



# National Fenestration Rating Council Incorporated

**NFRC 200A-2010**

Procedure for  
Determining Fenestration Attachment Product Solar Heat Gain  
Coefficient and Visible Transmittance at Normal Incidence

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## ***FOREWORD***

The National Fenestration Rating Council, Incorporated (NFRC) has developed and operates a uniform rating system for energy and energy-related performance of fenestration products. The Rating System determines the U-factor, Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT) of a product, which are mandatory ratings for labeling NFRC certified products, are mandatory ratings for inclusion on label certificates, and are supplemented by procedures for voluntary ratings of products for Air Leakage (AL), and Condensation Resistance. Together, these rating procedures, as set forth in documents published by NFRC, are known as the NFRC Rating System.

The NFRC Rating System employs computer simulation and physical testing by NFRC-accredited laboratories to establish energy and related performance ratings for fenestration product types. The NFRC Rating System is reinforced by a certification program under which NFRC-licensed responsible parties claiming NFRC product certification shall label and certify fenestration products to indicate those energy and related performance ratings, provided the ratings are authorized for certification by an NFRC-licensed certification and Inspection Agency (IA).

The requirements of the rating, certification, and labeling program (Certification Program) are set forth in the most recent versions of the following as amended, updated, or interpreted from time to time:

- NFRC 700 Product Certification Program (PCP).
- NFRC 705 Component Modeling Approach (CMA), Product Certification Program (CMA-PCP).

Through the Certification Program and the most recent versions of its companion programs as amended, updated, or interpreted from time to time:

- The laboratory accreditation program (Accreditation Program), as set forth in the NFRC 701 Laboratory Accreditation Program (LAP).
- The IA licensing program (IA Program), as set forth in NFRC 702 Certification Agency Program (CAP).
- The CMA Approved Calculation Entity (ACE) licensing program (ACE Program), as set forth in the NFRC 708 Calculation Entity Approval Program (CEAP).

NFRC intends to ensure the integrity and uniformity of NFRC ratings, certification, and

labeling by ensuring that responsible parties, testing and simulation laboratories, and IAs adhere to strict NFRC requirements.

In order to participate in the Certification Program, a Manufacturer/Responsible Party shall rate a product whose energy and energy-related performance characteristics are to be certified in accordance with mandatory NFRC rating procedures. At present, a Manufacturer/Responsible Party may elect to rate products for U-factor, SHGC, VT, AL, Condensation Resistance, or any other procedure adopted by NFRC, and to include those ratings on the NFRC temporary label affixed to its products, or on the NFRC Label Certificate. U-factor, SHGC and VT, AL, and Condensation Resistance rating reports shall be obtained from a laboratory that has been accredited by NFRC in accordance with the requirements of the NFRC 701.

The rating shall then be reviewed by an IA which has been licensed by NFRC in accordance with the requirements of the NFRC 702. NFRC-licensed IAs also review label format and content, conduct in-plant inspections for quality assurance in accordance with the requirements of the NFRC 702, and issue a product Certification Authorization Report (CAR), or approve for issuance an NFRC Label Certificate for site-built or CMA products and attachment products. The IA is also responsible for the investigation of potential violations (prohibited activities) as set forth in the NFRC 707 Compliance and Monitoring Program (CAMP).

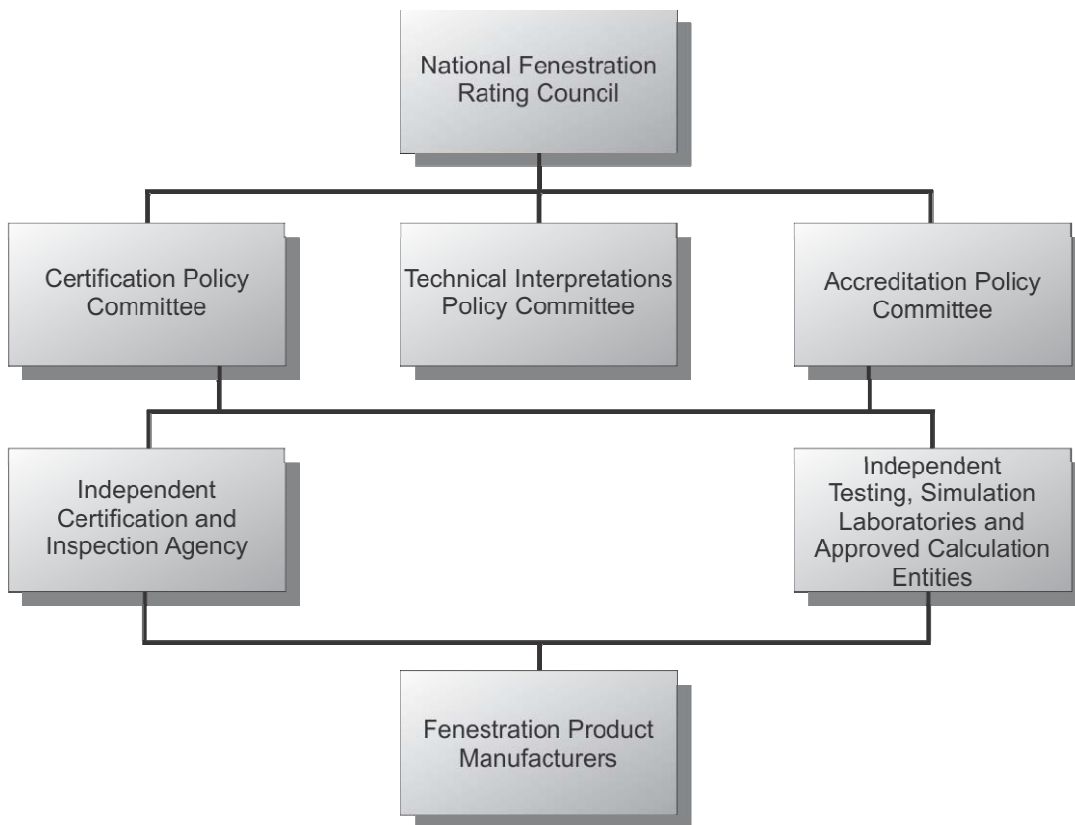
Ratings for products that are labeled with the NFRC Temporary and Permanent Label, or products that are listed on an NFRC Label Certificate in accordance with NFRC requirements, are considered to be NFRC-certified. NFRC maintains a Certified Products Directory (CPD), listing product lines and individual products selected by the manufacturer/responsible party for which certification authorization has been granted.

NFRC manages the Rating System and regulates the Product Certification Program (PCP), Laboratory Accreditation Program (LAP) and Certification Agency Program (CAP) in accordance with the NFRC 700 (PCP), the NFRC 701 (LAP), the NFRC 702 (CAP), the NFRC 705 (CMA-PCP), and the NFRC 708 (CEAP) procedures, and conducts compliance activities under all these programs as well as the NFRC 707 (CAMP). NFRC continues to develop the Rating System and each of the programs.

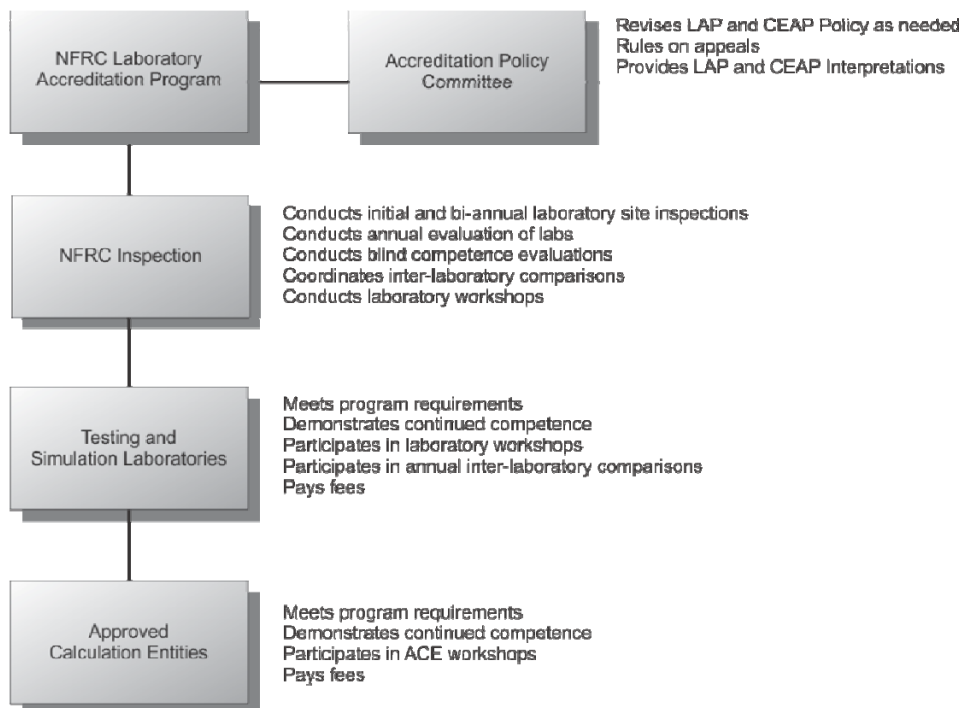
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The structure of the NFRC program and relationships among participants are shown in Figure 1, Figure 2, and Figure 3. For additional information on the roles of the IAs and laboratories and operation of the IA Program and Accreditation Program, see the NFRC 700 (PCP), NFRC 701 (LAP), and NFRC 702 (CAP) respectively.

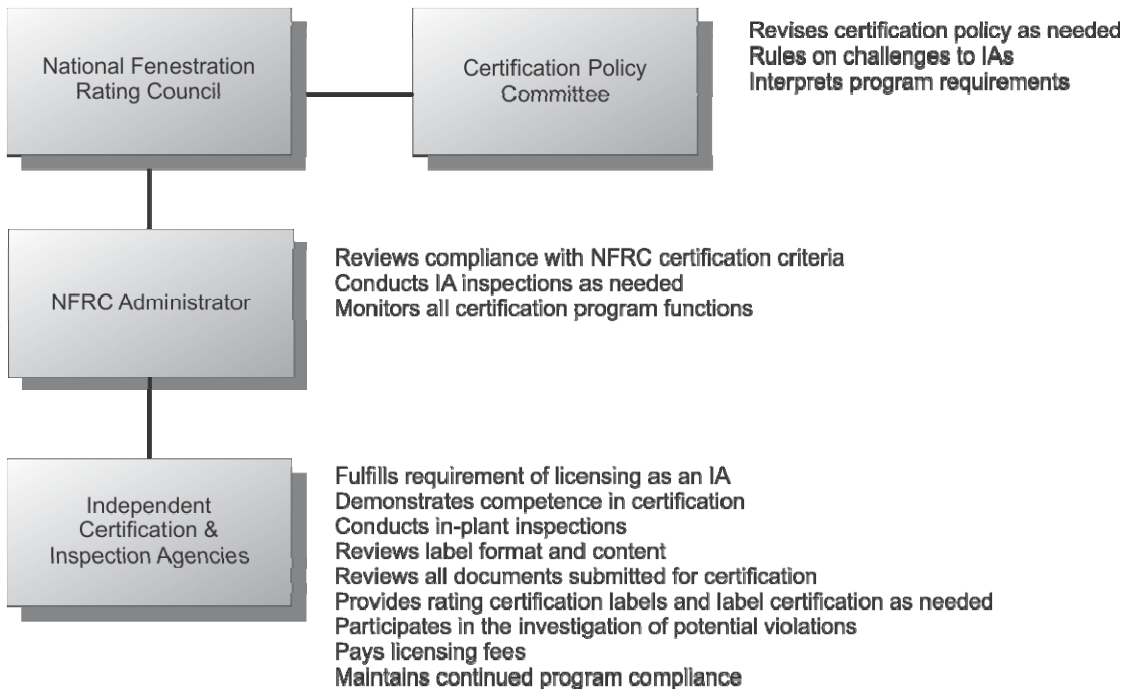
**Figure 1**



**Figure 2**



**Figure 3**



Questions on the use of this procedure should be addressed to:

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## ***DISCLAIMER***

NFRC certification is the authorized act of a Manufacturer/Responsible Party in: (a) labeling a fenestration or related attachment product with an NFRC Permanent Label and NFRC Temporary Label, or (b) generating a site built or CMA label certificate, either of which bears one or more energy performance ratings reported by NFRC-accredited simulation and testing laboratories and authorized for certification by an NFRC-licensed IA. Each of these participants acts independently to report, authorize certification, and certify the energy-related ratings of fenestration and related attachment products.

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## 1. PURPOSE

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To specify a method for calculating Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT) at normal (perpendicular) incidence for all fenestration attachment products that are co-planar to the fenestration products, excluding products covered in NFRC 200 Section 2.1 and Applied Films, with specular optical properties calculated or tested in accordance with NFRC 201.

[**Note:** This standard specifies a method for calculating the SHGC and VT from direct solar radiation through total fenestration products at normal incidence only.]

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## 2. SCOPE

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### 2.1 Fenestration Attachment Product Lines Covered

A fenestration attachment product line is a series of products with distinct structural configuration as listed and shown in Table 5.1. Only the product lines stated in Table 5.1 are covered for this technical procedure. Location (such as exterior and interior to the fenestration product) and orientation (such as vertical or horizontal) constitute separate product lines. The following changes are the only allowable changes within a product line:

- A. Orientation of slats, pleats, shutters, louvers, operating hardware, and mounting hardware such as vertical or horizontal;
- B. Width or thickness of slats, pleats, louvers, and shutters;
- C. Operating hardware, hardware enclosures, and mounting hardware and enclosures;
- D. Material composition such as wood, polymer, fabric, or metal;
- E. Opacity and openness of material such as opaque to translucent or perforated;
- F. Emissivity of the attachment material (shading or glazing for example); and
- G. The number of cells or compartments to trap air.

### 2.2 Fenestration Attachment Individual Products Covered

An individual fenestration attachment product is a variation of a specific product line as defined in Table 5.1. The following are the variables of a product line, which are changed to build an individual fenestration attachment product. Each individual fenestration attachment product based on manipulation of the following product line variables shall be simulated or tested in accordance with Section 4.1. Specular optical properties criteria are based on the attachment materials, excluding the hardware. The fenestration attachment product line variables are as follows:

### 2.2.1 Cellular Type Attachment

An individual cellular type attachment product is characterized by one or more of the following applicable variables:

- Cell structure is based on material fold manipulation (as shown in Figure 6-1). The different types of cell structures are:
  - Single cell
  - Cell within a cell
    - Full cell within a cell
    - Split cell within a cell
  - Two cells through depth
  - Three cells through depth
- Cell size based on 6 mm (0.25 in) intervals. Please refer to Figure 6-2 for an illustration on cell size determination
- Edge Seals
  - Track type seal
  - No seal
- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency measured using ASTM D7305-08a test method (Report Only)
- Material solar absorptance or reflectance measured using ASTM E1175, ASTM E903, EN 410, ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment edge seals (such as but not limited to Track type seal)

### 2.2.2 Slat or Louver Type Attachment

An individual slat or louver type attachment product is characterized by one or more of the following applicable variables:

- Slat/Louver size is based on 6 mm (0.25 in) intervals (as shown in Figure 6-3)

- Slat/Louver thickness is based on 0.25 mm (0.01 in) intervals (as shown in Figure 6-3)
- Louver profile: flat, curved, or complex
- Material translucency measured using ASTM D7305-08a test method (Report Only)
- Material solar absorptance or reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to track type seal)

### **2.2.3 Sheer Type Attachment**

An individual sheer type attachment product is characterized by one or more of the following applicable variables:

- Integrated Slat/Louver size is based on 6 mm (0.25 in) intervals (as shown in Figure 6-4)
- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency measured using ASTM D7305-08a test method (Report Only)
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material (such as but not limited to Metal, Wood, Fabric, and/or Film)
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)

- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

#### **2.2.4 Shutter Type Attachment**

An individual shutter type attachment product is characterized by one or more of the following applicable variables:

- Slat/Louver size is based on 6 mm (0.25 in) intervals (as shown in Figure 6-5)
- Slat/Louver thickness is based on 0.25 mm (0.01 in) intervals measured at the thickest point (as shown in Figure 6-5)
- Shutter frame dimensions (as shown in Figure 6-5)
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

#### **2.2.5 Pleated Type Attachment**

An individual pleated type attachment product is characterized by one or more of the following applicable variables:

- Pleat size is based on 6 mm (0.25 in) intervals (as shown in Figure 6-6)
- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency measured using ASTM D7305-08a test method
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)

- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

### **2.2.6 Roller Type Attachment**

An individual roller type attachment product is characterized by one or more of the applicable variables:

- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency measured using ASTM D7305-08a test method
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

### **2.2.7 Roman Shade Type Attachment**

An individual Roman type attachment product is characterized by one or more of the following applicable variables:

- Segment spacing is based on 6 mm (0.25 in) intervals (as shown in Figure 6-7)
- Segment loop overlap size is based on 3 mm (0.118 in) intervals (as shown in Figure 6-7)
- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency using ASTM D7305-08a test method

- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

### **2.2.8 Drape Type Attachment**

An individual drape type attachment product is characterized by one or more of the following applicable variables:

- Non-metalized material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Metalized material translucency measured using ASTM D7305-08a test method
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

### **2.2.9 Flat Panel Type Non-Glazed Attachment**

An individual flat panel type attachment product is characterized by one or more of the following applicable variables:

- Material translucency measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method

- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Type of material, such as but not limited to Metal, Wood, Fabric, and/or Film
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

### 2.2.10 Flat Panel Type Glazed Attachment

An individual glazed attachment product is characterized by one or more of the following applicable variables:

- Framing type and size
- Configuration (Fixed, Single, Double Hung, or other)
- Glazing thickness
- Material solar absorptance and reflectance measured using ASTM E1175, ASTM E903, EN 410, or ISO 9050 test method (Report Only)
- Material/air porosity as determined by ASTM D737 (Report Only)
- Material openness shall be determined by a test of the normal-normal transmittance in accordance with the procedure in EN 14500 (Report Only)
- Any type of frame with any type of fenestration attachment product (reference NFRC 100, Sections 4.2.1, 4.2.2, 4.2.4.5)
- Any fenestration attachment product that incorporates attachment Edge Seals (such as but not limited to Track type seal)

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## 3. DEFINITIONS

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Refer to NFRC 600 document for a definition on each of the attachment products. Following are some of the important terms referred in this document.

**Fenestration product with attachment:** the whole fenestration product with fenestration attachments resulting when a fenestration attachment is combined with (i.e., installed on) a reference fenestration product in the manner recommended by the manufacturer.

**Fenestration attachment:** a device designed to be physically attached to, incorporated with or covering a product that has been or may be rated according to NFRC procedures.

**Reference fenestration product:** the fenestration product that an attachment is combined with for the purposes of rating. A reference fenestration product comprises a reference glazing system and a reference frame with a specified construction.

**Solar Heat Gain Coefficient (SHGC):**

**Solar Heat Gain Coefficient (SHGC):** the ratio of the solar heat gain entering the space through the fenestration product to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and that portion of the absorbed solar radiation which is then reradiated, conducted or convected into the space.

**Total fenestration product Solar Heat Gain Coefficient (SHGC<sub>t</sub>):** the SHGC representative of the total fenestration product, as defined in NFRC 200-2010, Equation 4-3 of Section 4.7.

**SHGC<sub>0</sub>:** the total fenestration product Solar Heat Gain Coefficient for a center-of-glazing Solar Heat Gain Coefficient of 0.0.

**SHGC<sub>1</sub>:** the total fenestration product Solar Heat Gain Coefficient for a center-of-glazing Solar Heat Gain Coefficient of 1.0.

**Visible Transmittance (VT):**

**Visible Transmittance (VT):** the ratio of the visible light entering the space through the fenestration product to the incident visible light. The visible light entering a space is weighted by the photopic response of the eye (refer to NFRC 300).

**Total fenestration product Visible Transmittance (VT<sub>t</sub>):** the VT representative of the total fenestration product, as defined in NFRC 200-2010, Equation 4-4 of Section 4.7.

**VT<sub>0</sub>:** the total fenestration product visible transmittance for a center-of-glazing visible transmittance of 0.0.

**VT<sub>1</sub>:** the total fenestration product visible transmittance for a center-of-glazing visible transmittance of 1.0.

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## 4. GENERAL

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### 4.1 Compliance

Fenestration attachment product ratings shall be determined by following the procedure outlined in Section 4.1 in accordance with the criteria specified in Section 4.2 through Section 4.7. This Section presents and references methods for determining heat transfer properties for whole fenestration product with fenestration attachments or quantities used in the determination of these properties.

#### 4.1.1 Product Line Simulation and Testing

The whole fenestration product with fenestration attachment Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT) shall be evaluated in the Fully Opened and Fully Closed positions and in accordance with ISO 15099, using all Fenestration Attachments Reference Windows or Fenestration Attachments Reference Skylights defined in Table 5-2 and 5-3 of NFRC 100A. All attachment products shall be tested or simulated as an individual product without screens, applied film, removable grilles, or any other applied devices.

#### 4.1.2 Testing Alternative

The whole fenestration product with fenestration attachment SHGC shall be determined by testing in accordance with NFRC 201 only if the product cannot be simulated using NFRC approved simulation software.

[**Note:** It is anticipated that similar provisions for the VT will be implemented once NFRC adopts a VT test procedure.]

### 4.2 Fenestration Attachments Standard Simulation and Test Conditions

This section presents procedures for determining whole fenestration product with fenestration attachment Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT). For rating SHGC and VT of individual products at model sizes, follow Section 4.4.

#### 4.2.1 Installation Requirements for Testing and Simulation Interior Attachment

- A. Install the Reference Window or Skylight as per Table 5-2 and Table 5-3 of NFRC 100A;
- B. Mounted “inside” the window/skylight recess (reveal, day lighting region) which shall be based on the Fenestration Attachments Reference Windows/Skylights sizes,
  - i. Oriented in the maximum thickness configuration (typically fully open), the plane of the attachment nearest to the glazing shall be 25 mm (1 in) from the center of glazing interior surface,
  - ii. Maximum product to edge of frame allowance shall be 3 mm (0.118 in) for head and bottom rail and 12 mm (0.5 in) for edge of frame to attachment and is assumed to be a result of manufacturer’s standard deductions;
- C. Mounted “outside” the window/skylight frame which is based on the Fenestration Attachments Reference Windows/Skylights sizes,
  - i. Edge of attachment shall overhang the frame by 50 mm (2.0 in) +/- 6.0 mm (0.25 in) except as addressed in Section 4.2.1.D;
- D. Product shall be simulated as installed

- i. Products shall be installed according to manufacturer's installation instructions utilizing the specific dimension given above in 4.2.1.A-C,
  - ii. These dimensions may be adjusted if the construction and manufacturer-recommended installation instructions preclude their use. If the dimensions listed in 4.2.1.A-C are not used, the actual dimensions used will be recorded; and
- E. The fenestration attachment product shall be evaluated in the fully open and the fully closed positions.
- [Note:** utilize the "as installed" position for non-operating/fixed in place devices.]

#### **4.2.2 Installation Requirements for Testing and Simulation Exterior Attachment**

- A. Install the Reference Window or Skylight as per Table 5-2 and Table 5-3 of NFRC 100A;
  - B. Exterior attachments can be mounted "inside" the window recesses or "outside" the window frame,
    - i. For attachments mounted "inside"
      - (a) The maximum product to edge of frame allowance is 3 mm (0.118 in) for head and bottom rail and 12 mm (0.5 in) for edge of frame to attachment and is assumed to be a result of manufacturer's standard deductions,
    - ii. For attachments mounted "outside":
      - (a) The minimum attachment overlap beyond the edge of frame is 37 mm + 6 mm (1.5 in + 0.25 in);
  - C. Oriented in the maximum thickness configuration (typically fully open), the plane of the attachment nearest to the glazing shall be located from 50 mm +/- 6 mm (1.96 in +/- 0.25 in) from center of glazing exterior surface;
  - D. Attachment shall be simulated as installed
    - i. Attachment products shall be installed according to manufacturer's installation instructions utilizing the specific dimension given above in 4.2.2.A-C,
    - ii. These specific dimensions may be adjusted if the construction and manufacturer-recommended installation instructions preclude their use. If the dimensions listed in 4.2.2.A-C are not used, the actual dimensions utilized will be recorded;
  - E. The fenestration attachment product shall be evaluated in the fully open and the fully closed positions; and
- [Note:** Utilize the "as installed" position for non-operating/fixed in place devices.]

- F. The open space between attachment and window frame shall be between 0 mm (0 in -- no air space) and 50 mm (2 in).

#### **4.2.3 Environmental Conditions During NFRC 201 Testing**

- A. Average nominal inside air temperature shall be 24°C (75°F);
- B. Inside surface coefficient (as measured on a vertical CTS per Section 5.5.1 of NFRC 201) shall be 7.7 W/m<sup>2</sup>K ± 5% (1.4 Btu/h·ft<sup>2</sup>·°F ± 5%);
- C. The solar irradiance shall never be less than 680 W/m<sup>2</sup> (200 Btu/h·ft<sup>2</sup>);
- D. The incident angle of the direct solar irradiance shall be maintained at less than or equal to 5° from normal to the plane of the solar calorimeter aperture (i.e., perpendicular to the outside surface of the surround panel); and
- E. The aperture of the solar calorimeter (i.e., the plane of the outside surface of the surround panel) shall not be tilted more than 60° from vertical unless the laboratory can demonstrate that their calorimeter can meet the inside surface coefficient tolerance specified (Section 4.2.3.B) at the greater tilt angle.

#### **4.3 Model Sizes and Configurations**

Total fenestration attachment product SHGC and VT shall be determined using the reference window or skylight size shown in Table 5-2 and Table 5-3 of NFRC 100A.

#### **4.4 Simulation Procedures**

When available, approved simulation procedures shall be used to simulate all attachment products to determine SHGC and VT. Until then, test only procedures shall be used to determine SHGC for all attachment products.

#### **4.5 Test Procedures**

If a product cannot be simulated in accordance with Section 4.4, the test procedures in this section shall be used to determine the SHGC of the total fenestration attachment products. However, these test procedures shall only be used for the reporting of SHGC if the size conditions in Section 4.4 are met. The only time a product line shall contain tested total fenestration attachment product SHGC is when an accredited simulation laboratory states in writing that it cannot simulate an individual product(s) to a reasonable accuracy by using the computational procedure. In addition, the written permission of NFRC is required for products not specifically addressed in this document.

**[Note:** It is anticipated that similar provisions for VT will be implemented once NFRC adopts a VT test procedure.]

#### 4.5.1 Reference Window Test Procedure

Testing is conducted as detailed in NFRC 201 to determine the Reference Window SHGC with the following additions to the test procedure:

- Testing shall be conducted as detailed in NFRC 201 to determine the Fenestration Attachment Reference Window/Skylight SHGC
- The reference window SHGC will be verified utilizing NFRC 201 each time a reference window is installed and each time it is removed
  - All test data is thoroughly reviewed and compared to past testing to check calibration
  - Must be within 2% of simulation for clear specimens Low-e specimens are verified by past base calibrations
- An inspection log for each window will be maintained onsite detailing:
  - Construction date of window and who built it
  - The date of U-factor verification and the value
  - The general condition of the window
    - Seals intact
    - Glass intact
    - Frame intact – no dents, cracks, warping or tears
- All reference windows will be stored
  - In a dry area (70% RH or less), shielded from direct sunlight
  - Relative temperature between 50° F and 100° F
  - In such a manner as to minimize damage to framing and glass

#### 4.5.2 Whole Fenestration Product with Fenestration Attachment Product Test Procedure

Testing is conducted as detailed in NFRC 201. The Attachment will be mounted (as indicated in Sections 4.2.1 and 4.2.2) to the reference window with the following additions to the test procedure. The system shall be tested with the attachment in the fully open and fully closed positions.

- Monofilament line will be used to keep the attachment coplanar to the reference window during testing. The product should not vary in its distance from the reference window by more than 3mm (0.19 in) when the system is oriented horizontal – the thickness and number of lines used should be minimized and will vary depending on the product being tested

- Specific mounting configuration will be noted in the report
  - What monofilament line was used – manufacturer, diameter, material
  - How many lines were used?
  - How and where the lines were attached?
  - What was the distance between the surface of the reference window and the closest surface of the attachment?

#### **4.6 Total Fenestration Attachment Product Rating**

The whole fenestration product with fenestration attachment SHGC and VT shall be reported as follows:

##### **4.6.1 Solar Heat Gain Coefficient**

Calculate the final SHGC value to six significant digits (0.XXXXXX) for the whole system that is reference window and attachment. For labeling and reporting, round the final SHGC value to two significant digits (0.XX).

##### **4.6.2 Visible Transmittance**

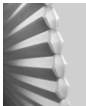



Calculate the final VT value to six significant digits (0.XXXXXX) for the whole system that is reference window and attachment. For labeling and reporting, round the final SHGC value to two significant digits (0.XX).



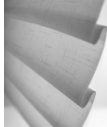


#### **4.7 Validation**


Simulated and tested SHGC for a given total fenestration product shall be considered equivalent if the agreement between the two numbers is within 10%.

## 5. TABLES

**Table 5-1 – Fenestration Attachment Product Lines – Interior and Exterior Attachments Generic Product Groups**

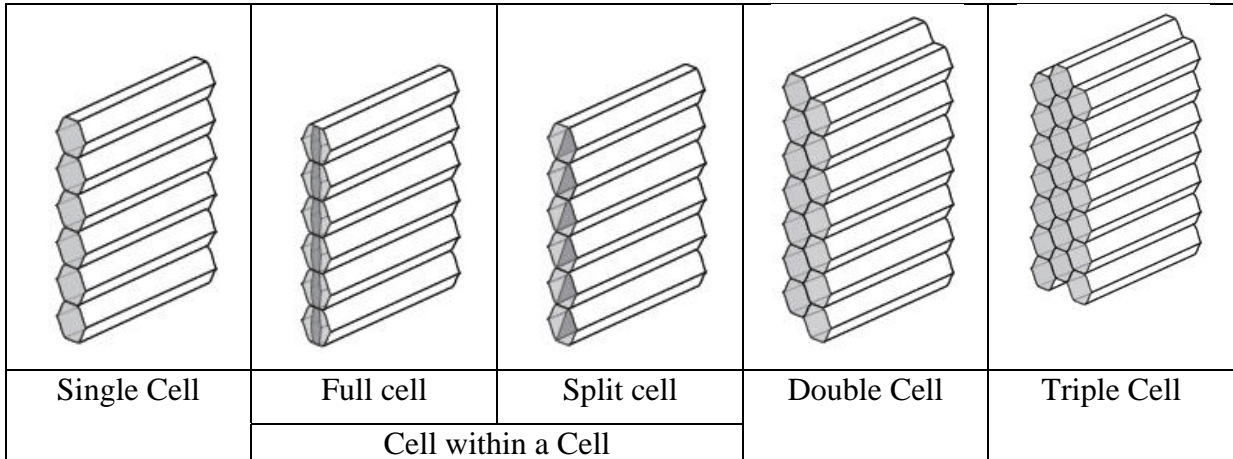
Product Line	Product Description	Picture / Sketch	Slat or Louver Adjustment (Tilt to Open & Close) Operable/non-operable
Cellular Type <i>Cellular blinds</i>	An attachment made from fabric or laminated film or any combination of material, which has cellular construction. Cellular structure is defined as two or more layers joined at the pleats to form compartments or cells that trap air. Cellular construction can be single cell, multiple cell, or cell-in-cell.		No
Slat or Louver Type <i>Venetian, Mini, Wood, Faux wood, Aluminum and Vertical blinds</i>	An attachment made from aluminum or wood or synthetic wood or fabric or any combination of material which has horizontal slats, one slat above another suspended by strips of cloth called tapes or by cords. The slit width can be from 0.5" to 20". The slat can be overlapping or non-overlapping.		Yes
Sheer Type <i>Sheer blind</i>	An attachment made from sheer fabric and with or without soft or semi-rigid louvers. The attachment can have following construction: a) A single layer of sheer fabric without louvers; b) A single layer sheer fabric with louvers on the back; c) Two parallel layers of sheer fabric with horizontal vane in between the two layers of fabric.		Yes
Shutter Type <i>Wood shutter Plantation shutter</i>	An attachment made predominantly from wood, synthetic wood or any combination of material, which is solid, stable and usually consisting of a frame of vertical stiles and horizontal rails (top, center and bottom). Set within this frame can be louvers (both operable or fixed), solid panels, fabric, glass and		Yes

Product Line	Product Description	Picture / Sketch	Slat or Louver Adjustment (Tilt to Open & Close) Operable/non-operable
	most any other item that can be mounted within a frame.		
Pleated Type <i>Single layer pleated blind</i>	An attachment made from a single layer of pleated fabric or any suitable flexible material. This attachment can be horizontal or vertical.		No
Roller Type <i>Roller binds, Solar shades Roller Shutters</i>	An attachment made from fabric or any suitable material which can be retracted and rolled on a shaft.		No
Roman Shade Type <i>Traditional roman shade Woven woods</i>	An attachment made from fabric or any combination of material which has horizontal loops at regular intervals. This attachment can be made with or without non-folded backing.		No
Drape Type <i>Traditional drapes Woven woods</i>	An attachment made from fabric or any material in drape form or in flat sheet form. The drape is usually hung from rail or from a rod with hooks.		No
Flat Panel non Glazed	An attachment made from fabric or any combination of material with a rigid flat panel frame.		No

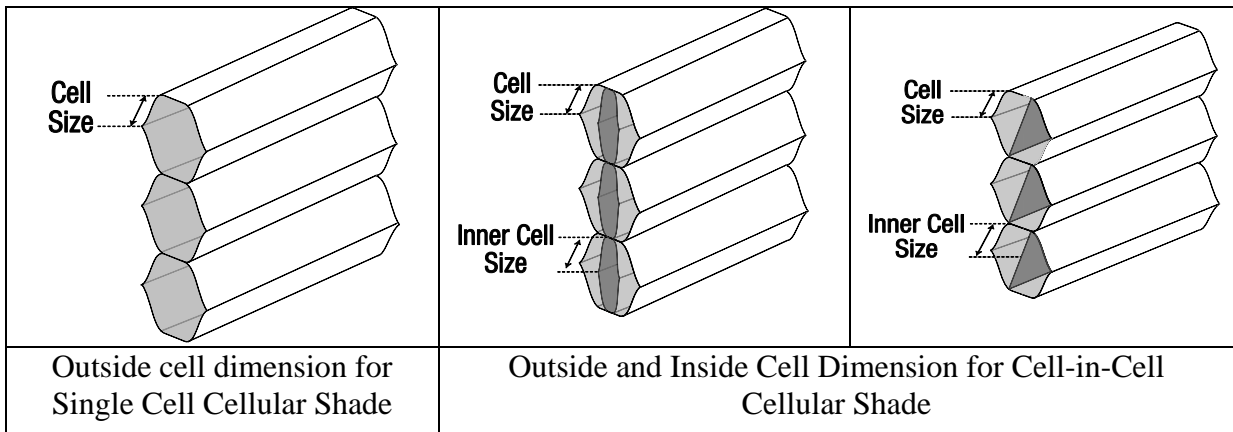
Product Line	Product Description	Picture / Sketch	Slat or Louver Adjustment (Tilt to Open & Close) Operable/non-operable
Flat Panel Glazed	An attachment made with glazing and incorporated into a frame.		This system may incorporate a movable glazing system

## 6. FIGURES

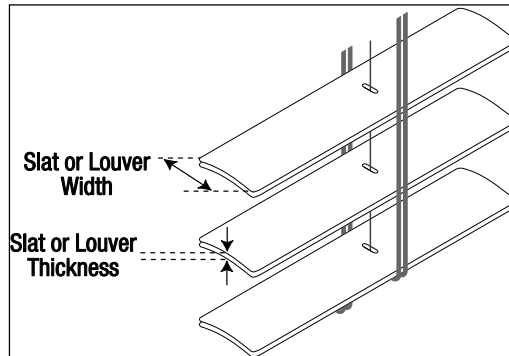
**Figure 6-1 – Illustration of Different Cell Structure of Cellular Type Attachment**



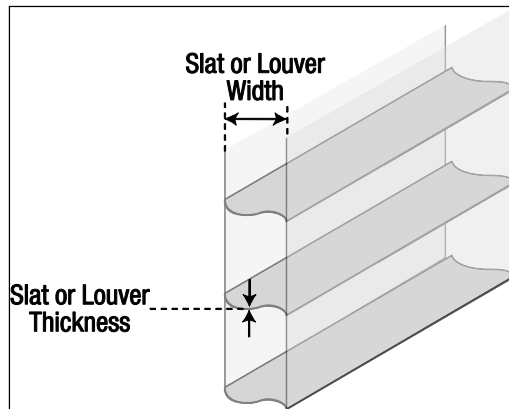
**Figure 6-2 – Cellular Type Attachment Cell Size Measurement Illustration**



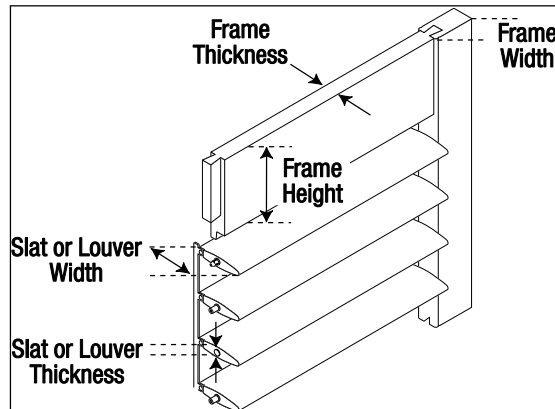
**Figure 6-3 – Slat/Louver Type Attachment Dimension Measurement Illustration**



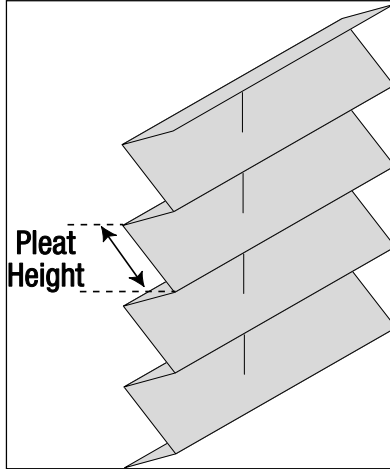
**Figure 6-4 – Sheer Type Attachment Dimension Measurement Illustration**



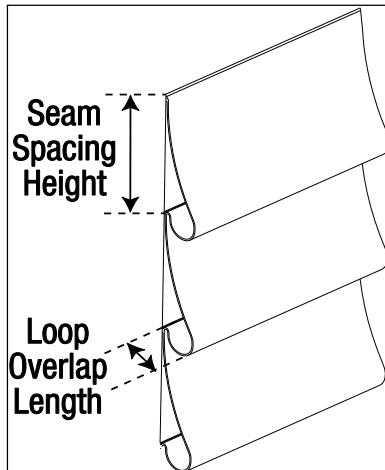
**Figure 6-5 – Shutter Type Attachment Dimension Measurement Illustration**



**Figure 6-6 – Pleated Type Attachment Dimension Measurement Illustration**



**Figure 6-7 – Roman Shade Type Attachment Dimension Measurement Illustration**



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