



National Fenestration Rating Council Incorporated

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NFRC 102 Thermal Test Reporting Requirements

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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 and 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 Rating System employs computer simulation and physical testing by NFRC-accredited laboratories to establish energy and related performance ratings for fenestration product types. The 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 (the "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 (the "PCP")
- NFRC 705 Component Modeling Approach ("CMA") Product Certification Program (the "CMA-PCP").

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

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

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 Compliance and Monitoring Program (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

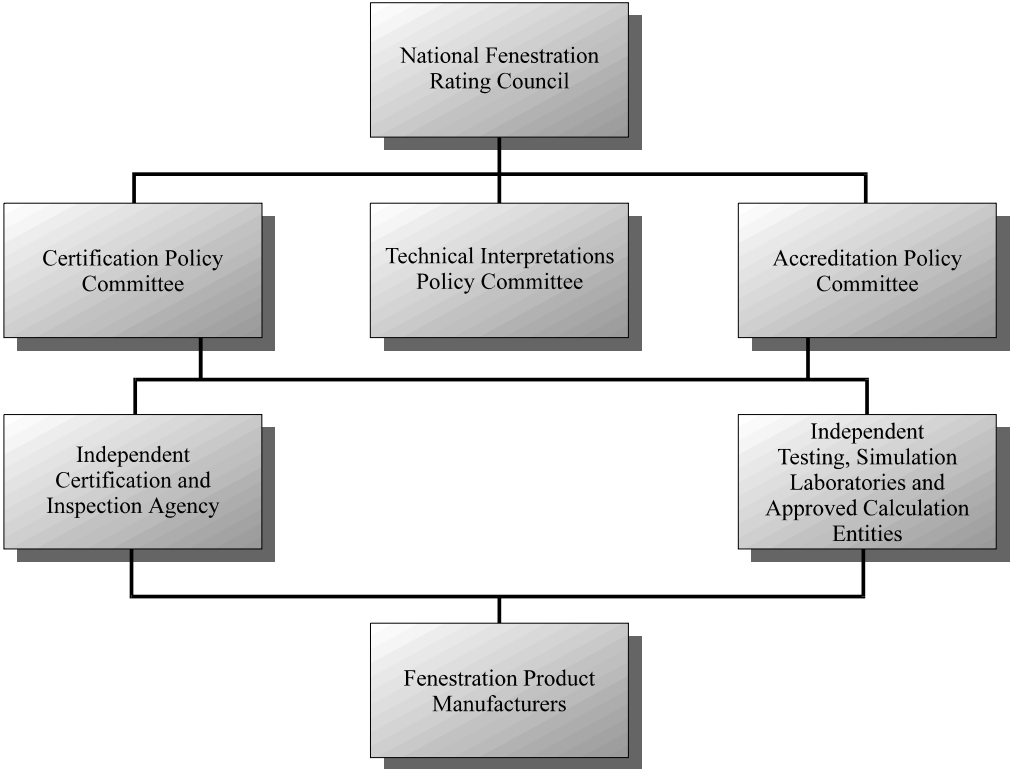


Figure 2

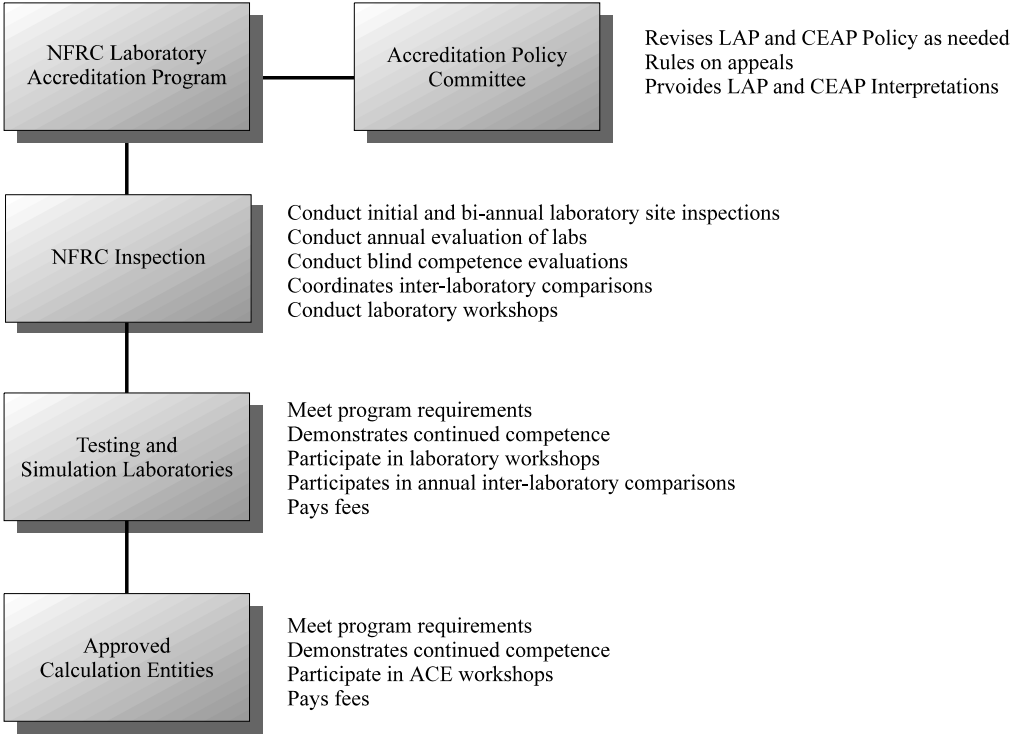
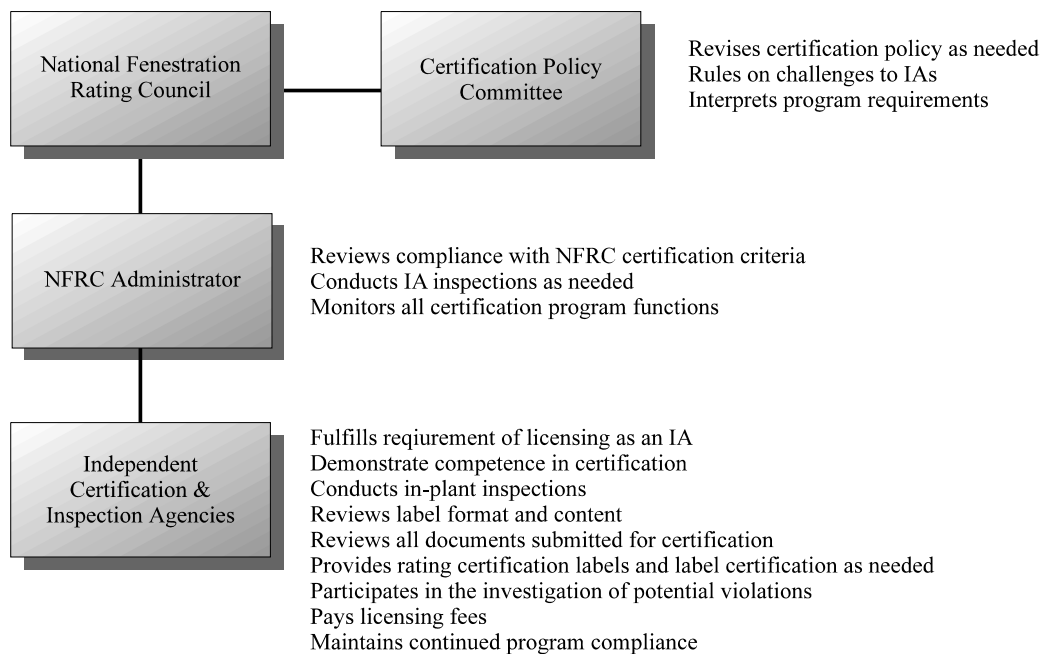


Figure 3



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.

NFRC THEREFORE DISCLAIMS ANY AND ALL LIABILITY THAT MAY ARISE FROM OR IN CONNECTION WITH SERVICES PROVIDED BY, DECISIONS MADE BY OR REPORTS OR CERTIFICATIONS ISSUED OR GRANTED BY ANY NFRC-ACCREDITED LABORATORY, NFRC-LICENSED IA OR ANY PRODUCT MANUFACTURER/ RESPONSIBLE PARTY; RELIANCE ON ANY NFRC PRODUCT DESCRIPTION, SPECIFICATION, RATING, TEST OR CERTIFICATION, WHETHER APPEARING IN A REPORT, A PRODUCT CERTIFICATION AUTHORIZATION OR A PRINTED OR ELECTRONIC DIRECTORY, OR ON A LABEL, OR ON A LABEL CERTIFICATE; OR THE SALE OR USE OF ANY NFRC-RATED OR CERTIFIED PRODUCT OR PRODUCT LINE; INCLUDING BUT NOT LIMITED TO DAMAGES FOR PERSONAL OR OTHER INJURY, LOST PROFITS, LOST SAVINGS OR OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES.

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



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1. MANDATORY REPORTING REQUIREMENTS FOR THERMAL TESTING LABORATORIES

1.1 Thermal Testing Laboratory Reporting Requirements for NFRC 102 and NFRC 500 (Physical Test)

1.1.1 Thermal Testing Laboratory Reporting Requirements

Testing laboratory shall issue a test report to the fenestration product manufacturer for whom NFRC testing was conducted and, upon approval from the manufacturer, shall issue the same report to the manufacturer's IA. Prior to the issuance of a final report, the test laboratory shall disassemble the test specimen in such a manner after testing in order to verify the description of the product in the test report. Test laboratories shall use the guidelines Appendix B to verify the manufacturer's product drawings. Attachment films are exempt from the guidelines of verification in Appendix B, but not other fenestration attachment products.

The thermal test report and the representative electronic upload shall identify one distinct product line represented by one upload matrix with a unique report number.

- A. Upon approval from the manufacturer (via written letter or electronic documentation), the same report shall be issued to the manufacturer's IA. The approval shall be included in the test folder or report.
- B. The testing laboratory shall include with the report the package of extrusion drawings, bill of materials, and assembly view drawings that shall be authenticated by the testing laboratory. The authentication shall be indicated by the laboratory stamp bearing the unique testing report number on the bill of materials and drawings to indicate that they are representative of the materials and profiles of the product.

The test report shall include the following information:

- C. Name, address and phone number of the laboratory
- D. Location (if different than the laboratory address) and identification of test equipment utilized
- E. Test date
- F. Name and address of the client

- G. Serial number, report number or other appropriate means of identifying each individual product line report
- H. A statement that the tests were conducted in full compliance with NFRC requirements
- I. NFRC Procedures and the editions under which the report was submitted (i.e. NFRC 102-2004)
- J. Drawing(s) and a detailed written description of the specimen including (where applicable):

[**Note:** some items listed may not be applicable in certain cases]:

- i. Manufacturer and series or model number
- ii. General description of product (i.e., operator type, size, framing type, glazing type, spacer type)
- iii. Test Specimen size (reported in both SI and IP units)
- iv. Bill of materials including vendor name and part numbers
- v. Parts drawings (i.e., frame, sash, glazing, hardware, etc.)
- vi. Physically measured parameters (sizes and thickness measured to 1 mm (1/32 inches); i.e., overall window dimensions, operable and/or fixed sash dimensions, glazing daylight openings, and door component parts)
- vii. Glazing material(s), including thickness, coatings, and/or internal films (emissivity, as reported by the sample manufacturer) and their location (surface)
- viii. Measured air space at the edge-of-glazing and design gas fill % concentration and type, as reported by the sample manufacturer
- ix. Spacer materials and construction
- x. Grille materials, placement and pattern
- xi. Detailed description of the framing, sash, frame and sash corner/joint construction, glazing installation, weather-stripping (types and locations), drainage and finish

- xii. All hardware, operator and other components
- xiii. All descriptive items in the test report, which have not been measured or verified by the test lab, must be clearly indicated in the report
- K. Test results, including all the information required
- L. Date of last complete hot box calibration and last calibration check
- M. Statement of experimental uncertainty associated with tests and data reduction when available
- N. Any additional comments or data deemed important in the understanding or review of the report
- O. Name and signature of individual conducting the test
- P. Name and signature of individual accepting responsibility for the technical accuracy of a test report
- Q. A statement that the report shall not be reproduced, except in full, without the approval of the laboratory
- R. A statement that the report relates only to the fenestration products tested
- S. A drawing indicating the location of each specified thermocouple and the corresponding surface temperature (when applicable)
- T. A statement indicating whether the product tested was a prototype unit, production line unit or as a test-only option as identified by the manufacturer, and indicate whether the product was submitted for initial certification or re-certification. A copy of the Submittal Form for Test Samples shall be submitted with the test report. Refer to Appendix D of NFRC 700 for submittal form.
 - i. Reissuance of reports to a fabricator or authorized private labeler that did not submit a test sample for validation testing shall include the following in the report:
 - a. Clear indication that the report is a "Reissued Report";

- b. Statement that indicates that the report was reissued via authorization from the lineal supplier, or private labeler, and that no test sample was submitted for testing;
 - c. Indication from the fabricator whether the report was reissued for Initial Certification or Recertification of the product line. (Note: Testing laboratory is not responsible to indicate whether the report is a plant qualification.)
- U. Rounding of numerical values shall be per NFRC 601, *NFRC Unit and Measurement Policy*.
- V. A statement indicating whether the weather side wind direction is perpendicular or parallel.
- W. The projecting height of the frame and sash members shall be included. Attachment products shall list reference product used.
- X. The format and content of the data sheets as defined in Appendix A are mandatory, shall be completed with the pertinent data and shall be included as part of the thermal performance test report.
- Y. The following statement shall be included in the report: “Ratings included in this report are for submittal to an NFRC-licensed IA for certification purposes and are not meant to be used for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) are to be used for labeling purposes.”
- Z. NFRC laboratories shall, as part of the report, upload the *NFRC Physical Testing CPD 2.0 Upload Sheet* to the NFRC database. The values in the *NFRC Physical Testing CPD 2.0 Upload Sheet* shall be consistent with any values in the NFRC report. The *NFRC Physical Testing CPD 2.0 Upload Sheet* must be in MS Excel[®] format and values must not be linked to other workbooks.
- AA. The test lab may choose to provide an electronic copy of the report as long as the report, in its entirety, is submitted in electronic format, stored on a remote secure server accessible by the designated IA or mailed on electronic media.

[*Note*: Electronic reports shall be protected by password or other means to prevent unauthorized modification. Laboratories shall maintain a secured back-up copy.]

BB. Any additional Component Modeling Approach reporting requirements specified in Section 5.6 of NFRC 100 shall be incorporated.

1.1.2 NFRC 500 Condensation Resistance Reporting

NFRC 102 standardized test conditions as well as the calculations in Section 5 of the NFRC 501 are used for the evaluation and rating of the Condensation Resistance rating.

At the discretion of the manufacturer and laboratory, the results of the NFRC 500 Condensation Resistance can be included within an NFRC 102 report for the identical product. All reporting requirements in accordance with NFRC 701.07 shall be met.

● APPENDIX A

Measured Test Data (NFRC 102 U-Factor Test Report)

Category	Parameter	Quantity	Units
Heat Flows	Total Measured Metering Box Input (Q_{total})		W (BTU/hr)
	Surround Panel Heat Flow (Q_{sp})		W (BTU/hr)
	Surround Panel Thickness		mm (Inches)
	Surround Panel Conductance		W/m ² ·°C (BTU/hr·ft ² ·°F)
	Metering Box Wall Heat Flow (Q_{mb})		W (BTU/hr)
	EMF vs. Heat flow equation (equivalent information)		N.A.
	Flanking Loss Heat Flow (Q_f)		W (BTU/hr)
	Net Specimen Heat Loss (Q_s)		W (BTU/hr)
Areas	Specimen, Projected (A_s)		m ² (ft ²)
	Specimen, Interior Total (3-D) Surface (A_{int})		m ² (ft ²)
	Specimen, Exterior Total (3-D) Surface (A_{ext})		m ² (ft ²)
	Metering Box Opening (A_{mb})		m ² (ft ²)
	Metering Box Baffle (A_{b1})		m ² (ft ²)
	Surround Panel Interior Exposed (A_{sp})		m ² (ft ²)
Test Conditions	Average Metering Room Air Temperature		°C (°F)
	Average Cold Side Air Temperature		°C (°F)
	Average Guard/Environmental Air Temperature		°C (°F)
	Metering Room Average Relative Humidity		%
	Measured Cold Side Wind Velocity		kph (mph)
	Measured Static Pressure Difference Across Test Specimen		Pa (psf)
Area Weighted Surface Temperature	Warm side specimen (t_1)		°C (°F)
	Cold side specimen (t_2)		°C (°F)
	Warm side frame (informational purposes only, not required)		°C (°F)

Category	Parameter	Quantity	Units
Data	Cold side frame (informational purposes only, not required)		°C (°F)
	Warm side edge-of-glass (informational purposes only, not required)		°C (°F)
	Cold side edge-of-glass (informational purposes only, not required)		°C (°F)
	Warm side center-of-glass (informational purposes only, not required)		°C (°F)
	Cold side center-of-glass (informational purposes only, not required)		°C (°F)
	Warm side surround panel		°C (°F)
	Cold side surround panel		°C (°F)
Thermal Transmittance	U_s, Measured		W/m²·C (BTU/hr·ft² ·°F)
	U_{st}, Standardized		W/m²·C (BTU/hr·ft² ·°F)

Calculated Test Data-Method B only, Not Both

Method	Parameter	Quantity	Units
“A” (Area Weighted, for informational purposes only)	Warm Side Surface Conductance (h_I)		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Cold Side Surface Conductance (h_{II})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Test Specimen Thermal Conductance (C_s)		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Standardized Warm Side Surface Conductance (h_{stI})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Standardized Cold Side Surface Conductance (h_{stII})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	U_{st}, Standardized Thermal Transmittance		$W/m^2\cdot C$ (BTU/hr\cdotft2 \cdot°F)
“B” (CTS)	Emittance of Glass (e_I)		N.A.
	Warm Side Baffle Emittance (e_{bI})		N.A.
	Equivalent Warm Side Surface Temperature		°C (°F)
	Equivalent Weather Side Surface Temperature		°C (°F)
	Warm Side Baffle Surface Temperature		°C (°F)
	Measured Warm Side Surface Conductance (h_I)		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Measured Weather Side Surface Conductance (h_{II})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Test Specimen Thermal Conductance (C_s)		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Convection Coefficient (K)		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Radiative Test Specimen Heat Flow (Q_{rI})		W (BTU/hr)
	Conductive Test Specimen Heat Flow(Q_{cI})		W (BTU/hr)
	Radiative Heat Flux of Test Specimen (q_{rI})		W/m 2 (BTU/(hr \cdot ft 2))
	Convective Heat Flux of Test Specimen (q_{r2})		W/m 2 (BTU/hr \cdot ft 2)
	Standardized Warm Side Surface Conductance(h_{stI})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	Standardized Cold Side Surface Conductance (h_{stII})		$W/m^2\cdot C$ (BTU/hr \cdot ft 2 \cdot °F)
	U_{st}, Standardized Thermal Transmittance		$W/m^2\cdot C$ (BTU/hr\cdotft2 \cdot°F)

Duration

The environmental systems were started at _____ (am/pm) on _____ (date).

The test parameters were considered stable for two consecutive two hour test periods from _____ hours, _____ minutes to _____ hours, _____ minutes.

The thermal performance test results were derived from _____ hours, _____ minutes to _____ hours, _____ minutes.

● APPENDIX B

GUIDELINES TO DETERMINE IF THE TEST SPECIMEN IS PROPERLY REPRESENTED BY THE MANUFACTURER'S PRODUCT DRAWINGS

1. The testing laboratory shall verify the test specimen to the drawings supplied by the manufacturer. This will be accomplished by comparing the physical samples of the product tested to the manufacturer's product drawings. The package of extrusion drawings, bill of materials, and fabrication drawings shall be authenticated by the testing laboratory's stamp referencing this data to the test report number or other test report identification. The testing laboratory's stamp or other mark on each individual drawing indicates that this drawing is representative of the material used in the tested sample. It also indicates, on the bill of materials and other data, in so far as it is possible to check, that the material used in the tested sample is that which was stated by the manufacturer.
2. The product samples should be verified in the following manner:
 - a. The base profile of the product sample extrusion must match the extrusion drawing. (i.e. internal air cavities, structural components, reinforcement, internal legs, etc. are the same)
 - b. The overall dimensions (width and height) of the sample profile should be checked to the physical dimensions stated on the profile drawings. In addition, other dimensions deemed critical should also be checked. Dimensional tolerances stated on the drawings should be used to indicate compliance.
 - c. Where possible, the bill of materials will be checked against the product tested to be certain that the type of material indicated on the drawings is the same type of material being used on the test specimen.
 - d. Any thermal break should be checked and verified for the effective distance (debridged width or effective width) between the inboard and outboard sides of the component containing the thermal break.
 - e. Where possible, check and indicate if the hardware described on the drawings and the bill of materials is the same type and is located in the same location as indicated on the assembly drawing.
3. The testing laboratory, by placing the stamp on a drawing, indicates that the drawing is representative of the test specimen.
4. If the test product drawing(s) do not verify that the product tested is the same as indicated on the drawings, the test laboratory shall illustrate on the drawing(s) the apparent differences in the test report.