Window Certifications: What’s In A Label?

A Brief Look at Window Certification Programs of Relevance To Passive House Design in the US

Prepared by Alison Ray of Alpen HPP
For the North American Passive House Conference October 19, 2013
OVERVIEW

- Introduction
- Why Certify?
- Structural Performance Certifications
- Thermal Performance Certifications
- Passive House Certifications
- Other Window Certifications
- Closing Thoughts: Open Discussion
WHY CERTIFY?

- Accurate, Useable Performance Data
- Product Comparison
- Validation
- Code Compliance
- Manufacturer Credibility
- Quality Assurance
  - Energy Efficiency & Comfort
  - Durability & Longevity
  - Purchase guarantee
  - Occupant safety and well being

Certifications can serve as assurance of performance, providing designers and homeowners freedom to focus on other valuable elements like color, style and material use.
STRUCTURAL PERFORMANCE
STRUCTURAL PERFORMANCE

Commonly refers to:

- Performance Grade (R, LC, CW, AW)
- Design Pressure
- Air Infiltration Resistance
- Water Infiltration Resistance
- Deflection – CW & AW only

New to 2012 IRC/IBC: All fenestration products must be AAMA/WDMA/CSA 101/A440-11 tested and labeled

Sample image of physical testing (www.officinetosani.com)
STRUCTURAL CERTIFICATIONS: NORTH AMERICA

- US & Canada:
  - North American Fenestration Standard
  - AAMA including Gold Label
  - WDMA including Hallmark
  - CSA A440

Purpose: to establish and provide a material-neutral metric for rating window durability, safety, strength and longevity in service.
BEHIND A STRUCTURAL PERFORMANCE LABEL: AAMA GOLD EXAMPLE

AAMA Gold Label

- Manufacturing/Plant Controls
  - Plant Inspections (2x per year)
    - Quality Assurance Program Inspection
    - Verified Component Compliance Review
    - IG Certification Prog. Reqmmts
  - Equipment Calibration

- Physical Testing
  - Full Window
    - Initial Test (every type, every class)
    - Random In-Line Product Testing (during audits or mfr. QC prog. cycle)
    - Renewal Certification (every 4 years)
  - Components Testing
    - Verified Component Database (suppliers)
    - IG Certification ASTM E 2190 (by window mfg. or IG supplier)

- Thermal Certification
  - NFRC Certification
    - Simulation
    - Full-Window Physical Test (every 4 years)

Quality Assurance

- Quality Control
  - Quality Assurance Program Inspection
  - Verified Component Compliance Review
  - IG Certification Prog. Reqmmts

Equipment Calibration

Verified Component Database (suppliers)

IG Certification ASTM E 2190 (by window mfg. or IG supplier)
Passive House:
- Applicable code-required certifications/performance classifications (could utilize AAMA/CSA/WDMA testing)
- Physical testing of actual installed windows
  - Blower Door
  - Infrared Camera
  - PHIUS+ & PHI Rater Inspection Checklists
- Others?
THERMAL PERFORMANCE
Describes:
- Energy Efficiency & Comfort
- Function of Heat Loss/Heat Gain

Measured by:
- U-Value (R-Value)
- Solar Heat Gain Coefficient
- Visible Light Transmission
- Condensation Resistance
- Air leakage
United States

- NFRC
  - NFRC Rating System (1989)
  - Whole Window
  - Standardized sizes, vary by type
    - Fixed/Picture: 47” x 59”
    - Casement: 24” x 59”
  - Required for IBC, IRC, IECC code
  - To claim higher-than-default-table perf
  - Simulation and Physical Testing
  - ISO 15099 / NFRC 100-2010
  - 2010: Mandatory IG Certification
“Regardless of chosen compliance path, the following fenestration energy properties are critical for compliance with the code: U-factor, solar heat gain coefficient (SHGC), air leakage, and possibly visible transmittance.

These properties must be provided as certified ratings determined by independent laboratories in accordance with National Fenestration Ratings Council (NFRC) standards. “


www.commercialwindows.org
Canada

- CWDMA
  - CSA A440.2 (NFRC also recognized)
  - Whole-Window Energy Rating (ER)
  - Standardized Sizes, Vary by Type
  - Limited Building Code Requirements
    Thermal certification not mandatory in most jurisdictions
  - IG Testing Optional
  - ISO 15099 / NFRC 100-2010

- Label includes both thermal and structural performance information
THERMAL CERTIFICATIONS PROGRAMS

- European Union
  - BFRC
    - Window Energy Rating System (EWERS) – Est. 2001
    - Whole Window Energy Properties, Standard Sizes by Type
    - EN 10077, EN 673
  - Traffic-light style rating system for consumers shows estimated energy loss per year
  - Advocates selection of high SHGC windows

Image from: http://www.bfrc.org/consumer/
THERMAL CERTIFICATIONS: PASSIVE HOUSE

Passive House

- PHI & PHIUS
  - Based on Component, Whole Window and Installed Performance
  - Whole-window performance, same size for all window types – casement and picture window same
  - Simulation only (cost-sensitive approach)
  - EN 10077, EN 673, PHI and PHIUS procedural docs

- Provides validated component performance data for PHPP/WUFI
  - PHI or PHIUS window certification are not prerequisite for whole-building Passive House Certification

Image from Passive House Institute: http://www.passivhaustagung.de/Passive_House_E/window_U.htm
THERMAL PERFORMANCES: DIFFERENCES STANDARDS, DIFFERENT RESULTS

- Thermal (U-value) differences well documented
- Ongoing international/inter-agency collaborative effort toward crossover programs

A Tale of Two Rating Systems: NFRC & PHI window testing protocols
Apples to apples?

Can the North American Window Industry Collaborate to Jump Start the Effort?

- We compete respectfully but aggressively and can continue to do so
- We absolutely can not share competitive information obviously
- Possibly through the use of third party simulating firms, we can agree on training, process, format for presentation of information
- Through coordination with PHIUS, perhaps we can define a North American certification process
- May include NA modification to add and explain NFRC data to NA certification to avoid possibility of consumer confusion

Discrepancies Between ISO Window Simulation Standards

Low-e (soft coat) Triple Glazing:

Discrepancies Between ISO Window Simulation Standards, November 23, 2005, by Charlie Curcija, University of Massachusetts, Center for Energy Efficiency and Renewable Energy (currently Scientist, LBNL)
BEHIND A THERMAL PERFORMANCE LABEL: NFRC EXAMPLE

Certified Products Directory

NFRC

Inspection Agency (IA)
AAMA | WDMA | NAMI

Simulation/Modeling

Factory Control Programs
Product Data, QC Assurance, Labels, Component Supplier List, Inspections

Physical Testing

Whole-Window Thermal Validation Test

Insulated Glazing Unit (IG) Testing

Approved/Certified 3rd Party Test Facility

Approved/Certified 3rd Party Test Facility

Simulation Lab
Independent/3rd Party

LBL / IGDB: Glazing

NFRC Certified Material Database

Component Suppliers/Vendors

(IGCC/IGMA frequent in commercial specs)
NFRC IG CERTIFICATION PROGRAM

- 2010 - NFRC 706: Mandatory use of independently tested and certified IGs

- Testing and Inspections – *Rigorous, Thorough* and *Frequent*

- Manufacturer Responsibilities
  - Pass bi-annual in-plant inspections
  - Maintain documented, inspected quality assurance programs
  - Follow all requirements for proper labeling and reporting

- Physical testing every 2-years – IG durability and gas containment
  - EG: ASTM E 2190 (among other standard tests)

Images from Northeast Window & Door Association, “Insulating glass units and how they fail testing.” www.nwda.net/presentations/10%20QC%20Fill%20Rate.pdf
ASTM E 2190 is a harmonized standard test protocol adopted by the U.S. and Canada for evaluating insulating glass (IG) performance, durability, and longevity. There are three main parts to the standard:

- **High Humidity Test** subjects samples to high humidity and temperature with the objective of forcing moisture into the sealed air space in an IG unit. Specimens are tested for 42 days and subjected to 95% ±5% relative humidity.

- **Accelerated Weather Cycling** simulates weather cycling from hot to cold extremes with moisture added during the hot cycle. Specimens are tested for 63 days and subjected to 252 cycles.

- **Volatile Fog Test** shows that components, or trapped impurities, will not out-gas a volatile fog, which could result in a deposit on the interior glass surface. No fog must be visible at arm's length.
Even if NFRC ratings are not required on a project, the IG Certification program provides consumers with assurances that insulated glazing units have been tested and manufactured to meet rigorous quality standards.
“The use of high quality building components [like those in the Certified Passive House Component Database] is key, but simply using Passive House suitable components does not make a building a Passive House.”

-”Passive House Certification Criteria,” IPHA
  http://www.passivehouse-international.org/index.php?page_id=150
THERMAL CERTIFICATIONS: PASSIVE

- Passive House
  - PHI & PHIUS
    - Based on Component, Whole Window and Installed Performance
    - Whole-window performance, same size all types
    - Simulation only (cost-sensitive approach)
    - EN 10077, EN 673, PHI and PHIUS procedural docs

- Provides validated component performance data for PHPP/WUFI
  - PHI or PHIUS window certification are not prerequisite for whole-building Passive House Certification
Certified Passive House Component

- Simulation and review/validation
- PHI provides consultation assistance and simulation of design variants
- Publishes results in clear, concise certificate including window, frame, spacer and installation U-values
- Product listing on Passive House Institute website component database

Minimum performance requirement:

- \( U_w > 0.80 \)
- \( U_{w,\text{install}} > 0.85 \)

Certified windows mostly European
5 Classification of regions with equivalent requirements (glazing and transparent components)

<table>
<thead>
<tr>
<th>Region No.</th>
<th>Region Description</th>
<th>Cities</th>
<th>Recommended Glazing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arctic</td>
<td>Tromso, Murmansk, Novosibirsk, Magadan</td>
<td>Vacuum low-e</td>
</tr>
<tr>
<td>2</td>
<td>Cold</td>
<td>Anchorage, Calgary, Regina, Winnipeg, Quebec, Halifax, Reykjavik, Oslo, Stockholm, Warszawa, Kiev, Moscow, Ekaterinburg, Urumqi, Yinchuan, Harbin, Ushuaia (AR)</td>
<td>Quadruple glazed low-e</td>
</tr>
<tr>
<td>4</td>
<td>Warm-temperate</td>
<td>San Francisco, Los Angeles, Albuquerque, Juarez, Chihuahua, Casablanca, Lisbon, Porto, Bilbao, Toulouse, Marseille, Corrisc, Sardegna, Sicily, Aqaba, Gaza, Kathmandu, Guilin, Quanzhou, Elizabeth, Melbourne (Southern Australia), Wellington (NZ Northern Island), Santiago (CL), Antofagasta (CL), Buenos Aires (AR)</td>
<td>Double glazed low-e</td>
</tr>
<tr>
<td>5</td>
<td>Warm</td>
<td>Campala (Lake Victoria), Hawassa (ET), Johannesburg, Hawaii, Mexico City, Zinacatecas, Taron, Minatova, Oquito, Trujillo</td>
<td>Double glazed</td>
</tr>
<tr>
<td>6</td>
<td>Hot</td>
<td>Mataram (MM), Varacruz (MM), Palm Bay, Maiami, Homestead, Havana, Caparazon (VZ)</td>
<td>Double glazed</td>
</tr>
</tbody>
</table>
An industry leading European uPVC window manufacturer with Passive House certifications on some of their lines has undergone certification and simulations to both PHPP and NFRC rating formats. This offers a unique opportunity for comparative study of both U-value and SHGC differences between results when modeled to different standards/conditions.

| Operator Type: DATT | Air Leakage: - |

**RATINGS INFORMATION**

Export to Excel

<table>
<thead>
<tr>
<th>CPD #</th>
<th>Manufacturer Product Code</th>
<th>U-factor</th>
<th>SHGC</th>
<th>VT</th>
<th>Condensation Resistance</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WWW-M-2-00003-00001</td>
<td>4mm ClimaGuard Premium/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium</td>
<td>0.17</td>
<td>0.31</td>
<td>0.46</td>
<td>77</td>
<td>Vinyl w/ All Members Reinforced/Vinyl w/ All Members Reinforced, Fill 1: ARG/AIR (90/10), Fill 2: ARG/AIR (90/10), LowE, CL, No Grid</td>
</tr>
<tr>
<td>WWW-M-2-00003-00002</td>
<td>6mm SunGuard SuperNeutral 70/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium</td>
<td>0.17</td>
<td>0.23</td>
<td>0.41</td>
<td>77</td>
<td>Vinyl w/ All Members Reinforced/Vinyl w/ All Members Reinforced, Fill 1: ARG/AIR (90/10), Fill 2: ARG/AIR (90/10), LowE, CL, No Grid</td>
</tr>
<tr>
<td>WWW-M-2-00003-00003</td>
<td>6mm ClimaGuard Premium/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium</td>
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<td>Vinyl w/ All Members Reinforced/Vinyl w/ All Members Reinforced, Fill 1: ARG/AIR (90/10), Fill 2: ARG/AIR (90/10), LowE, CL, No Grid</td>
</tr>
<tr>
<td>WWW-M-2-00003-00004</td>
<td>6mm SunGuard SuperNeutral 51/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium</td>
<td>0.17</td>
<td>0.16</td>
<td>0.29</td>
<td>77</td>
<td>Vinyl w/ All Members Reinforced/Vinyl w/ All Members Reinforced, Fill 1: ARG/AIR (90/10), Fill 2: ARG/AIR (90/10), LowE, CL, No Grid</td>
</tr>
</tbody>
</table>

Image from NFRC Certified Product Database: www.nfrc.org
Minimum performance requirement:
- $U_w > 0.80$
- $U_w, \text{install} > 0.85$

PHI currently only offers certification for arctic, cold and cold-temperate climates

Simulation procedure and acceptance criteria is a completely different language, method and approach compared to North American programs

Simulation software based on BISCO and WinDat - common to Europe

No opportunity to re-use simulated filesets derived from NFRC cert. process

These factors may contribute to the lack of participation by North American window manufacturers: the program may be perceived as inaccessible, foreign, or too complex/confusing to be appealing or encourage participation. Perhaps the market value is also perceived to be too small?
The initial goal is to calculate and make available valid thermal performance parameters for US windows so that designers have more choices and can do building energy models with more confidence in their accuracy.
- PHIUS-trained simulators model and calculate
- PHIUS administrators (at first) and simulator peer-review validate results
- Certificate issued for each window type, frame and glazing combination
- 3 paths for psi-install incl. disclosure/publication of verified THERM models
Based on LBL WINDOW and THERM software familiar to US manufacturers and modelers

Encouraging exploration of NFRC crossover program opportunities
Wright 2012 conference paper: to “demyistify” simulation procedure following PHI and LBL docs

PHIUS Program = Critical asset and survival tool for the confused and overwhelmed North American window manufacturer
Alpen HP was the first North American window manufacturer to complete the certification program. As recent as Monday this week, Alpen HPP received and posted additional certificates for its 925 and 725 Series windows.

There are now 5 North American window manufacturers who have won certification:
- Alpen HPP (CO)
- Northwin (Vancouver)
- Marvin Window & Doors (MN)
- Casagrande Woodworks (CA)
- Wooden Window Inc. (CA)

And we hope that the list keeps growing!
OTHER NOTEABLE WINDOW CERTIFICATION PROGRAMS
Energy Star and NRCan
- Extremely well-recognized throughout the US and Canada, basis for multiple incentives and rebate programs. Although we are “beyond Energy Star” the value of its brand recognition alone may merit participation.

LEED
- No window-specific certification but windows can contribute in several categories. LEED modeling draws largely from NFRC whole-window performance values.

Living Building Challenge
- Fastidious documentation of material composition of every individual element of a window. Notable for its purity in purpose, may be challenging for very high performance windows to achieve.

NFRC’s Component Modeling Approach (CMAST)
- Valuable simulation program for rating performances of assemblies created from multiple supplier components
- Simulation-only approach is cost-conscious and best suited to respond to increasing use of multi-supplier window assemblies, like commercial windows (frame, glass from others)

Hurricane/Impact Test Certifications
- Increasingly important in light of IECC 2012 revised wind maps
CONCLUDING THOUGHTS: OPEN DIALOGUE

Topics I didn’t cover but would have liked to:

- Impact of standard size on overall window performance
  - NFRC Label shows full-frame performance, SHGC and TVIs deceptively low
  - How would Passive House windows with very-wide frame/sash dimensions perform if constrained to the 24”x59” test size?

- SHGC: when the battleground is in the second-decimal place arena, is it a fight worth fighting?
  - Dirt, grime and pigeon poop diminish SHGC
  - SHGC can be shifted +/- 0.02 simply by changing glass thickness or choosing a supplier of clear float glass vs. default value, or even changing RADIANCE simulation standard settings (EN 673 / ISO 10097)
  - Tempering and SHGC: tempering does not require special simulation inputs, does not alter the physical properties of the basic float glass, does it have any measurable impact at all?
What have I overlooked?

Can we learn anything from European structural or IG testing?

Is European IG testing & certification similar in style and scope to IGCC/IGMA ASTM E 2190?

How does Passive House engage the structural performance certification component? Are certifications like AAMA Gold important?

What ways might redundancy among certification programs be reduced or streamlined to reduce cost and headache?

What window certifications or performance ratings are most important to the Passive House approach?

Are any of these certifications valuable? How can we present them in the most meaningful way to Passive House designers?