



National Fenestration Rating Council Incorporated

FS 1100-2017 [E0A2]

FenStar Certification Program Verification Testing Procedure

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FOREWORD

The FenStar™ Certification Program is the formal name of the Environmental Protection Agency (EPA)-recognized certification program that performs third-party conformity assessment activities for window, door and skylight products. Products are submitted for ENERGY STAR® certification after ratings have been certified by the NFRC Product Certification Program (PCP). Window, door and skylight products that are evaluated to meet ENERGY STAR requirements are officially certified as ENERGY STAR by the FenStar Certification Program.

The FenStar Certification Program is operated by the National Fenestration Rating Council Incorporated (NFRC). NFRC developed and operates a uniform rating system for energy and energy-related performance of windows, doors, and skylights. The FenStar Certification Program is available only to active licensees in the NFRC Product Certification Program (PCP).

Through the FenStar Certification Program, manufacturers shall demonstrate their products meet all applicable ENERGY STAR performance parameters prior to being labeled as ENERGY STAR certified. Further, the partner shall demonstrate, through verification testing, the product continues to meet the ENERGY STAR requirements to maintain its ENERGY STAR certification through The FenStar Certification Program.

If there are changes that affect the performance of the product with respect to the relevant ENERGY STAR program requirements, the partner shall report these changes to The FenStar Operations Staff.

Manufacturers authorize the FenStar Operations Staff to share the results of any relevant testing or product review with the EPA.

NFRC, specifically the FenStar Certification Program, is ~~ANSI accredited as~~ a certification body operating to the ISO/IEC 17065 standard.

The following referenced documents are indispensable for the application of The FenStar Certification Program. The latest edition of the referenced document (including any amendments) applies. These are not auditable standards and are used solely for guidance.

- [NFRC 700-2017: Product Certification Program](#). National Fenestration Rating Council: Greenbelt, MD; 2017. www.nfrc.org
- [ANSI/NFRC 100-2017: Procedure for Determining Fenestration Product U-factors](#). National Fenestration Rating Council: Greenbelt, MD; 2017. www.nfrc.org

- [NFRC 102-2017: Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems](#). National Fenestration Rating Council: Greenbelt, MD; 2017. www.nfrc.org
- [ANSI/NFRC 200-2017: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence](#). National Fenestration Rating Council: Greenbelt, MD; 2017. www.nfrc.org
- [ANSI/NFRC 400-2017: Procedure for Determining Fenestration Product Air Leakage](#). National Fenestration Rating Council: Greenbelt, MD; 2017. www.nfrc.org
- ASTM E283 – 04(2012): 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, 2006, DOI: 10.1520/E0283-04R12.
- ENERGY STAR Directives:
https://www.energystar.gov/index.cfm?c=third_party_certification.tpc_directives

To participate in the Certification Programs, 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, Solar Heat Gain Coefficient (SHGC), Visible Transmittance (VT), Air Leakage (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, 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 FenStar Certification Program evaluates products against the ENERGY STAR certification program requirements.

The FenStar Certification Program maintains a FenStar Program Certified Products Directory (FCPD), listing product lines and individual products selected by the Manufacturer/Responsible Party for which ENERGY STAR certification authorization has been granted.

NFRC owns all rights in and to all documents and procedures, which are a component of the FenStar Certification Program, as well as each of its registration marks, trade names, and other intellectual property.

For additional information on the roles of those entities associated with the NFRC PCP (IAs and laboratories, and operation of the IA Program and Accreditation Program), see the NFRC 700: Product Certification Program, NFRC 701: Laboratory Accreditation Program (LAP), and NFRC 702: Certification Agency Program (CAP) documents.

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DISCLAIMER

The use of the FenStar™ Certification Program as a Certification Body does not constitute a warranty by the NFRC or the FenStar Certification Program regarding the energy performance properties of windows, doors, and skylights. The rating indices are not an endorsement of, or recommendation for, any windows, doors, or skylights. The FenStar Certification Program is not a merchant in the business of selling windows, doors, or skylights, and therefore, cannot warrant products as to their merchantability or fitness for a particular use.

The FenStar Certification Program, therefore, disclaims any and all liability, including but not limited to, damages for personal or other injury, lost profits, lost savings or other consequential or incidental damages that may arise from or in connection with:

- A. services provided by, decisions made by, or reports issued or granted by any ENERGY STAR Partner;
- B. reliance on The FenStar Certification Program product description, specification, rating or test, whether appearing in a report, in a product Certificate of Authorization (CA) or a printed or electronic directory, or on a label; or
- C. the sale or use of The FenStar Certification Program certified windows, doors, or skylights.



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1. INTRODUCTION

1.1 Scope of Procedure

As a recognized Certification Body for the ENERGY STAR® windows, doors, and skylights program, NFRC is required to operate an ENERGY STAR Partner-funded verification testing procedure. The FenStar™ Certification Program Verification Testing Procedure (FVTP) fulfills that requirement. This procedure shall be separate from the inspection and validation testing requirements of the *NFRC 700: Product Certification Program* (PCP). NFRC Licensees shall remain subject to the requirements of the PCP as a prerequisite to the FenStar Program participation.

All FenStar Program parties involved with the FVTP shall maintain a high-level code of ethics and respect for the confidentiality of FVTP product selection, testing, and results.

1.1.1 Ratings Verified within the FVTP

- A. U-factor ratings generated in accordance with *ANSI/NFRC 100: Procedure for Determining Fenestration Product U-factors*.
- B. Solar Heat Gain Coefficient (SHGC) ratings generated in accordance with *ANSI/NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence*.
- C. Air Leakage (AL) ratings generated per *ASTM E283-04(2012): Standard Test Method for Determining Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen* in accordance with *ANSI/NFRC 400: Procedure for Determining Fenestration Product Air Leakage* or *AAMA/WDMA/CSA 101/I.S.2/A440-11: North American Fenestration Standard/Specification for windows, doors, and skylights*.

1.1.2 Ratings Not Verified within the FVTP

- A. SHGC ratings generated in accordance with *NFRC 201: Procedure for Interim Standard Test Method for Measuring Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods*.
- B. Visible Transmittance (VT) ratings generated in accordance with *ANSI/NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence*, *NFRC 202: Procedure for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence*, and *NFRC 203: Procedure for Determining Visible Transmittance of Tubular Daylighting Devices*.

- C. Condensation Resistance ratings generated in accordance with *NFRC 500: Procedure for Determining Fenestration Product Condensation Resistance Values* and *NFRC 501: User Guide to the Procedure for Determining Fenestration Product Condensation Resistance Rating Values*.

1.1.3 Additional Elements Verified within FVTP

- A. Environmental Protection Agency (EPA) mandated elements in the manufacturer's installation instructions and the ready availability of those instructions online or packaged with the product.
- B. The ENERGY STAR and NFRC temporary labels for the correct zone and ratings.
- C. The presence of an NFRC permanent label.

1.2 Roles

The following are descriptions of the roles of entities that are participating in the FVTP.

1.2.1 Role of FenStar Operations Staff

The FenStar Program shall establish, sponsor, and operate the FVTP in accordance with the *FS-1100: FenStar Certification Program Verification Testing Procedure*. Under the FVTP, the FenStar Program shall:

- A. Maintain online databases containing selected products and appropriate and relevant information.
- B. Select products from the FenStar Certified Products Directory (FCPD) for verification via a weighted-average algorithm.
- C. Review verification test results prepared by NFRC 701-Accredited Laboratories.
- D. Enforce corrective actions in accordance with FS-1100.
- E. Submit all reports in a timely manner to the EPA in accordance with the requirements of the scheme.
- F. Provide a report of the verification test results to the ENERGY STAR Partner (hereafter referred to as the Licensee).
- G. Ensure that the FVTP requirements are fair and administered uniformly.
- H. Report any NFRC PCP non-compliance discovered during the FVTP to NFRC PCP Compliance and Monitoring Program.

1.2.2 Role of ENERGY STAR Partners/Licensees (FenStar-licensed Manufacturer)

Licensees who have certified products through FenStar are required to participate in the FVTP and shall have the following responsibilities:

- A. Certify and maintain product lines through the FenStar Certification Program.
- B. Enroll, sign an agreement, and pay annual fees to NFRC for participation in The FenStar Certification Program.
- C. Assist FenStar Operations Staff in procurement of fenestration product, air leakage certification, and installation instructions for FVTP.
- D. Assume corrective actions in accordance with FS-1100.
- E. Pay the fees associated with unsuccessful FVTP tests.
- F. Take corrective actions in accordance with the appropriate certification body. If a product has ENERGY STAR deficiencies, the Licensee shall take corrective actions in accordance with the FenStar Program and/or the ENERGY STAR Program. If a product has NFRC PCP deficiencies, FenStar Operations Staff shall report those to NFRC PCP Compliance and Monitoring Program.

1.2.3 Role of Laboratory

NFRC 701-Accredited Laboratories testing fenestration products in accordance with FS-1100 shall have the following responsibilities:

- A. Maintain accreditation status in accordance with *NFRC 701: Laboratory Accreditation Program* document.
- B. Provide all test results to FenStar Operations Staff in a timely manner.
- C. Work with FenStar Operations Staff to determine any verification discrepancies.

1.2.4 Role of Inspection Agency

NFRC-licensed Inspection Agencies (IA) shall have the following responsibilities:

- A. Provide documentation regarding NFRC Certification upon request.
- B. Work with FenStar Operations Staff to determine any verification discrepancies.

- C. Verify that any NFRC PCP compliance-related issues are resolved.

1.3 Confidentiality

All parts of the FVTP including the selection, testing, and reporting shall be confidential in accordance with requirements developed by the FenStar Program and revised from time to time. In addition, without FenStar Operation Staff's prior written consent and except for disclosures required by applicable law, neither the Licensee, the IA, nor the test laboratory shall disclose any information developed or received in connection with the FVTP including any test results or data to each other or to any other parties except FenStar Operations Staff.

2. PRODUCT SELECTION

Manufacturers that are participating in the FenStar Certification Program and are ENERGY STAR Partners are required to participate in the FVTP as required by EPA.

Per [EPA Directive 2011-06](#), the FVTP shall require testing of a minimum of 5% of the total number of unique product lines that are ENERGY STAR-certified each year or the designated percentage for that year.

- A. In accordance with NFRC definitions, a product line is the model of a specific product type, for example, a Series "1000" Double Hung. FenStar Operations Staff and EPA will then select an ENERGY STAR Certified individual product option listed within the product line for verification testing. The EPA will select approximately 50% of the required percentage using EPA's nomination process.
- B. FenStar Operations Staff shall select the remaining required unique products in a manner using the criteria described below in Section 2.1.

2.1 Product Selection Criteria

- A. The products selected shall be any ENERGY STAR-certified individual product option within an ENERGY STAR certified product line listed in the FenStar Certified Products Directory (FCPD).
- B. A Licensee's product selected shall be based on a summary of the data from the FCPD in conjunction with the energy performance rating and criteria as determined by FenStar Operations Staff.
- C. The following criteria are part of the selection process:
 - i. ENERGY STAR-certified products
 - (a) NFRC shall select approximately 50% of the remaining designated percentage for that year of certified product lines from each Licensee, in conjunction with the number of EPA nominated products.

- (b) FenStar Operations Staff and the EPA shall endeavor to apply the verification testing percentage requirement fairly across all Licensees.
- ii. FVTP unsuccessful tests – Licensees shall have a product selected the year following an unsuccessful test.
- iii. Product lines tested and evaluated in accordance with FVTP requirements within the past 12 months shall not be eligible unless the previous results were unsuccessful.

NOTE: One function of the selection criteria is to select a group leader of a series of grouped individual product options listed within a product line. This is to verify the actual simulated rating versus the tested rating. Selection of the group leader eliminates the possible confusion with verifying “grouped” individual product options. The grouped options must have ratings that meet or exceed ENERGY STAR requirements.

2.2 Product Procurement Process

The Licensee and the product line’s individual product option are selected from the listing of FenStar certified product lines.

- A. ENERGY STAR-certified product lines shall be available for selection.
- B. All active ENERGY STAR-certified individual product options listed in the FCPD shall be subject to participation.
- C. In cases when the selected product is unavailable for procurement, staff shall coordinate with the Licensee to select another product for verification testing.
- D. The process to procure a product shall be conducted in a manner that ensures no Licensee interferes with a test sample.
- E. Upon confirmation of the product selected, the product shall be shipped to an NFRC 701-accredited laboratory.

2.3 Laboratory Selection

FenStar Operations Staff may designate the NFRC 701-accredited laboratory to perform verification testing. When applicable, the Licensee and FenStar Operations Staff shall mutually agree upon a laboratory.

3. VERIFICATION TESTING PROCESS

Product evaluation and verification in the FVTP shall be accomplished through the following testing and inspection process:

- Products chosen for the FenStar Program verification testing shall be evaluated to determine if the product’s performance is consistent with the performance of the product as authorized for NFRC certification.

- All selected products shall be inspected and tested by an NFRC 701-accredited laboratory.
- Proof of air leakage certification or rating shall be provided.
- The method for making the ENERGY STAR®-required installation instructions readily available shall be provided.
- Reference “Section 7: Categorization of Issues” for the protocol regarding labeling, pre-test, and/or post-test issues.

3.1 Laboratory Testing Requirements

A. Upon receipt, the laboratory shall check the product for the following:

- i. There shall be no visibly-observable damage to the product.
- ii. The product shall be the correct individual option. Per Section 7, issues related to receiving the incorrect product shall be categorized.
- iii. The NFRC, ENERGY STAR, and if applicable, the approved Certification Body’s air leakage labels are applied correctly.
- iv. The manufacturer installation instructions are attached to the product if applicable.

If any of the above criteria are not met, the laboratory shall contact FenStar Operations Staff for instruction. FenStar Operations Staff shall determine if the product is to be tested or if another product will be required to be sent for verification.

- B. Laboratories shall not modify products upon arrival.
- C. Products shall be placed in ambient room conditions for a minimum of 48 hours prior to testing.
- D. When a product with a removable nail flange is selected for verification, the laboratory shall contact FenStar Operations Staff to determine if the flange is to be removed.
- E. The cut-up test specimen shall be stored by the laboratory for a minimum of two and a half years from the verification test date.

3.2 Product Verification Testing

Verification testing shall consist of a thermal hot box test to verify the product’s performance and a component evaluation.

3.2.1 Thermal Hot Box Test

A thermal hot box test in accordance with *NFRC 102: Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems* shall be conducted to verify the product’s U-factor.

The test laboratory shall provide a detailed report to FenStar Operations Staff:

- A. The report shall be in accordance with NFRC 701.04L *NFRC 102 Thermal Test Reporting Requirements*, Section 1.1.3.A.
- B. A photo of the NFRC temporary label, NFRC permanent label, and ENERGY STAR labels displayed on the product.

3.2.2 Component Evaluation

After performing the thermal hot box test per Section 3.2.1 and at FenStar Operations Staff's direction, the laboratory shall disassemble (cut-up) the test specimen per Section 3.2.2.1.

The test lab shall provide a detailed report.

- A. FenStar Operations Staff shall use the component evaluation (CE) report to confirm the product matches the FCPD description prior to assigning a grade.
- B. The CE report shall not be used as part of the grading of a product's performance.
- C. Staff shall provide all necessary documentation for use in verification.

3.2.2.1 Inspection of frame, sash, components and cavities

- A. The test laboratory shall cut up the specimen and provide a detailed report on frame and sash members, and components. The report shall be completed and returned to FenStar Operations Staff in accordance with NFRC 701.04, Section 1.1.3.A.
- B. The collection and number of cut cross-sections by operator type shall be as follows:
 - i. Four-sided units with two lites of glass, side-by-side (e.g. sliding glass doors, glazed wall systems, or sliding windows).
 - (a) Collect a minimum of four cut cross-sections; a top corner, an opposite lower corner, meeting stile-to-head and meeting stile-to-sill.
 - (b) Collect parts of the product that are deemed uncharacteristic to the four cross-sections per (a).
 - ii. Four-sided units with two lites of glass, one above the other (e.g. double or single hung).

- (a) Collect of minimum of three cross-sections; a top corner, an opposite lower corner, and one meeting rail-to-jamb.
 - (b) Collect parts of the product that are deemed uncharacteristic to the three cross-sections per (a).
 - iii. Four-sided units with a single-lite of glass (e.g. casements, awnings, picture or dual-action, etc.), excluding entry doors with embossments or raised panels.
 - (a) Collect a minimum of two cut cross-sections; a top corner and an opposite lower corner.
 - (b) Collect parts of the product that are deemed uncharacteristic to the two cross-sections per (a).
 - iv. Entry Doors with embossments or raised panels.
 - (a) Collect the following cut cross-sections: a top corner of frame/panel, an opposite lower corner of frame/panel, one corner of the embossment or raised panel, one top corner of the glass lite and an opposite corner of glass lite, one door core that shall include both the horizontal and vertical intermediates.
 - (b) Collect parts of the product that are deemed uncharacteristic to the cross-sections selected per (a).
- C. For specimens that are not rectangular or four-sided (e.g. octagon or garden windows), consult with FenStar Operations Staff for the cross-sections to be collected.
- D. The placement and orientation of any reinforcement inside the frame cavities shall remain intact for verification. A minimum of 300 mm (12 in) of cross-section shall be cut and photographed as part of the reporting process, since reinforcement may fall out during the corner cutting, and may not run the entire length of the frame/sash member.
- E. To verify the correct spacer type was provided with the test specimen, the spacer shall be compared to the manufacturer spacer specifications. See Section 3.2.2.2.C for instructions of spacer verification procedures.

- F. Test specimen components shall be compared to frame and sash component drawings provided by FenStar Operations Staff.
- G. When applicable, a minimum of six dimensions shall be verified for each profile. At a minimum, the following dimension verifications shall be recorded:
 - i. Overall profile height
 - ii. Overall profile width
 - iii. Wall thickness(es), if applicable
 - iv. Other dimensions deemed appropriate by laboratory
 - v. The tolerance(s) listed on the profile drawing shall be used for verifying the profile dimensions.

3.2.2.2 Inspection of glazing components

Glazing components shall be compared to glazing component drawings provided by FenStar Operations Staff. Gap fill characteristics shall be measured and recorded, at a minimum, upon receipt, pre-test, and post-test. The test laboratory shall cut up the glass specimen and provide a detailed report of the glazing contents in accordance with NFRC 701.04, Section 1.1.3.B, which includes, but is not limited to, the following characteristics:

- A. Overall Glazing Configuration
 - i. Overall insulating glass dimensions
 - ii. Individual pane thickness(es)
 - iii. Gap thickness(es)
 - iv. Low-emissivity coating location(s)
 - v. Grille (divider, muntin) details

- B. Gap Fill Characteristics

Gap fill contents shall be determined using one of the following methods. The laboratory shall be capable of performing at least one of these methods. In the event the laboratory is not able to determine gap fill due to test method or equipment limitations, the reason for this omission shall be reported.

- i. *ASTM E2649 -12: Standard Test Method for Determining Argon Concentration in Sealed*

Insulating Glass Units Using Spark Emission Spectroscopy, or

- ii. *ASTM E2269 – 14: Standard Test Method for Determining Argon Concentration in Sealed Insulating Glass Units using Gas Chromatography.*

NOTE: This requirement is currently limited to argon gas fills and may not be possible with certain product configurations.

C. Spacer System Characteristics

The following spacer system characteristics shall be reported:

- i. Orientation
- ii. Offset from bottom of glazing
- iii. Material types (excluding sealants), including but not limited to, plastic, foam, stainless steel, mild steel, and aluminum
- iv. Presence of desiccant
- v. Sealant configurations

3.3 Air Leakage Certified Rating Verification

Licensees employing air leakage ratings certified by an independent Certification Body shall provide to FenStar Operations Staff the product's air leakage certification authorization issued by that body and shall apply the appropriate label.

3.4 Installation Instructions Verification

Licensees shall provide to FenStar Operations Staff the installation instructions. FenStar Operations Staff shall verify the installation instructions include the EPA-mandated elements and are available online or packaged with the product.

When applicable, the test laboratory shall verify instructions were included in packaging.

3.5 Other Verification Testing

Simulation to evaluate conductivities shall be performed in accordance with ANSI/NFRC 100 and ANSI/NFRC 200 by FenStar Operations Staff, if required to verify performance.

4. VERIFICATION RESULTS

The following section provides the methodology by which FenStar Operations Staff shall apply a grade to the verification test results received from an NFRC 701-accredited laboratory per the reporting requirements of NFRC 701 supplemental documents.

The Licensee is responsible for the performance of all product components including, but not limited to, insulating glass units, door frames, spacers, etc.

4.1 Grading Investigation Processes

4.1.1 Thermal Verification

As FenStar Operations Staff deem necessary, the following tasks may be required to validate the comparison between the thermal verification test results and the expected certified performance rating of the product selected for FVTP:

- A. Verify the product tested matches the product's description in the FCPD or CPD.
 - i. Verify configuration per Section 3.2.2.
 - ii. Verify possible groupings within the product line.
 - iii. Verify any waiver and/or exemptions within the product line.
- B. Validate the results of the confirmed configuration verification test product using the tolerances and conditions in Section 4.2.
 - i. FenStar Operations Staff may review any discrepancies between the certified and tested results with the laboratory that performed the testing, the IA, and/or the Licensee in cases where the reasons for the discrepancies are uncertain.
 - ii. In some cases, the thermal hot box test product's size may differ from the model sizes listed in Table 4-3 of ANSI/NFRC 100. Since the product's certified (labeled) value is based on NFRC model sizes, FenStar Operations Staff may be required to adjust the certified (simulated) model size to match the size of the product that was verified.
 - iii. In cases when verifications require the modeling or verification of simulated components, any simulations required may be performed by FenStar Operations Staff.

- iv. If the thermal verification test results are unsuccessful per the requirements of Section 4.3.B.i, the FenStar Program shall take the actions set forth in Section 4.4.1.
- C. FenStar Operations Staff may require the product be shipped to another NFRC 701-accredited laboratory for additional testing.
- D. The product's date of manufacturing and labeling shall be taken under consideration.
 - i. Review of archived FCPD or CPD data may be necessary.
 - ii. Staff may need to compare current testing procedures with the test procedures used at the time the product was certified.

4.1.2 Air Leakage Verification

- A. For air leakage performance ratings from other Certification Bodies, FenStar Operations Staff shall verify current certification authorization and application of appropriate labels.
- B. ANSI/NFRC 400 air leakage performance ratings shall be verified by reviewing the FCPD or CPD and confirming the rating on the NFRC temporary label.

4.1.3 Installation Instructions Verification

- A. FenStar Operations Staff shall verify the manufacturer's installation instructions or the online instructions conform to the ENERGY STAR requirements.
- B. For installation instructions attached to the product, the testing laboratory shall forward to FenStar Operations Staff.

4.1.4 SHGC Verification

FenStar Operations Staff shall verify the received product's low-e glass location is consistent with the CPD listing.

4.2 Grading Tolerances or Conditions

FenStar Operations Staff shall use the following tolerances and conditions when comparing the certified value and the verification results from the thermal hot box test, and the requirements for labeling, air leakage performance, and installation instructions.

- A. Thermal Hot Box Verification Rating Value Tolerances
 - i. Comparison of the physical test FVTP value is based on the following:

Table 1 – U-factor Tolerance

Certified U-factor¹	Accepted Difference Between Tested and Certified U-factor
1.7 W/m ² K (0.3 Btu/h·ft ² ·°F) or less	0.17 W/m ² K (0.03 Btu/h·ft ² ·°F)
Greater than 1.7 W/m ² K (0.3 Btu/h·ft ² ·°F)	10% of Certified U-factor
¹ Certified U-factor shall be adjusted due to tested product size not equivalent to the NFRC model size	

- ii. The tolerance to compare a certified (simulation only) performance value and a verification simulated value shall be 0.11 W/m²k (0.02 Btu/h ft² F).
- iii. Simulated values shall be adjusted for any difference between tested size and NFRC model size.

B. Labeling Verification Conditions

The verification of the product’s label shall be based on the following conditions:

- i. Presence of the proper ENERGY STAR label meeting the Scheme requirements.
- ii. Energy performance values displayed on the NFRC temporary label meets the ENERGY STAR climate zone certification criteria within NFRC allowed tolerances.

NOTE: When a grouped individual product option within the product line was selected for verification, the value on the label shall not be used as the expected verification value.

- iii. Product is listed in the FCPD.
- iv. Display of an air leakage rating on the NFRC temporary label or the presence of another EPA-recognized Certification Body label for air leakage.
- v. The ENERGY STAR label width is equal to the NFRC Temporary label.

C. Air Leakage Verification Conditions

The verification of the Air Leakage rating label and authorized certification shall be based on the following conditions:

Table 2 – Air Leakage Tolerance

Product	Air Leakage Rating
Window, Sliding Door or Skylight	≤ 1.5 l/(s·m ²) (0.3 cfm/ft ²)
Swinging Door	≤ 2.5 l/(s·m ²) (0.5 cfm/ft ²)

D. Installation Instructions Verification Conditions

Verify that the installation instructions are available online or packaged with the product and meet the EPA requirements.

4.3 Performance-Based Verification Grades

FenStar Operations Staff shall grade the product’s performance based on the verification reports, certification reports, and installation instructions in conjunction with tasks listed in Section 4.1. FenStar Operations Staff shall verify that the results of the review are within the tolerances and meet the conditions listed in Section 4.2.

A. Successful Verification

- i. Thermal hot box test results meet the rating performance value per Table 3, Table 4, and Table 5.
- ii. Air leakage ratings are certified and meet the rating performance value per Table 2.

B. Unsuccessful Verification

Per Section 7, the following are categorized as R-1.

- i. Thermal hot box test results do not meet the rating performance value per Table 3, Table 4, and Table 5; or
- ii. SHGC ratings do not meet the rating performance value per Table 3, Table 4, and Table 5 based on incorrect low emissivity surface location; or
- iii. Air leakage ratings are not certified or do not meet requirements per Table 2.

C. Range of tolerance to determine an unsuccessful and successful test based on the ENERGY STAR zone U-factor and SHGC performance criteria and product category:

Table 3 – ENERGY STAR U-factor Performance Tolerances for Windows

Climate Zone	Required U-factor	SHGC	Windows	
			Successful Test U-factor Tolerances	Unsuccessful Test U-factor Tolerances
Northern	≤ 0.27	Any	≤ 0.30	≥ 0.31
	= 0.28	≥ 0.32	≤ 0.31	≥ 0.32
	= 0.29	≥ 0.37	≤ 0.32	≥ 0.33
	= 0.30	≥ 0.42	≤ 0.33	≥ 0.34
North-Central	≤ 0.30	≤ 0.40	≤ 0.33	≥ 0.34

South-Central	≤ 0.30	≤ 0.25	≤ 0.33	≥ 0.34
Southern	≤ 0.40	≤ 0.25	≤ 0.44	≥ 0.45

Table 4 – ENERGY STAR U-factor Performance Tolerances for Skylights

Climate Zone	Required U-factor	SHGC	Skylights	
			Successful Test U-factor Tolerances	Unsuccessful Test U-factor Tolerances
Northern	≤ 0.50	Any	≤ 0.55	≥ 0.56
North-Central	≤ 0.53	≤ 0.35	≤ 0.58	≥ 0.59
South-Central	≤ 0.53	≤ 0.28	≤ 0.58	≥ 0.59
Southern	≤ 0.60	≤ 0.28	≤ 0.66	≥ 0.67

Table 5 – ENERGY STAR U-factor Performance Tolerances for Doors

Climate Zone	Glazing Level	Required U-factor	SHGC	Doors	
				Successful Test U-factor Tolerances	Unsuccessful Test U-factor Tolerances
All	Opaque	≤ 0.17	No Rating	≤ 0.20	≥ 0.21
All	≤1/2-Lite	≤ 0.25	≤ 0.25	≤ 0.28	≥ 0.29
Northern and Northern-Central	>1/2-Lite	≤ 0.30	≤ 0.40	≤ 0.33	≥ 0.34
South-Central and Southern	>1/2-Lite	≤ 0.30	≤ 0.25	≤ 0.33	≥ 0.34

- i. The “Required U-factor” column displays the expected value from the FCPD/NFRC Certified Label.
- ii. The “SHGC” column displays the required Solar Heat Gain Coefficient value and is verified via labeling and listing in FCPD.
- iii. The “Successful Test U-factor Tolerances” column displays the maximum verification tested U-factor value for a thermally tested product.
- iv. The “Unsuccessful Test U-factor Tolerances” column displays the beginning verification tested U-factor value that exceeds the ENERGY STAR performance criteria.

4.4 Reporting of Test Grade

FenStar Operations Staff shall provide a notice to licensees when the thermal test result indicates a potential unsuccessful test, and a notice upon determination of the final grade of the test.

4.4.1 Potential Unsuccessful Test

In cases where the U-factor results are outside of the established tolerances in Section 4.3, FenStar Operations Staff shall notify the EPA of the test results. FenStar Operations Staff shall notify the Licensee of the test results and the Licensee may then select one of the following options:

- i. Option 1: Licensee Inspection of the Intact Unit
 - (a) Within five business days from the date of the licensee's receipt of the notice from FenStar Operations Staff, the Licensee shall have the right to provide written notice to FenStar Operations Staff that the Licensee elects to inspect the intact unit. If the Licensee decides to inspect the intact unit, the Licensee shall not be entitled to appeal the unsuccessful test results to the FenStar Certification Program, and all appeals by the Licensee shall be directed to EPA.
 - (b) The inspection of the unit shall be completed within 15 business days from the date the Licensee elects to inspect the unit. At the expiration of that 15 business day period, testing shall continue per Section 3.2.2.
 - (c) The inspection of the intact unit by the Licensee shall be overseen by the laboratory. A description of the inspection shall be included in the CE report.
 - (d) Air leakage verification per Section 3.3, and installation instruction verification per Section 3.4, shall be performed.
 - (e) Upon completion of the CE, under Section 3.2.2, the licensee may keep any remaining parts of the specimen which are not required to be retained by the laboratory for the CE.
 - (f) During the inspection, the Licensee shall not alter the unit. No materials may be added or removed from the unit. The Licensee may be present for the CE performed by the laboratory.
 - (g) The licensee shall retain the ability to appeal to EPA.
- ii. Option 2: Licensee Does Not Inspect Intact Unit

- (a) If the licensee does not respond within 5 business days or decides not to perform an inspection of the intact unit, the component evaluation shall continue per Section 3.2.2, 3.3, and 3.4
- (b) Verification testing will continue per Sections 5 and 6
- (c) The licensee shall retain the ability to appeal to the FenStar Management Committee and EPA.

4.4.2 Tests Graded as Successful

For tests that are graded as successful, Licensees shall receive a Notice of Verification.

4.4.3 Tests Graded as Unsuccessful

Products that are graded as unsuccessful tests per Section 4.3 are considered a failure per the EPA directives.

Reference the EPA document, Disqualification Procedures ENERGY STAR Products for non-compliance actions within the ENERGY STAR program.

4.4.3.1 Provide Reports to EPA

Per EPA Directive 2011-06, FenStar Operations Staff shall report “failures” to EPA within two business days after determining an unsuccessful test.

As requested by the EPA, Certification Bodies shall provide a summary of models tested since the previous report submitted to the EPA.

4.4.3.2 Provide Reports to Licensees

FenStar Operations Staff shall provide to the Licensee a Notice of Non-compliance containing the results of the unsuccessful test after the result has been reported to the EPA. The Licensee will receive a full test report via email.

4.5 Verification Test Results Not Attributable to Licensee

There may be situations where the test result of a product is inaccurate and that inaccuracy is not attributable to the product’s actual performance but to errors in the NFRC PCP and/or FenStar Certification Program process, such as but not limited to, simulation errors, typographical errors, omissions, etc. These situations require additional investigation by FenStar Operations Staff and other parties, as necessary.

In this circumstance, the grade for the test shall not be finalized until FenStar Operations Staff has received all the necessary information to confirm if the test results were the result of errors in the certification process. In some cases, the

Licensee may be required to update certification ratings during the period of investigation to remedy the issue.

Concerns, such as but not limited to shipping, installation, and/or calibration issues, are excluded from this section as these concerns are addressed during FenStar Operations Staff's investigation.

5. NOTICE OF NON-COMPLIANCE PROCESS

In accordance with Section 4.4.3.2, licensees shall receive a Notice of Non-compliance in the event of an unsuccessful test. The Notice of Non-compliance shall provide the performance results of the unsuccessful test.

- A. Licensees shall have the right to inspect the failed test specimen cross-sections within the following guidelines:
 - i. The inspection shall occur after the result has been finalized and reported to EPA.
 - ii. The Licensee shall notify FenStar Operations Staff prior to inspecting the failed test specimen cross-sections.
 - iii. The failed test specimen cross-sections shall remain in the custody of the testing laboratory.
 - iv. The Licensee shall assume all costs associated with conducting the inspection.
 - v. If the product or any cross-section components are discarded, manipulated, or modified by the Licensee in any manner during the inspection, the Licensee shall be subject to disciplinary action and the EPA shall be notified.
- B. Licensees shall have the right to appeal the verification tests that result in an EPA reportable event in accordance with Section 6.
- C. Licensees are subject to corrective actions per the EPA's "Disqualification Procedures" document. FenStar Operations Staff may work with the EPA and the Licensee to assist in determining the deficiency and reason for the failure.
- D. After the first unsuccessful test, all costs for any additional product procurement, shipping, and retesting as a follow-up to the initial verification test shall be assumed by the Licensee.
- E. The Licensee shall be subject to higher probability of selection per the verification testing algorithm.

5.1 Thermal Hot Box Unsuccessful Test

- A. FenStar Operations Staff shall provide a failure report to the EPA.

- B. The Licensee shall be subject to compliance actions per the EPA's "Disqualification Procedures" document.

5.2 Air Leakage Unsuccessful Verification

FenStar Operations Staff shall inform the EPA that the product does not meet the rating tolerances. The Licensee shall be subject to compliance actions per the EPA's "Disqualification Procedures" document.

5.3 Issues of Concern

Each of the instances below shall be categorized in accordance with Section 7.

- A. In cases where the ENERGY STAR label is not applied or inaccurate, the Licensee shall rectify the labeling issue with the EPA.
- B. In cases where the values are inaccurate or the product option is not authorized for certification, the individual product option shall no longer be eligible for ENERGY STAR certification until the issue is resolved.
- C. In cases where the installation instructions do not meet EPA requirements and/or are not available per Licensee's preferred methodology, the Licensee shall correct the issue(s) with the EPA.

5.4 Test Results Not Attributable to Licensee

With respect to matters addressed in Section 4.5, the Licensee shall have 30 days from receipt of the Notice of Non-compliance to cooperate with the proper entities (labs, IA, etc.) to achieve compliance by rectifying certification issues. If compliance is not achieved by the deadline or reasonable progress toward that goal is not demonstrated, FenStar Operations Staff shall notify the EPA of the matter.

6. APPEALS

This section sets forth the procedures for appealing the finding of an unsuccessful verification test that constitutes a failure under the EPA directives. FenStar shall report to the EPA the outcome of any appeals under Section 6. This appeals process is exclusive of any appeal made by the Licensee directly to the EPA and occurs after the unsuccessful test has been reported to EPA. This appeal is a separate and distinct procedure from certification appeals as detailed in FenStar FS-1001.

6.1 Grounds for Appeal

An appeal may be made in situations where the Licensee believes that negligence, error, or intentional bias on behalf of the FenStar Certification Program resulted in the unsuccessful grade. Technical appeals or appeals regarding laboratory issues shall be made directly to EPA. Items which shall not be grounds for an appeal under Section 6 include, but are not limited to:

- A. Poor workmanship.

- B. Absence or deficiency of the prescribed gas fill.
- C. Damage that is not visible. (All products shall be inspected for damage upon arrival at the laboratory. Only products that are in testable condition shall be tested.)

6.2 Appeal Procedure

- A. Upon receipt of the Notice of Non-compliance, the Licensee shall have a period of 15 days to appeal an unsuccessful test result by submitting a completed FVTP Appeal Form (electronic submission acceptable). The appeal shall set forth in reasonable detail the Licensee's basis for contending that the Notice of Non-compliance is inaccurate or incorrect.
 - i. The Licensee shall present their appeal to the FenStar Management Committee for review of the initial independent findings.
 - ii. FenStar Management Committee will solicit input from the Verification Policy Advisory Group (VPAG) as needed. FenStar Operations Staff shall provide a recommendation on the appeal to the FenStar Management Committee. At the discretion of the FenStar Management Committee, the Licensee may present an appeal directly. The FenStar Management Committee shall review the FenStar Operations Staff recommendation, including all underlying information presented in the appeal and make the final decision on the appeal.
 - iii. All FenStar Management Committee decisions on the appeal shall be final. If the appeal is denied, the Notice of Non-compliance shall remain in effect. If the appeal is upheld, the FenStar Management Committee shall provide direction to FenStar Operations Staff.
- B. If the Licensee does not submit an appeal within 15 days of the receipt of the Notification of Non-compliance, the verification test result shall be final and binding.

7. CATEGORIZATION OF ISSUES

ID	Labeling Issues	FVTP Action	FenStar Action	EPA Action	FVTP (Pass / Fail)
L-1	No ENERGY STAR® or NFRC labels (Laboratory indicated no labels on product)	Hold test; Licensee required to send new properly labeled product.		Incident included in EPA bi-annual report.	n/a
L-2	No ENERGY STAR label (No ENERGY STAR label, only NFRC label on product)	Hold test; Licensee required to send new properly labeled product.		Incident included in EPA bi-annual report.	n/a
L-3	No temporary and/or permanent NFRC label (No NFRC label, only ENERGY STAR label on product)	Hold test; Licensee required to send new properly labeled product.		Inform EPA for ENERGY STAR label compliance; incident included in EPA bi-annual report.	n/a
L-4	Incorrect NFRC label (Option) with correct ENERGY STAR zone label (Ex: Ordered and received a product with an intercept spacer, however the product is mislabeled and NFRC label states aluminum spacer.)	Test if product is listed in FCPD and meets ENERGY STAR. Licensee required to send a hardcopy label to laboratory location and electronic label to FenStar.	Initiate NFRC compliance process if applicable.		Result
		No test if product is not listed in FCPD; Licensee required to send new product.	Initiate NFRC compliance process if applicable.	Inform EPA for ENERGY STAR label compliance; and the incident is also included in EPA bi-annual report.	n/a

ID	Labeling Issues	FVTP Action	FenStar Action	EPA Action	FVTP (Pass / Fail)
L-5	Incorrect NFRC label (Values) with correct ENERGY STAR zone (Ex: U-factor on NFRC label is 0.28 and was supposed to be 0.27. ENERGY STAR map is correct.)	Test if product is listed in FCPD and meets ENERGY STAR. Licensee required to send a hardcopy label to Laboratory location and electronic label to FenStar.	Initiate NFRC compliance process if applicable.		Result
		If not found in FCPD or does not meet ENERGY STAR; No test, and Licensee required to send new product.	Initiate NFRC compliance process	Inform EPA for ENERGY STAR label compliance; incident included in EPA bi-annual report.	n/a
L-6	Incorrect zone designated on ENERGY STAR label based on correct NFRC label. (Product and NFRC label are accurate; however, ENERGY STAR label displays incorrect zone(s))	Test product		Inform EPA for ENERGY STAR label compliance.	Result of test
L-7	Not an NFRC certified product with ENERGY STAR label. (Product is received with a NFRC and ENERGY STAR label however the product is not listed in CPD or CAR; except on a case by case basis when a product line is recertified after selection)	No test; and Licensee required to send new product.	Initiate NFRC compliance process	Inform EPA for ENERGY STAR label compliance; incident also included in EPA bi-annual report.	n/a
L-8	Incorrect zone designated on ENERGY STAR label and incorrect NFRC label. (Both the ENERGY STAR and NFRC label on product are incorrect.)	Hold test; Licensee required to send new properly labeled product.	Initiate NFRC compliance process	Inform EPA for ENERGY STAR label compliance; and incident also included in EPA bi-annual report.	n/a

ID	Labeling Issues	FVTP Action	FenStar Action	EPA Action	FVTP (Pass / Fail)
L-9	Installation instructions not available and or incomplete.	Test product. Licensee must justify instruction discrepancy.	NFRC to contact Licensee to determine appropriateness of instructions to product installation type	Inform EPA for ENERGY STAR program compliance when appropriate; and incident also included in EPA bi-annual report.	Result of test
L-10	NFRC Standard size outside IA permanent label certification for AWS	Test; Licensee builds NFRC standard size product and sends permanent label separately (not attached to unit) which typically certifies AWS	n/a	n/a	Result
L-11	Canadian ENERGY STAR label applied due to Licensee's labeling system recognizing product's Canadian shipping destination	Test; Licensee required to send hard-copy of US label to laboratory and electronic copy to FenStar		Inform EPA for ENERGY STAR label compliance; and incident also included in EPA bi-annual report	Result

ID	Certification Issues	FVTP Action	FenStar Action	EPA Action	FVTP (Pass / Fail)
C-1	Expired product line (not applicable if due to recertification during verification/surveillance testing)	No test;	Initiate NFRC compliance process.		n/a
C-2	Not listed in product line	No test; and Licensee required to send new product	Initiate NFRC compliance process.		n/a

ID	Component Issues	FVTP Action	FenStar Action	EPA Action	FVTP (Pass / Fail)
Pre-test					
Pr-1	Different glazing configuration (Ex: product received has different spacer system than ordered and is labeled correctly according to the product received.)	Test if product is listed in FCPD and meets ENERGY STAR.			Result
		No test if product is not listed in FCPD; and Licensee required to send new product.	Initiate NFRC compliance process.	Inform EPA for ENERGY STAR label compliance; and the incident is also included in EPA bi-annual report.	n/a
Pr-2	Default door frame used in simulation (Ex: product received has different frame than expected; however, product was simulated with default door frame.)	Test product			Result
Post test					
Po-1	Modified profile	Tested; Option is listed in FCPD	Initiate NFRC Compliance process.		Result
Po-2	Different profile	Tested; Option is listed in FCPD	Initiate NFRC Compliance process.		Result
Po-3	With or without foam	Tested; Option is listed in FCPD	Initiate NFRC Compliance process.		Result
Po-4	Different reinforcement	Tested; Option is listed in FCPD	Initiate NFRC Compliance process.		Result
Po-5	Default door frame	Tested; not an issue.			n/a
Po-6	Incorrect glazing configuration	Tested; Option is listed in FCPD	If applicable, initiate NFRC Compliance process.	If applicable, inform EPA for ENERGY STAR label compliance; and the incident is also included in EPA bi-annual report.	Result

ID	Results Issues	FVTP Action	NFRC Action	EPA Action	FVTP (Pass / Fail)
R-1	Not within ENERGY STAR tolerance	FenStar certification revoked for disqualified product options as determined by the EPA.	Possibly initiate NFRC Compliance process.	Notify EPA within 2 days of verification; and the incident is also included in EPA bi-annual report.	Fail
R-2	Not within NFRC tolerance		Initiate NFRC Compliance process.	If applicable, inform EPA for ENERGY STAR label compliance; and the incident is also included in EPA bi-annual report.	Result