# Curbless Skylights

## Insulated glass mounted flush with the roof in a low-cost, site-built design

by Rob Thallon

Builders find themselves installing lots of skylights these days. There are some excellent manufactured skylights on the market, the best of which are well insulated and can be opened for ventilation and cleaning. These top-of-the-line units are expensive—$25 per sq. ft. or so. Less costly store-bought skylights are not operable, usually not insulated, and they are often translucent rather than transparent. Some of these budget skylights come with an attached, pre-flashed curb to raise the glazing above the roof, but many require on-site curb construction.

The curbless skylights that I started to build about nine years ago are installed more like large shingles, in contrast to most of the manufactured or site-built skylights that I've seen. As the photo at right shows, eliminating the curb gives the skylight a lower profile so that it looks more continuous with the roof.

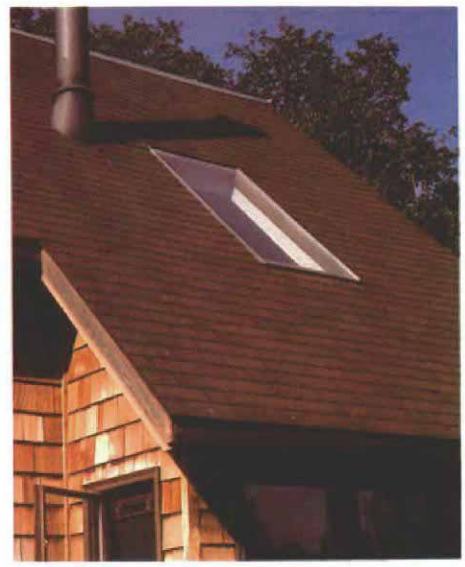
In the last six years my partner, David Edrington, and I have installed more than 50 curbless skylights, and they've held up well. We use insulated, tempered-glass panels in standard sizes when possible, and we've simplified construction details to the point that we now feel confident that our skylights are the best fixed skylights available.

Our design can accommodate just about any type of glass or acrylic panel (providing you allow extra room for expansion), and replacing the glass is an easy job. The design doesn't rely on caulks and sealants, which have unpredictable lives, but rather on the behavior of water in contact with metal and glass. With slightly different flashing details, these skylights can be ganged to form continuous bands of roof glass such as those found in greenhouses. And perhaps best of all, our skylights cost about $4 per sq. ft., if you use off-the-shelf sizes of insulated glass.

**General suggestions**—The glass and side flashing drains in our system are at a slightly lower angle than the roof, so the amount of pitch is important. We've used this detail in 4-in-12 roofs, but I don't recommend going any shallower than this.

The skylight construction details can be adjusted to work with most roofing materials. We try to use those that fit closely, like cedar or composition shingles. Roll roofing or metal would also work fine, but with looser-fitting materials like shakes or tiles, the step and side flashing dimensions should be increased.

*Architect and builder Rob Thallon lives in Eugene, Oregon. Photos by the author.*



**Organizing materials**—Since the size of the glass determines the size of everything else, this is the first part of the skylight to consider. Insulated tempered-glass door blanks come in a standard 76-in. length and in three standard widths—28 in., 34 in., and 46 in. We usually use the 34-in. wide blank, and the installation I'll describe uses this size.

You can also adapt these instructions for glass of any size. We've had smaller tempered windows custom-built, but they end up costing more than the larger ready-made ones. On the other hand, glass larger than 34 in. by 76 in. usually isn't strong enough to be safe. Consult your glazing supplier about the panel strength in relation to size and snow loads in your area, and check with your building inspector for the minimum glass-thickness requirements for skylights.

It's important to understand that ordinary window glass isn't recommended for skylights because of its relatively low strength and because, if it should break, a large piece of it falling into a living space could be extremely dangerous. The three types of glass recommended for skylights—tempered glass, safety glass and wire glass—have overcome this problem in different ways. When it breaks, tempered glass is supposed to dice into tiny bits, each no larger than 3/16 in. Safety glass (also called laminated glass) is a sandwich of two layers of ordinary glass held together by a layer of plastic. Wire glass has a network of tiny wires running through it that prevent the glass from breaking into dangerous shards.

Of all the kinds of glass, we prefer the tempered for skylights because it's the most transparent and, under uniform conditions, its strength exceeds that of laminated or wire glass by a factor of about four. The chief disadvantage of tempered glass is the potential for incomplete dicing when it breaks (for more on the dangers of tempered glass, see *FHB* #16, p. 21). We've never had such a problem with any of our skylights, but the possibility has emerged, so codes governing tempered-glass skylights have been stiffened here in Oregon. Building departments require insulated units to have a safety-glass layer on the inside or a screen below tempered glass. The screen has to be at least 12 USA-gauge wire with a mesh no larger than 1 in.

Once you've decided on the type and size of the glass, you can order the flashing. General dimensions for each flashing configuration are noted in the bottom drawings on the facing page; the dimensions in parentheses are for a 34-in. by 76-in. unit. The bends are straightforward and should be easy work for any reputable sheet-metal shop. We usually specify 26-ga. galvanized steel or 16-oz.-copper, but Prepainted or stainless-steel flashing will work fine. We don't use aluminum because it won't bend to these shapes without fracturing.

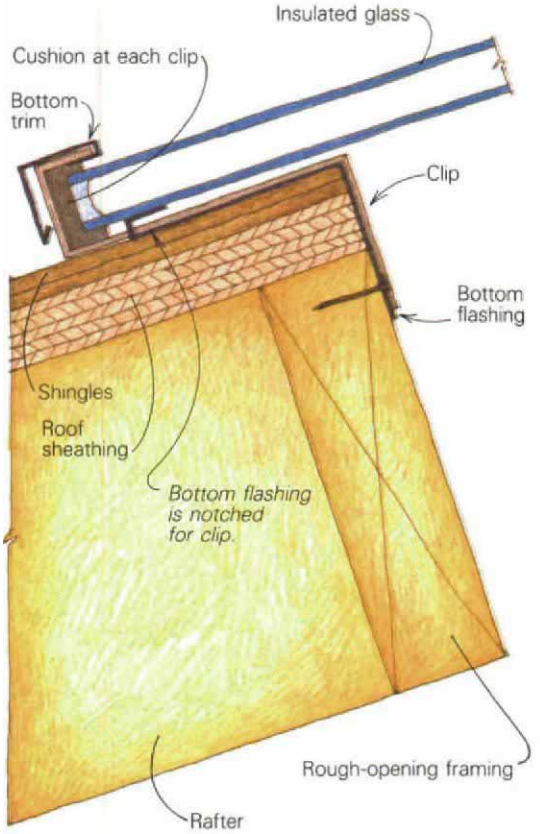
At our local shop, the flashing package for a 34-in. by 76-in. unit costs $32.75 for galvanized steel, $81.00 for copper, $42.50 for prepainted and $77.00 for stainless steel.

**Roof framing and flashing**—The rough opening for the skylight needs to be ½ in. wider (across the roof) and 2½ in. shorter (parallel to the rafters) than the dimensions of the glass. For example, the rough opening for a 34-in. by 76-in. glass panel should be 34½ in. by 73½ in.

Sheathe the roof to the edges of the rough opening (but don't let the sheathing project into the opening), and install the roofing material up to the bottom edge of the opening. Next, fasten 1x4s to each side of the rough opening so their top edges project a couple of inches above the sheathing. These are just temporary fences for the step flashing, but

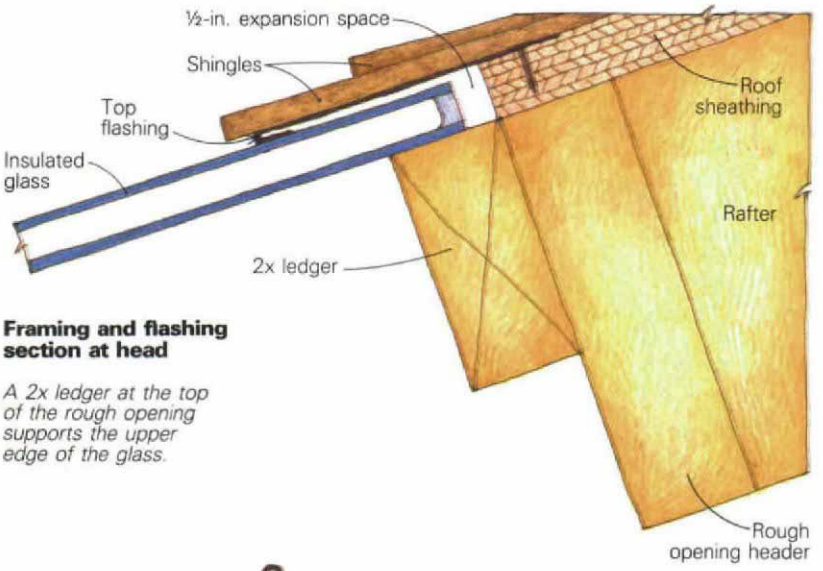
**Framing and flashing section at bottom**

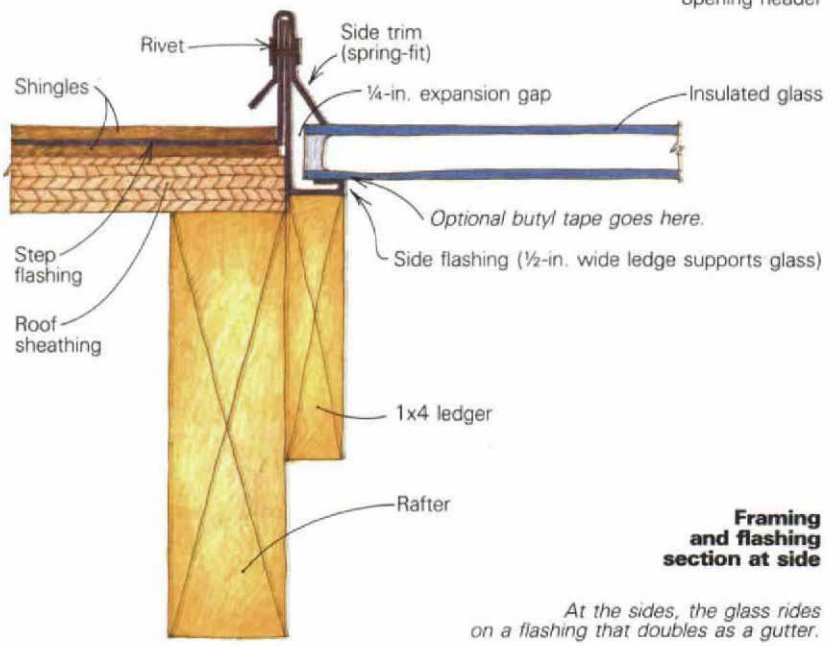
*Clips screwed to the rough-opening framing cradle the glass from below.*




**Framing and flashing section at head**

*A 2x ledger at the top of the rough opening supports the upper edge of the glass.*

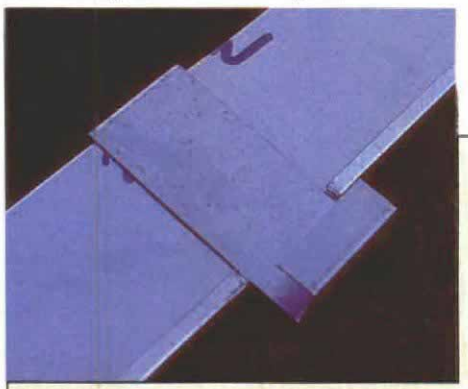



**Framing and flashing section at side**

*At the sides, the glass rides on a flashing that doubles as a gutter.*

**The glass is held by clips made of 1/16-in. galvanized steel (drawing, below). Each clip is screwed to the bottom header and notched into the flashing, as shown in the photo.**

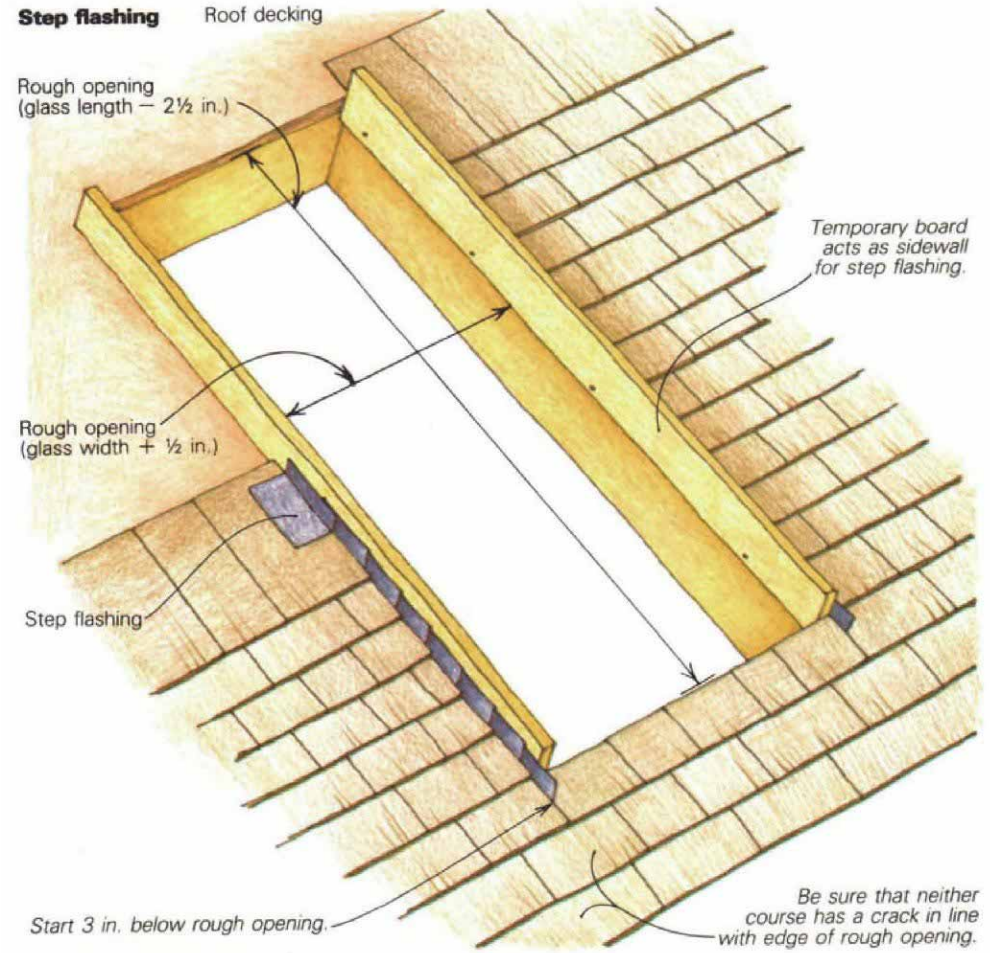


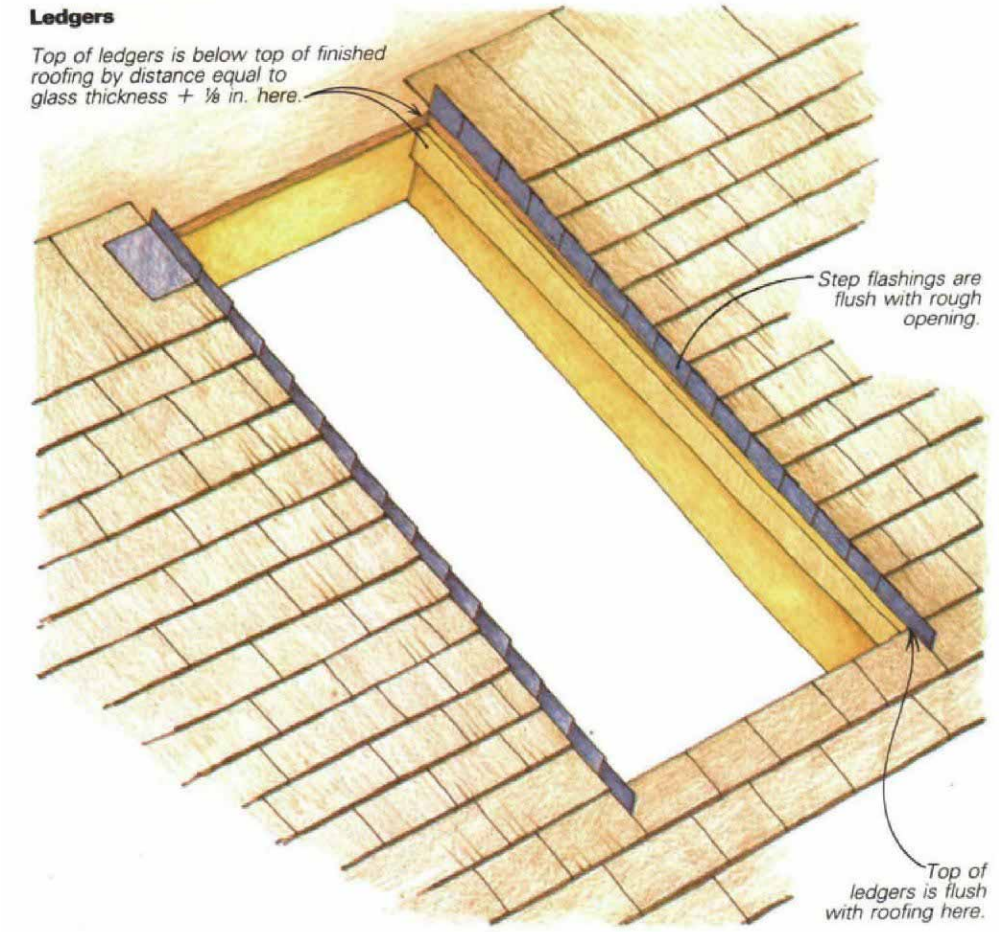
**Flashing sections**

*All dimensions are for a 34-in. by 76-in. glass.*




Illustrations: Frances Ashforth




they should be fairly secure just the same, since you'll use them as though they were sidewalls. Continue roofing up the sides of the opening, installing the step flashing tight against the 1x4s (drawing top left). When the step flashing reaches the top of the rough opening, remove the temporary sidewalls.

Next, nail permanent 1x4 ledgers to the sides of the rough opening (drawing, bottom left). These should be cut from dry wood that has a moisture content of less than 15%, to reduce any chance of warpage. At the downhill end of the opening, make these side ledgers flush with the installed roofing. At the uphill end, set the ledgers below the surface of the roofing by a distance equal to the thickness of the glass plus ⅛ in. This is very important. These ledgers can be used as finish trim inside the opening, so you might want to use clear material and rip these pieces so they're flush with the ceiling finish.

At the top of the rough opening, install a 2x ledger with its top edge parallel to the angle of the roof, and set ⅛ in. above the side ledgers already installed. This detail is shown on the facing page, drawing top right.

Now you can install the flashing for the glass. The side flashing butts against the already installed step flashing, with its uphill end at the top of the rough opening and its bottom projecting 3 in. over the new roofing. The side flashing has a J-shaped profile, which creates a small gutter between the top of the side ledger strips and the sides of the glass panel. This gutter acts as a runway for moisture that gets past the counterflashing.

The side flashings don't need to be nailed to the ledgers to hold them in place, but if the roof is especially steep you might want to tack each one down at the very top to hold it steady during assembly. Use tin snips if necessary to trim the top of the side flashing flush with the top edge of the step flashing.

Next comes the only tricky part of the operation. Using tin snips, cut a notch out of the step flashing 3 in. down from the top of the rough opening and flush with the roofing, as shown in the top drawing on the facing page. Make a vertical cut in the side flashing 2¾ in. down from the top of the rough opening and fold the resulting flap onto the adjacent step flashing. There is now a ¼-in. wide tab in the side flashing that should be folded around the step flashing for a mechanical connection.

The tiny gap between the step and side flashings needs to be caulked or soldered against the weather. Soldering, which works on copper and galvanized, is more permanent than caulking, but also more difficult, so we usually seal this tiny crack with a gutterseal caulk made for galvanized gutters.

The bottom flashing is next. Cut out two notches in the bottom flashing wide enough for the panel clips to pass through and about 6 in. in from the bottom corners of the panel. Lay this flashing across the bottom edge of the rough opening and install the clips in their notches by screwing them to the header at the bottom of the rough opening (photo, previous page). Now you can install the glass.

**Placing the glass**—The glass panel is laid so that its edges rest on the side flashing and its bottom edge is supported by the clips. Neoprene cushions (setting blocks) inside the clips will lessen the chance of the clips starting a crack in the glass. We usually use the pads that protect the glass as it comes from the factory for this purpose.

As you get ready to install the glass, remember that a standard 34-in. by 76-in. double wall unit weighs about 105 lb. Be sure your footing is solid, and have as many hands available as is practical.

Here in Oregon, we haven't had problems with excessive air infiltration, but people in cold climates might want to bed the glass on a perimeter of butyl tape. Use narrow (¼-in.) tape to avoid clogging any of the drainage channels, and don't let the butyl tape come in contact with the edge seals of the glass panel—they aren't compatible and may cause each other to deteriorate (see *FHB* #8, p. 42).

With the glass in place, you can install the top flashing. (For installation details of the top, side and bottom flashing and counterflashing, see the drawings at the top of p. 37.) The top flashing fits 3 in. over the top of the glass, with its bottom edge resting at the notches in the side flashing. Lay this top flashing in place and tack it to the roof sheathing with a couple of nails near its top edge. Now finish the roofing, and be sure not to put any nails into the part of the glass that's hidden under the flashing.

The last step is installing the counterflashing. First slide the bottom trim piece over the clips so that it covers the bottom edge of the glass and is supported by the clips. This shields the sealant at the panel's bottom edge from the ultraviolet rays of the sun. Next slip the counterflashing pieces over the lip formed by the step flashing and the side flashing. This counterflashing is spring-fit against the glass. You'll have to cut out a small notch at the bottom of the counterflashing where it passes over the bottom trim. Fasten step flashing, side flashing and counterflashing together with three pop rivets per side—about 3 ft. o. c. If you're using galvanized flashing, dab caulk on these rivets to prevent rust.

If you want to make a skylight larger than the size of a standard tempered-glass unit, your best bet is to gang several together. We've done this often in solariums and greenhouses. The details remain the same except between adjacent pieces of glass. The flashing for this condition is a twin piece of side flashing (see p. 37, drawing bottom center). It's treated at the top and the bottom exactly like the side flashing already described. If, as is often the case in greenhouses, you want the glass to come right to the eave and drain directly into the gutter, you can eliminate the side ledgers, and just use the rafters to support the glass and flashings. This works especially well when the thickness of the roof sheathing approximates the thickness of the glass, as it often does. Here the glass can lie directly on the rafters, which can be finished to be an integral part of the installation. □