



What is the definition of fenestration?

Fenestration products include windows, doors and skylights. The definition in the Washington State Energy Code, Residential (WSEC-R) defines fenestration as:

Fenestration. *Products classified as either vertical fenestration or skylights. (WSEC-R 2021)*

Vertical fenestration consists of windows and doors installed at a slope of 60 degrees or greater from horizontal. The definition is:

Vertical Fenestration: *Windows (fixed or operable), glazed doors, glazed block and combination opaque/glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees from horizontal. Opaque areas such as spandrel panels are not considered vertical fenestration. (WSEC-R 2021)*

Skylights are windows installed at an angle of less than 60 degrees from horizontal. The definition is:

Skylight. *Glass or other transparent or translucent glazing material installed at a slope of less than 60 degrees from horizontal. (WSEC-R 2021)*

Are opaque doors fenestration? Yes

All doors – whether opaque, glazed or a combination of opaque and glazed -- are fenestration, although this may not be obvious in the definition of “vertical fenestration” given in the WSEC-R. Other residential codes more clearly include opaque doors as fenestration. For example, the International Energy Conservation Code (IECC 2021) defines “vertical fenestration” as:

Vertical fenestration. *Windows that are fixed or operable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors composed of glass or other transparent or translucent glazing materials and installed at a slope of not less than 60 degrees (1.05 rad) from horizontal. (IECC 2021)*

That opaque doors are intended to be included in fenestration is clear when considering that opaque doors are not treated separately anywhere in the rest of the WSEC-R. For example, in Table R402.1.1 “Insulation and Fenestration Requirements by Component”, maximum U-values are given for fenestration except skylights (0.3) and for skylights (0.5). From this we can assume, “fenestration except skylights” is intended to include all doors because their required U-value would not otherwise be specified.

Do all windows have to meet the U-factor target for the code baseline or energy credit option I select?

To meet code baseline, the target U-value for vertical windows and doors is 0.3 or less. However, your windows and doors do not each need to meet the U-factor target individually. It is the *area-weighted average U-value* of all your vertical fenestration that needs to meet the target value. This means that you can select some vertical fenestration with U-values exceeding the target of 0.3 as long as others are sufficiently less than the target to compensate.



We recommend calculating the area-weighted average U-value of fenestration using the Glazing Schedule Worksheet, which is available from WSUEP’s energy code website at <https://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx#Permit>.

Example 1

Five windows will be added in an addition. **Figure 1** illustrates using Glazing Schedule Worksheet to calculate the area weighted U-factor of these windows. Two 3’x4’ windows have a U-value 0.34 and three 4’x4’ windows have a U-value of 0.28. The area weighted U-value of 0.30 is shown in Row 60.

Figure 1. Excerpt from Glazing Schedule Worksheet with example of area-weighted U-factor of five windows.

Vertical Fenestration (Windows and doors)										
Component		Ref.	U-factor	Width		Height		Area	UA	
Description				Qt.	Feet	Inch	Feet			Inch
16	Window Model 1		0.34	2	3		4	24.0	8.16	
17	Window Model 2		0.28	3	4		4	48.0	13.44	
57								0.0	0.00	
58	<i>Sum of Vertical Fenestration Area and UA</i>								72.0	21.60
59	<i>Vertical Fenestration Area Weighted U = UA/Area</i>									0.30
60										

Do you have any tips for finding very low U-value windows?

- The Energy Star website has listings for the “most efficient” products in several categories that are updated annually at https://www.energystar.gov/products/most_efficient. The window listings are for [vertical sliders](#), [horizontal sliders](#), [casement style](#), [fixed or picture](#), and [sliding glass door](#).
- The Efficient Windows Collaborative has an easy to use Window Selection Tool that gives good, better and best options with links to manufacturer product information. Visit <https://efficientwindows.org/>.

Where can I find the rated U-value of my windows, doors and skylights?

NRFC ratings for various fenestration types may be obtained from manufacturer’s product information or from the [National Fenestration Rating Council’s Certified Products Directory](#) on their website at <https://www.nfrc.org/>.

Click on the link in the CPD# column for the product to show a summary table of data for the product. An example is shown in **Figure 2**.



Figure 2. Example detail for a window from the NFRC’s Certified Products Directory

CPD #	U-factor	SHGC	VT	Condensation Resistance	Air Leakage	Ventilation Rating (Standard Screen)	Ventilation Rating (Enhanced Screen)
MAR-N-325-01101-00001	0.26	0.24	0.55	44			

Group ID	Manufacturer Product Code	Frame/Sash Type	Glazing Layers	Low-E	Gap Widths	Spacer	Gap Fill	Grid	Divider	Tint
1	CDIFbavm0120000	FG/NA	2	0.02(2), 0.149(4)	0.640	SS-D	Fill 1: AIR(100)	N	-	CL

What U-value should I use for a window or door that is not in the NFRC database?

If a window, door or skylight does not have a NFRC rated U-value, then you must use the default U-values in WSEC-R Tables R303.1(1) to R303.1(5).

Example 2

A home has an existing double-pane metal-framed window with thermal break that does not have a rated U-value. For use in calculations and permit submittals, select the default U-value of 0.65 from Table R303.1.3(1), as shown in **Figure 3**.

Figure 3. Example showing selection of default U-value from Table R303.1.3 for double-pane metal-framed window with thermal break.

TABLE R303.1.3(1)
DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT U-FACTOR

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT
	SINGLE PANE	DOUBLE PANE	
Metal	1.20	0.80	See Table R303.1.3(4)
Metal with Thermal Break ^a	1.10	0.65	
Nonmetal or Metal Clad	0.95	0.55	
Glazed Block	0.60		

How is the fenestration area measured?

Use the rough opening of the door, window or skylight to calculate the area, per the definition of “fenestration area”:

FENESTRATION AREA. Total area of the fenestration measured using the rough opening, and including the glazing, sash and frame.



The rough opening is generally defined as “the full untrimmed opening for a window or door.” The rough opening is large enough for proper installation of the door or window, allowing for shim space. (<https://www.builder-questions.com/construction-glossary/rough-opening-ro/>.)

For small dwelling units, does the limit of 300 ft² include all doors, windows and skylights? Yes

A “small dwelling unit” is defined as a dwelling unit that is “less than 1500 square feet in conditioned floor area *with less than 300 square feet of fenestration area.*”

This fenestration area includes all doors, windows and skylights. This is because the general word “fenestration” is used without qualifying it as vertical or specifically referring to doors, windows or skylights.

How are exempt doors and exempt windows used? Are these exempt from the 300 ft² calculation for small dwelling units? No

A certain amount of fenestration area is permitted to be exempt from prescriptive U-factor requirements. The intention is to allow decorative doors and windows commonly used in entries. Up to 15 square feet of glazed fenestration and one side-hinged opaque door assembly up to 24 square feet per dwelling can be exempted.

Notably, this exempt fenestration is not exempt from the following:

- Exempt fenestration is included in heat loss calculations and system sizing calculations using, for example, the Heating System Sizing Worksheet, available from WSUEP’s energy code website at <https://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx#Permit>.
- The exemptions do not apply if you are using the Total UA Alternative compliance pathway per Section R402.1.4.
- Exempt fenestration must be included in the 300 ft² of fenestration area allowed for small dwelling units.

If I have a 48 sq. ft. French door assembly, can I take half of that as my exempt door area? No

Section R402.3.4 “Opaque door exemption” specifically refers to “one side-hinged opaque door assembly up to 24 square feet in area” as permitted to be exempt. Note it is the door *assembly* -- which includes the door frame and jamb -- that must be 24 square feet or less. You cannot divvy the area of a larger door assembly up and take a portion of it as exempt because it is the size of the *assembly* that matters.

Conversely, if you have a smaller door – say 20 sq. ft. – you cannot use the excess 4 sq. ft. to take part of a second door as exempt. The exemption clearly applies to one single door. As well, you cannot apply the exemption to any type of vertical roll up door. It must be side-hinged.

These restrictions are based on the original intention of the exempt door area as allowing one decorative entry door for architectural reasons.



Can a skylight be considered exempt glazed fenestration? Yes

Section R402.3.3 allows up to 15 square feet of “glazed fenestration” to be exempt from U-factor and SHGC requirements. There is nothing in this section that restricts exempt glazed fenestration to vertical glazing.

Can more than one window or skylight be counted as exempt glazed fenestration per dwelling unit? Yes

Section R402.3.3 does not restrict the quantity of fenestration products per dwelling unit that can be included as exempt glazed fenestration, only the total area.

How is the “maximum fenestration U-factor” in Section R402.5 used in UA trade off analyses?

UA tradeoffs allow a higher performing building component to compensate for a lower performing component. For example, if the area weighted average U-factor of your windows exceeds the target U-value, you could offset this by installing, for example, more ceiling insulation than is required prescriptively. The amount of extra insulation to offset the poorer performing windows depends on your home’s design and may be calculated using a tool such as the Code Compliance Calculator, available from WSUEP’s energy code website at

<https://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx#Permit>.

In such analyses, Section R402.5 sets a maximum on the area-weighted U-factor for fenestration of 0.48. This section essentially disallows installing mostly very poorly performing windows, such as single-pane windows, even if you are able to compensate for their poor performance in a UA trade off with some other building component.

Is there a maximum percent fenestration glazing area using the prescriptive compliance path?

No, the prescriptive path does not have a maximum percent fenestration glazing area.

If however you are using the Total UA Alternative compliance path per Section R402.1.4, the *baseline* UA calculated per Equation 1 does have a maximum percent fenestration glazing area of 15% of the conditioned floor area. So, if the glazing percent of your proposed design is greater than 15%, the UA of the reference baseline is calculated setting the glazing area to 15% of the floor area with the net being allocated to walls. This means you must make up for the poorer performance of the windows relative to walls for the area in excess of 15% by over-insulating some building component.

We suggest you use our Code Compliance Calculator for Total UA Alternative calculations, available from WSUEP’s energy code website at

<https://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx#Permit>.

What about garage doors?

If your garage will be conditioned, then the thermal envelope of the garage must meet the insulation and fenestration requirements of the WSEC-R. Note a space is considered conditioned if a heating



system provides heat to it – regardless of how frequently you intend to heat it. The garage doors of conditioned garages are treated like any other door by the energy code. This means you will need to include the garage door with your other doors and windows in the calculation of the area-weighted U-value of your vertical fenestration.

If a low U-value garage door is cost prohibitive, consider doing a UA trade off (see previous question) to offset a lower performing garage door by over-insulating another building element, being careful to not exceed the maximum fenestration U-factor in your selection.

Keep in mind that a conditioned garage needs to be included in any required blower door testing of the thermal envelope. So you will need to make sure its bottom door seal and the weather stripping on the stop molding along the sides and top of the door are in good condition and properly installed to ensure you meet the target air leakage rate.

For a curved structure, such as a dome or Quonset hut, how do I distinguish windows and skylights?

Any fenestration installed at an angle of 60 degrees or greater from the horizontal is defined as vertical fenestration and any glazed fenestration at an angle less than 60 degrees as skylights. For a curved structure, such as domes and Quonset huts, there may be no other distinction between its skylights and windows other than their installation angle.

Note that the WSEC-R does not have a similar distinction between walls and roofs based on angle for curved structures. Instead of angle, roofs are defined by their materials and function.

For More Information:

- Energy Star, [“Guide to Energy-Efficient Windows”](https://www.energy.gov/sites/prod/files/guide_to_energy_efficient_windows.pdf), U.S. Department of Energy, https://www.energy.gov/sites/prod/files/guide_to_energy_efficient_windows.pdf
- [“Air Sealing Window and Door Rough Openings”](#), Office of Energy Efficiency and Renewable Energy, Building America Solution Center
- National Fenestration Ratings Council, <https://www.nfrc.org>

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