



National Fenestration Rating Council Incorporated

NFRC 302-2010

Verification Program for Optical Spectral Data

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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

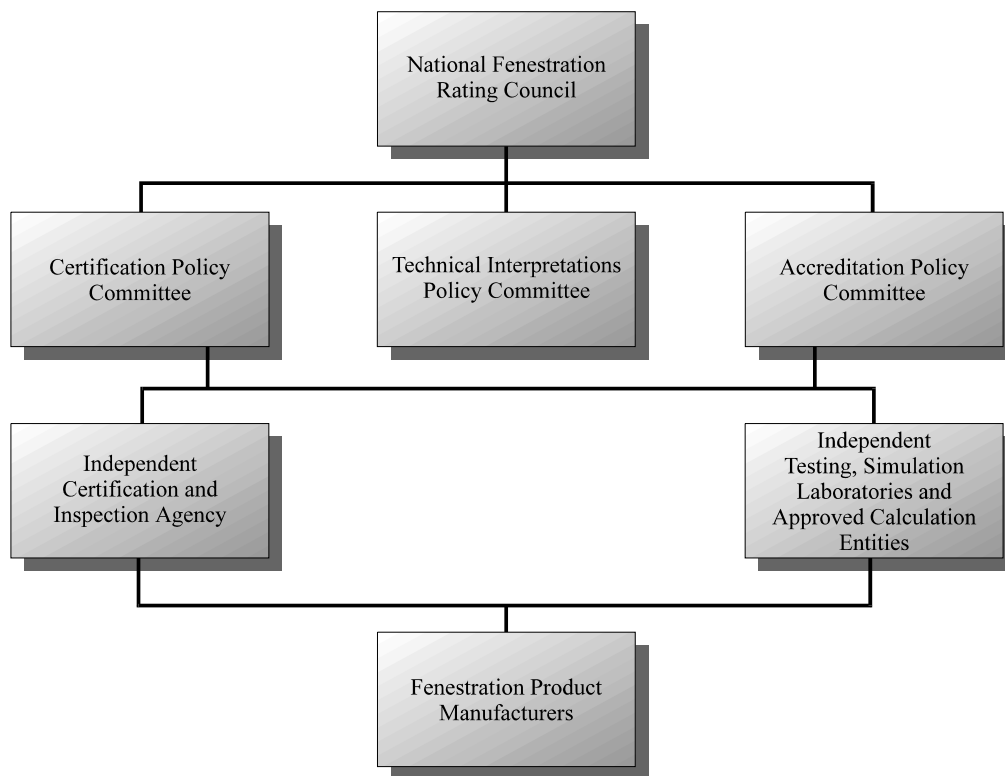


Figure 2

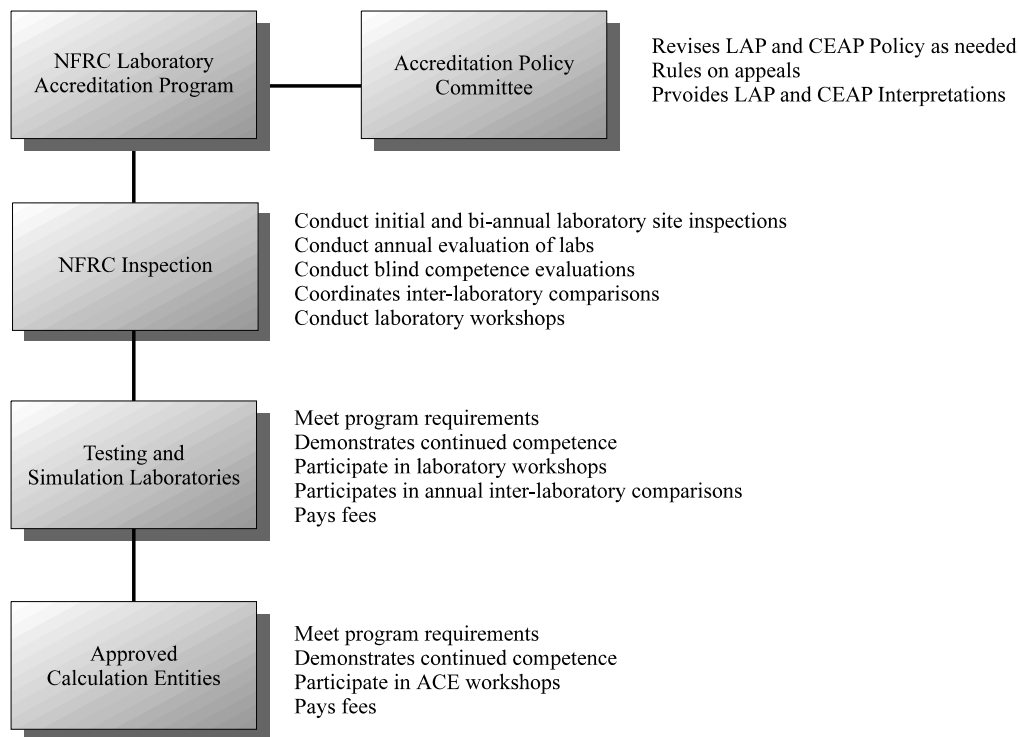
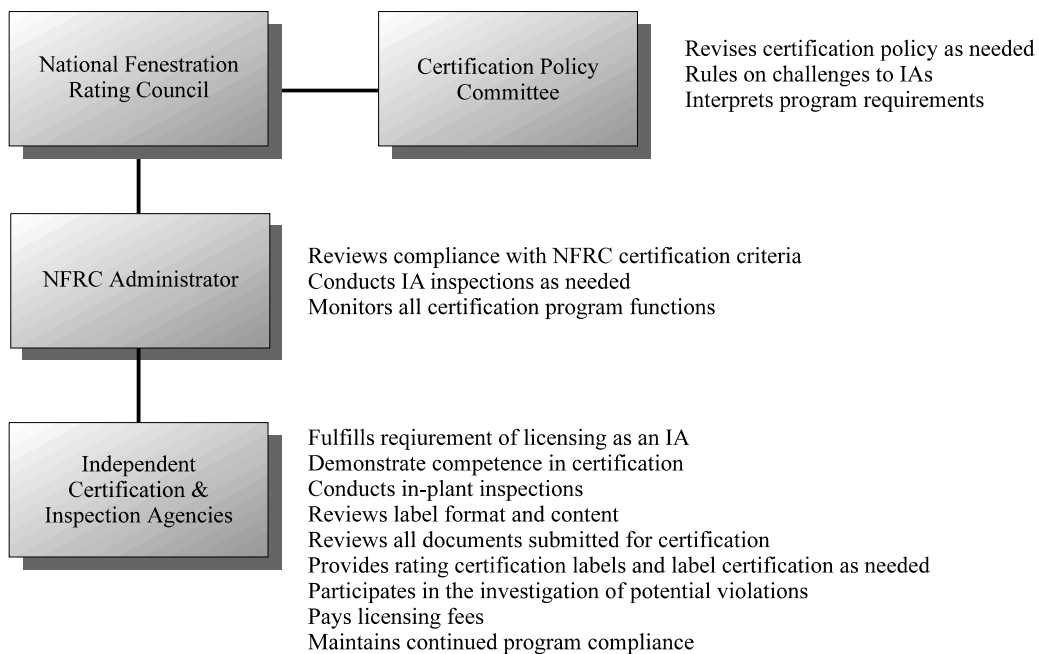


Figure 3



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

National Fenestration Rating Council
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770
Voice: (301) 589-1776
Fax: (301) 589-3884
Email: info@nfrc.org
Website: www.nfrc.org



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. General Information

The National Fenestration Rating Council has developed a uniform national rating system for energy performance characteristics of fenestration products.

The rating system is reinforced by a product certification program under which ratings developed by NFRC accredited laboratories are reviewed and authorized by NFRC licensed independent certification and inspection agencies (IAs) as conforming to NFRC requirements.

2. INTRODUCTION

The NFRC rating system relies on NFRC approved computer simulation programs for calculating total fenestration thermal performance indices. Algorithms and a glazing database (i.e., the International Glazing Database (IGDB)) that includes the spectral properties of glass and glazing (transmittance, reflectance, and emittance) determine fenestration performance calculations. Glass suppliers, coaters, and film manufacturers have relied upon a variety of standards for determining the optical properties of products, including ASTM, ISO, ASHRAE, and other proprietary methods. The subsequent development and approval of NFRC 300 has provided a uniform method for determining the spectral properties of glass and glazing.

In order to provide NFRC approved spectral data to the IGDB, a verification program is outlined in this document.

3. PROGRAM REQUIREMENTS

3.1 Spectroradiometric Measurements Qualifications

All submitters of spectroradiometric data (or their representatives) shall have successfully participated in an NFRC Round Robin. NFRC shall conduct or sponsor future round robins at least every four years or on an "as needed" basis, in accordance with ASTM E 1301.

3.2 Representative Data

The submitter shall choose the products to be included in the spectroradiometric data files as NFRC approved for the IGDB. For each uncoated glazing product, the submitter shall determine the data that represents measured solar transmittance, solar reflectance (front), and solar reflectance (back) in accordance with NFRC 300. For each coated glazing product, the submitter shall determine the data that represents measured emittance, solar transmittance, solar reflectance (front), and solar reflectance (back) in accordance with NFRC 300. This representative data shall be based

on the actual glass thickness (not nominal thickness). The representative data shall be the equivalent of a sample with average spectroradiometric properties for the product as sold by the submitter (prior to any fabrication processes). The criteria to be used for identifying the representative data shall be determined by each submitter in accordance with the guidelines specified by Lawrence Berkeley National Laboratory (LBNL). The submitter that supports and describes the selection of the representative data shall keep a record.

3.3 Sample Selection and Storage

The submitter shall store and retain, for a period of four years, the sample which best fits the integrated spectroradiometric properties of the submitted representative data (see Section 3.2.) and which, if possible, falls within the allowable measurement tolerances (see Note 2). If the physically stored sample does not fall within these tolerances for all integrated properties, the spectral data of the physical sample shall also be saved. One sample may be used to develop the representative data for a grouping of products of different thickness. In those cases, where sample storage is undesirable (certain types of coatings are known to be unstable outside of a sealed insulating glass unit) challenge procedures shall be related only to submitted data (see Note 2) and not to a sample. In any case, a sample shall be saved for Section 3.5.

3.4 Data submittal

3.4.1 Maintenance of database

The IGDB is a public database containing spectral optical properties and other information for glazing products, maintained by Lawrence Berkeley National Laboratory (LBNL) with the support of the U.S. Department of Energy and NFRC. The data in the IGDB that are certified for use with the NFRC rating system are a subset of the entire database. All glazing data shall be submitted to LBNL according to the procedures listed in the LBNL document #49790, International Glazing Database: Data Submission Procedures. This document can be downloaded from either the NFRC website (www.nfrc.org) or the LBNL website (www.windows.lbl.gov/software).

3.4.2 NFRC notification

NFRC shall be notified by LBNL when new data are submitted, when existing data are replaced or changed, or when data are withdrawn. In the case of withdrawn data, it shall be specified whether the data are to be removed entirely from the main database or simply taken off the approved list for NFRC purposes.

3.4.3 Notification Form

- A. For each NFRC approved spectral data file submission to LBNL, the submitter shall fill in the submittal forms provided

by LBNL (Appendix A). In addition, each data submitter shall have on file with NFRC the forms shown in Appendix B and Appendix C. If the information contained in the forms in Appendix B or Appendix C changes, the submitter shall revise those forms and provide them to NFRC

- B. The submitter shall provide the following information (contained in the LBNL submittal form, Appendix A):
 - i. Name of the person measuring the data
 - ii. Type of instruments and accessories used
 - iii. Date of last calibration of the instruments
 - iv. Name of the responsible person who transmits the form, from an email address on an NFRC list (to avoid the use of paper forms with signatures)
 - v. Statement that the data was measured in accordance with the procedures specified in this document and that the submitter permits NFRC to use the data for rating purposes

3.4.4 Additional glazing information

Glazing data files may include additional information about the structure, types of materials, and appearance of the glazing product.

[*Note 1:* No information will be required about proprietary design of coatings or formulation of bulk materials.]

3.5 Data Review

All spectroradiometric data files shall be submitted to LBNL for review. LBNL shall notify NFRC upon receipt of submittals for the NFRC rating system.

3.6 Technical Review

- A. Initial review of format and content will be performed for each new file at LBNL. Data will be checked for conspicuous problems including discontinuity, excessive noise, physically impossible values, incorrect intervals, and completeness of the file.
- B. Comparisons will be made with other files in the same series or with similar products already in the database to check for consistency.
- C. The review shall normally occur within two weeks of submission. If problems are discovered, the technical review stage shall be extended until the problems are resolved. NFRC staff shall be notified of such extension in writing by LBNL. LBNL shall also provide periodic updates to NFRC staff about the resolution of the problems.

3.7 Peer Review

- A. Upon completion of the initial technical review, data shall be distributed for peer review by LBNL. At minimum, the peer review group shall consist of all approved data submitters and is open to any other interested party.
- B. The peer-review phase shall last for three weeks. If no questions are raised during this time, then the data shall automatically be approved.
- C. If a question or objection is raised, the objector shall be required to provide the following information in writing:
 - i. The name of the product and the data file in question.
 - ii. A clear statement of the suspected problem.
 - iii. Any supporting evidence for the objection including purely technical data, such as a measurement on a similar sample, or it might be non-technical, such as a reference to contradictory product literature.
- D. A copy of this correspondence shall be provided to NFRC either by the submitter or by LBNL.
- E. The data supplier shall be given the opportunity to resolve a misunderstanding or otherwise demonstrate that the objection is not valid. This process shall occur anonymously through LBNL staff. If the objector is not convinced, then one or more samples shall be requested from the supplier. If the results agree with the originally supplied data then the objection shall be overturned.
- F. If the measurements do not agree with the originally supplied data then the supplier can either withdraw the data from consideration or resubmit the data after taking corrective action.
- G. If after review of the sample, the results fall outside the allowable instrument measurement tolerances (see Note 2); the submitter shall choose one of the following three options:
 - i. Withdraw that product from consideration for use in the IGDB.
 - ii. Agree to re-submit another set of representative data of the product to be used as NFRC approved data in the IGDB.
 - iii. Ask for reconsideration of the representative data in accordance with Section 3.10.

3.8 Acceptance Process

3.8.1 Inclusion of the Data in the IGDB

- A. Important: No glazing data may be used for NFRC window rating purposes until formally accepted by the NFRC. Acceptance is at the sole discretion of NFRC and is

independent of the verification process. All NFRC approved data are encrypted and indicated with a “#” symbol in the WINDOW program.

- B. Upon successful completion of the technical review and peer review, LBNL will notify NFRC by email if the data was specified for NFRC use. The email message shall contain the following minimum information: the name of the products, their ID numbers, and a statement that the data has passed review.
- C. Upon its acceptance of the data, NFRC shall notify the supplier of the data, all Accredited Simulators, and LBNL that data is ready to be included in the database. Ordinarily, this process of notification by NFRC should take no more than one week.
- D. Once notified by NFRC, LBNL shall prepare a database update program that will be posted on the database website. Download and execution of this program automatically adds the new data records to the previous Access database file. Records that have been accepted by NFRC shall be designated by an entry in the appropriate field of the database. WINDOW5, by default, will show only NFRC records unless the user changes this option.
- E. All submitters (and their representatives), that have followed the procedure outlined in Section 3.1 to Section 3.5, shall receive a formal reply letter from NFRC (or its delegated representative) stating that the representative data for each product has been accepted into the IGDB for use in determining NFRC ratings on fenestration products.

3.9 General Challenge Procedure

- A. The General Challenge Procedure applies to NFRC approved spectral data files appearing in the IGDB and any appeals.
- B. The spectroradiometric data for NFRC approved files published in IGDB is open for challenge by any interested party. General Challenge Procedures shall be filed through NFRC and shall follow the procedures outlined in Section 5 of the NFRC Product Certification Program (PCP) with the following exceptions:
 - i. References to products identified in the Certified Product Directory shall now apply to products identified in the IGDB.
 - ii. Notice of Challenges shall be submitted directly to NFRC rather than an accredited Independent Certification and Inspection Agency (IA).
 - iii. Escrow deposits charged to the challenger shall be held by NFRC.

- iv. The validity of the challenge shall be determined by the NFRC Board of Directors and in accordance with the guidelines and tolerances outlined under Section 3.5.

3.10 Appeals Procedure

If a submitter of spectroradiometric data to the IGDB disagrees with the measurements determined for a sample by NFRC (or its designated representative), the submitter may choose to submit a secondary set of samples for the product challenged. This secondary set shall consist of a minimum of 10 samples chosen at random from two or more production runs. NFRC shall distribute the samples to two other facilities (not involved in the question or challenge) that have successfully submitted spectral data to the IGDB. These facilities have a maximum of fourteen days to review the samples and return results to NFRC. NFRC shall review the results of the spectrometric measurements from these sources to make the final determination regarding validity of the representative data of a product.

3.11 Withdrawal of Acceptance

Any challenged product that is NFRC approved and determined to have spectroradiometric measurements outside of the acceptable range shall have its "acceptance" status removed from the IGDB. NFRC shall send a formal letter to the submitter notifying them of the results of the appeal/challenge. Subsequent updates of the IGDB shall exclude the product from its data files, unless the submitter re-submits the product in accordance with the timelines and procedures outlined in this program.

[**Note 2:** Allowable instrument measurement tolerance for spectroradiometric measurements shall be defined as ± 0.01 for transmittance data and ± 0.02 for reflectance and emittance data. (For example, a published transmittance value of 0.50 should have a retested transmittance value between 0.49 and 0.51. A published reflectance value of 0.20 should have a retested reflectance value of between 0.18 and 0.22). It should be noted that NFRC (or its designated representative) should judge any challenges to the representative data (from Section 3.5 or from Section 3.9) for accuracy.]

[**Note 3:** Spectral data should be correlated back to the glass thickness for which the representative data was reported. Note that representative data is submitted for a target glass thickness, actual samples will most likely vary in thickness.]

**APPENDIX A. SPECTRAL DATA SUBMITTAL FORM FOR THE
INTERNATIONAL GLAZING DATABASE**



Spectral Data submittal form for the International Glazing Database

Submitted to Lawrence Berkeley National Laboratory

1 Cyclotron Road, Berkeley, CA 94720

Contact: IGDB@lbl.gov

Company

Name: _____

Mailing address: _____

Contact for data submission

Name: _____

Telephone: _____

Fax: _____

E-mail: _____

Data measured by

Name: _____

Telephone: _____

Fax: _____

E-mail: _____

Data

Filename(s): _____

Submission date: _____

Samples

Sample(s) measured: One / More then one (specify) _____

Selection method: Random / Other (specify) _____

Samples stored: All / Less then all (specify) _____

Storage location: At company / Elsewhere (specify) _____



Spectral Data submittal form for the International Glazing Database
(continued)

Company Name: _____ Date Submitted: _____

Measurement equipment used

0.3 μm – 2.5 μm: _____

>2.5 μm: _____

Date of last instrument calibration: _____

Post-measurement data treatment

If more than one sample has been measured, how has the spectral data been selected that is being submitted?

Not applicable / One sample selected / All samples averaged /
Other (specify) _____

Has the data been treated in any other way after the measurement? Please specify:

Signature

Name: _____

Date _____

For NFRC Certification only (contact NFRC for certification information):

I certify that the spectral data submitted to Lawrence Berkeley National Laboratory for inclusion in the International Glazing Database (IGDB) has been measured in accordance with the National Fenestration Rating Council (NFRC) document 302, "Verification Program for Optical Spectral Data".

Signature

Name: _____

Date _____

¹ For example: Two files can simply be "joined", or, if the measured wavelength regions of the two apparatuses partly overlap, the data can be averaged in the overlapped region.

**APPENDIX B. NFRC PRODUCT CERTIFICATION PROGRAM
GLAZING SUPPLIER DATA SHEET**

NFRC 302-2004

**NFRC Product Certification Program
Glazing Supplier Data Sheet**



1. Name of Glazing Supplier: _____
2. Technical Contact: _____
Phone: _____ Fax: _____
Email address: _____
3. Spectral Data Review Contact: _____
Phone: _____ Fax: _____
Email address: _____
4. Marketing Contact: _____
Phone: _____ Fax: _____
Email address: _____
5. Billing Contact: _____
Phone: _____ Fax: _____
Email address: _____
6. Mailing Address _____
Address: _____
City: _____ State: _____ Zip Code: _____
Country: _____
Date: _____

Note: Please resubmit form if a change occurs to the above information.

**APPENDIX C. NFRC SPECTRAL DATA CERTIFICATION
PROGRAM
GLAZING SUPPLIER DATA MEASUREMENT
LOCATION INFORMATION**

NFRC 302-2004

**NFRC Spectral Data Certification Program
Glazing Supplier Data Measurement
Location Information**

1. Name of Glazing Supplier _____

2. Please check the line that applies.

a. Glazing Data submitted for NFRC Certification is measured in-house. (If measured in-house submit the information about the procedure and equipment used. Also submit the equipment calibration information to NFRC)

b. Glazing Data submitted for NFRC Certification is measured at a commercial lab or at another facility.

If (b) applies, please provide the following info:

Name of Lab: _____

Contact Name: _____

Address: _____

Phone: _____

Fax: _____

Signature: _____

Note: Please resubmit form if a change occurs to the above information.

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