Skylights and Sloped Glazing

RCI SPRING SEMINAR
MAY 16, 2017
PRESENTED BY AL JAUGELIS

Western Canada Chapter
RDH BUILDING SCIENCE

Topics covered

1. What do we mean by skylights?
2. Review of critical barriers
3. Illustrative case study

Skylights in the North American Fenestration Standard

NAFS presents us with several skylight “product types”:

WITHIN THE SCOPE OF NAFS

OUTSIDE THE SCOPE OF NAFS

Skylights in the NAFS standard

1.1 General
This fenestration Standard/Specification applies to both operating and fixed, new construction and replacement windows, doors, SPS, TECs, roof windows, and skylights integrated into exterior building envelopes.

Skylights in the building code (BCBC Rev. 8)

5.10.2.0 WINDOWS, DOORS, SKYLIGHTS AND OTHER GLAZED PRODUCTS

5.10.2.1.0 General

Same in VBBL, NBC, but only BCBC adds the term “other glazed products”
Skylights in ASHRAE 90.1

ASHRAE 90.1 Table 5.5 has three categories of skylight:

<table>
<thead>
<tr>
<th>Category</th>
<th>Min. U</th>
<th>Max. U</th>
<th>Min. SHGC</th>
<th>Max. SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skylight with Curb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skylight without Curb</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Skylights in the National Energy Code for Buildings

The 2011 NECB defines skylight this way:

"Skylight means a form of fenestration that is inclined less than 60° from the horizontal."

The NECB does not distinguish between single lite and multiple-lite skylights

Skylights in the BC Energy Efficiency Act

→ Like the NECB, the BCEEA uses the single term "skylight" for all overhead glazing, but does not define it

Skylight terminology—the takeaway

We need to be clear about the distinctions the code makes between two categories of overhead glazing products:

→ Unit skylights: factory glazed skylight products containing a single lite of glass or plastic glazing
  → Variants include operable roof window, TDD
  → May be curb mounted or deck mounted units with integral curbs

→ Sloped glazing: typically field glazed assemblies containing multiple lites of glass or plastic glazing
Skylight terminology—the takeaway
When discussing skylights, be sure you understand the context:

→ NAFS distinguishes between unit skylights, roof windows and TDDs, but excludes “sloped glazing systems” from its scope
→ ASHRAE 90.1 distinguishes between curb-mounted skylights and “sloped curtain wall” skylights, with different U-values for each
→ Part 5 of the code distinguishes between unit skylights and “other glazed systems”, which include sloped glazing
→ In NECB and BCCEA, the term “skylights” includes sloped glazing

Continuity of critical barriers
→ Critical barrier continuity and integrity must be maintained throughout the enclosure
→ At penetrations
→ At joints between assemblies (window-wall, roof-skylight)
→ Within assemblies of dissimilar materials (windows, doors, skylights)

Critical barriers
Materials and components that perform a control function within a building enclosure
→ Water shedding surface (WSS)
→ Water resistive barrier (WRB) *
→ Air barrier (AB)
→ Vapour retarder (vapour barrier, VB)

When designing or installing products such as skylights, you need to identify the critical barriers in in adjacent assemblies, and consider how to connect them to the critical barriers in the product

* Not to be confused with “weather resistive barrier” (also WRB), such as breathable sheathing membranes (Tyvek)
Illustrative case study
- Leonard S. Klinck Building, UBC
- Roof and skylight replacement

Klinck Building—existing sloped glazing

Klinck Building aerial view

Klinck Building—existing sloped glazing

Klinck Building roof plan

Klinck Building—new sloped glazing
Klinck Building—existing pyramid skylights

Klinck Building—new pyramid skylights

Klinck Building renewals
Scope: Renew roof, replace skylights
→ Roof and “skylight without curb” insulation levels to ASHRAE 90.1 prescriptive requirements
→ Sloped glazing system: Spectrum Skyworks “tubular rafter pressure plate system”
→ Spectrum system designed with “open gutter” infiltrating water management
→ Purlin-rafter connection modified to achieve “closed gutter” drainage from purlins to rafters
→ “Closed gutter” drainage pressure-equalized to exterior

Sloped glazing framing terminology
Sloped glazing systems typically have two types of framing member:
→ Rafters span the opening structurally and drain infiltrating water to the exterior
→ Purlins span between rafters and drain infiltrating water to the rafters
Purlins and rafters typically have different cross section profiles

Sloped glazing system drainage
→ Sloped glazing systems differ in how they manage infiltrating water:
→ Open gutter systems collect infiltrating water into gutters mounted along the sides of the rafter and purlin members
→ Closed gutter systems collect infiltrating water into internal gutters, separated from the interior environment by air and water barrier seals

Closed gutter system drainage at sill
→ Closed gutter systems allow drainage without penetrating air barrier between skylight and sill
Self adhered membrane with all joints sealed completes the air-water-vapour barrier
Sheet metal membrane support
Row of air barrier / WRB at sill

Sloped glazing system drainage
→ Sloped glazing systems differ in how they manage infiltrating water:
→ Open gutter systems collect infiltrating water into gutters mounted along the sides of the rafter and purlin members
→ Closed gutter systems collect infiltrating water into internal gutters, separated from the interior environment by air and water barrier seals

Plane of air barrier
Row of glass
Row of glass
Row of glass
Row of glass
Row of glass
Klinck purlin-rafter drainage

A closed gutter drainage method was desirable for critical barrier continuity both within the system and with adjacent assemblies.

→ Original design: open gutter framing system

Klinck purlin-rafter drainage

A closed gutter drainage method was desirable for critical barrier continuity both within the system and with adjacent assemblies.

→ Original design: open gutter framing system

→ Modified fabrication method can convert the product to function as a closed gutter system

Single span sloped glazing assemblies

Single span sloped glazing cross-section

Klinck purlin-rafter drainage

A closed gutter drainage method was desirable for critical barrier continuity both within the system and with adjacent assemblies.

→ Original design: open gutter framing system

→ Modified fabrication method can convert the product to function as a closed gutter system
Sloped glazing head
→ Water shedding surface
→ Water resistive barrier
→ Air barrier
→ Vapour retarder

Pyramid sloped glazing sill
→ Water shedding surface
→ Water resistive barrier
→ Air barrier
→ Vapour retarder
Closed gutter systems allow drainage without penetrating air barrier between skylight and sill.

Self-adhered membrane with all joints sealed completes the air-water-vapour barrier.

Sloped glazing sill

Water shedding surface

Water resistive barrier

Air barrier

Vapour retarder

Sloped glazing sill

Pyramid sloped glazing sill

Sloped glazing sill

Pyramid sloped glazing sill
Sloped glazing sill

Sloped glazing jamb

- Water shedding surface
- Water resistive barrier
- Air barrier
- Vapour retarder

Concluding thoughts
Concluding thoughts

- Pay attention to "skylight" terminology: the code and ASHRAE 90.1 have different requirements for unit skylights and sloped glazing.
- The NAFS standard applies only to unit skylights, roof windows, and TDDs.
- **Think in terms of critical barriers** when designing, reviewing shop drawings, installing, and reviewing installations.
  - Critical barriers are functional constructs, not materials.
  - Some materials can perform multiple functions, and continuity of barriers must be analyzed across all materials used to construct them.