



National Fenestration Rating Council Incorporated

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Procedure for Determining Fenestration Product Ventilation
Rating

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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), Ventilation, 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.

NFRC owns all rights in and to each of the NFRC 700, NFRC 701, NFRC 702, NFRC 705, NFRC 707, NFRC 708 and each procedure, which is a component of the Rating System, as well as each of its registration marks, trade names, and other intellectual property.

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

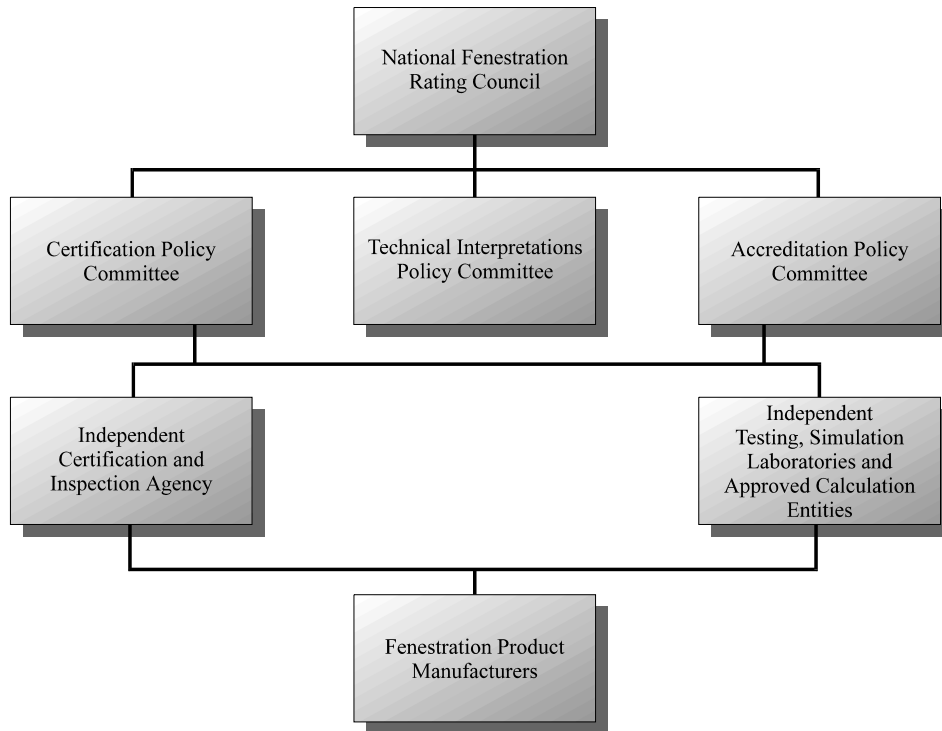


Figure 2

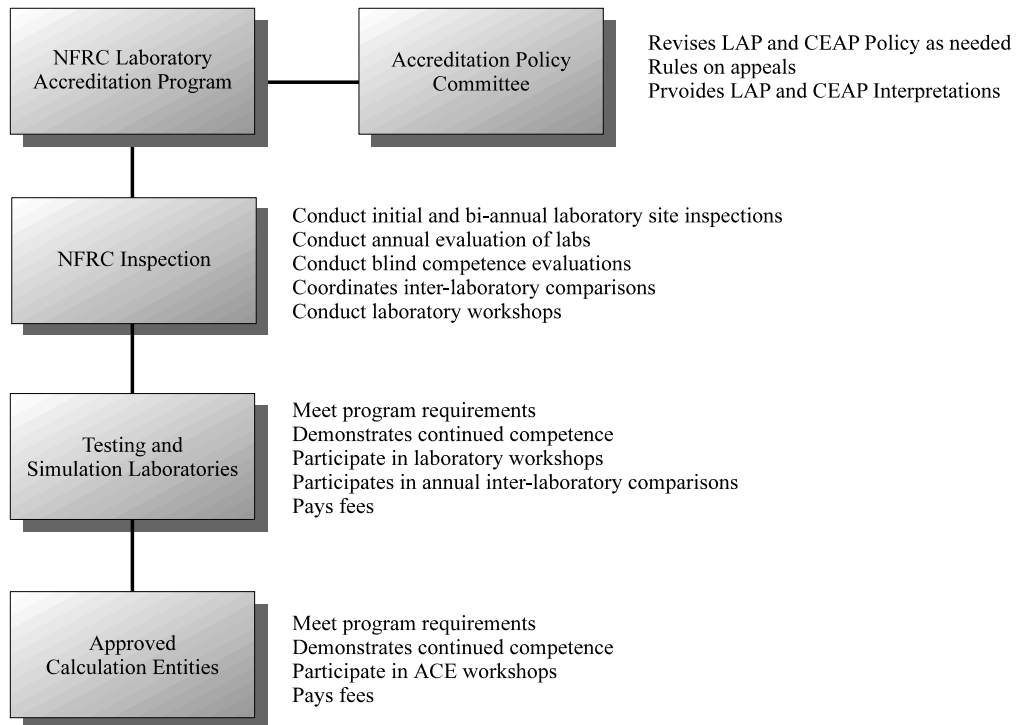
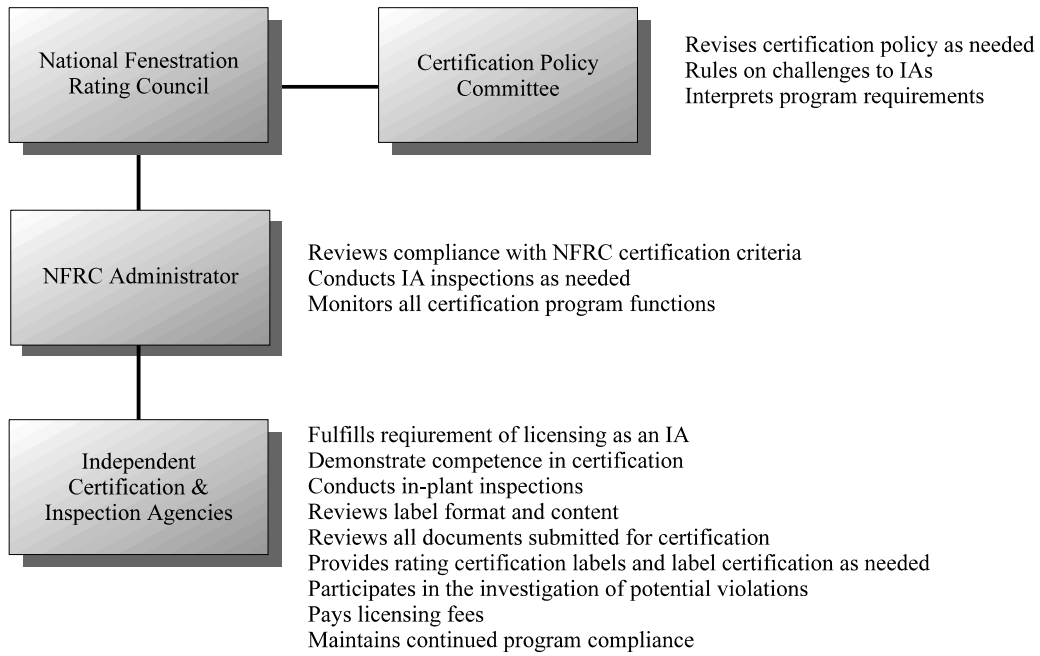


Figure 3



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.

NFRC does not certify a product and certification does not constitute a warranty of NFRC regarding any characteristic of a fenestration or fenestration-related attachment product. Certification is not an endorsement of or recommendation for any product or product line or any attribute of a product or product line. NFRC is not a merchant in the business of selling fenestration products or fenestration-related products, and therefore cannot warrant products as to their merchantability or fitness for a particular use.

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NFRC program participants are required to indemnify NFRC from and against such liability.



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1. PURPOSE

To specify a method for calculating a Ventilation Rating (VR) for fenestration products.

2. SCOPE

To create an NFRC Ventilation Rating (VR) utilizing a standardized net clear opening determination that includes a Screen Factor.

2.1 Products and Effects Covered

- A. Products of all operable unit types including (but not limited to) vertical sliding windows, horizontal sliding windows, casement windows, projecting windows, non-standard shaped windows, glazed wall systems, bay or bow windows, and skylights;
- B. Single or multiple assemblies of sliding and swinging exterior doors;
- C. Operable products of any size (see Appendix A for further details);
- D. Operable products designed for installation at any tilt.

2.2 Products and Effects Not Covered

All non-operable, fixed products and tubular daylighting devices. Screen meshes other than those specified in Section 4 are beyond the scope of this procedure.

3. DEFINITIONS

Definitions and terms are in accordance with definitions in NFRC 600.

4. GENERAL

4.1 Total Fenestration Product Ventilation Ratings (VR)

Total fenestration product VR shall be determined following the procedure outlined in Section 4.5.

VR shall be calculated for operable products using the fenestration product model sizes as given in Table 4-3 of NFRC 100. Please refer to Appendix A for information on non-standard sizes.

Fenestration products shall be evaluated at their maximum design opening dimension. Fenestration products shall be evaluated with screens. Restriction of opening area resulting from releasable opening-limitation devices shall not

be considered in VR calculations. Any other applied devices are beyond the scope of this procedure.

4.2 Product Lines and Individual Products

4.2.1 Product Lines

Refer to Section 4.2.1 of NFRC 100 for the definition of a product line.

4.2.2 Individual Products

Refer to Section 4.2.2 of NFRC 100 for the definition of an individual product, except that variations in glazing characteristics shall be permitted within an individual product.

4.2.3 Grouping of Products (Optional)

Grouping of individual products shall be permitted provided all individual products within the group fall into the same category as defined in Section 4.3. The Group Leader shall be the individual product within the group with the lowest VR as calculated in accordance with Section 4.5. All individual products within the group shall be assigned the VR associated with the Group Leader.

4.3 Ventilation Area Calculation Procedures

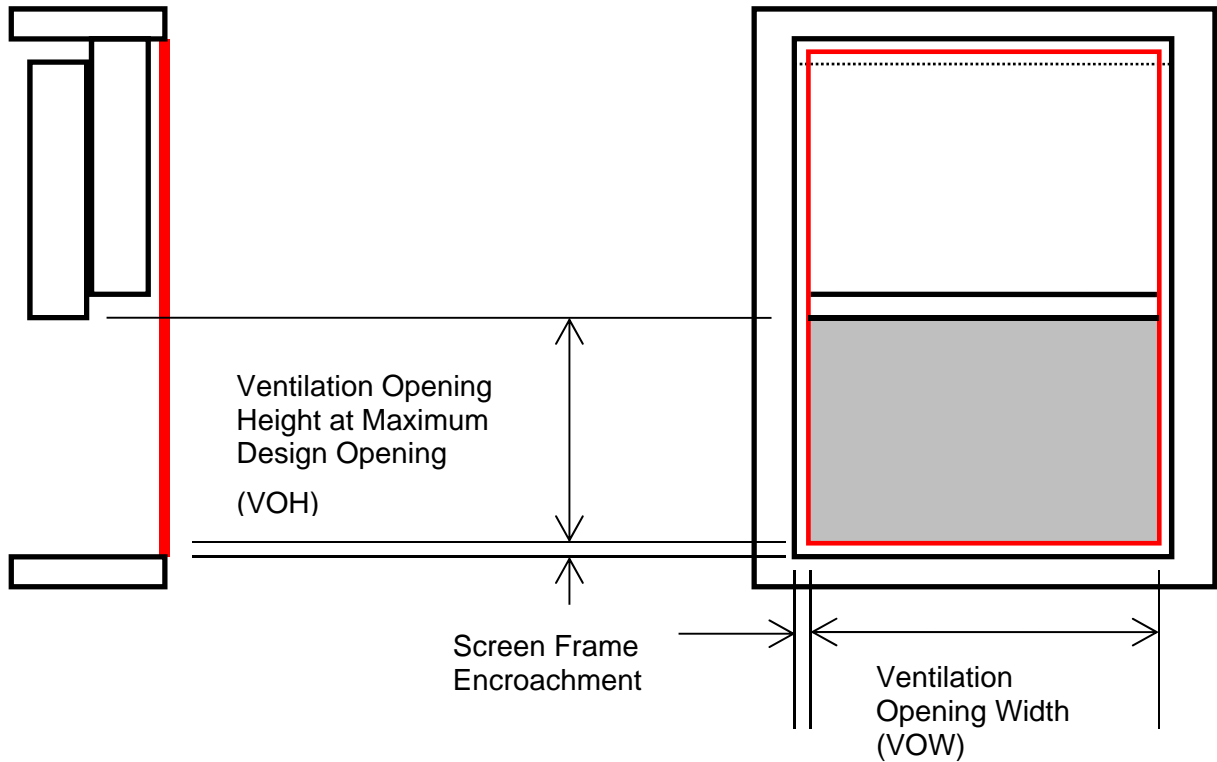
4.3.1 Sliding Products

- For all sliding products, the Ventilation Area (VA) expressed in square meters (square feet) shall be the gray shaded area in Figure 4-1 below, calculated as follows:

$$VA = VOH \cdot VOW$$

- Where:
 - VA is Ventilation Area
 - VOH is Ventilation Opening Height at Maximum Design Opening
 - VOW is Ventilation Opening Width
- If the screen frame encroaches into the opening, as indicated in red in Figure 4-1, VOH and VOW shall be reduced accordingly.
 - Intermediate braces, if used, shall not be included in the VA calculation.

Figure 4-1



4.3.2 Projecting Products

For all projecting products where the maximum design opening dimension is less than 30°, the Ventilation Area (VA) expressed in square meters (square feet) shall be calculated as follows:

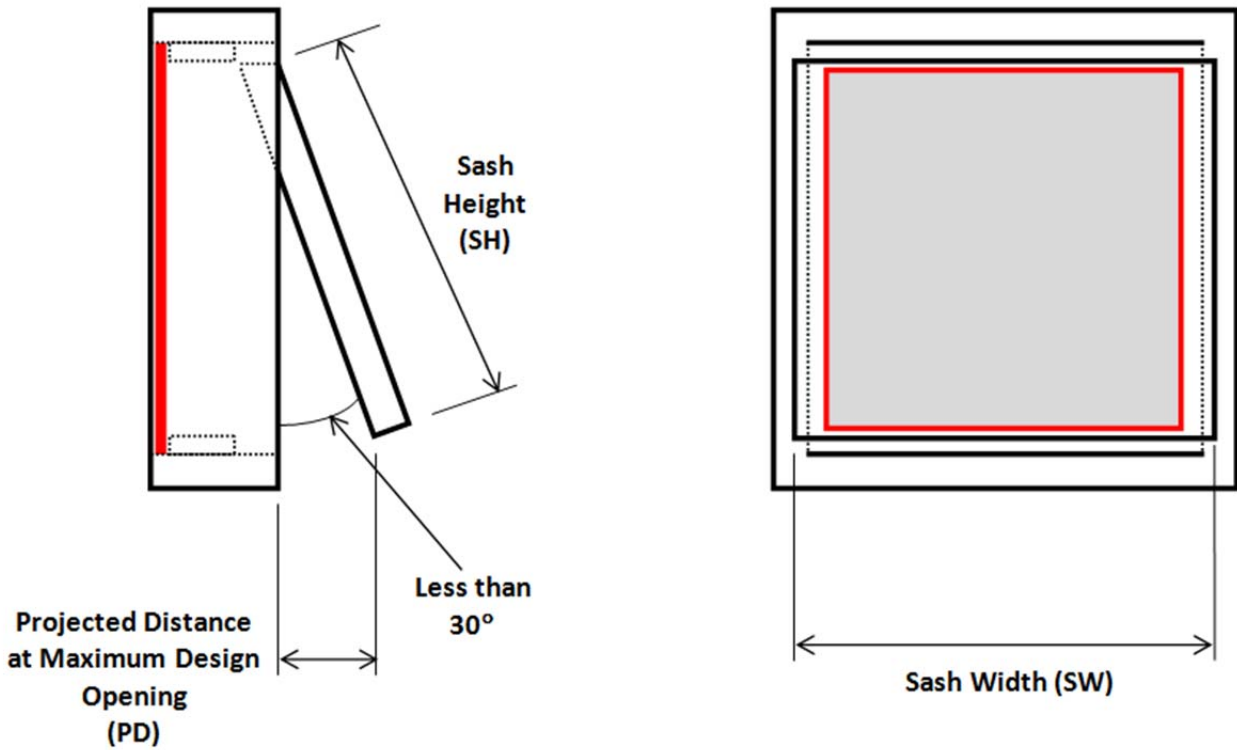
$$VA_1 = VA \text{ as calculated in accordance with Section 4.3.3}$$

$$VA_2 = PD \cdot (SH + SW)$$

Where:

- PD is Projected Distance at Maximum Design Opening
- SH is Sash Height
- SW is Sash Width
- VA = the lesser of VA_1 and VA_2

Figure 4-2



4.3.3 Projecting Products where the Maximum Design Opening Dimension is 30° or Greater

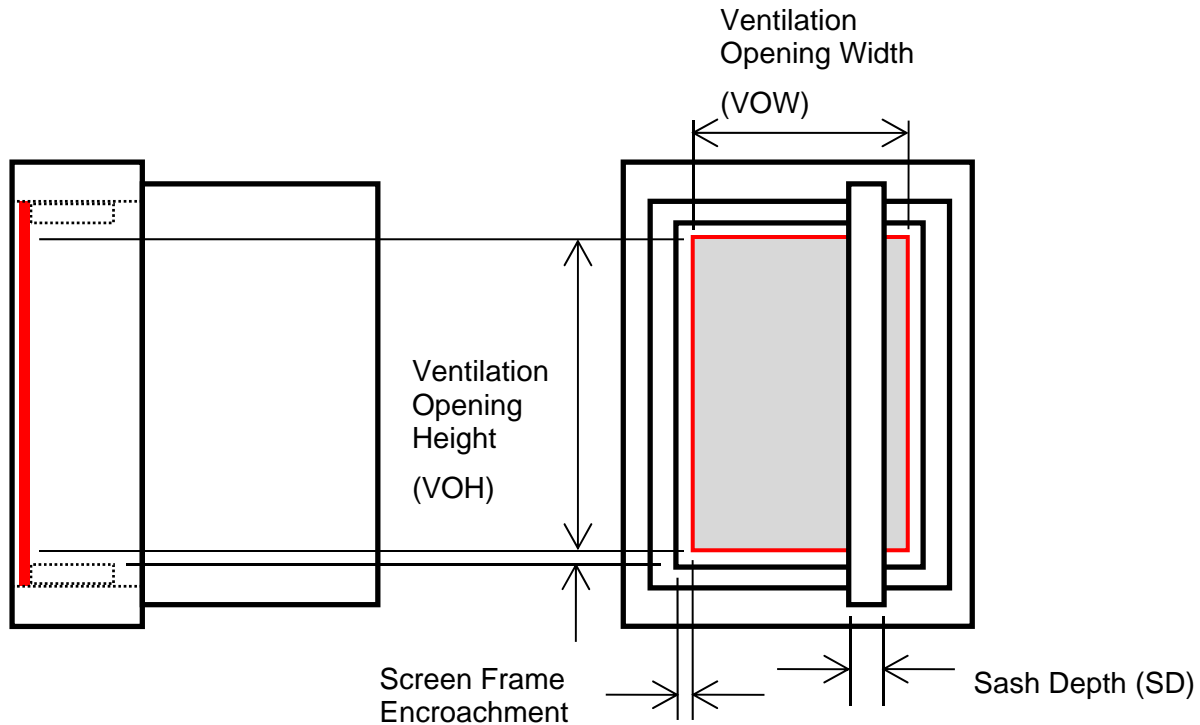
For all projecting products (including swinging doors) where the maximum design opening dimension is 30° or greater, the Ventilation Area (VA), expressed in square meters (square feet), shall be the gray shaded area in Figure 4-3 below, calculated as follows:

$$VA = VOH \cdot (VOW - SD)$$

Where:

- VA is Ventilation Area
- VOH is Ventilation Opening Height
- VOW is Ventilation Opening Width
- SD is Sash Depth.
 - The Sash Depth reduction shall apply only if the open sash is within the VA.
- If the screen frame encroaches into the opening, as indicated in red in Figure 4-3, VOH and VOW shall be reduced accordingly.
 - Intermediate braces, if used, shall not be included in the VA calculation.

Figure 4-3



4.3.4 Dual-Action Products

For dual-action products, such as tilt-turn windows or doors, the Ventilation Area (VA) shall be calculated and reported based on the mode of operation that yields the greatest Ventilation Area.

4.3.4.1 Optional Calculations

Optionally, at the manufacturer's discretion, the Ventilation Area (VA) may also be calculated and reported based on both modes of operation.

4.4 Screen Factor

A Screen Factor (SF) multiplier of either 60% for standard screens or 70% for enhanced screens shall be used in all calculations. For a product to qualify for the enhanced Screen Factor, its air permeability must be 9000 L/s·m² (1770 cfm/ft²) or greater as per ASTM D737 testing at a pressure differential of 125 Pa (2.6 psf). Air permeability testing shall be conducted by an ISO 17025-accredited testing laboratory. All other products, including products offered without screens, shall use the standard Screen Factor (60%).

4.5 Ventilation Rating (VR) Calculation Procedure

$$VR = \left(\frac{VA}{FA} \cdot SF \right) \cdot 100$$

- VR = Ventilation Rating expressed as a percentage, rounded to a whole number per NFRC 601.
- VA = Ventilation Area as defined in Section 4.3
- FA = Projected Frame Area based on model sizes of NFRC 100 (Table 4-3); width x height = FA
- SF = Screen Factor as defined in Section 4.4, expressed as a decimal (e.g., 0.6 or 0.7)

5. CALCULATION INFORMATION REQUIREMENTS

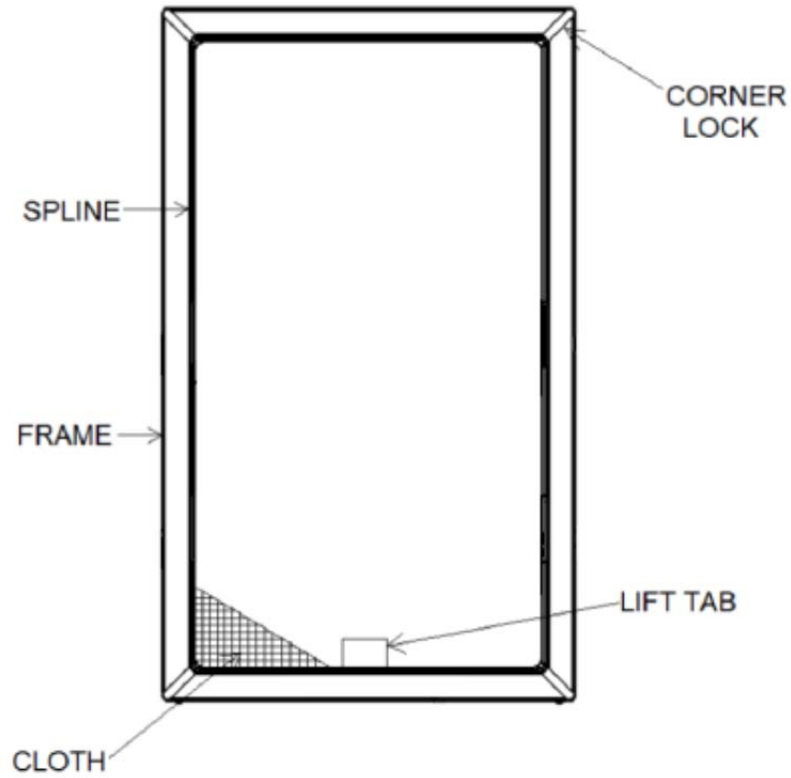
5.1 Required Information

For each product line to be rated, the Licensee shall deliver bill of materials, product assembly drawings, detailed dimension die drawings, and all individual product options within the product line to an NFRC-accredited simulation laboratory. Individual products to be rated shall meet the requirements set forth in NFRC rating procedures. In addition to traditional information, the simulator will need the following details:

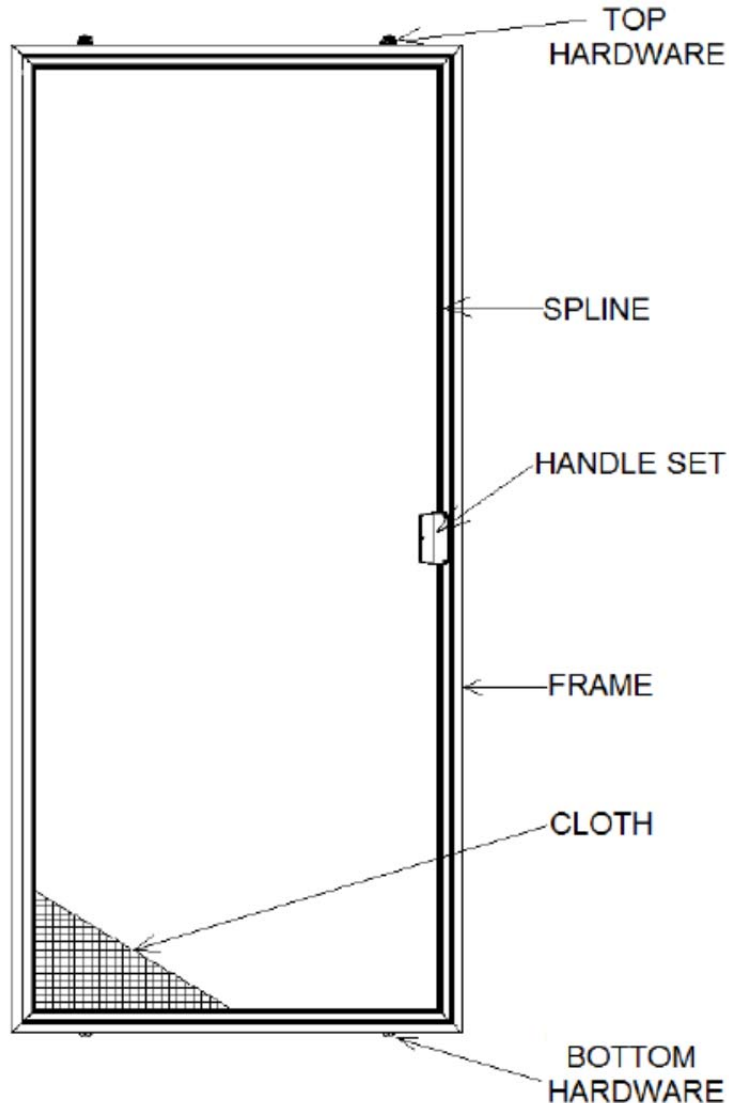
- Screen frame shall be included to determine screen frame encroachment.
- Screen cloth specifications to determine correct screen cloth factor. Manufacturer must supply ASTM D737 report when claiming the enhanced Screen Factor (70%). Air permeability testing shall be conducted by an ISO 17025 accredited testing laboratory. (Note: Air permeability testing does not need to be conducted by an NFRC-accredited lab.)
- Opening stops – details of any product or material that limits the opening of a product.
- Hardware that affects the ability of the product to open.
- Drawings for hardware that enable the calculation of the opening dimension (angle).

6. EXAMPLE SCREEN DRAWINGS

Typical Window Screen



Typical Door Screen



7. REPORTING REQUIREMENTS

See NFRC 701.03 for the reporting requirements.

8. REFERENCES

- 1) *ANSI/NFRC 100-2014: Procedure for Determining Fenestration Product U-factor*. National Fenestration Rating Council: Greenbelt, MD; 2013. www.nfrc.org.
- 2) *ASTM D737 - 04(2016) Standard Test Method for Air Permeability of Textile Fabrics*. ASTM International, West Conshohocken, PA; 2016. www.astm.org

- 3) *NFRC 601-2017: NFRC Unit and Measurement Policy*. National Fenestration Rating Council: Greenbelt, MD; 2013. www.nfrc.org.
- 4) *NFRC 600-2017: Glossary and Terminology*. National Fenestration Rating Council: Greenbelt, MD; 2013. www.nfrc.org.

APPENDIX A - NON-MANDATORY INFORMATION

Determination of VR (and/or VA) at Non-Standard Sizes

The approved total fenestration product VR (and/or VA) calculation procedure may be used to calculate total fenestration product VR (and/or VA) for sizes other than the Model Sizes defined in Table 4-3 of NFRC 100. Such VRs (and/or VAs) shall be calculated only for those product lines and individual products of a product line that have been submitted to an NFRC-licensed independent certification and Inspection Agency (IA) for certification authorization purposes at the Model Sizes defined in Table 4-3 of NFRC 100.

VRs (and/or VAs) that are calculated for sizes other than the Model Sizes in Table 4-3 of NFRC 100 are for informational purposes only and shall not be used for purposes of certification and labeling.

APPENDIX B – SAMPLE VENTILATION CALCULATION VALUES

Ventilation Calculations (examples only) - These calculations are generic examples and should not be used for actual ratings. (Products sorted in ascending order, based on frame area)

Ventilation Rating Calculation based on:				NFRC 401 Section 4		
	NFRC Model Size (NFRC 100 Table 4-3)		Projected Frame Area (4.5)	Ventilation Area (4.3)	Ventilation Rating Including Screen Factor (4.4)	
<i>Unit Type</i>	<i>width, mm (in)</i>	<i>height, mm (in)</i>	<i>FA, m² (sf)</i>	<i>VA, m² (sf)</i>	With Standard Screen Factor (60%)	With Enhanced Screen Factor (70%)
Projecting Products >30° (4.3.3)	600 (24)	1500 (59)	0.9 (9.83)	0.49 (5.38)	33	38
Projecting Products <30° (4.3.2)	1500 (59)	600 (24)	0.9 (9.83)	0.44 (4.77)	29	34
Skylight >30 (4.3.3)or <30° (4.3.2)	1200 (47)	1200 (47)	1.44 (15.34)	1.18 (12.71)	49	57
Single Hung (4.3.1)	1200 (47)	1500 (59)	1.8 (19.26)	0.75 (8.1)	25	29
Double Hung (4.3.1)	1200 (47)	1500 (59)	1.8 (19.26)	0.75 (8.1)	25	29
Horizontal Slider (4.3.1)	1500 (59)	1200 (47)	1.8 (19.26)	0.75 (8.1)	25	29
Sliding Door (4.3.1)	2000 (79)	2000 (79)	4.0 (43.34)	1.75 (18.81)	26	31
Swinging Door (XX, Double Swinging Door)	1920 (75.5)	2090 (82.375)	4.01 (43.19)	3.24 (34.83)	48	57

Note: These calculations are based on the ratio of frame area versus ventilation area.