

How to bring light and air in—and keep water out

by Donna Milner

SKYLIGHTS: DESIGN & INSTALLATION BASICS



Partial shading from mature trees above helps prevent unwanted heat gain.

Skylights have their roots in industrial and commercial buildings of the nineteenth century. In the days when electric light consisted of a few bare bulbs dangling from wires, skylights were the only way to get light inside large buildings.

Today, builders use skylights to solve design problems, increase customer satisfaction, and bring natural light and ventilation to dark corners.

Problem Solvers

Duplex. In a duplex or zero-lot-line house, kitchens and baths are often grouped near a common, inside wall. The rooms must be vented and lighted mechanically. Operable skylights installed over a light shaft can provide light and ventilation for such windowless rooms.

Small lots. Skylights can enhance privacy in dense housing developments. While it's great to have windows in the kitchen and bath, privacy can be a problem. Operable skylights with light shafts can solve the privacy problem, without sacrificing ventilation and natural light.

Remodeling. If a customer wants more space but has a limited budget, a builder can use skylights to convert unused attic space. Typically, attics are poorly lit and ventilated, with little or no vertical wall area. Skylights can solve this problem by providing light, ventilation, and safe egress.

Model building codes require that all bedrooms have a window large enough to allow a person to escape in case of fire. Skylight manufacturers have developed operable skylights to meet the egress requirements of the model codes. However, the skylight must be installed low enough in the room for the occupant to escape.

As part of an attic conversion or kitchen remodel, a contractor can suggest bringing natural light to a dark kitchen or bath. In some houses, a light well can be built in the attic or kneewall area, bringing natural light to the sink, stove, countertop, or bath (see Figure 1, next page).

How Many Skylights and Where?

The size, number, and arrangement of skylights depends on many factors. The nature of the space determines how much light is required. For example, you will need less light over a stairway than a work table, kitchen counter, or office. Spacing between trusses and rafters and the location of attic ductwork, chimneys, or conduit can also determine the size and arrangement of skylights.

For ideal lighting, skylights should cover about 5 to 15 percent of the room's floor area. For a hallway or bedroom, 5-percent ceiling coverage

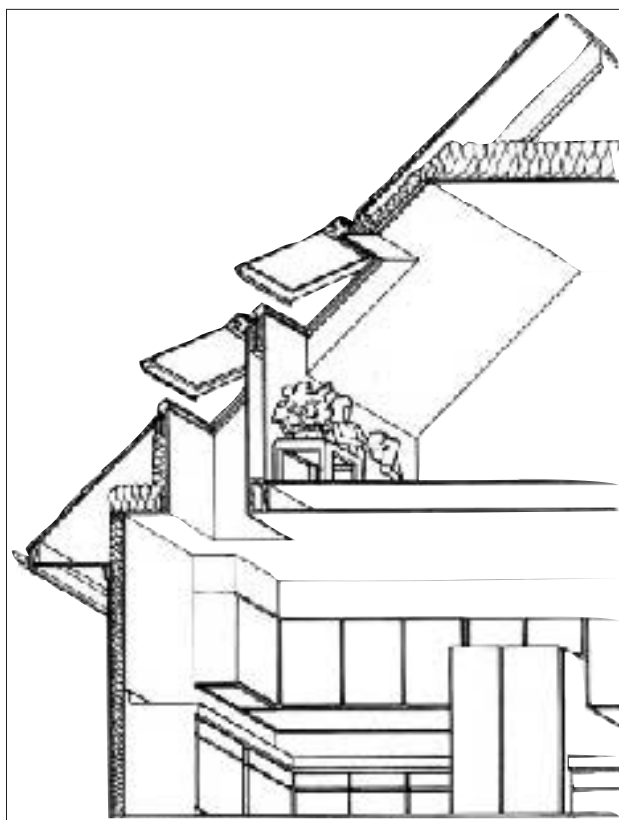


Figure 1. A light well brings light to the kitchen and attic.

might provide adequate natural light. For a kitchen, work area, sun porch, or bathroom, 15-percent coverage would be better.

Shaft design. The design of the shaft or opening affects the distribution of natural light to the space below. A splayed (flared) opening provides the best distribution of light (see Figure 2).

In an attic conversion, if you install the skylight just above the knee wall, the light from the skylight will wash down the wall. Frame the top of the opening so it projects horizontally from the top of the window. This will allow the light to penetrate as far back into the room as possible.

Northern exposure gives a soft gentle light, excellent to work by. Southern exposure is good for winter solar heat gain. But avoid a western orientation because the harsh western sunlight, particularly on summer afternoons, can be intolerably hot.

In a room with a flat ceiling and attic above, you will have to build a light well. The walls of the light well can be vertical, or they can be splayed so that the opening in the ceiling is larger than the skylight itself. To bring in the most light, the sides of the light well should be flared as widely as possible.

Energy

Heat gain, heat loss, and solar orientation are considerations for skylights just as they are for conventional

windows. Northern exposure gives a soft gentle light, excellent to work by. A southern exposure produces more light than a northern one, and is good for winter solar heat gain. However, the light is harsher and more likely to cause glare. Eastern and western exposures provide varying light levels throughout the day. But avoid a western orientation because the harsh western sunlight, particularly on summer afternoons, can be intolerably hot.

Double glazing. Winter heat loss is a problem for skylights as it is for windows, but summer heat gain is especially a problem for skylights. Double glazing is still the industry standard (1/2-inch to 5/8-inch air space is best). But its performance still leaves a lot to be desired. Double-glazed skylights cut heat loss in half, but they reduce heat gain by only ten percent. The summer heat gain adds to customers' air-conditioning bills. Try to incorporate supplemental shading devices or put skylights where they will be shaded by mature trees.

Low-e glass. One option offered by some manufacturers is low-emissivity glass.

The exact energy savings with low-e will vary with the thickness of the air space, but generally double-glazed low-e reduces winter heat loss by another 50 percent. Summer solar gain can be reduced from 74 to 56 percent. Carpets and furniture won't fade as much, and the slightly higher surface temperature of the inner pane of glass reduces condensation in winter.

In spite of these energy savings, some homeowners complain they can see the film, and that the windows look discolored. The films are inconspicuous enough that most occupants will not notice reduced interior light levels, and color should not be a problem—but the customer is always right. Make sure

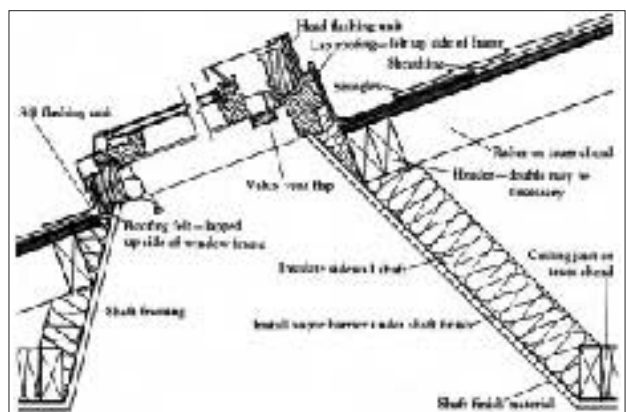


Figure 2. To create a splayed opening between rafters, you'll need to hold the headers back from the sheathing cut-out. Notches in the frame receive the drywall.

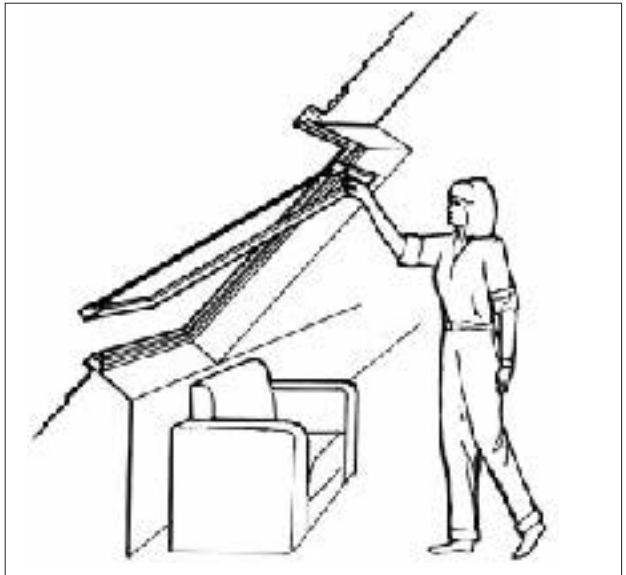


Figure 3. Place the window so the customer can reach the crank without bending over or climbing on a chair. This is a center-pivoting skylight.

they look at samples before you install a skylight with low-e film.

Acrylic glazing. Acrylic glazing provides fewer of the options for energy control than glass does. Because acrylic glazing won't seal tightly, double acrylic glazing is prone to fogging. Like glass, acrylic units are available with a bronze tint to reduce unwanted heat gain and glare.

Gas-filled air spaces. Some window manufacturers are starting to fill the air spaces of low-e units with argon. Argon is an inert gas that insulates better than air and can raise the R-value of a window to R-3 or R-4 compared to about R-2 for conventional double glass.

Fixed or Operable

There are hundreds of skylights on the market—from low-end fixed units to high-end operable products with a host of features.

Fixed. When light rather than ventilation is required, fixed skylights are the most economical choice. You can put them in, flash them, and forget about them.

Operable. Some operable skylights are hinged at the top, and some are center pivoting.

Skylights that hinge at the top operate like awning windows. A crank at the bottom of the unit swings the sash outward. These skylights open with the screen in place. You should install them high enough (on a sloped

wall) that the occupant can reach the crank without bending over.

Center pivoting units usually operate from the top, with the top of the sash coming into the room, and the bottom swinging out. If the window is placed low in the ceiling, operating from the top will be comfortable and convenient for the occupants (see Figure 3).

While some center pivot units have insect screens as an option, these screens must be removed at least part way in order to open the window. Most pivoting units can be tilted into the room for cleaning. This feature is available on certain models of top hinged skylights too, and is a popular option with neatnik customers.

Where potential leaks, heavy rainfall, or snow buildup could cause problems, curb mounting is the way to go.

Installation

With a truss-framed roof, begin by selecting a unit that will fit the truss spacing. Never cut a truss to install a skylight. Use a skylight that is

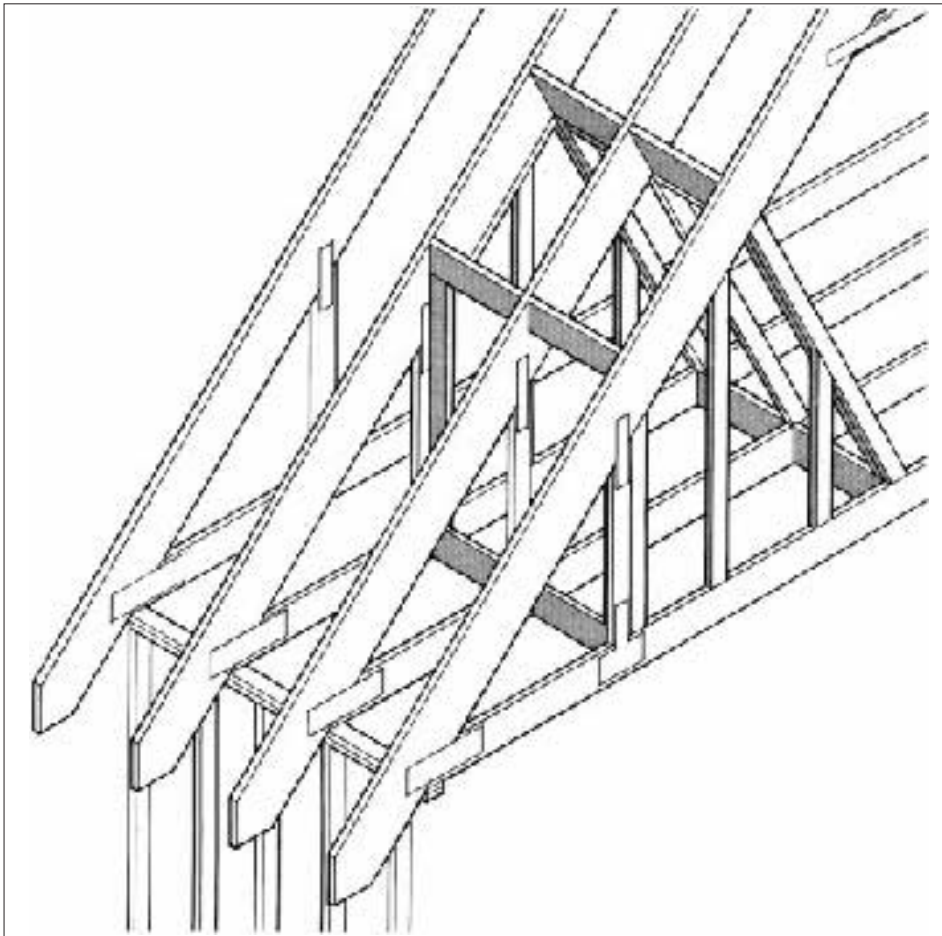


Figure 4. Manufactured roof windows come in standard widths to fit between trusses. The members with plates on them are existing roof trusses. The darker members are framing added for a light well.

designed for truss spacing (see Figure 4). Call the truss manufacturer to find out how to frame the light shaft without harming the structural integrity of the trusses.

When installing a skylight between rafters, you should add doubled headers if you need to cut a rafter. Double the rafters around the opening too. Then follow the instructions shown in Figure 5a-d. It is usually easier to build the light shaft below before cutting back the sheathing and installing the skylight.

Curbless skylights. Curbless skylights are the easiest and cheapest to install. They mount directly on the roof deck and are self-flashing. However, since they don't have a curb, they are more likely to leak than others.

If you use them in a garage, shed, or closed-in porch they'll probably be okay. (The Uniform Building Code restricts the use of curbless skylights to roofs where the roof pitch is 3:12 or steeper.)

To install these, you frame the opening, then prime the edges of the deck with lap cement. Spread asphalt cement around the opening, and bring 30# felt up to the edges of the opening. Embed it in the cement. If the roof has no roofing paper or if the paper is in bad shape, lay strips of 16-inch-wide paper around the perimeter of the opening. Start by laying the bottom layer across the bottom of the opening. Then do the two side strips. Overlap them across the bottom strip. Then do

the top. Make sure the top strip overlaps the side strips. Tuck it up and under the shingles above the skylight as far as possible.

Bring the shingles up to the bottom of the opening. Spread more asphalt cement around the opening and set the unit in the cement. Bring the shingles up the sides, cementing them to the flange of the unit as you go. Lap the shingles over the flange of the unit at the top, and cement the shingles. Finish shingling the roof as you normally would.

Curbed skylights. Where potential leaks, heavy rainfall, or snow buildup could cause problems, curb mounting is the way to go. The simplest curbmounted skylights are modified versions of the curbless bubble, with a lip that extends over a job-built curb. With these units, the installer must supply both the curb and the flashing. The molded lip on the unit hangs over the curb and acts as counterflashing. Unless you are good at cutting, breaking, and soldering roll goods, it is easier to get a watertight installation using flashing supplied by the manufacturer than to try to do the metal flashing yourself.

Hybrid skylights. Several manufacturers produce skylights that are neither curbless nor curb-mounted. These hybrid units install easily but have features that help them stay watertight – similar to curb-mounted skylights. The unit forms its own curb when installed according to manufacturers' instructions. Flashing, supplied by the manufacturer, may be either an integral part of the unit (self-flashing) or separate.

The self-flashing units are simpler to install. These have metal strips down the sides and metal flashing at the top and the bottom. The manufacturer gives good instructions for installing the units, and these instructions generally involve laying down additional strips of roofing felt and asphalt roofing cement around the skylight opening.

Manufacturer-supplied curb flashing may be either vinyl or metal depending on the construction of the unit. Better units have copper flashing. Another feature of better flashing systems is a rain gutter – a small L formed at the edge of the side flashing as a protection against wind-driven rain.

While these continuous flashings are an improvement over job-built flash-



Figure 5a. This skylight fits between two 16-inch on-center rafters. After framing the opening with double headers, drive a spike in each corner to mark the opening on the roof.

Figure 5b. After stripping the shingles, cut the opening, and seal the roofing paper to the deck with lap cement.



Figure 5c. Then set the skylight box or flashing in a bed of roof cement.

Figure 5d. Shingle it up holding shingles back 1/2-inch from the curb. Never nail through the flashing or flatten the turned edge (rain gutter) of the side flashing. For the best protection against leaks, use step flashing.



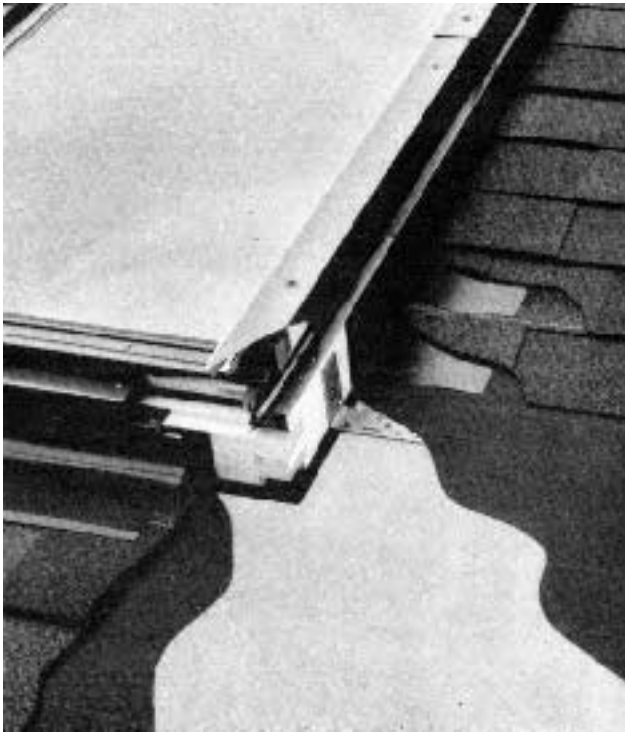


Figure 6. The Velux roof window mounts on angle brackets. Brackets, step flashing, head and sill flashing, and counterflashing are anodized for longer wear.

ing, the best skylights come with a complete metal flashing kit. The kit contains a formed and soldered bottom apron, many L-shaped steps (for step flashing), and a formed and fitted cap for the head.

An example of this type of hybrid window with step flashing is the Velux roof window. For these units, the opening is prepared in much the same way as in Figure 5. Instead of setting the window in a cement bed, however, you bolt the window to steel angle brackets (see Figure 6). The angle brackets are securely screwed to the rough framing around the opening. This leaves about a 1/2-inch gap around the opening. The gap looks strange, but it is easily insulated and will be covered by the flashing system. These units come with matching step flashing – the angle iron, the base flashing, head flashing, and step flashing are all anodized. The head flashing has a deep cricket to divert

water. The counterflashing covers the top of the sash as well as the head of the skylight.

Often the skylights supplied with metal buildings are little more than overgrown pieces of plastic

Standing seam skylight. The standing seam skylight patented by the Kenergy corporation is a specialty skylight designed for use in metal buildings (see Figure 7). Standing-seam skylights feature the low profile of curb-free skylights. But they have improved resistance to rain penetration from the standing seam step flashing.

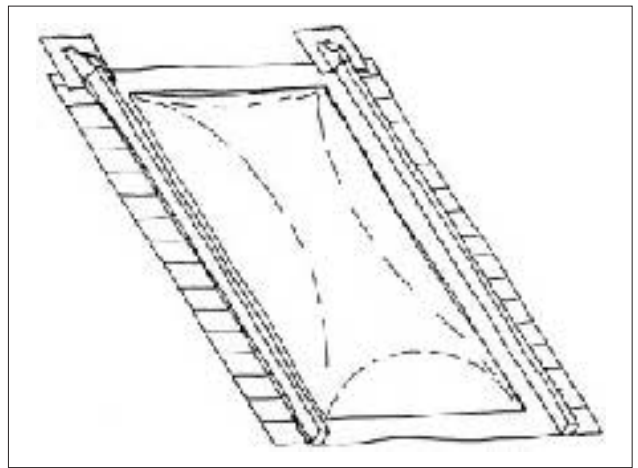


Figure 7. Kenergy's standing-seam skylights come with step flashing. You can use these in standing-seam metal roofs. Or, you can gang them at the ridge in wood-frame construction.

For metal buildings or buildings with metal roofs, these units offer a solution to the skylight dilemma. Often the skylights supplied with metal buildings are little more than overgrown pieces of plastic, prone to leaks and condensation. Some owners of metal buildings have given up on the idea of using skylights in their offices and plants because of the potential damage to goods. These specialty skylights are also great for wood-frame construction. You can install them in clusters near the ridge.

Preventing Leaks

Leaks around skylights are caused by faulty flashing or by installing the skylight at the wrong slope. For more residential skylights, the minimum recommended slope is 3:12 or 4:12. Some manufacturers have an adapter kit that raises the curb and increases the pitch of the roof. (Velux provides this option.)

With asphalt shingles, you can often get away with self-flashing skylights. But with thicker roofing materials such as wood shakes, shingles, tile or slate, step flashing is mandatory. You may even need special flashing kits with lead aprons (see Figure 8). Use these with thick or high profile roofing materials such as Spanish tile (a Velux option). Step flashing or specialty flashing takes a little longer to install, but, if done correctly, offers more protection against penetration



Figure 8. Flashing kits with lead aprons can be ordered from some manufacturers – for thick or high profile roofing materials.

by wind-driven rain.

All skylights are not created equal. Some have patented features you won't find in others. There are too many manufacturers to list here, but most supply literature to help you pick the right skylight for your job. ■

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