

Ask Jon Eakes

# Skylights that don't leak.

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Skylights are basically windows that are not vertical, but usually closer to horizontal as they sit on top of the roof. Most are fixed but some open a bit for summer ventilation. There also exist roof windows which are basically skylights that open wide and are much more common in Europe where the roofs are extremely steep by our North American standards, some even opening to allow you to step out onto a small “roof balcony”. Sitting exposed on a roof, rather than being installed buried in a vertical insulated wall, makes skylights much more prone to leakage and condensation than regular windows. Unfortunately many skylights are designed and/or installed in Canada without taking the freezing temperatures and the extra condensation on the inside and ice on the outside into account. For years I have had so many complaints that I was rather against skylights in a cold climate.

Comparing Velux and Fakro

I first wrote this web entry in 2004 when I was delighted that the best known of the warm climate skylight companies, Velux, came out with insulated curbs for cold country installations, solving a number of our cold climate problems. They even came to my HGTV TV show to show off their thick insulated curbs, which you can see in the photo here. Recently (2013) I was studying new skylight systems from Fakro, and I discovered that somewhere along the way Velux dropped their insulated curbs and now in their catalogue they only reference “site built or prefabricated curbs, provided by others”. The reality is that few people want to put their skylight high up on an insulated curb, it just looks weird – so we are always stuck with custom built curbs.

The complaints I receive have not stopped asking about condensation dripping from skylights or roof leaks coming through the skylight assembly and all of this seems to get worse the colder the climatic region. Do I need to reiterate my skepticism about even installing skylights in a cold climate or are there some that do work?

Before looking at brands, let's ask the tough question:

What is required of a skylight for it to work in a cold climate?

Thermal resistance in the frame

If a roof collects enough snow to bury the skylight most of the winter, you should be putting your skylight on a curb to get it above the snow and let the light in. Ideally that curb would be as well insulated as your walls, but getting at least R-10 with 2” of extruded foam insulation and plywood on each side is a good compromise.

This graphic shows insulated curbs with the skylight frame sunk into the curb for maximum thermal resistance and full light entry. This horizontal design is sloped to create water runoff on a flat roof. With or without a curb between the skylight and the deck of the roof, the frame of the skylight itself needs to provide enough thermal resistance to reduce if not eliminate condensation on the inside.

Thermal resistance in the glazing

Sealed double glazing in flat glass or a double dome is an essential minimum in a cold climate.

Eliminate thermal bridging

Metal brackets, braces and fasteners can sabotage the thermal properties of the frame or curb.

Careful design and installation doesn't allow outboard metal supports and roof fasteners to reduce the temperature on the house side of a skylight, where humidity is high and can cause condensation.

Block all air leaks

Air leakage paths through the assembly can cause frost problems, on the inside or on the outside. A flat frame, tight fitting corner joints and strength to not open up joints either during installation or from ice forces helps to keep the skylight and its gaskets air tight.

Drain condensate

And despite everything else, in extreme cold there will be a bit of condensation on the glazing just as on the bottom of windows. The skylight must provide a path to direct this condensate to the outside –

a bit of a trick as we want a water path to the outside that is not a significant air path to the inside. One trick for condensation on skylights in high humidity areas, like bathrooms, is to add temporary glazing to the ceiling level below the skylight in the cold season – follow this link for details. This totally blocks the room humidity from the skylight tunnel – meaning there will be no condensation to deal with.

On cathedral ceilings where there is not much of a skylight tunnel, flaring out both the bottom and top of the passage through the compact roof as seen in the graphic above will keep air moving over the glazing and reduce if not prevent condensation as well.

A look at the best of the cold climate skylights

Probably the best Canadian skylight that deals with all of this is a very expensive commercial custom made aluminum and foam skylight system built in Québec, Unicel Architectural, and they only work through architects. For people with ordinary budgets, we are looking at Columbia, Velux, or Fakro skylights.

I have no personal experience with Columbia other than they are considered by most to be the least expensive product.

Velux makes great skylights and skylight mechanisms, like electric opening and internal black-out blinds and they are quite easily available at renovation centres or from any window dealer but Velux concentrates on selling to the sunny south. I just wish they would recognize our cold climate needs and bring back their insulated curbs and help to promote the necessary "look" of insulated curbs for trouble free skylights in Canada. Put on an insulated curb, these make quality skylights.

So let's take a look at Fakro, who has insulated curbs as part of their basic models.

Made for cold weather

Rather than importing a skylight that works in a southern US climate and ignoring the temperature difference, Fakro has reversed the design formula as they sell their skylights all around the world.

They have built their standard unit to work in a cold climate, which will also work without problems in a warm climate.

The Frames

Fakro makes their solid wooden frames almost twice as large as the competition. This almost doubles the thermal resistance of the frame. The corner joints are not only tightly fitting wooden joints, but the corners are sealed air tight to prevent moisture moving outward and turning to ice where it gets cold.

At the same time this thicker frame gives a larger sealed seat for the glazing to sit on and still leaves enough meat for as few as 6 long screws to go through the frame, through the roof deck and solidly into the roof trusses. The "buried" attachment screw technique eliminates thermal bridging by metal roof deck fasteners.

Until now little attention has been paid to condensation on the outside of the wooden frames caused by metal attachment brackets and thermal bridging with the many surface penetrating screws. Also placing elastomeric membranes on the roof deck and up onto the wooden frames is a key to a leak proof installation, but when trying to lay this membrane "flat" over attachment brackets, it is all too common for small wrinkles in the membrane to become water paths into the house. Fakro leaves the deck/frame junction free of obstructions for easy placement of the membrane.

Glazing support & condensate drain

The wide depth of the shoulder holding the glazing in the Fakro frame reduces thermal bridging both by burying the glass spacers over the gasketed frame support, not over the drywall and buries the entire glass unit down in the wood rather than on top of the wood where there would be thermal bridging. It also allows for a very effective condensate drain system that will flow water away from the inside part of the wooden frame and walls out onto the roof. This prevents any condensate from reaching the drywall in the tunnel.

## Insulated flashings

Although the Fakro skylight kit comes with flashings designed specifically for their frames, and either flat for regular shingled roofs, or undulated for metal roofs, they also sell optional metal flashings that have an insulating cushion on the underside. This insulates both the deck around the frame and the frame itself from the outside, further increasing the thermal performance of the frame/roof junction.

## Deck Gaskets

As you can see in the photo, the frame is wide enough to incorporate a frame to roof deck gasket right under the skylight itself. This is an extra line of water infiltration protection completely on the inside of all the roofing water shedding protection. This underneath gasket eliminates any air infiltration or moisture exfiltration for better thermal performance. The shingles on the roof shed most of the water; the metal flashings deflect any exterior water away from the skylight and down the roof. Below those two layers, the elastomeric waterproof flashing on the deck and brought up onto the side of the skylight frame waterproof this protrusion through the roof and the gasket only doubles that protection. Note, there is no caulking used anywhere – no caulking maintenance to worry about either.

## One person installation from the inside

In Europe the roofs are generally so steep that they tend to install what they call “Roof Windows” rather than skylights. Working from the outside on a steep roof is potentially very dangerous. That is why Fakro developed a method that allows cutting the hole in the roof from inside the house, sticking your head through and arranging the shingles and deck surface around the roof window opening, then lifting the very light frame up through the hole and sitting it on the roof. Brackets set in the frame line it up with the hole and hold it on the roof – allowing someone working alone to simply pop through the hole, screw down the 6 screws and proceed to do all the roof work from a ladder inside the house alone. The entire installation can be done without going on the roof! That may just sound like a convenience, but in reality it translates into far better workmanship – and less chance of leaking – because you can do the attachment and roof membrane work securely with both hands free to do things carefully.

That same technique with simple alignment pins has been brought to Canadian skylights. Of course that only works for roof windows or skylights that can be opened – basically separating the glass and hardware from the light weight frame. Fixed glazed skylights (non-opening) must be installed from the outside.

## Distribution

The difficulty with Fakro is that as a European company they have spent years trying to get their skylight distribution established in Canada -- concentrating mostly on their attic ladders. Recently they gave their whole skylight distribution over to Columbia Skylights which gives this company their own economy product and a quality product as an option, and makes Fakro easier to obtain.

The existence of both skylights and roof windows means that you can get any opening configuration you might want from side opening windows, to awning windows to pivoting windows or simply fixed or ventilating skylights as well as "walk out" roof windows. Automatic rain closure and blinds are also available for a complete line-up – all with the same energy saving and condensation control features. Yes I recommend Fakro skylights and roof windows for our cold climate. They are well built and their installation design helps to achieve a permanent leak free installation in our cold climate. Other brands like Velux could do an equally good or better job if you study carefully how to build, install and flash, raised site built insulated curbs. As Canadian consumers with lots of snow cover, we need to get used to the look of skylights with snow curbs.

Jon Eakes

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