

## **NFRC 200-2009, Section 5.6 (Non-Residential Fenestration)**

Revised: November 2008

### **5.6 Non-Residential building fenestration products:**

This section covers methods for determining fenestration product SHGC and VT, for fenestration products installed in non-residential buildings, including but not limited to fenestration products that are site assembled (built). This section also covers methods for determining fenestration product SHGC and VT, for solarium/sunroom systems.

#### **5.6.1 Scope**

To specify a method for determining the SHGC and VT of non-residential fenestration systems, including site-built fenestration systems for Non-residential buildings.

The ratings derived from this procedure may be used to compare thermal performance characteristics of non-residential fenestration systems and/or to provide architects, code specifiers, builders, etc. with a uniform and accurate means of determining and evaluating thermal performance characteristics of a specifically designed non-residential fenestration system. As an alternative, ratings determined in accordance with Section 4 are permitted.

#### **5.6.2 Variations from Standard Product Lines**

Non-residential fenestration systems covered by this method include products that are listed in NFRC 100, Table 4, including, but not limited to:

- a) Transparent and translucent wall systems where the glazing material is glass, plastic or other light transmitting panels (including opaque spandrel panels within the system), except those products where no testing or calculation procedure exists;
- b) Glazed wall support and framing systems;
- c) Changes made to a product type to address structural loads; e.g., changes made to frame components to build different size products, address wind-loads and aesthetics.
- d) Products with single or multiple glazing layers;
- e) Products with spacer systems between glazings;
- f) Horizontal, vertical, and sloped systems;
- g) Products that, by design, may have multiple framing components and/or glazing combinations;

- h) Fenestration systems using Unitized Construction, where a system is field assembled from factory assembled sub-units.
- i) Spandrel Panels
- j) Non-residential products or systems not covered by NFRC 100 Section 4.4, Table 4.

**Combination assembly with common frame treatment:** A combination assembly that includes common frame members that wrap around the assembly and/or contain common mullion members that connect various individual products, so that the fenestration assembly is a single product and installed as such. A combination assembly with a common frame shall be treated as an assembly, consisting of individual products and rated as such, unless the heat flow through the common frame members differs by more than 20% from the heat flow through the frame assemblies of individual products. The heat flow shall be calculated using the best glazing option for individual cross-sections of common frame members, and their frame U-factors shall be compared to the respective frame U-factor of the individual cross-sections in the assembly.

### **5.6.3 Variations from Standard Individual Products**

The following products and product configurations have special provisions:

- A. Single glazed products
- B. Double-sash products

### **5.6.4 Variations from Standard Simulation and Test Conditions**

- A. For single glazed products, framing members shall be modeled using single glazing best and worst options, as detailed in section 5.6.5.3.
- B. For double-sash products, framing members shall be modeled using the same distribution of best/worst insulating and single glazing as in actual product. For example, if the actual product incorporates IG and single glazing in a double-sash configuration, best/worst options should incorporate best/worst IG + single glazing. Reverse product configuration (i.e., single + IG) shall also result in modeling frame members using single + IG best/worst option. If double sash incorporates IG + IG configuration, that needs to be reflected in best/worst modeling.

#### **5.6.4.3 Simplifications to a Product Line – Frame Components**

This section presents additional product line simplification rules specific to frame components.

- A. Frame Grouping

All grouping rules contained in Section 4 shall be permitted to be utilized with the calculation procedures of Section 5.6. In addition, if the frames are grouped by U-factor in accordance with NFRC 100, Sections 4 and 5.6, the frame SHGC ( $SHGC_f$ ) shall be calculated in accordance with Section 5.6.5 by using the frame U-factor group leader and the actual individual frame component projected frame depth (PFD) within that group.

## 5.6.5 Calculation of Total Product Rating

### 5.6.5.1 Component Modeling Procedure

The SHGC and VT rating of a fenestration product may vary by size. In order to provide a uniform rating procedure, as well as size specific information, the component modeling procedure, as described in this section shall be used [as the primary method]. For the comparison rating of non-residential systems, the SHGC and VT rating for model (standard) size per NFRC 100 Table 1 is calculated. SHGC and VT ratings for sizes other than standard size can be calculated for informational purposes when applicable.

### 5.6.5.2 Basic Product Line Model and Component Information for Calculating and Reporting SHGC and VT

SHGC and VT shall be reported on a component basis for each frame assembly (i.e., sill, jambs, head, etc.), each spacer configuration, and each glazing system (center-of-glass). The SHGC and VT for frame components shall be reported as  $SHGC_f$  and  $VT_f$  (i.e. frame SHGC and VT) using the four representative options (Low and High), as defined in Table 5.6.1, and which gives a template for reporting SHGC and VT.

### 5.6.5.3 Definition of Low and High configurations

A total of four Low/High or L/H configurations are defined. The glazing and spacers used in the L/H configurations are defined in NFRC 100 with the best glazing system  $SHGC_{cog} < 0.2$ . In the case of single glazing systems, use the best glazing with  $SHGC_{cog} < 0.3$  and clear glass for the worst glazing option.

These configurations are assembled from two different glazing options at the extreme ends of thermal performance and two spacer configurations at the extreme ends of thermal performance. The following are four Low and High configurations:

- (a) b1 in Table 5.6.1: low glazing with low spacer ( $SHGC_{b1}$  and  $VT_{b1}$ ),
- (b) b2 in Table 5.6.1: low glazing with high spacer ( $SHGC_{b2}$  and  $VT_{b2}$ ),
- (c) w1 in Table 5.6.1: high glazing with low spacer ( $SHGC_{w1}$  and  $VT_{w2}$ ),
- (d) w2 in Table 5.6.1: high glazing with high spacer ( $SHGC_{ww}$  and  $VT_{ww}$ ).

**Table 5.6.1 - Template for Reporting Component SHGC and VT**

	Frame			
	w1	w2	b1	b2
<i>SHGC</i>				
<i>VT</i>				
<i>PFD</i> <i>[mm](inch)</i>				
<i>OWL</i> <i>[mm](inch)</i>				

Center of Glass:  $SHGC_c$  (dimensionless)

Spacer:  $k_{eff} = \frac{W}{m-K}$  (Btu/hr-ft-F)

The quantities w1, w2, b1, and b2 are defined in Reference [15].

For each individual product, total fenestration product SHGC and VT shall be reported for the specified configuration at the model size, as shown in Table 4 of NFRC 100. The calculation of this total product SHGC and VT, is done using procedure detailed in Reference [15].

**5.6.5.4 Approved Total Fenestration Product SHGC Calculation Procedure**

The total fenestration product SHGC and VT calculation procedure shall be calculated as per the procedure detailed in Reference [15].

Approved software shall be used for calculating the total fenestration product SHGC and VT. NFRC-approved software is listed in Reference 7.

Follow the NFRC-approved procedure for rounding the final result. The SHGC and VT rating shall be reported to X.XX decimals. All variables used in the formula shall be expressed to at least three (3) significant decimal places.

**5.6.5.5 Determining SHGC and VT for sloped glazing systems**

All sloped glazing systems shall be rated for SHGC and VT at a slope of 90 degrees above the horizontal.

**5.6.5.6 Approved Total Fenestration Product SHGC and VT for Non-Model Sizes**

The procedure in Reference [15] and NFRC-approved software as defined in Section 5.6.5.1 shall be used to determine size specific product indices.

**References:**

- [15] **Curcija, D.C. 2003.** *“Component Model Approach In Modeling Non-Residential Fenestration Products”*