WAC 51-11C-40215 Section C402.1.5—Component performance alternative.

C402.1.5 Component performance alternative. Building envelope values and fenestration areas determined in accordance with Equation 4-2 shall be permitted in lieu of compliance with the *U*-factors and *F*-factors in Table C402.1.4 and C402.4 and the maximum allowable fenestration areas in Section C402.4.1.

Equation 4-2

$$A + B + C + D = \leq \text{Zero}$$

Where:

A = Sum of the (UA Dif) values for each distinct assembly type of the building thermal envelope, other than slabs on grade

UA Dif	=	UA Proposed – UA Table
UA Proposed	=	Proposed *U*-value x Proposed Area
UA Table	=	(*U*-factor from Table C402.1.4 or C402.4) x Area

B = Sum of the (FL Dif) values for each distinct slab on grade perimeter condition of the building thermal envelope

FL Dif	=	FL Proposed – FL Table
FL Proposed	=	Proposed *F*-value x Proposed Perimeter length
FL Table	=	(*F*-factor specified in Table C402.1.4) x Proposed Perimeter length

The maximum allowed prescriptive vertical fenestration area, identified as "Vertical Fenestration Area allowed" in factor CA below, is the gross above-grade wall area times either:

1. 30%
2. 40% if the building complies with Section C402.4.1.1 or Section C402.4.1.4; or
3. 40% if the *U*-values used in calculating A for vertical fenestration are taken from Section C402.4.1.3 rather than Table C402.4

Where the proposed vertical fenestration area is less than or equal to the Vertical Fenestration Area allowed, the value of C (Excess Vertical Glazing Value) shall be zero. Otherwise:

C = (CA x UV) – (CA x U_{Wall}), but not less than zero

CA	=	(Proposed Vertical Fenestration Area) – (Vertical Fenestration Area allowed)
UAW	=	Sum of the (UA table) values for each above-grade wall assembly
U_{Wall}	=	UAW/(sum of proposed wall area + CA)

UAV	=	Sum of the (UA Table) values for each vertical fenestration assembly
UV	=	UAV/Total Vertical Fenestration Area allowed

Where the proposed skylight area is less than or equal to the skylight area allowed by Section C402.4.1, the value of D (Excess Skylight Value) shall be zero. Otherwise:

D = (DA x US) – (DA x U_{Roof}), but not less than zero

DA	=	(Proposed Skylight Area) – (Allowable Skylight Area from Section C402.4.1)
UAR	=	Sum of the (UA Table) values for each roof assembly
U_{Roof}	=	UAR/(sum of proposed roof area + DA)
UAS	=	Sum of the (UA Table) values for each skylight assembly
US	=	UAS/ the Allowable Skylight Area from Section C402.4.1

Where required by other sections of the code Proposed Total Envelope UA and Allowed Total Envelope UA shall be calculated as:

Proposed Total Envelope UA	=	Sum of UA Proposed and FL Proposed for each distinct envelope assembly
Allowed Total Envelope UA	=	Sum UA Table - C — D

Where:

Sum UA Table	=	Sum of UA Table and FL Table for each distinct envelope assembly

C402.1.5.1 Component *U*-factors. The *U*-factors for typical construction assemblies are included in Chapter 3 and Appendix A. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Chapter 3 or Appendix A, values shall be calculated in accordance with the ASHRAE *Handbook—Fundamentals*, using the framing factors listed in Appendix A.

For envelope assemblies containing metal framing, the *U*-factor shall be determined by one of the following methods:

1. Results of laboratory measurements according to acceptable methods of test.

2. ASHRAE *Handbook—Fundamentals* where the metal framing is bonded on one or both sides to a metal skin or covering.

3. The zone method as provided in ASHRAE *Handbook—Fundamentals*.

4. Effective framing/cavity *R*-values as provided in Appendix A.

When return air ceiling plenums are employed, the roof/ceiling assembly shall:

a. For thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and

b. For gross area purposes, be based upon the interior face of the upper plenum surface.

5. Tables in ASHRAE 90.1 Normative Appendix A.

C402.1.5.2 SHGC rate calculations. Fenestration SHGC values for individual components and/or fenestration are permitted to exceed the SHGC values in Table C402.4 and/or the maximum allowable fenestration areas in Section C402.4.1 where the proposed values result in $SHGCA_p$ less than $SHGCA_t$ as determined by Equations 4-3 and 4-4.

Equation 4-3—Target $SHGCA_t$

Equation C402-3

Target $SHGCA_t$

$$SHGCA_t \quad SHGC_{ogt}(A_{ogt}) + SHGC_{vgt}(A_{vgt} + A_{vgmt} + A_{vgmot} + A_{vgdt})$$

Where:

$SHGCA_t$ = The target combined solar heat gain of the target fenestration area.

$SHGC_{ogt}$ = The solar heat gain coefficient for skylight fenestration found in Table C402.4.

A_{ogt} = The target skylight area.

$SHGC_{vgt}$ = The solar heat gain coefficient for vertical fenestration found in Table C402.4 which corresponds to the proposed total fenestration area as a percentage of gross exterior wall.

A_{vgt} = The target vertical fenestration area with nonmetal framing.

A_{vgmt} = The target vertical fenestration area with fixed metal framing.

A_{vgmot} = The target vertical fenestration area with operable metal framing.

A_{vgdt} = The proposed vertical fenestration area of entrance doors.

NOTE: The vertical fenestration area does not include opaque doors and opaque spandrel panels.

If the proposed vertical fenestration area does not exceed the Vertical Fenestration Area allowed, the target area for each vertical fenestration type shall equal the proposed area. If the proposed vertical fenestration area exceeds the Vertical Fenestration Area allowed, the target area of each vertical fenestration element shall be reduced in the base envelope design by the same percentage and the net area of each above-grade wall type increased proportionately by the same percentage so that the total vertical fenestration area is exactly equal to the Vertical Fenestration Area allowed.

If the proposed skylight area does not exceed the Allowable Skylight Area from Section C402.4.1, the target area shall equal the proposed area. If the proposed skylight area exceeds the Allowable Skylight Area from Section C402.4.1, the area of each skylight element shall be reduced in the base envelope design by the same percentage and the net area of each roof type increased proportionately by the same percentage so that the total skylight area is exactly equal to the allowed percentage per Section C402.3.1 of the gross roof area.

Equation 4-4

Proposed $SHGCA_p$

$SHGCA_p = SHGC_{og}A_{og} + SHGC_{vg}A_{vg}$

Where:

$SHGCA_t$ = The combined proposed solar heat gain of the proposed fenestration area.

$SHGC_{og}$ = The solar heat gain coefficient of the skylights.

A_{og} = The skylight area.

$SHGC_{vg}$ = The solar heat gain coefficient of the vertical fenestration.

A_{vg} = The vertical fenestration area.

NOTE: The vertical fenestration area does not include opaque doors and opaque spandrel panels.

[Statutory Authority: RCW 19.27A.020, 19.27A.025 and chapters 19.27A and 19.27 RCW. WSR 19-02-089, § 51-11C-40215, filed 1/2/19, effective 7/1/19. Statutory Authority: RCW 19.27A.025, 19.27A.045, 19.27A.160, and 19.27.074. WSR 17-10-062, § 51-11C-40215, filed 5/2/17, effective 6/2/17; WSR 16-24-070, § 51-11C-40215, filed 12/6/16, effective 5/1/17; WSR 16-13-089, § 51-11C-40215, filed 6/15/16, effective 7/16/16. Statutory Authority: RCW 19.27A.025, 19.27A.160, and 19.27.074. WSR 16-03-072, § 51-11C-40215, filed 1/19/16, effective 7/1/16.]