

temperature of a cool roof is lower on hot sunny days than for a conventional roof, reducing cooling loads and the energy required to provide air conditioning.

The benefit of a high reflectance is obvious: while dark surfaces absorb the sun’s energy (visible light, invisible infrared, and ultraviolet radiation) and become hot, light-colored surfaces reflect solar energy and stay cooler. However, high emittance is also important. Emittance refers to the ability of heat to escape from a surface once it is absorbed. Surfaces with low emittance (usually shiny metallic surfaces) contribute to the transmission of heat into the roof components under the roof surface. The heat can increase the building’s air conditioning load resulting in increased air conditioning load and less comfort for the occupants. High-emitting roof surfaces give off absorbed heat relatively quickly through the path of least resistance - upward (and out of the building).

Rating and Labeling

Roofing products that are used for compliance with the standards (prescriptive and performance approaches) are required to be tested and labeled by the Cool Roof Rating Council (CRRC) per §10-113 and that liquid applied products meet minimum standards for performance and durability per §118(i)4. The CRRC is the supervisory entity responsible for certifying cool roof products. The CRRC test procedure is documented in CRRC-1, the CRRC Product Rating Program Manual. This test procedure includes tests for both solar reflectance and thermal emittance.

The roofing products manufacturer must have its roofing product tested for solar reflectance and thermal emittance, and be labeled according to CRRC procedures. Figure 8-1 provides an example of an approved CRRC product label.

	Initial	Weathered	
	Solar Reflectance	0.00	Pending
	Thermal Emittance	0.00	Pending
	Rated Product ID Number	-----	
Licensed Seller ID Number	-----		
Classification	Production Line		
<p>Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.</p> <p>Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.</p>			

Figure 8-1-CRRC Product Label and Information

8.3.2 Prescriptive Requirements for Additions Alone

§152(a)

In general, the prescriptive requirements apply to additions in the same way they apply to entirely new buildings and must be documented on the new CF-1R Form. However, there are a few exceptions as noted below and summarized in Table 8-2. Mechanical ventilation requirements do not apply to additions that are less than 1,000 ft².

Use the CF-1R-ADD form to document existing, removed and proposed fenestration by orientation. The total net percentage of fenestration should be 20 percent or less including West facing fenestration. West facing area includes skylights tilted to the west or tilted in any direction when the pitch is less than 1:12 (9.5 degrees from the horizontal), and must not exceed 5 percent of the conditioned floor area (CFA) in climate zones 2, 4, and 7-15.

Plan checkers will verify the CF-1R-ADD form, total Percentage of Fenestration calculation against the Total Net Fenestration and the CFA to make sure that they do not exceed the allowable limits for total fenestration area as well as west-facing fenestration area.

1. If the Total of Fenestration exceeds 20 percent of the conditioned floor area (CFA), the performance compliance approach must be used. Likewise, if the total west-facing fenestration area in climate zones 2, 4, and 7-15, exceeds 5 percent of the CFA, then the performance compliance approach must be used.
2. If the addition has a floor area of 100 ft² or less, then up to 50 ft² of fenestration area is allowed. Additions that add up to 50 ft² of fenestration area need to meet the Package D requirements for fenestration U-factor and SHGC, but are exempt from the fenestration maximum total area limits (this includes both 20 percent of conditioned floor limit and the 5 percent west-facing limit). There is no credit for glazing removed when using this option. For additions with floor areas of 100 ft² or less that have greater than 50 ft² of added fenestration area, the performance compliance is optional, or choose the less than 1,000 ft² Column.
3. If the addition has a floor area equal to or less than 1,000 ft², then only R-13 wall insulation is required in all climate zones. All other requirements of Package D apply, as indicated in Table 8-2.

The Standard allows the area of fenestration removed during the remodel to be added to the Package D fenestration area allowance (20 percent of floor area). However, the total allowed for west-facing fenestration is 5 percent of the CFA of the addition plus the amount of west-facing glazing removed from the existing building as a result to make way for the addition. The CF-1R-ADD Form is used to determine credit for glazing removed.

4. If the addition has a floor area greater than 1,000 ft² the new fenestration must meet the Package D requirements for fenestration U-factor and SHGC. The 20 percent CFA limitation on added fenestration area and 5 percent limitation on west-facing fenestration (in climate zones 2, 4, and 7-15) applies.

Table 8-2 – Prescriptive Envelope Requirements for Additions

Component	Size of Addition		
	100 ft ² or less	1,000 ft ² or less	More than 1,000 ft ²
Ceiling Insulation	R-19	Package D	Package D
Wall Insulation ¹	R-13	R-13	Package D
Floor Insulation	R-13	Package D	Package D
Fenestration U- factor	Package D	Package D	Package D
Glazing Area	≤ 50 ft ²	Package D (20%) + Glass Removed to make way for the addition ³	Package D
		For west orientation: CFA x 5% of the addition + glass removed to make way for the addition ⁴	
Solar Heat Gain Coefficient (SHGC)	Package D	Package D	Package D
Radiant Barrier ²	N/A	Package D	Package D
Roofing Products	N/A	Package D	Package D

1. Heavy mass and light mass walls may meet the Package D requirements for mass wall insulation instead of R-13.
2. Radiant barrier requirements are not applicable for additions less than 100 ft². For additions greater than 100 ft² in climate zones 2, 4, and 8-15 it is applicable to the roof area of the addition. It is not necessary to retrofit a radiant barrier in the existing attic. N/A (not allowed) means that feature is not allowed in a particular climate zone.
3. The removed glass area can be added to the maximum allowed 20% of the CFA of the addition.
4. For west orientations in climate zones 2, 4, 7-15, no more than 5% of the CFA is allowed for west facing glass plus west-facing glass area removed to make way for the addition.

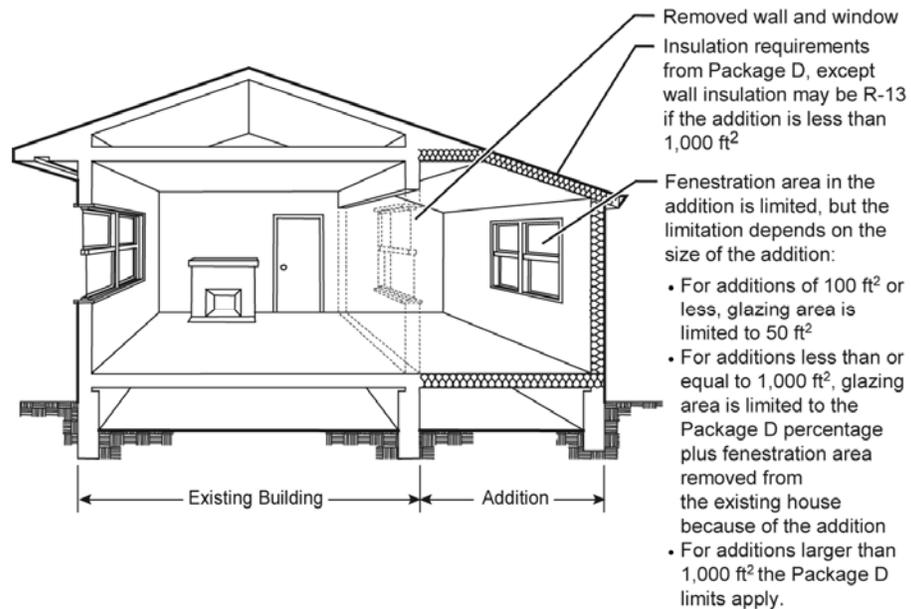


Figure 8-2 – Addition Alone Prescriptive Compliance Approach

Greenhouse Windows

Greenhouse windows are special windows that project from the façade of the building. In addition to the projected area, greenhouse windows typically have two sides, a top and a bottom surface from which heat is exchanged. The NFRC-rated U-factor for greenhouse windows is typically quite high and does not meet the prescriptive requirements for fenestration products.

When greenhouse windows are used in additions or alterations, they are deemed to comply with the prescriptive U-factor requirement when they are dual-glazed, though the prescriptive SHGC limit still applies. This applies only for greenhouse windows used in additions or alterations, not in newly constructed buildings. Greenhouse windows must either meet the SHGC requirements with an NFRC rating, or, if they are being installed with other fenestration products, they may use the default SHGC values from Standards Table 116-B and weight average the SHGC values as described in §151(f)4A.

Greenhouse windows add volume, but not floor area to the building and are therefore alterations, not additions, if this is the only change.

Skylights

Skylights must still comply with the prescriptive U-factor and SHGC maximum values limit in Package D. The SHGC for skylights may be determined either by using an NFRC rating, a default value from Standards Table 116-B, or by calculating the SHGC using a manufacturer's center of glass SHGC_c to determine SHGC_{fen} with the following equation:

$$SHGC_t = 0.08 + 0.86 \times SHGC_c$$

8.3.3 Prescriptive Requirements for Alterations

§152(b)1A and §152(b)1B

Fenestration

When over 50 ft² of fenestration area is added to an existing building, then the fenestration must meet the requirements of Package D for U-factor, fenestration area, and SHGC. The area requirement means that the total fenestration area for the whole building, including the added fenestration, must not exceed 20 percent of the conditioned floor area, and in climate zones 2, 4, and 7-15, the 5 percent west-facing area limit must be complied with. Use the worksheet form CF-1R ALT to document existing, removed and proposed fenestration by orientation. Plan checkers will verify the CF-1R ALT Total Percentage of Fenestration calculation against the Total Net Fenestration and the CFA to make sure that they do not exceed the allowable limits for total fenestration.

If the Total Percentage of Fenestration exceeds 20 percent, the performance compliance approach must be used. Alterations add up to 50 ft² of fenestration area (Exception to §152(b)1A) need to meet the Package D requirements for fenestration U-factor and SHGC, but are exempt from the fenestration maximum 20 percent total area and the 5 percent west-facing areas' limits.