractors I used to work for depended on me for this ability, especially when they were trying to get that last course of shingles on before an approaching thunderstorm.

One thing prospective skylight owners worry about is not being home to close the skylight in case of rain. You could hire a bald guy to sit on the roof and wait for rain, but skylight manufacturers have come up with a better idea: rain sensors, which are small printed circuit boards that look as if they shouldn't be exposed to bad weather (photo left).

The rain-sensor circuit board basically consists of two conductors in a grid pattern. When a drop of rain lands on the grid, it completes a circuit that signals a motor to close the skylight.

Virtually every skylight company that offers a motorized opener also offers a rain-sensor option for their operating skylights. The better openers have battery backups for their motors. You may consider battery backup to be overkill, but if the electricity is knocked out and it starts to rain (as often happens in thunderstorms), you'll appreciate battery backup.

Some skylights with motorized openers can also be opened manually in case of emergency. This feature can be important if the motor fails or if you need to open the skylight before the power comes back on.

The controls for automated-skylight functions vary among manufacturers. Some control just the opening and closing functions, and others can be programmed to control motorized-skylight accessories such as the interior shades that most companies offer. Velux says it has a system that will interface with any homewide computer system. The system can control multiple functions on multiple skylights from a single remote box.

Glazing options can reduce UV-damage and heat transferral—

Jefferson Kolle, a former renovation contractor, told me that he once dropped a worm-drive circular saw onto a skylight of tempered glass and was amazed when the saw just bounced off. For safety reasons, skylights are made of tempered glass or laminated glass. Tempered glass is extremely strong, but when it breaks, it shatters into a million glass pebbles.

Laminated glass has a thin plastic sheet attached to the glass. It's generally not as strong as tempered glass, but when it breaks, the plastic keeps the glass in a sheet. For this reason, codes in some areas specify laminated glass for the interior-facing skylight glass in certain applications, such as over a bathtub or spa. Skylights with laminated glass usually have tempered glass on the exterior and are designated "tempered over laminated." This option can be ordered for nearly every skylight on the market. It's best to check with a local building official to find out if any stipulations apply to your installation.

Most skylight brochures include performance tables for the different glazing configurations. Those tables are usually broken down into four categories: light transmission, shading coefficient, UV-blockage and U-value. Light transmission is the amount of light allowed through the glass. Shading coefficient is the amount of solar-heat gain through the glass as compared with a single pane of 1/8-in. clear glass. The lower the shading coefficient, the lower the solar-heat gain.

The percentage of the sun's ultraviolet radiation stopped by the glazing is the UV-blockage number. The sun's UV-rays can fade and degrade furniture, carpet and draperies, and they can even discolor wood floors. The last category, U-value, is a measure of heat transfer through a glazing system. The lower the U-value, the better the insulating performance of the glazing system. With seemingly endless combinations and permutations of glass types and coatings, the insulating performance of glass is a topic worthy of a separate article. But I'll try to give a brief description of the options that are available.

Like window glass, skylight glass can be coated, such as with a tint or a low-E coating, to affect heat and light transmissions. However, the effectiveness of the various coatings depends on which of the four surfaces in the insulated-glass sandwich are coated.

Southwall Technologies (1029 Corporation Way, Palo Alto, Calif. 94303; 800-365-8794) has put a new spin on glazing performance with its Heat Mirror products, which have a clear film suspended between two sheets of glass. Southwall's Superglass, arguably the most efficient glazing option for skylights, has two film layers between the glass sheets.

The right combination of glass types and coatings will depend a lot on your situation (photo right). For instance, if you live in warmer climate and you want to put a skylight on a south-facing roof, a tint or a coating that cuts down on solar gain may be more important than the insulating value of the glazing. You'll also want a skylight with a high UV-blockage number. One note of caution: If you choose a skylight with tinted glass, the color of the tint can affect the color of everything lighted by the skylight. The added cost of special coatings and glass configurations varies among skylight manufacturers. The difference in price between Velux's FS 106 unit with clear tempered glass and the same skylight with laminated glass with a low-E coating is only \$30, which seems like a bargain given the prospective energy savings over the life of the skylight.

Glazing performance is not the same for windows and skylights—

A lot has happened recently in the study of glass performance. The National Fenestration Rating Council (1300 Spring St., Suite 120, Silver Spring, Md. 20910; 301-589-6372) certifies the performance of windows, doors and skylights from the major manufacturers with all of their various glazing options. But the numbers provided in the NFRC Certified Products Directory come from testing all of these skylights in a vertical position and may be suspect. When insulated glass is put in a slanted configuration, as with a skylight on a roof, its internal dynamics change dramatically (drawing right). The U-value of certain glazings can degrade up to 30% when changed from vertical to a slope of just 27°.

Skylight glazings are available in a mind-boggling variety of coatings and configurations that affect skylight performance. The NFRC is testing each of these variations and combinations in a sloped orientation and compiling new ratings for each skylight manufacturer. Until those new numbers are out, the NFRC's U-value ratings for skylights should be viewed with some skepticism.

Skylights are designed to accommodate conventional roof framing—

Skylights have always been made to fit between regularly spaced rafters, either 2 ft. or 16 in. o.c. If you're looking to put a skylight between rafters 2 ft. apart, you'll find a variety of skylights with a width of 22 in., usually plus a fraction. If your rafters are 16 in. apart, every manufacturer offers a skylight that will span two bays, and many offer skylights that will fit into three 16-in. bays or two 2-ft. bays.

Roof trusses can limit skylight options. In new construction trusses can be engineered to accommodate wider skylights (top photo, p. 52). But in a remodel you've got to deal with what's there, and altering trusses without an engineer's approval is a no-no. If you are one of the unlucky ones who wants to put a skylight in your 1970s raised ranch but the trusses in your roof are 16 in. o.c., take heart. Roto makes the Sweet 16, a fixed skylight that fits into 16-in. o.c. truss or rafter bays. This spring, Roto is introducing a Sweet 16 operating skylight.

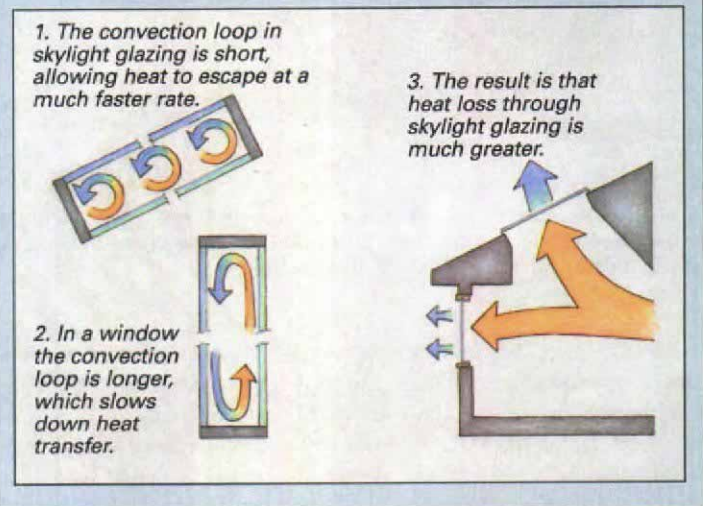
Another alternative to cutting rafters is ganging skylights together. Many manufacturers offer flashing kits for side-by-side installations. According to Chuck Silver of Hudson River Design in New Paltz, New York, the best combo kit belongs to Crestline (P. O. Box 8007, Wausau, Wis. 54402-8007; 800-444-1090), which incorporates a raised fin on its skylights to make ganging almost foolproof; they are also good at keeping out the weather.



Skylight glazing should fit the application. Clear tempered glass was chosen for the skylights in this sunroom to let in plant-friendly light. Skylights that open with a latch are less convenient but were chosen because they open wider for maximum ventilation in summer.

Insulated-glass performance changes when installed on a roof

When insulated glass is moved from a vertical to a sloped orientation, the internal dynamics change dramatically. Between the panes of glass, convection currents cause heat to be transferred from the warmer inside surface to the cooler outside.



Flashing is the key to a good installation—I installed my first skylights back in 1982. The guy I was working for handed me two Velux venting skylights still in the box and told me to prep them for installation. I spent a whole morning removing the aluminum cladding and fastening the mounting brackets at just the right height. Luckily, my boss had installed skylights before, and I watched in awe as he wove in the flashing. My duties were to prevent all of the pieces from blowing away and to keep the screws from jumping off the roof until they could be put back in the cladding. After those skylights were installed, they looked as if they could fend off any kind of weather or an attack from a Klingon squadron.

Aside from the glazing choices, the biggest distinction between different makes of skylights is the flashing. In 1941 in Denmark, V. Kann Rasmussen



Wide skylights in truss roofs. A truss roof can be engineered to accept a wide skylight. Here, trusses have been doubled, and a small monotruss that fills in the roof below the skylight hangs on a header.



A shiny alternative finish. Sun-Tek offers its Classic Series skylights in polished copper with a clear, protective finish designed to keep the skylight shiny for years. Photo courtesy of Sun-Tek.

designed one of the first self-contained skylights. His work evolved into what is now the Velux company. Part of his design was the patented Velux flashing system, which today remains basically unchanged (photo bottom right, facing page). One-piece head and sill flashings wrap the top and bottom of the skylight, and step flashing seals the sides. Cladding on the sash, which is removed and replaced during installation, extends down over the top edge of the flashing, serving as counterflashing to create an impenetrable shell.

Other skylight manufacturers such as Roto and Andersen use an EPDM rubber gasket that covers the top of flashing (photo top left, facing page). Mike Guertin, a builder in East Greenwich, R. I., says that he prefers Roto skylights because with the gasket, the sash and all of its cladding do not need to be removed for installation, making the process go a lot quicker.

On the other hand, curb-flashed or perimeter-flashed skylights with a solid flange that runs around the circumference of the skylight always worried me. I'd always associated this type of flashing system with less expensive skylights—that is, until I began my research on this article.

I found many well-made skylights available with welded metal, vinyl or flexible-PVC flanges (photo top center, facing page). The skylights with metal or vinyl have to be installed in mastic to make them waterproof,

and the word *mastic* always conjures up images of goo stuck in my beard and sleepless nights as I worried that the mastic seal might not be complete. Nevertheless, many contractors will use nothing else; in fact, these mastic marvels are popular for commercial installations.

The E-Class skylight made by Wasco has a flexible-PVC flange extruded as an integral part of a PVC frame (photo top right, facing page). The flange has an inverted "L" about an inch away from the frame; the roof shingles slip under the inverted "L." Outboard of the "L" are three water-diversion ridges. The design of the flange eliminates the need for mastic or sealant and is self-healing so that it can be nailed without worry. E-Class skylights are carried to the roof in one piece and installed with small metal brackets that lock into a channel in the skylight frame. Installation of a Wasco skylight takes a fraction of the time it usually takes for a step-flashed skylight.

Sun-Tek (10303 General Drive, Orlando, Fla. 32824; 800-334-5854) offers a variation on the same theme. Its Elite series uses a welded aluminum flange with similar-looking water-diversion ridges. Predrilled, the flange doubles as a nailing flange and eliminates the need for extra brackets. However, installation of the Elite does require mastic or sealant.

Perimeter-flashed skylights also are installed on top of the roof sheathing, which lets the skylight frame be as large as the framed opening in the roof, while the frames for step-flashed skylights usually fit inside of the roof framing. A larger frame means more glass area and more daylight. Wasco's E-Class 2246 venting skylight has 6.39 sq. ft. of glass compared with 3.99 sq. ft. with Velux's VS 106, or 2.4 sq. ft. more daylight for basically the same-size hole in your ceiling. In all fairness to Velux, this spring the company's skylights will be featuring more streamlined and more installer-friendly flashing that will increase glass area for their VS 106 skylight to 4.68 sq. ft.

Special flashing for shallow pitches—The flashing systems I've discussed so far are restricted to installations on roofs with a 4-in-12 pitch or greater. Most skylight companies offer special flashing kits for skylights on shallow pitches, but many of these shallow-slope kits are cumbersome. Because these flashing kits raise the skylight to a higher pitch than the roof, framing and finishing the skylight chase can be a real puzzle. Another alternative for a shallow-pitched roof is a curb-mounted skylight.

Tom O'Brien, a restoration carpenter in Richmond, Virginia, explained that installing a curb-mounted skylight on a shallow roof (4-pitch or less) involved first building a 2x6 frame or curb on top of the sheathing. Tom usually hires an experienced roofer to fabricate metal flashing around the curb. The flashing is embedded with mastic or sealant, and the roofing material is then run on top of the flashing. The curb-mounted skylight sash with built-in counterflashing is then installed on top of the curb in a bed of mastic or sealant. On a flat roof the roofing membrane is carried up the sides of the curb with the sash mounted on top.

Special flashing kits are also needed if your roof is covered with something other than asphalt or wood shingles, such as metal or tile. If it is, be sure the company that makes the skylight you choose also makes the right flashing kit for your type of roof. This type of installation can be tricky, and I also recommend leaving it to a professional roofer.

Step-flashed skylights are harder to make airtight—Although step-flashing is a great system for keeping water out, its weakest point probably is preventing inside air from escaping. No doubt it must seem strange to consider such a factor when venting skylights are designed specifically to allow air to escape, but air leakage around skylights can be a big problem, especially in colder climates.

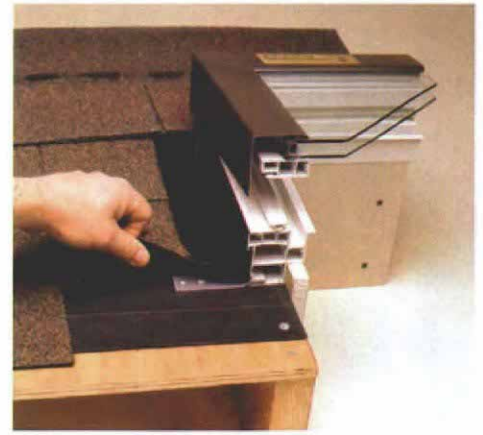
The problem is not with the step-flashed skylight itself, but rather with the installation. Sealing a step-flashed skylight against air leakage requires felt paper to be run from the roof up the sides of the skylight frame, which means that the installer has to haul yet another item onto the roof in addi-



A rubber gasket seals the flashing. Many skylight manufacturers use rubber gaskets to cover the top of the flashing, such as the Roto skylight pictured here.



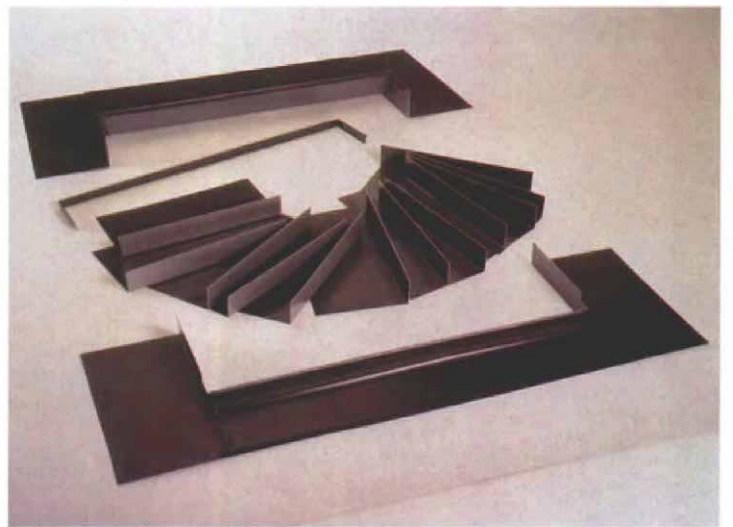
Curb-flashed skylights rely on a mastic seal. When the mastic seal around these curb-flashed skylights failed, roof cement was incorrectly applied on the shingles to stop a leak.



A new wrinkle in skylight technology. Wasco's E-Class skylight, shown here in cross section, has a PVC frame extruded in one piece with a flexible flange for flashing.



Bare shingles can indicate air leakage. Step-flashed skylights have to be sealed with felt paper under the flashing to make them airtight. If not done properly or skipped altogether, warm air leaking from inside will melt the snow around the perimeter of the skylight.



Tried-and-true flashing system. Velux's patented system consists of head flashing for the top of the skylight, sill flashing for the lower end and step flashing for the sides. Cladding on the sash seals the top of the flashing from the weather. Photo courtesy of Velux-America.

tion to all of the flashing pieces. If this step is skipped or not done properly, air from inside can escape through the spaces between the step flashing, along with lots of heating dollars. After a snowstorm here in Connecticut, it's common to see skylights on snow-covered roofs with halos of bare shingles (photo bottom left). In some cases melting can occur because of heat loss through the skylight frame, but air leakage is usually the culprit.

Skylights with solid flanges don't require felt-paper seals. The folks at Wasco do a little demonstration where they place a \$50 bill under one of their fixed E-Class skylights on top of a solid table. Anyone who can lift the skylight off the table can have the bill. But because the flexible flange forms an airtight seal, the skylight won't budge, and no one has won the \$50 yet. The flange functions the same way on the roof, forming an airtight seal against the roof sheathing and preventing warm air from finding its way out and around the skylight.

Designer skylights are available in colors—Most companies offer the choice of just a couple of colors. Roto, however, offers its Sunrise II skylights in five different colors including forest green and fire red. Other companies will custom-paint skylights to match or complement any funky color you might have on your roof. A word to the wise: Check out price

and lead time before ordering your sea-foam green skylights. You may decide that basic brown won't look so bad after all.

To me, the neatest-looking skylights are the copper-clad skylights available from Velux and Sun-Tek. Velux's copper-clad skylight is unfinished so that it will weather to a green patina. The Velux copper-clad skylight may be the best choice when skylights are used on historic buildings.

Sun-Tek's copper-clad skylight has a clear, protective finish for a shiny copper-kettle look (bottom photo, facing page). In the right application, this skylight has my vote for sexiest skylight on the market. The cost of upgrading to a copper-clad skylight is reasonable, adding \$61 to the price of Velux's VS 106 and \$33 to the price of Sun-Tek's VCG 2246.

One final word about availability. Most lumber stores carry many different makes and models and can order what you need if they don't have it in stock. If you are stuck for time and need an out-of-stock skylight yesterday, go with Velux. They pride themselves on being able to ship any of their standard skylights or accessories to your dealer free of charge within 24 hours of receiving an order. □

Roe A. Osborn is an associate editor at Fine Homebuilding magazine. Photos by the author except where noted