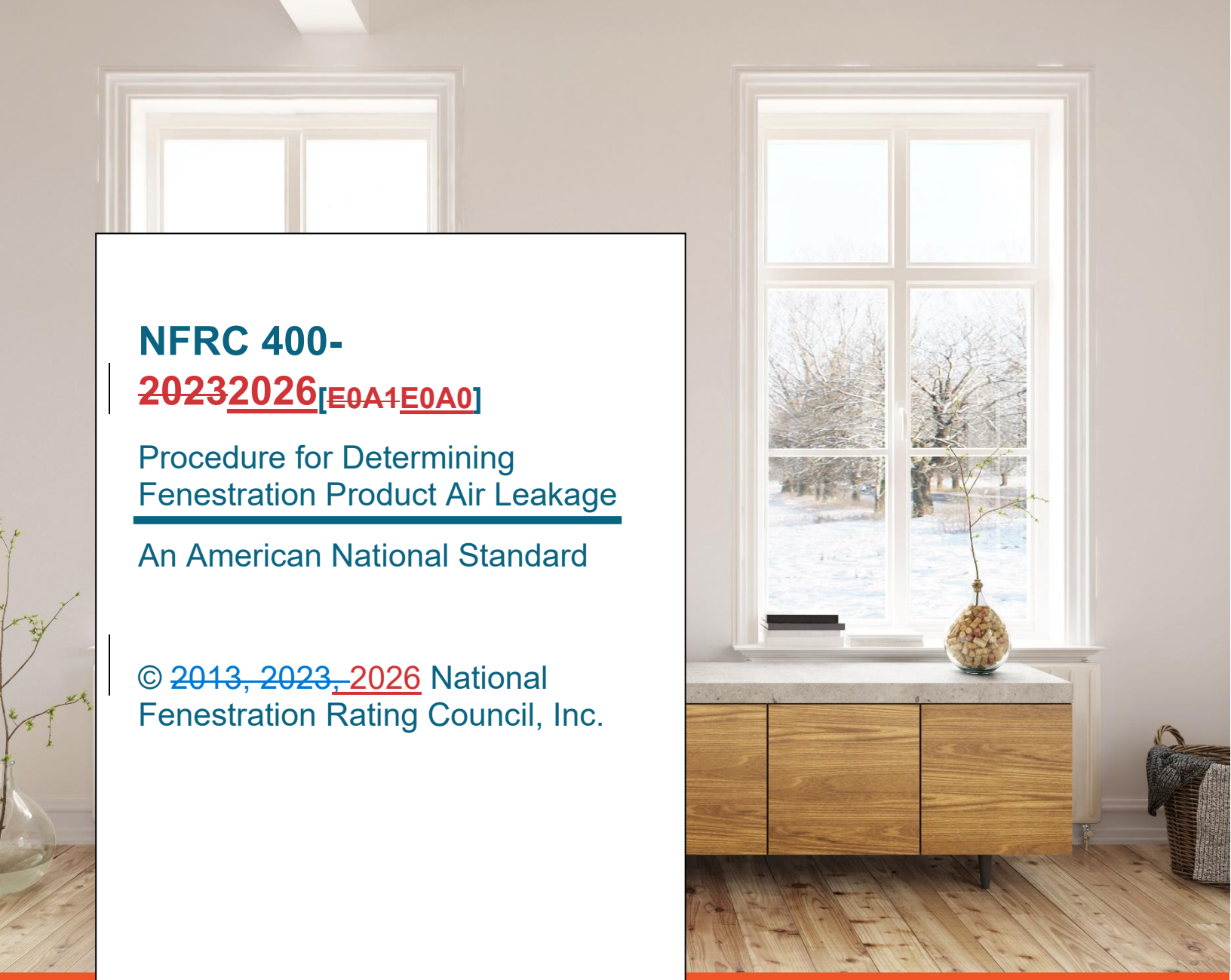


NFRC 400-~~2023~~2026[~~E0A1~~E0A0]

Procedure for Determining Fenestration Product Air Leakage

An American National Standard

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NFRC
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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).

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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 7007 (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 7007, 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.

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Figure 1

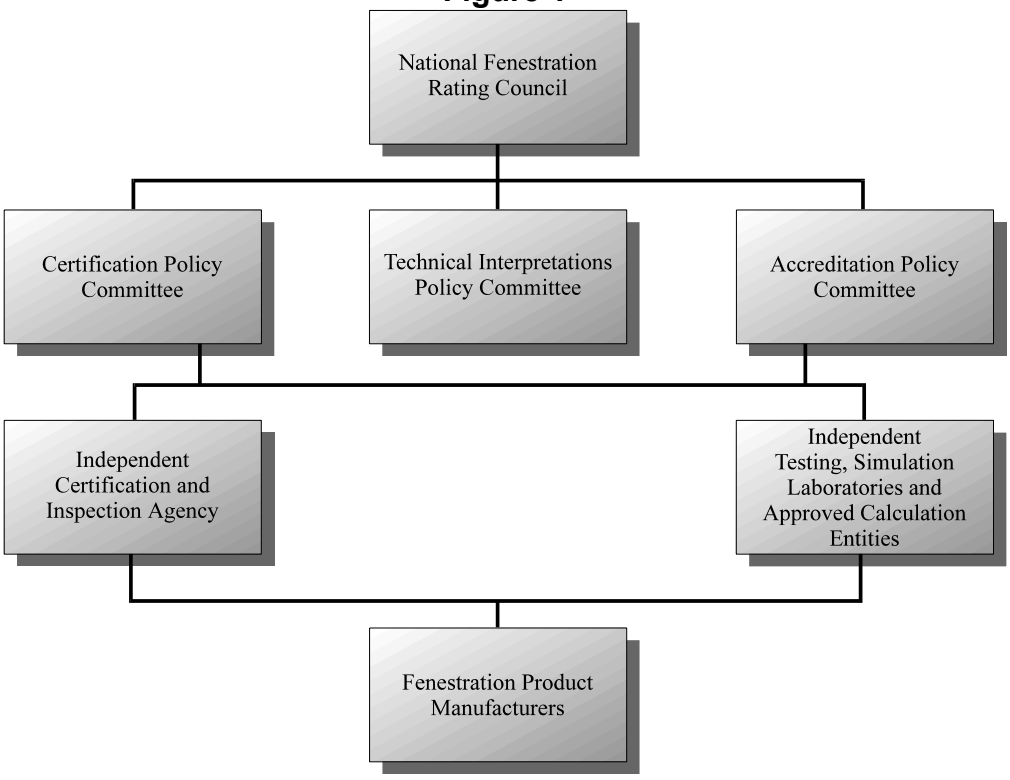
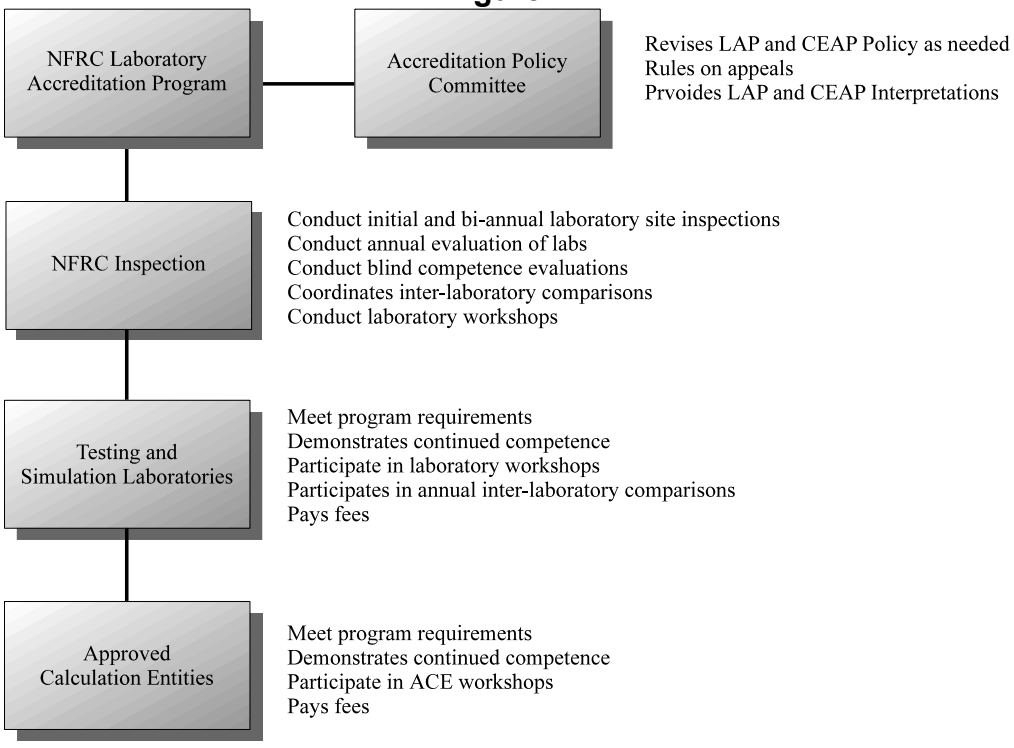
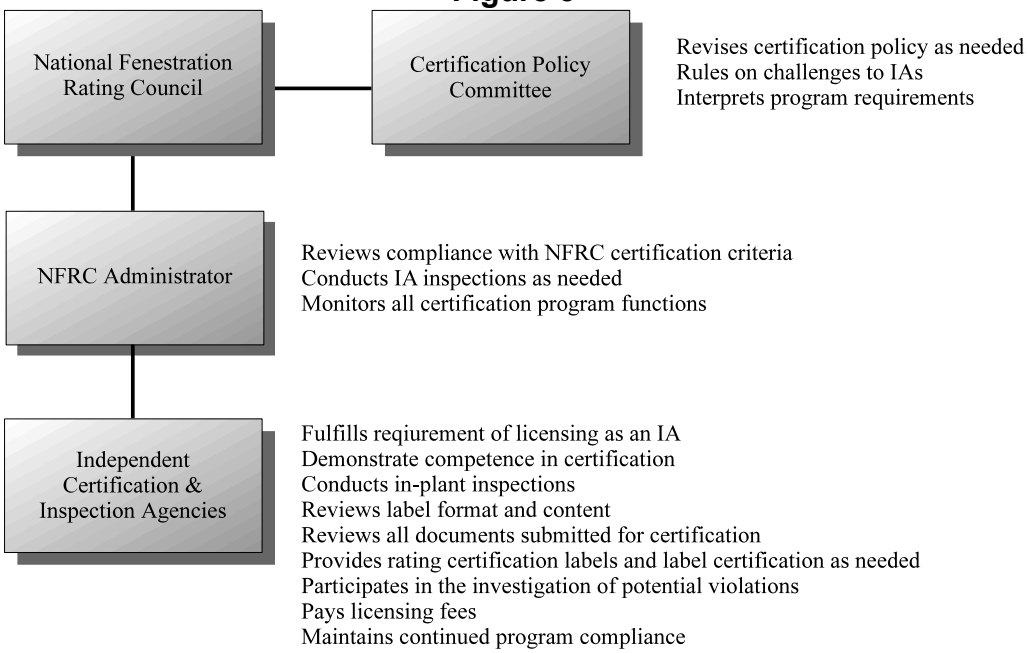


Figure 2



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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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This standard is maintained by the Continuous Maintenance Process.

Approval of ANSI/ANSI/NFRC 400 as an American National Standard is maintained using the continuous maintenance process. Comments or proposals for revisions on any part of this standard may be submitted to National Fenestration Rating Council at any time. Written comments or proposals must be in writing and be submitted to the NFRC Accredited Standards Developer at standards@nfrc.org.

Any written comments or proposals submitted to NFRC as provided above shall be submitted by NFRC to its consensus body for consideration within a reasonable timeframe not to exceed one year. The submitter will be notified by NFRC of the expected time frame for consideration of the proposal or comments. NFRC shall apply for reaffirmation of this standard regardless any comment or proposals every three years.

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1. PURPOSE

To specify a procedure for determining fenestration product air leakage.

2. SCOPE

This procedure defines the criteria for testing fenestration air leakage rates to the requirements and guidelines as established by the NFRC. Many of the criteria are referenced from other ASTM standards and ANSI/NFRC 100 [1]. Issues of test pressures, leakage mode, test size, and test temperatures are based on currently acceptable and recognized industry practices for air leakage testing of fenestration. Within this procedure the *AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights* (also known as NAFS) [8,9,10] or the Florida Building Code Testing Application Standard (TAS) 202 [5] can alternately be used to report product air leakage provided all conditions in Section 4 are met.

This procedure is applicable to fixed and operable fenestration products.

Air leakage rates for a given fenestration product may vary depending on quality control, environmental factors (temperature, barometric, pressure, humidity, etc.), usage-stresses, operating style differences, long term durability, variable installation methods, and material/design selection. This procedure does not address any of these issues. The air leakage rates obtained from this procedure are intended primarily for product comparison purposes.

3. DEFINITIONS

Reference NFRC 600: Glossary and Terminology [2].

4. TEST CRITERIA

ASTM E283 [3] shall be the only method used to measure product air leakage rates (see Note 1). The following conditions shall apply:

A. The differential static test pressure shall be 75 pascals (~1.57 psf) or 300 pascals (~ 6.24 psf), as determined by the fenestration manufacturer, applied to the test specimen so as to cause the air

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leakage to occur at the specimen's interior side. Any type of chamber may be used;

B. The measured air leakage shall be corrected to standard test conditions per ASTM E283;

C. The rate of air leakage for all window fenestration products shall be reported as l/s·m^2 (cfm/ft^2);

D. The specimen test size shall not be less than the Model Size per ANSI/NFRC 100, Table 4-3 [1].

> Exception: If the largest production size is smaller than the NFRC Model Size per ANSI/NFRC 100, Table 4-3, then use the standard production size with the least deviation from the Model Size as defined in ANSI/NFRC 100, Section 4.6.1

E. Product lines cannot be grouped for air leakage testing;

F. The measured air leakage rate shall be permitted to be reported to ~~one~~two decimal places or converted to one decimal place per NFRC 601 [6] in l/s·m^2;

G. Operating force shall be measured and recorded per NAFS for all operable fenestration products. The specimen shall be operated per ASTM E283 prior to an air leakage test being performed. No adjustments shall be made to the specimen between conducting the operating force and air leakage tests; and

H. Once the test specimen has been received by the laboratory, no material or component modifications to the product shall be performed by the laboratory without written instructions from the manufacturer. The laboratory shall report all adjustments and modifications that were made to the specimen to obtain the reported air leakage rates.

> Note 1: This procedure references the use of ASTM E283 as the only method for measuring individual product air leakage rates. ASTM E283 is a laboratory test method that has been used for many years to measure air leakage rates under controlled conditions. Since the ANSI/NFRC 400 procedure measures air leakage rates at only one pressure differential, it is best used to compare the relative performance of fenestration products. It does not directly provide information on how a product will perform in a specific building application at field conditions.

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5. REPORT

Report results per NFRC 701.06 [4].

6. REFERENCES

1) *ANSI/NFRC 100-2023: Procedure for Determining Fenestration Product U-factors.* National Fenestration Rating Council: Greenbelt, MD; 2023. www.nfrc.org.

2) *NFRC 600: Glossary and Terminology.* National Fenestration Rating Council: Greenbelt, MD; 2020. www.nfrc.org.

3) *ASTM E283/E283M-19: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.* ASTM International. West Conshohocken, PA, 2019; *www.astm.org.*

4) *NFRC 701.06: ANSI/NFRC 400 Air Leakage Test Reporting Requirements.* National Fenestration Rating Council: Greenbelt, MD; 2023. www.nfrc.org.

5) *TAS 202-94, Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure*. Florida Building Commission: Tallahassee, FL. 1994 www.floridabuilding.org

6) *NFRC 601: NFRC Unit and Measurement Policy. National Fenestration Rating Council: Greenbelt, MD; 2020. www.nfrc.org.*

7) *ASTM E2068-00(Reapproved 2022): Standard Test Method for Determination of Operating Force of Sliding Windows and Doors.* ASTM International. West Conshohocken, PA; 2022. *www.astm.org.*

8) *AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS 2011- North American Fenestration Standard/Specification for windows, doors, and skylights.* American Architectural Manufacturers Association: Schaumburg, IL; 2011. www.aamanet.org. Window & Door Manufacturers Association: Washington, DC; 2011. www.wdma.com. Canadian Standards Association: Mississauga, Ontario, Canada; 2011. www.csa.ca.

9) *AAMA/WDMA/CSA 101/I.S.2/A440-17 - North American Fenestration Standard/Specification for windows, doors, and skylights.* American Architectural Manufacturers Association: Schaumburg, IL; 2017. www.aamanet.org. Window & Door Manufacturers Association:

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Washington, DC; 2017. www.wdma.com. Canadian Standards Association: Mississauga, Ontario, Canada; 2017. www.csa.ca.

10) *AAMA/WDMA/CSA 101/I.S.2/A440-22 - North American Fenestration Standard/Specification for windows, doors, and skylights. Fenestration and Glazing Industry Alliance (FGIA): Schaumburg, IL; 2022*. www.fgiaonline.org. Window & Door Manufacturers Association: Washington, DC; 2022. www.wdma.com. Canadian Standards Association: Toronto, Ontario, Canada; 2022. www.csa.ca.

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