# Proposal Submeasure Summary

**2022 California Energy Code (Title 24, Part 6)**

## Nonresidential High Performance Envelope – High Performance Windows

Updated: April 19, 2020

Prepared by: Kiri Coakley, Energy Solutions & Eric Shadd, Determinant

### Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during a utility-sponsored stakeholder meeting on April 23rd, 2020. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. Please share comments by email to info@title24stakeholders.com.

### Measure Description

This measure proposal considers updates to the U-factor and solar heat gain coefficient (SHGC), for windows in nonresidential buildings while recognizing that updates are most critical in heating and cooling dominated climate zones.

The structural, thermal, and optical characteristics of fenestration influence total energy performance in buildings. The California Energy Code already sets requirements for U-factors, SHGCs, visible transmittance (VT) and air leakage for fenestration products and exterior doors in Section 110.6(a) of Title 24, Part 6. This measure proposal evaluates improvements to the requirements of this key envelope component.

This submeasure would also revise the relative solar heat gain coefficient (RSHGC) requirement to offer credit for both fixed exterior horizontal slats (louvers) and overhangs based on an equation derived from updated Time-Dependent Valuation (TDV) energy values. This revision will also eliminate unexpected characteristics of the current formula and create consistent terms between the RSHGC equation, overhang exception and Daylighting Design Power Adjustment Factors. This portion of the submeasure was formerly known as "Refine Prescriptive Exterior Shading Reflective Solar Heat Gain Coefficient Requirements" under the 2022 Daylighting measure proposed by the Statewide CASE Team.

Improving the performance of windows could improve daylighting, occupant comfort, and overall envelope efficiency.

### Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). Expected sections or tables of the proposed code (but not specific changes at this time) are highlighted in yellow.

We are not proposing to remove any multifamily Title 24, Part 6 requirements at this time. The Multifamily Restructuring CASE Team has not decided whether they will create a table in the multifamily section or

reference nonresidential tables. One potential issue is that if the multifamily codes are scattered in multiple places, it is going to create confusion to the design community and the enforcement team.

### SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

~~**AZIMUTH** is the degrees of clockwise rotation from absolute North.~~

~~OVERHANG PROJECTION is the horizontal distance, measured outward horizontally from the surface of exposed exterior glazing at the head of a window to the outward edge of an overhang.~~

~~OVERHANG RISE is the vertical distance between the projected edge of an overhang and the sill of the vertical fenestration below it.~~

### SECTION 110.6 – MANDATORY REQUIREMENTS FOR FENESTRATION PRODUCTS AND EXTERIOR DOORS

(a)**Certification of Fenestration Products and Exterior Doors other than Field-fabricated.** Any fenestration product and exterior door, other than field-fabricated fenestration products and field-fabricated exterior doors, may be installed only if the manufacturer has certified to the Commission, or if an independent certifying organization approved by the Commission has certified that the product complies with all of the applicable requirements of this subsection.

1. **Air leakage.** Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft$^2$ of window area, 0.3 cfm/ft$^2$ of door area for residential doors, 0.3 cfm/ft$^2$ of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft$^2$ for nonresidential double doors (swinging), when tested according to NFRC-400 or ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft$^2$), incorporated herein by reference.

**NOTES TO SECTION 110.6(a)1**:Pet doors must meet 0.3 cfm/ft$^2$ when tested according to ASTM E283 at 75 pascals (or 1.57 pounds/ft$^2$). AAMA/WDMA/CSA 101/I.S.2/A440-2011 specification is equivalent to ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft$^2$) and satisfies the air leakage certification requirements of this section.

**EXCEPTION to Section 110.6(a)1:** Field-fabricated fenestration and field-fabricated exterior doors.

2. **U-factor.** The fenestration product and exterior door's U-factor shall be rated in accordance with NFRC 100, or use the applicable default U-factor set forth in TABLE 110.6-A.

**EXCEPTION 1 to Section 110.6(a)2:** If the fenestration product is a skylight ~~or a vertical site-built fenestration product in a building covered by the nonresidential standards with less than 200 square feet of site-built fenestration,~~ the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

**EXCEPTION 2 to Section 110.6(a)2:** If the fenestration product is an alteration consisting of any area replacement of glass in a skylight product ~~or in a vertical site-built fenestration product,~~ in a building covered by the nonresidential standards, the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

3. **Solar Heat Gain Coefficient (SHGC).** The fenestration product's SHGC shall be rated in accordance with NFRC 200, or use the applicable default SHGC set forth in TABLE 110.6-B.

**EXCEPTION 1 to Section 110.6(a)3:** If the fenestration product is a skylight ~~or a vertical site-built fenestration product in a building covered by the nonresidential standards with less than 200 square~~

~~feet of site-built fenestration~~, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

**EXCEPTION 2 to Section 110.6(a)3:** If the fenestration product is an alteration consisting of any area replacement of glass in a skylight product ~~or in a vertical site-built fenestration product~~, in a building covered by the nonresidential standards, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

4. **Visible Transmittance (VT).** The fenestration product's VT shall be rated in accordance with NFRC 200 or ASTM E972, for tubular daylighting devices VT shall be rated using NFRC 203**.**

   **EXCEPTION 1 to Section 110.6(a)4:** If the fenestration product is a skylight ~~or a vertical site-built fenestration product~~ in a building covered by the nonresidential standards with less than 200 square feet of site-built fenestration, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

   **EXCEPTION 2 to Section 110.6(a)4:** If the fenestration product is an alteration consisting of any area; replacement of glass in a skylight product ~~or in a vertical site-built fenestration product~~ in a building covered by the nonresidential standards, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

5. **Labeling.** Fenestration products and exterior doors shall:

   A. Have a temporary label for manufactured fenestration products and exterior doors or a label certificate when the Component Modeling Approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)1. The temporary label shall not be removed before inspection by the enforcement agency; and

   B. Have a permanent label or a label certificate when the Component Modeling Approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)2 if the product is rated using NFRC procedures.

6. **Fenestration Acceptance Requirements.** Before an occupancy permit is granted, site-built fenestration products in other than low-rise residential buildings shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified in the Reference Nonresidential Appendix NA7 to ensure that site-built fenestration meet Standards requirements, including a matching label certificate for product(s) installed and be readily accessible at the project location. A Certificate of Acceptance certifying that the fenestration product meets the acceptance requirements shall be completed, signed and submitted to the enforcement agency.

   **EXCEPTION to Section 110.6(a):** Fenestration products removed and reinstalled as part of a building alteration or addition.

(b) **Installation of Field-fabricated Fenestration and Exterior Doors.** Field-fabricated fenestration and field-fabricated exterior doors may be installed only if the compliance documentation has demonstrated compliance for the installation using U-factors from Table 110.6-A and SHGC values from Table 110.6-B. Field-fabricated fenestration and field-fabricated exterior doors shall be caulked between the fenestration products or exterior door and the building, and shall be weatherstripped.

**EXCEPTION to Section 110.6(b):** Unframed glass doors and fire doors need not be weather stripped or caulked.

*TABLE 110.6-A DEFAULT FENESTRATION PRODUCT U-FACTORS*

| **Frame** | **Product Type** | **Single Pane [3, 4] U-Factor** | **Double Pane [1, 3, 4] U-Factor** | **Glass Block [2,3] U-Factor** |
|---|---|---|---|---|
| Metal | Operable | 1.28 | 0.79 | 0.87 |
| | Fixed | 1.19 | 0.71 | 0.72 |
| | Greenhouse/garden window | 2.26 | 1.40 | N.A. |
| | Glazed Doors | 1.25 | 0.77 | N.A. |
| | Skylight | 1.98 | 1.30 | N.A. |
| Metal, Thermal Break | Operable | N.A. | 0.66 | N.A. |
| | Fixed | N.A. | 0.55 | N.A. |
| | Greenhouse/garden window | N.A. | 1.12 | N.A. |
| | Glazed Doors | N.A. | 0.59 | N.A. |
| | Skylight | N.A. | 1.11 | N.A. |
| Nonmetal | Operable | 0.99 | 0.58 | 0.60 |
| | Fixed | 1.04 | 0.55 | 0.57 |
| | Glazed Doors | 0.99 | 0.53 | N.A. |
| | Greenhouse/garden windows | 1.94 | 1.06 | N.A. |
| | Skylight | 1.47 | 0.84 | N.A. |
| 1. For all dual-glazed fenestration products, adjust the listed U-factors as follows: | | | | |
| a. Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide. | | | | |
| b. Add 0.05 to any product with true divided lite (dividers through the panes). | | | | |
| 2. Translucent or transparent panels shall use glass block values when not rated by NFRC 100. | | | | |
| 3. Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6. | | | | |
| 4. Windows with window film applied that is not rated by NFRC 100 shall use the default values from this table. | | | | |

*TABLE 110.6- B DEFAULT SOLAR HEAT GAIN COEFFICIENT (SHGC)*

| Frame Type | Product | Glazing | Fenestration Product SHGC | | |
|---|---|---|---|---|---|
| | | | Single Pane[2,3] SHGC | Double Pane[2,3] SHGC | Glass Block[1,2] SHGC |
| Metal | Operable | Clear | 0.80 | 0.70 | 0.70 |
| | Fixed | Clear | 0.83 | 0.73 | 0.73 |
| | Operable | Tinted | 0.67 | 0.59 | N.A. |
| | Fixed | Tinted | 0.68 | 0.60 | N.A. |
| Metal, Thermal Break | Operable | Clear | N.A. | 0.63 | N.A. |
| | Fixed | Clear | N.A. | 0.69 | N.A. |
| | Operable | Tinted | N.A. | 0.53 | N.A. |
| | Fixed | Tinted | N.A. | 0.57 | N.A. |
| Nonmetal | Operable | Clear | 0.74 | 0.65 | 0.70 |
| | Fixed | Clear | 0.76 | 0.67 | 0.67 |
| | Operable | Tinted | 0.60 | 0.53 | N.A. |
| | Fixed | Tinted | 0.63 | 0.55 | N.A. |
| 1. Translucent or transparent panels shall use glass block values when not rated by NFRC 200. | | | | | |
| 2. Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6. | | | | | |
| 3. Windows with window film applied that is not rated by NFRC 200 shall use the default values from this table. | | | | | |

**SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS**

(d) **Automatic Daylighting Controls. The general lighting in skylit daylit zones and primary sidelit daylit zones, as well as the general lighting in the combined primary and secondary sidelit daylit zones in parking garages, shall provide controls that automatically adjust the power of the installed lighting up and down to keep the total light level stable as the amount of incoming daylight changes. For skylight located in an atrium, the skylit daylit zone definition shall apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium.**

**EXCEPTION 2 to Section 130.1(d):** Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the

~~ratio of the overhang projection to the overhang rise~~ projection factor as calculated by Equation 140.3-D is greater than 1.5 for South, East and West orientations or greater than 1 for North orientations.

**SECTION 140.3 – PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES**

5. Exterior Windows. Vertical windows in exterior walls shall:

A. Percent window area shall be limited in accordance with the applicable requirements of i and ii below:

i. a west-facing area no greater than 40 percent of the gross west-facing exterior wall area, or 6 feet times the west-facing display perimeter, whichever is greater; and

ii. a total area no greater than 40 percent of the gross exterior wall area, or 6 feet times the display perimeter, whichever is greater; and

**NOTE:** Demising walls are not exterior walls, and therefore demising wall area is not part of the gross exterior wall area or display perimeter, and windows in demising walls are not part of the window area.

B. Have an area-weighted average U-factor no greater than the applicable value in TABLE140.3-B, C or D.

**EXCEPTION to Section 140.3(a)5B:** For vertical windows containing chromogenic type glazing:

i. The lower-rated labeled U-factor shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

ii. Chromogenic glazing shall be considered separately from other glazing; and

iii. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

C. Have an area-weighted average Relative Solar Heat Gain Coefficient, RSHGC, excluding the effects of interior shading, no greater than the applicable value in TABLE 140.3-B, C or D.

For purposes of this paragraph, the Relative Solar Heat Gain Coefficient, RSHGC, of a vertical window is:

i. The Solar Heat Gain Coefficient of the window; or

ii. Relative Solar Heat Gain Coefficient is calculated using EQUATION 140.3-A, if the window has an overhang or exterior horizontal slats that extends beyond each side of the window jamb by a distance equal to the overhang's horizontal projection.

**EXCEPTION 1 to Section 140.3(a)5C:** An area-weighted average Relative Solar Heat Gain Coefficient of 0.56 or less shall be used for windows:

a. That are in the first story of exterior walls that form a display perimeter; and
b. For which codes restrict the use of overhangs to shade the windows.

**EXCEPTION 2 to Section 140.3(a)5C:** For vertical windows containing chromogenic type glazing:

i. the lower-rated labeled RSHGC shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

ii. chromogenic glazing shall be considered separately from other glazing; and

iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**NOTE:** Demising walls are not exterior walls, and therefore windows in demising walls are not subject to SHGC requirements.

D. Have an area-weighted average Visible Transmittance (VT) no less than the applicable value in TABLE 140.3-B and C, or EQUATION 140.3-B, as applicable.

**EXCEPTION 1 to Section 140.3(a)5D:** When the window's primary and secondary sidelit daylit zones are completely overlapped by one or more skylit daylit zones, then the window need not comply with Section 140.3(a)5D.

**EXCEPTION 2 to Section 140.3(a)5D:** If the window's VT is not within the scope of NFRC 200, or ASTM E972, then the VT shall be calculated according to Reference Nonresidential Appendix NA6.

**EXCEPTION 3 to Section 140.3(a)5D:** For vertical windows containing chromogenic type glazing:

i. The higher rated labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity; and

ii. Chromogenic glazing shall be considered separately from other glazing; and

iii. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

**NOTE:** Demising walls are not exterior walls, and therefore windows in demising walls are not subject to VT requirements.

*EQUATION 140.3-A RELATIVE SOLAR HEAT GAIN COEFFICIENT, RSHGC*

~~RSHGC = SHGCwin × [1 + aH/V + b (H/V)2]~~

$$\underline{RSHGC = SHGC \times [1 + a(e^{-PF} - 1)(\sin(b \times Az) - c)]}$$

WHERE:

RSHGC = Relative Solar Heat Gain Coefficient.

$SHGC_{\sout{win}}$ = Solar Heat Gain Coefficient of the vertical fenestration ~~window~~.

Az = Azimuth of the vertical fenestration in degrees

PF = Projection factor as calculated by Equation 140.3-D

~~H = Horizontal projection of the overhang from the surface of the window in feet, but no greater than V.~~

~~V = Vertical distance from the window sill to the bottom of the overhang in feet.~~

~~a = -0.41 for north-facing windows, -1.22 for south-facing windows, and -0.92 for east and west-facing windows.~~

~~b = 0.20 for north-facing windows, 0.66 for south-facing windows, and 0.35 for east and west-facing windows.~~

| | a | b | c |
|---|---|---|---|
| Overhang | 0.150 | 0.130 | 5.67 |
| Exterior Horizontal Slat | 0.144 | 0.133 | 5.13 |

*EQUATION 140.3-B VERTICAL FENESTRATION MINIMUM VT*

VT ≥ 0.11/ WWR

WHERE:

WWR = Window Wall Ratio, the ratio of (i) the total window area of the entire building to (ii) the total gross exterior wall area of the entire building. If the WWR is greater than 0.40, then 0.40 shall be used as the value for WWR in EQUATION 140.3-B.

VT = Visible Transmittance of framed window.

6. **Skylights.** Skylights shall:

   A. Have an area no greater than 5 percent of the gross exterior roof area Skylight Roof Ratio (SRR); and

      **EXCEPTION to Section 140.3(a)6A:** Buildings with an atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

   B. Have an Area-Weighted Performance Rating U-factor no greater than the applicable value in TABLE 140.3-B, C or D.

      **EXCEPTION to Section 140.3(a)6B:** For skylights containing chromogenic type glazing:

      i. the lower-rate labeled U-factor shall be used with automatic controls to modulate the amount of U-factor heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

      ii. chromogenic glazing shall be considered separately from other glazing; and

      iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

   C. Have an area-weighted performance rating Solar Heat Gain Coefficient no greater than the applicable value in TABLE 140.3-B, C or D.

      **EXCEPTION to Section 140.3(a)6C:** For skylights containing chromogenic type glazing:

      i. the lower-rated labeled SHGC shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

      ii. chromogenic glazing shall be considered separately from other glazing; and

      iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

   D. Have an Area-Weighted Performance Rating VT no less than the applicable value in TABLE 140.3-B or C; and

**EXCEPTION to Section 140.3(a)6D:** For skylights containing chromogenic type glazing:

i. the higher-rated labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity and;

ii. chromogenic glazing shall be considered separately from other glazing; and

iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

E. Have a glazing material or diffuser that has a measured haze value greater than 90 percent, determined according to ASTM D1003, or other test method approved by the Energy Commission.

**EXCEPTION to Section 140.3(a)6E:** Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of the skylight and light well.

*EQUATION 140.3-D PROJECTION AND DISTANCE FACTOR CALCULATION*

Projection Factor = Projection / Spacing

Distance Factor = D / ($H_{AS}$ x Projection Factor)

**WHERE**:

Projection = The horizontal distance between the base edge and the projected edge of the overhang, slat or light shelf.

Spacing = For overhangs, the vertical distance between the projected edge of the overhang and sill of the vertical fenestration below it.

For horizontal slats, the vertical distance between the projected edge of a slat to the base edge of the slat below it.

For interior light shelves, the vertical distance between the projected edge of the light shelf and head of the clerestory fenestration above it.

For exterior light shelves, the vertical distance between the projected edge of the light shelf and sill of the vertical fenestration below it.

D = Distance between the existing structure or nature object and the fenestration

$H_{AS}$ = Height difference between the top of the existing structure or nature object and the bottom of the fenestration

**NOTE:** The base edge is the edge of an overhang, slat or light shelf that is adjacent to the vertical fenestration. The projected edge is the opposite edge from the base edge.

*TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE~~, NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS~~)*

| | | | | Climate Zone | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Envelope | Maximum U-factor | **Roofs/ Ceilings** | Metal Building | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 | 0.041 |
| | | | Wood Framed and Other | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.049 | 0.049 | 0.049 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 | 0.034 |
| | | **Walls** | **Metal Building** | 0.113 | 0.061 | 0.113 | 0.061 | 0.061 | 0.113 | 0.113 | 0.061 | 0.061 | 0.061 | 0.061 | 0.061 | 0.061 | 0.061 | 0.057 | 0.061 |
| | | | Metal-framed | 0.069 | 0.062 | 0.082 | 0.062 | 0.062 | 0.069 | 0.069 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 |
| | | | Mass Light[1] | 0.196 | 0.170 | 0.278 | 0.227 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.170 | 0.170 | 0.170 | 0.170 | 0.170 | 0.170 | 0.170 |
| | | | Mass Heavy[1] | 0.253 | 0.650 | 0.650 | 0.650 | 0.650 | 0.690 | 0.690 | 0.690 | 0.690 | 0.650 | 0.184 | 0.253 | 0.211 | 0.184 | 0.184 | 0.160 |
| | | | Wood-framed and Other | 0.095 | 0.059 | 0.110 | 0.059 | 0.102 | 0.110 | 0.110 | 0.102 | 0.059 | 0.059 | 0.045 | 0.059 | 0.059 | 0.059 | 0.042 | 0.059 |
| | | **Floors/ Soffits** | Raised Mass | 0.092 | 0.092 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.092 | 0.092 | 0.092 | 0.092 | 0.092 | 0.058 |
| | | | Other | 0.048 | 0.039 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.039 | 0.071 | 0.071 | 0.039 | 0.039 | 0.039 |
| | Roofing Products | **Low-sloped** | Aged Solar Reflectance | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| | | | Thermal Emittance | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | | **Steep-Sloped** | Aged Solar Reflectance | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| | | | Thermal Emittance | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0. 75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| | **Air Barrier** | | | NR | NR | NR | NR | NR | NR | NR | NR | NR | REQ | REQ | REQ | REQ | REQ | REQ | REQ |
| | Exterior Doors, Maximum U-factor | | Non-Swinging | 0.50 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 1.45 | 0.50 |
| | | | Swinging | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |

*CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE~~; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS~~)*

| | | | | All Climate Zones | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fixed Window | Operable Window | Curtainwall or Storefront | Glazed Doors[2] |
| Envelope | **Fenestration** | **Vertical** | Area-Weighted Performance Rating — Max U-factor | ~~0.36~~ 0.34 | 0.46 | ~~0.41~~ 0.38 | 0.45 |
| | | | Area-Weighted Performance Rating — Max RSHGC | ~~0.25~~ 0.22 | 0.22 | ~~0.26~~ 0.25 | 0.23 |
| | | | Area-Weighted Performance Rating — Min VT | 0.42 | 0.32 | 0.46 | 0.17 |
| | | | Maximum WWR% | 40% | | | |
| | | **Skylights** | | Glass, Curb Mounted | Glass, Deck Mounted | Plastic, Curb Mounted | Tubular Daylighting Devices (TDDs) |
| | | | Area-Weighted Performance Rating — Max U-factor | 0.58 | 0.46 | 0.88 | 0.88 |
| | | | Area-Weighted Performance Rating — Max SHGC | 0.25 | 0.25 | NR | NR |
| | | | Area-Weighted Performance Rating — Min VT (Min $VT_{annual}$ for TDDs) | 0.49 | 0.49 | 0.64 | 0.38 |
| | | | Maximum SRR% | 5% | | | |

## Reference Appendices

NA7.4.5 Interior and Exterior Horizontal Slats ~~for PAF~~

### *NA7.4.5.1 Procedures*

These procedures detail the installation and verification protocols necessary to meet acceptance requirements of interior and exterior horizontal slats ~~for PAF~~. In addition, the responsible person shall fill out Certificate of Acceptance. The responsible person shall verify the horizontal slat to be installed matches the energy

compliance documentation (Certificate of Compliance) and building plans. A copy of the Installation and Acceptance certificate shall be given to the building owner and the enforcement agency for their records.

For buildings with up to seven (7) horizontal slat assemblies claiming the Interior and Exterior Horizontal Slats for PAF or RSHGC for exterior horizontal slats, all horizontal slat assemblies shall be tested. For buildings with more than seven (7) horizontal slat assemblies ~~claiming the PAF~~, random sampling may be done to select the seven horizontal slat assemblies. If any of the horizontal slat assemblies in the sample group or seven horizontal slat assemblies fails the acceptance test, another group of seven horizontal slat assemblies must be tested.