ALPEN
CLEAR PERFORMANCE

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

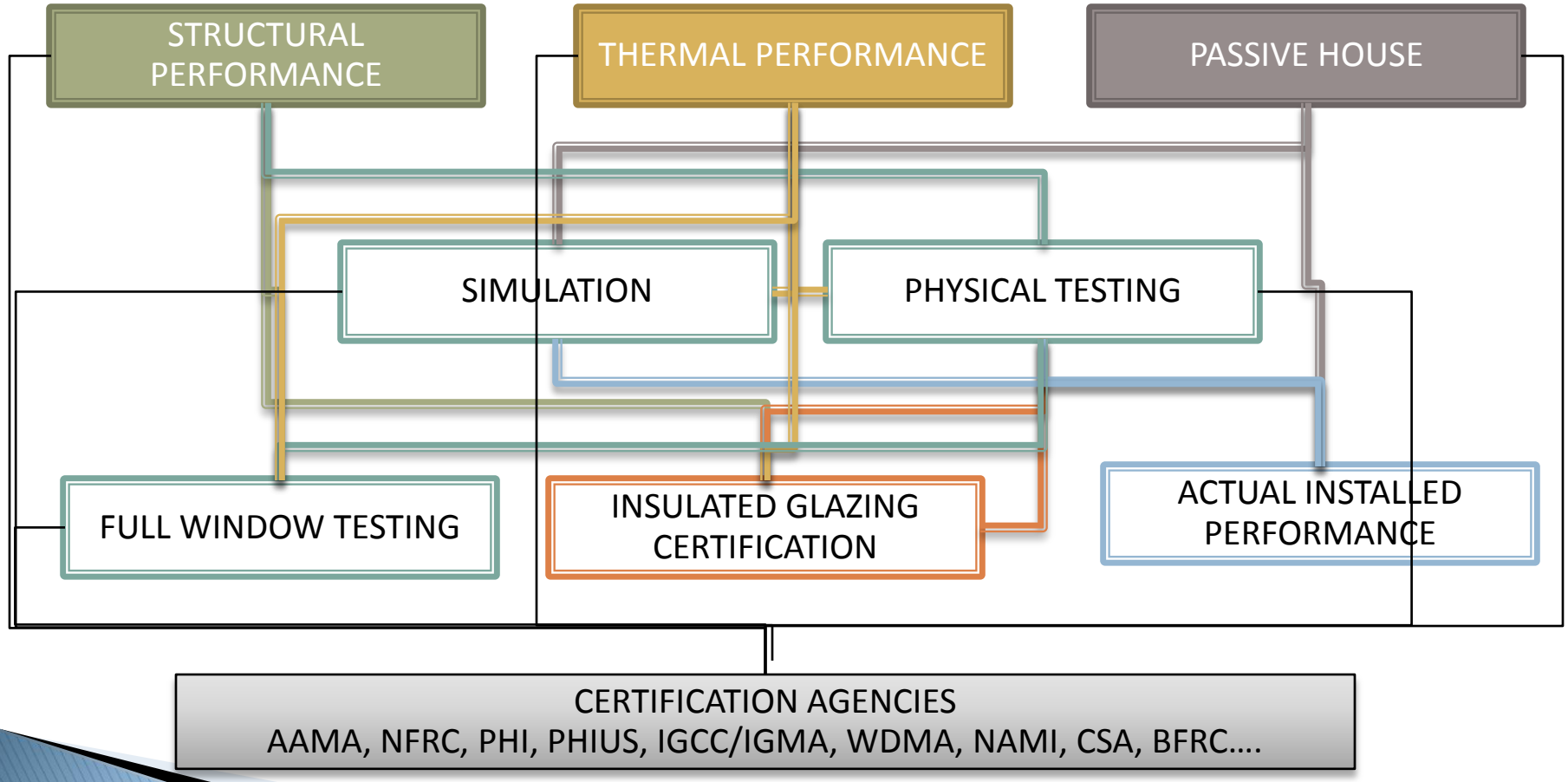
- Introduction
- Why Certify?
- Structural Performance Certifications
- Thermal Performance Certifications
- Passive House Certifications
- Other Window Certifications
- Closing Thoughts: Open Discussion

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*

PRESENTATION OVERVIEW



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

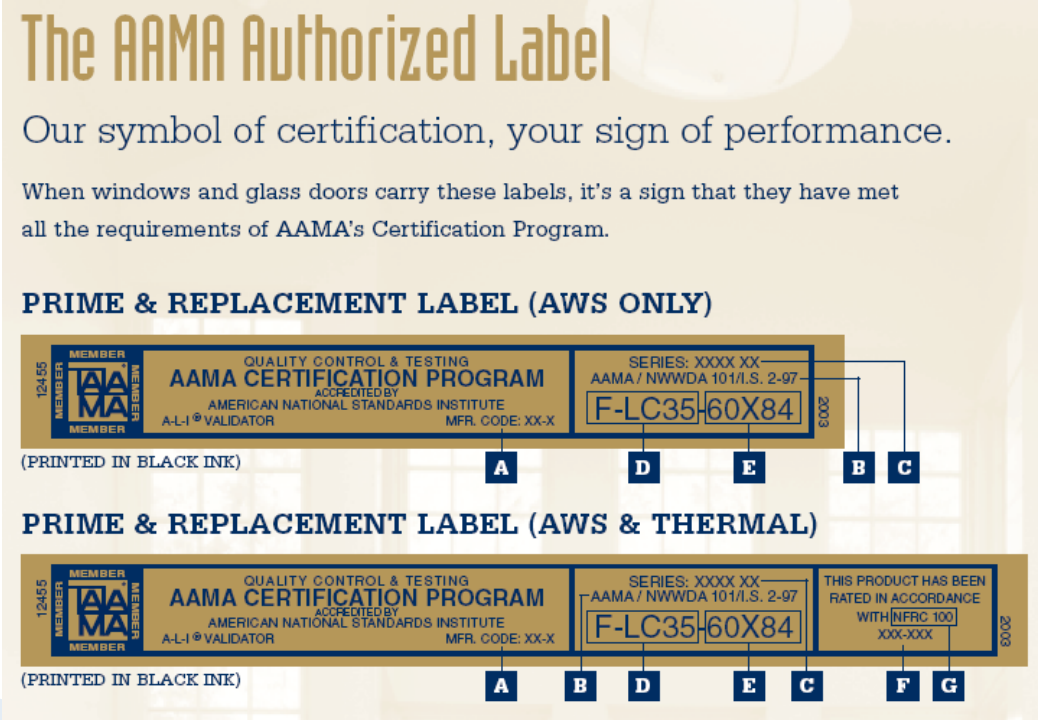
New to 2012 IRC/IBC: All fenestration products must be ***AAMA/WDMA/CSA 101/A440-11*** *tested and labeled*

Sample image of physical testing (www.officinetosani.com)

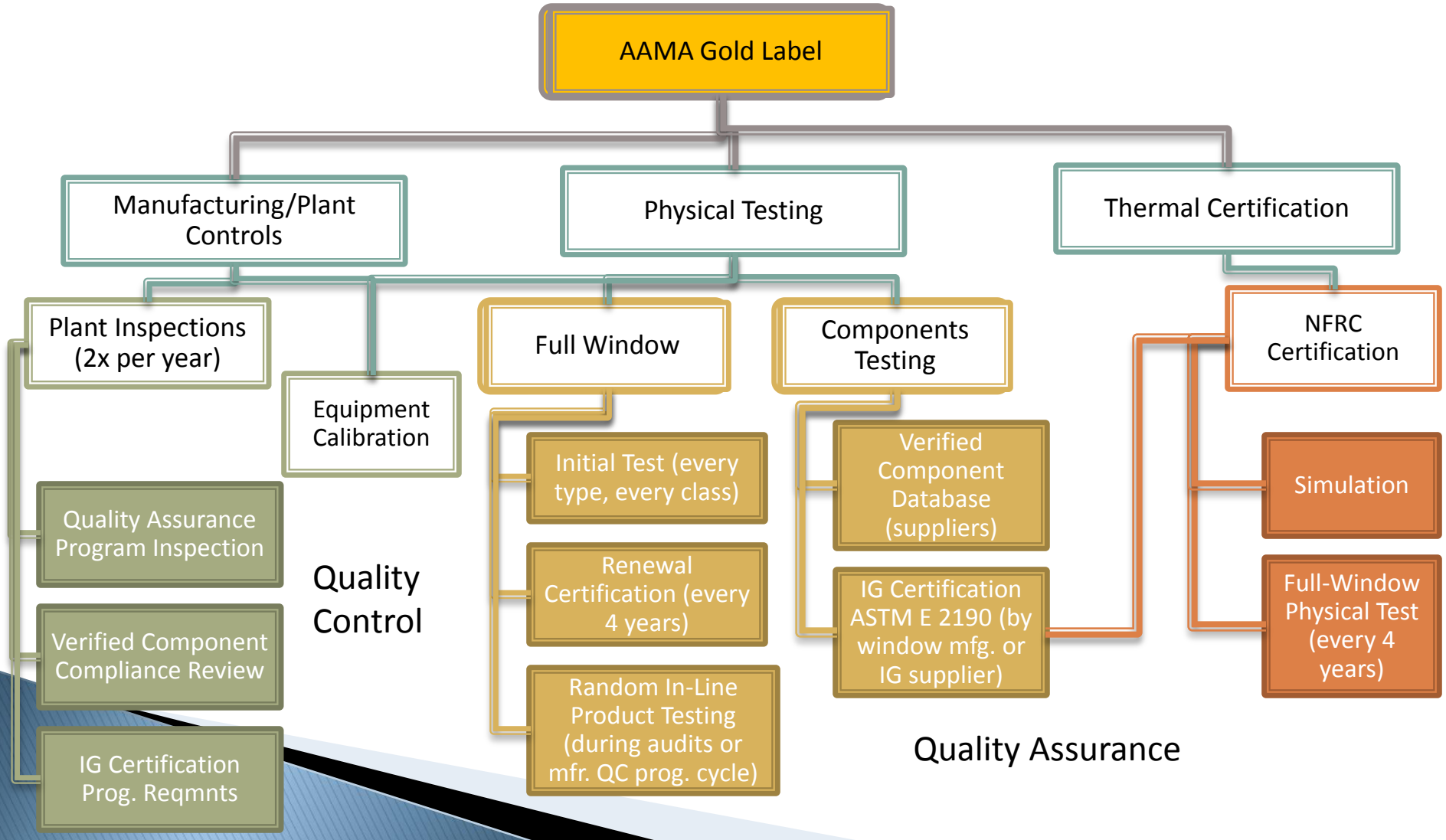
STRUCTURAL CERTIFICATIONS: NORTH AMERICA

- 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.

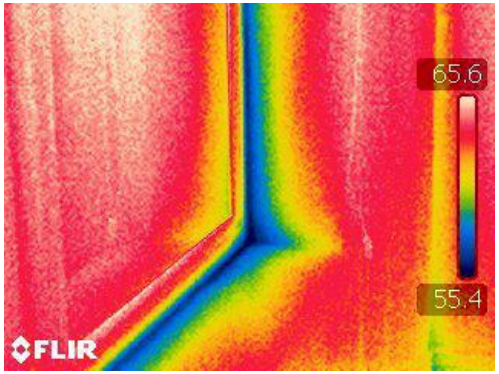


BEHIND A STRUCTURAL PERFORMANCE LABEL: AAMA GOLD EXAMPLE



STRUCTURAL PERFORMANCE: PASSIVE HOUSE

- 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

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*

THERMAL CERTIFATION: US

- United States
  - NFRC
    - NFRC Rating System (1989)
    - Whole Window
    - Standardized sizes, <u>vary by type</u>
      - 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

2012 IECC RESIDENTIAL PERSCRIPTIVE WINDOW REQUIREMENTS

"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.

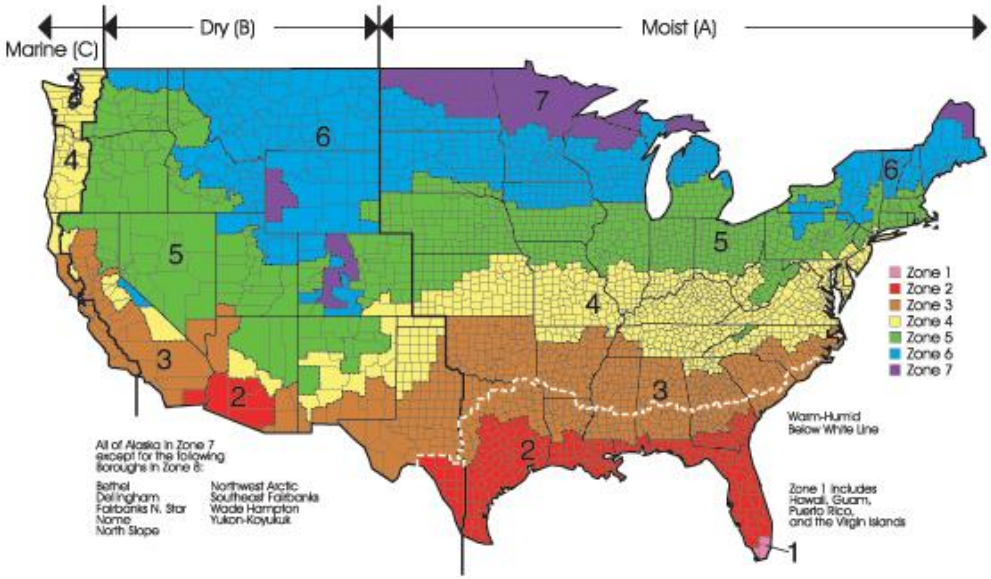
These properties **must be provided as certified ratings** determined by independent laboratories **in accordance with National Fenestration Ratings Council (NFRC) standards**. "

- "Windows for High Performance Commercial Buildings," University of Minnesota Center for Sustainable Buildings Research, 2013. www.commercialwindows.org

Residential Prescriptive Window Requirements in the 2012 IECC

Climate Zone	Window U-factor	Skylight U-factor	Window & Skylight SHGC
1	≤0.65	≤0.75	≤0.25
2	≤0.40	≤0.65	≤0.25
3	≤0.35	≤0.55	≤0.25
4 except Marine	≤0.35	≤0.55	≤0.40
5 & Marine 4	≤0.32	≤0.55	No Requirement
6	≤0.32	≤0.55	No Requirement
7 & 8	≤0.32	≤0.55	No Requirement

IECC Climate Zone Map



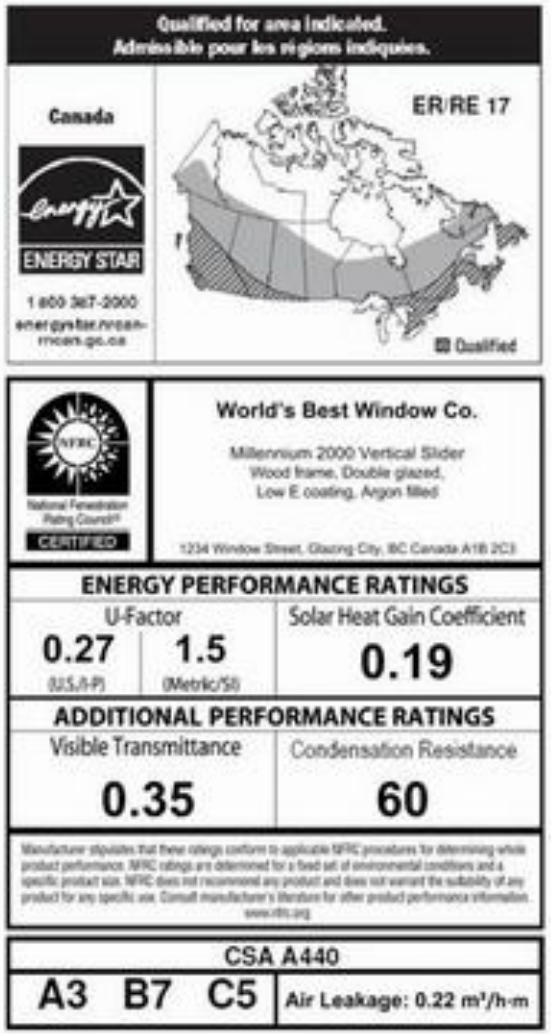
www.efficientwindows.org/standards_codeoverview.php

THERMAL CERTIFICATION: CANADA

- Canada
  - CWDMA
    - CSA A440.2 (NFRC also recognized)
    - Whole-Window Energy Rating (ER)
    - Standardized Sizes, Vary by Type
    - Limited Building Code Requirements

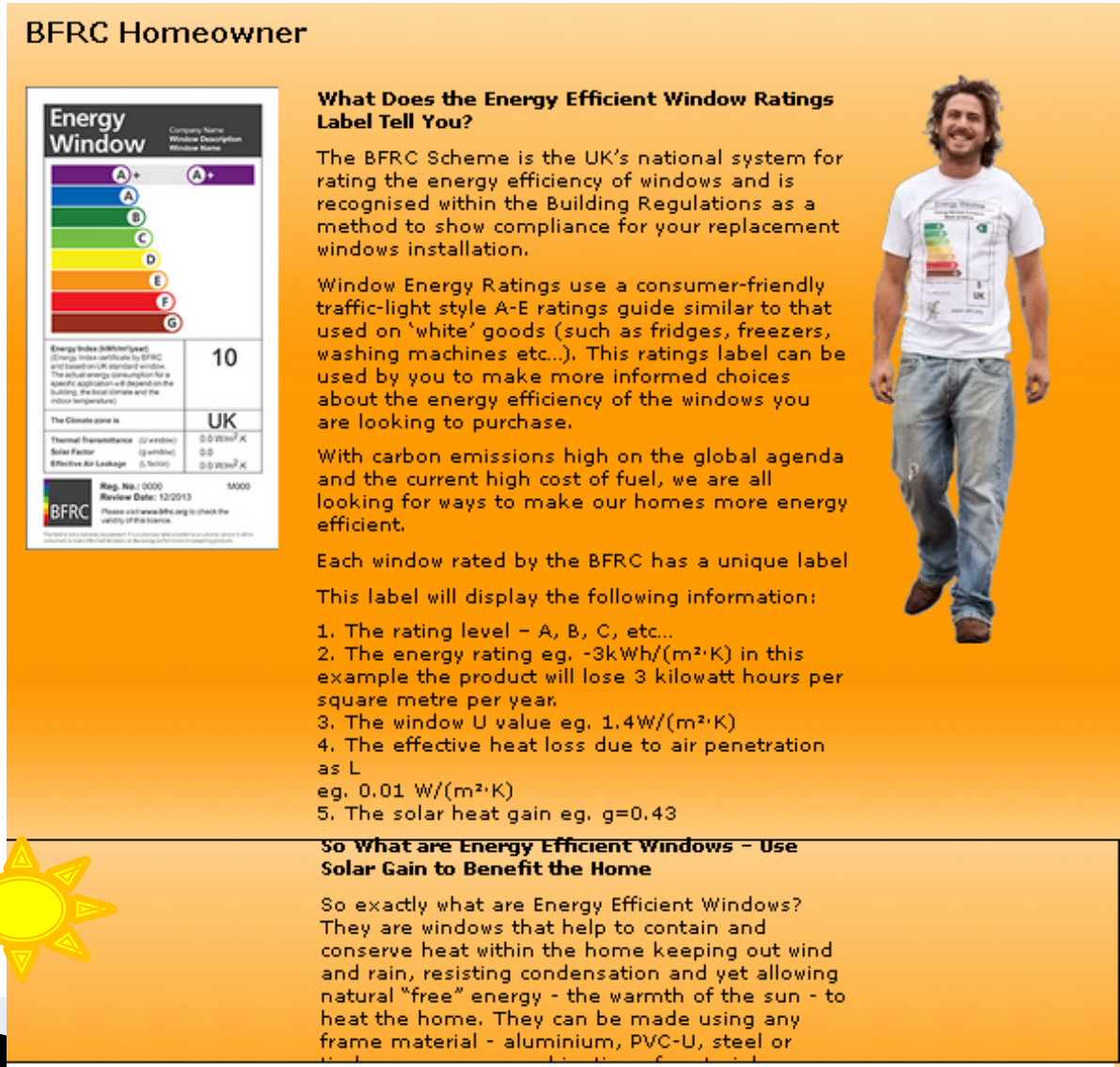
      Thermal certification not mandatory in most jurisdictions
    - IG Testing Optional
    - ISO 15099 / NFRC 100-2010

    - 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



BFRC Homeowner

What Does the Energy Efficient Window Ratings Label Tell You?

The BFRC Scheme is the UK's national system for rating the energy efficiency of windows and is recognised within the Building Regulations as a method to show compliance for your replacement windows installation.

Window Energy Ratings use a consumer-friendly traffic-light style A-E ratings guide similar to that used on 'white' goods (such as fridges, freezers, washing machines etc...). This ratings label can be used by you to make more informed choices about the energy efficiency of the windows you are looking to purchase.

With carbon emissions high on the global agenda and the current high cost of fuel, we are all looking for ways to make our homes more energy efficient.

Each window rated by the BFRC has a unique label

This label will display the following information:

1. The rating level – A, B, C, etc...
2. The energy rating eg. -3kWh/(m²·K) in this example the product will lose 3 kilowatt hours per square metre per year.
3. The window U value eg. 1.4W/(m²·K)
4. The effective heat loss due to air penetration as L
eg. 0.01 W/(m²·K)
5. The solar heat gain eg. g=0.43

So What are Energy Efficient Windows – Use Solar Gain to Benefit the Home

So exactly what are Energy Efficient Windows? They are windows that help to contain and conserve heat within the home keeping out wind and rain, resisting condensation and yet allowing natural "free" energy - the warmth of the sun - to heat the home. They can be made using any frame material - aluminium, PVC-U, steel or

Image from:
http://www.bfrc.org/consumer/

THERMAL CERIFICATIONS: PASSIVE HOUSE

- Passive House
  - PHI & PHIUS
    - Based on Component, Whole Window <u>and</u> Installed Performance
    - Whole-window performance, <u>same</u> 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 **<u>not</u>** prerequisite for *whole-building* Passive House Certification

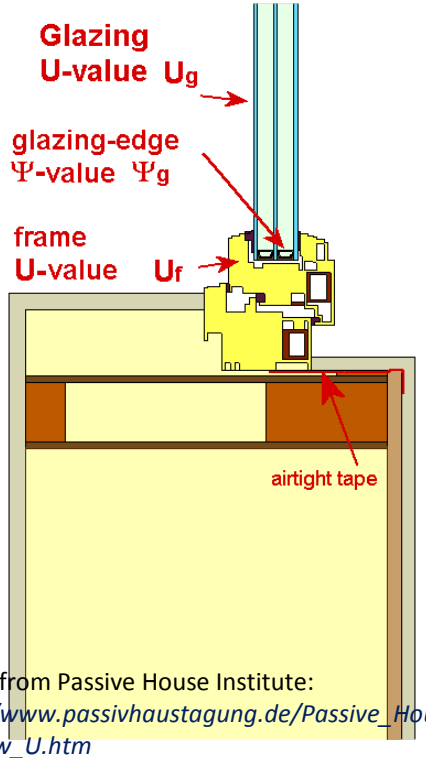


Image from Passive House Institute: *http://www.passivhaustagung.de/Passive_House_E/window_U.htm*

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?

First draft presented at:
Passive House California Mtg.
October 23, 2011
Published: Nov.22, 2011

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

Windows Roundtable
2010 Passive House Conference

Brad Begin
Serious Materials
November 5, 2010

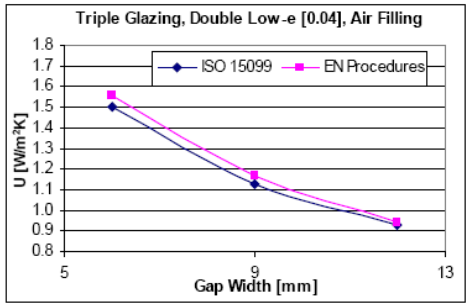
UNIVERSITY OF MASSACHUSETTS AMHERST
Mechanical and Industrial Engineering Department
Center for Energy Efficiency and Renewable Energy
Engineering Laboratory Building • 160 Governors Dr. Tel: 413-545-4454 Fax:413-545-1027
Amherst, MA 01003-9265 web: www.ceere.org email: curcija@ceere.org

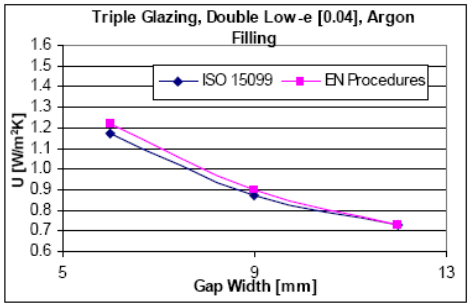
ISO/TC 163/SC 2/WG 9 N 176

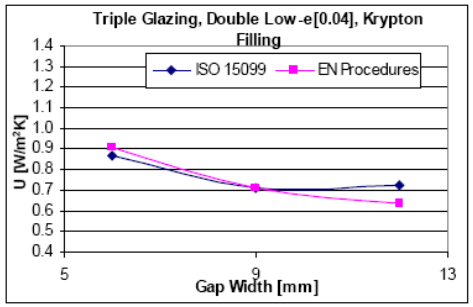
DISCREPANCIES BETWEEN ISO WINDOW SIMULATION STANDARDS

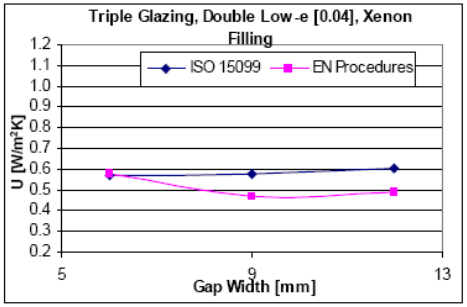
By: Charlie Curcija
Date: November 23, 2005

Low-e (soft coat) Triple Glazing:



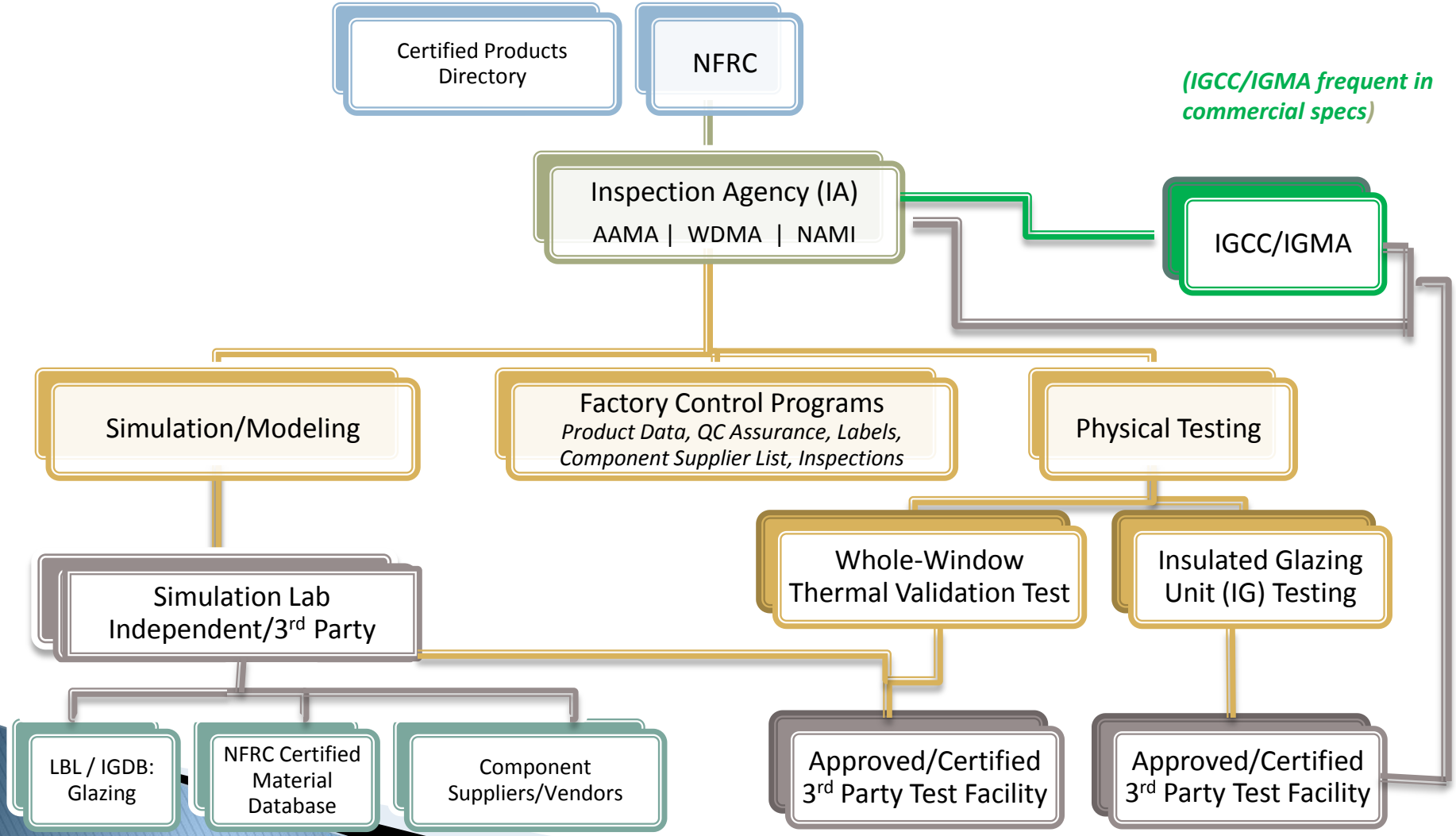






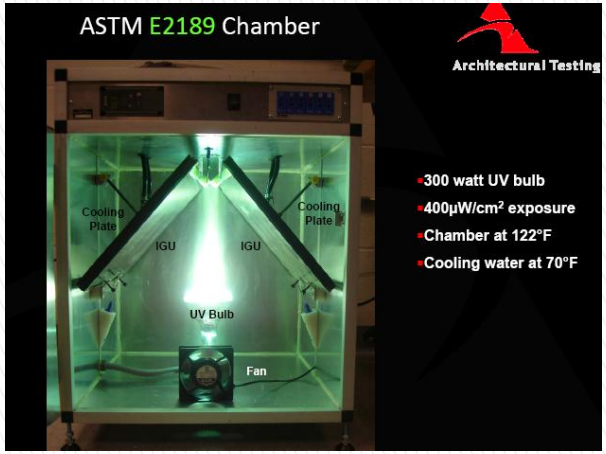
Discrepancies Between ISO Window Simulation Standards, November 23, 2005, by Charlie Curcija, University of Massachusetts, Center for Energy Efficiency and Renewable Energy (currently Scientist, LBNL)

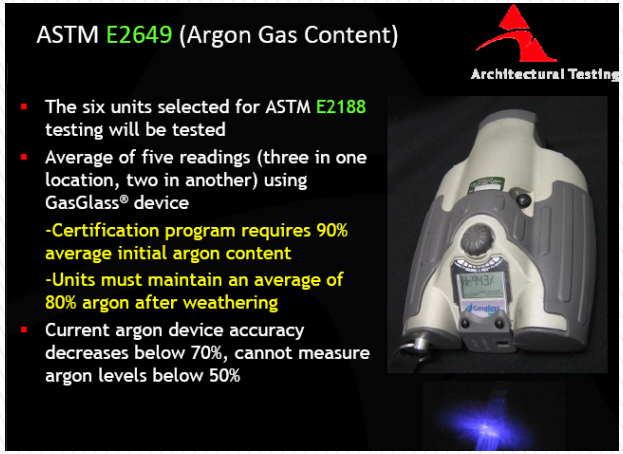
BEHIND A THERMAL PERFORMANCE LABEL: NFRC EXAMPLE

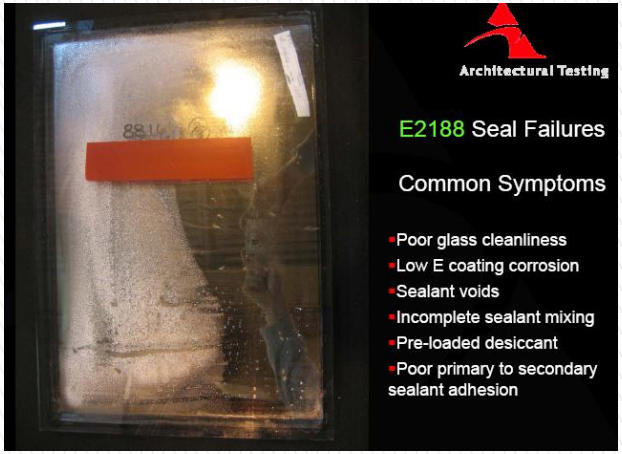


NFRC IG CERTIFICATION PROGRAM

- 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*

IG CERTIFICTION ASTM E 2190

- 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

IG TESTING & CERTIFICATION

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.

PASSIVE HOUSE

"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."

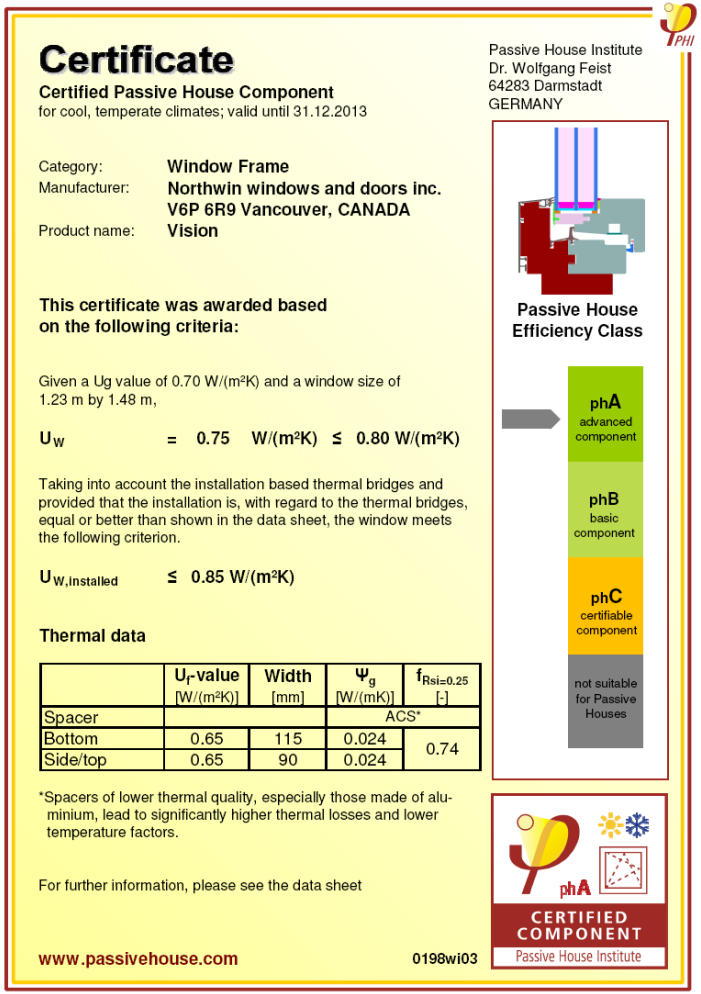
-"Passive House Certification Criteria," IPHA
http://www.passivehouse-international.org/index.php?page_id=150

THERMAL CERIFICATIONS: PASSIVE

- Passive House
  - PHI & PHIUS
    - Based on Component, Whole Window <u>and</u> 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 **<u>not</u>** prerequisite for *whole-building* Passive House Certification

PASSIVE HOUSE INSTITUTE (PHI)



Certificate

Certified Passive House Component
for cool, temperate climates; valid until 31.12.2013

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Category: **Window Frame**
Manufacturer: **Northwin windows and doors inc. V6P 6R9 Vancouver, CANADA**
Product name: **Vision**

This certificate was awarded based on the following criteria:

Given a Ug value of 0.70 W/(m²K) and a window size of 1.23 m by 1.48 m,

U_W = 0.75 W/(m²K) ≤ 0.80 W/(m²K)

Taking into account the installation based thermal bridges and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the window meets the following criterion.

$U_{W,installed}$ ≤ 0.85 W/(m²K)

Thermal data

	U_f-value [W/(m²K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			ACS*	
Bottom	0.65	115	0.024	0.74
Side/top	0.65	90	0.024	

*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

For further information, please see the data sheet

www.passivehouse.com 0198wi03

Passive House Efficiency Class

phA advanced component
phB basic component
phC certifiable component
not suitable for Passive Houses

CERTIFIED COMPONENT
Passive House Institute

This year Northwin Windows became one of the first North American window manufacturers to complete certification and become a Certified Passive House Component by PHI

Image from Passive House Certified Component Database, http://www.passiv.de/komponentendatenbank/en-EN

Certified Passive House Component

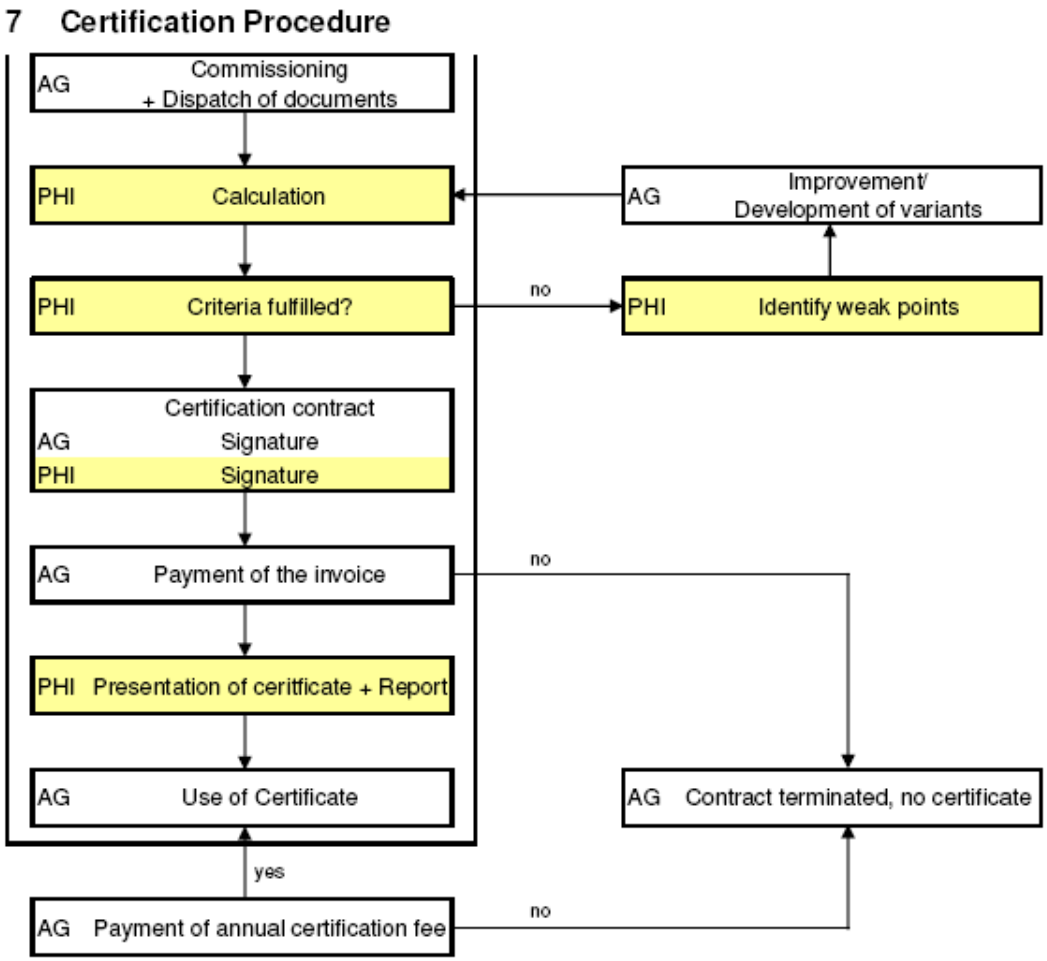
- Simulation and review/validation
- PHI provides consultation assistance and simulation of design variants
- Publishes results in clear, concise certificate including window, frame, spacer and installation U-values
- Product listing on Passive House Institute website component database

Minimum performance requirement:

- Uw > 0.80
- Uw,install > 0.85

Certified windows mostly European

PASSIVE HOUSE INSTITUTE
CERTIFICATION PROCESS FOR GLAZINGS AND TRANSPARENT COATINGS



PASSIVE HOUSE INSTITUTE
REGIONAL/CLIMATE-ZONE RECOMMENDATION

5 Classification of regions with equivalent requirements (glazing and transparent components)

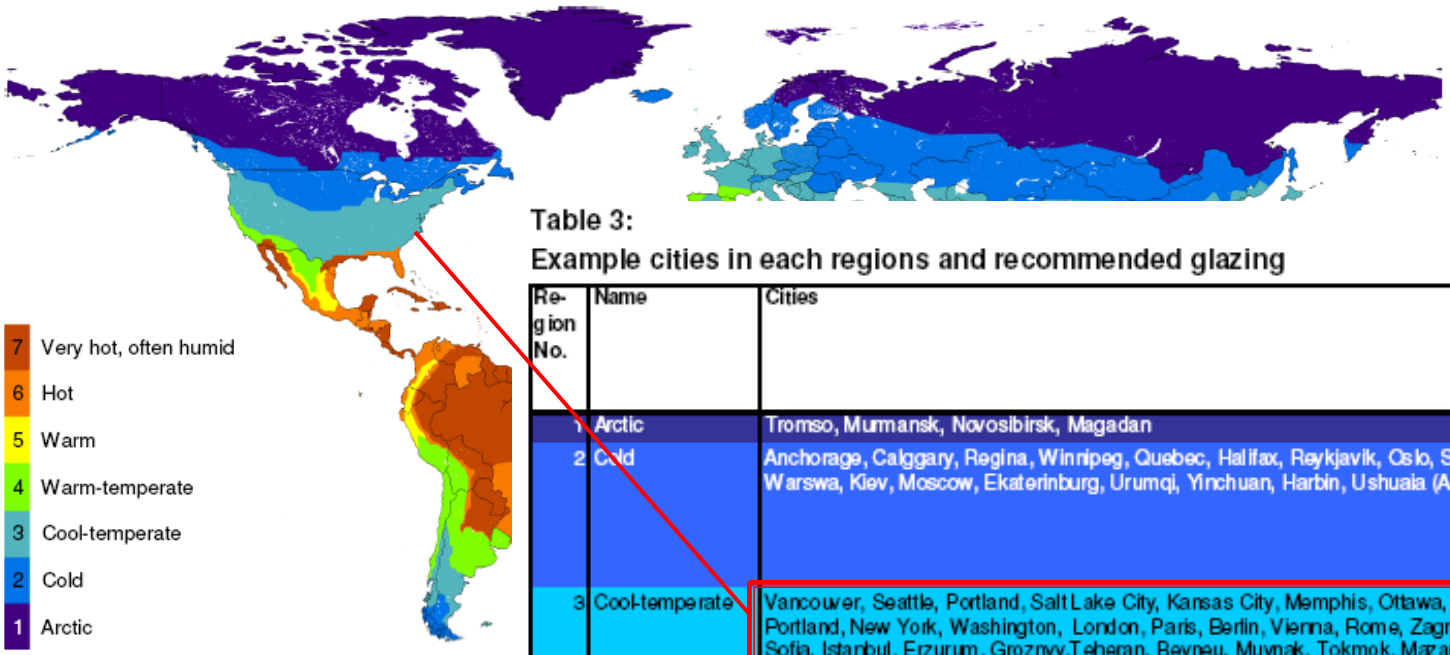


Figure 4: Classification of regions with equivalent re

Table 3:
Example cities in each regions and recommended glazing

Region No.	Name	Cities	Recommended glazing
1	Arctic	Tromso, Murmansk, Novosibirsk, Magadan	Vacuum low-e
2	Cold	Anchorage, Calggary, Regina, Winnipeg, Quebec, Halifax, Reykjavik, Oslo, Stockholm, Warswa, Kiev, Moscow, Ekaterinburg, Urumqi, Yinchuan, Harbin, Ushuaia (AR)	Quadruple glazed low-e
3	Cool-temperate	Vancouver, Seattle, Portland, Salt Lake City, Kansas City, Memphis, Ottawa, Montreal, Portland, New York, Washington, London, Paris, Berlin, Vienna, Rome, Zagreb, Budapest, Sofia, Istanbul, Erzurum, Groznyy, Teheran, Beyneu, Muynak, Tokmok, Mazari Sharif, Chengdu, Wuhan, Shanghai, Beijing, Seoul, Tokio, Christchurch (NZ South Island), Comooro Rivadavia AR, Rio Grande (AR), Conchi (CL)	Triple glazed low-e
4	Warm-temperate	San Francisco, Los Angeles, Albuquerque, Juarez, Chihuahua, Casablanca, Lisbon, Porto, Bilbao, Toulouse, Marseilles, Corsica, Sardinia, Sicily, Aqaba, Gaza, Kathmandu, Guilin, Quanzhou, Elizabeth, Melbourne (Southern Australia), Wellington (NZ Northern Island), Santiago (CL), Antofagosta (CL), Buenos Aires(AR), Vedna (AR), Cape Town (ZA), Post Elizabeth, Quthing	Double glazed low-e
5	Warm	Campala (Lake Victoria), Hawassa (ET), Johannesburg, Hawaii, Mexico City, Zcatecas, Torreon, Monclova, Quito, Trujillo	Double glazed
6	Hot	Matamoros (MX), Veracruz (Mx), Palm Bay, Maiami, Homestead, Havana, Caparazon (VZ),	Double glazed

Image from "Certification Criteria for Certified Passive House Glazings and Transparent Components," June, 2012. Passive House Institute . http://passiv.de/downloads/03_certification_criteria_transparent_components_en.pdf

SAMPLE PASSIVE HOUSE TRIPLE PANE WINDOW ACCORDING TO NFRC

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 **(Found 24 Products)**

Export to Excel

<< First < Previous Next > Last>>

CPD #	Manufacturer Product Code	U-factor	SHGC	VT	Condensation Resistance	Product Description
MWV-M-2-00003-00001	4mm ClimaGuard Premium/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium	0.17	0.31	0.46	77	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
MWV-M-2-00003-00002	6mm SunGuard SuperNeutral 70/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium	0.17	0.23	0.41	77	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
MWV-M-2-00003-00003	6mm ClimaGuard Premium/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium	0.17	0.31	0.46	77	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
MWV-M-2-00003-00004	6mm SunGuard SuperNeutral 51/ARG/4mm ExtraClear/ARG/4mm ClimaGuard Premium	0.17	0.16	0.29	77	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

Image from NFRC Certified Product Database: www.nfrc.org

PASSIVE HOUSE INSTITUTE (PHI)

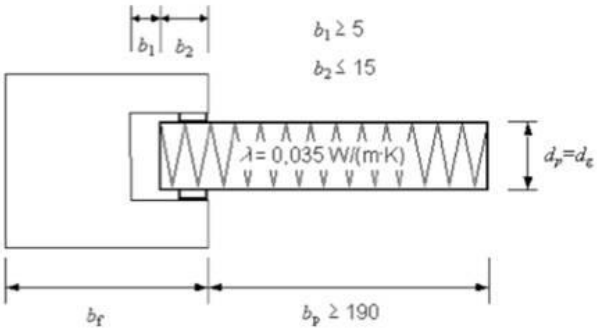


Figure C.1 — Profile section with panel installed

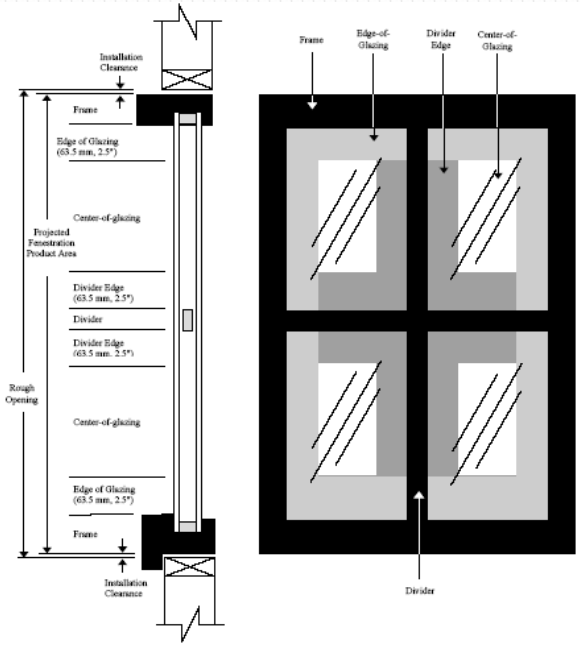


Figure 4-3. Components for the whole product area-weighted calculation. The view on the left is a section, and the view on the right is an elevation.

- Minimum performance requirement:
  - Uw > 0.80
  - Uw,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?

PASSIVE HOUSE INSTITUTE US (PHIUS)

PHIUS Certified Data for Window Performance Program

PHIUS

Passive House Institute US

- Established 2012
- Facilitate faster adoption of Passive House approach in North America
- Expand database of verified performance data in PHPP-ready format

"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 Certified Data for Window Performance Program, Oct. 29, 2012
(http://www.passivehouse.us/passiveHouse/CertifiedWindowData.html)

PASSIVE HOUSE INSTITUTE US (PHIUS)

PHIUS Certified Data for Window Performance Program

Product name: **Alpen HP fixed 107**

PHIUS
Passive House Institute US

ASHRAE/IECC /DOE North American Climate Zone	South-facing	North, East, West - facing	Whole-window installed U-value W/m2K	Whole-window installed U-value BTU/hr.ft2.F	Center-of-glass properties: Alpen _107 SHGC	Ucog-Value W/m2K	Ucog-Value BTU/hr.ft2.F
Climate specific recommendations:							
8			0.73	0.13	0.316	0.422	0.074
7			0.73	0.13	0.316	0.423	0.074
6		✓	0.73	0.13	0.316	0.421	0.074
5		✓	0.73	0.13	0.316	0.426	0.075
4		✓	0.73	0.13	0.316	0.427	0.075
Marine North		✓	0.74	0.13	0.316	0.430	0.076
Marine South	✓		0.74	0.13	0.316	0.432	0.076
3	✓		0.74	0.13	0.316	0.436	0.077
2 West			0.74	0.13	0.316	0.434	0.076
2 East			0.74	0.13	0.316	0.432	0.076

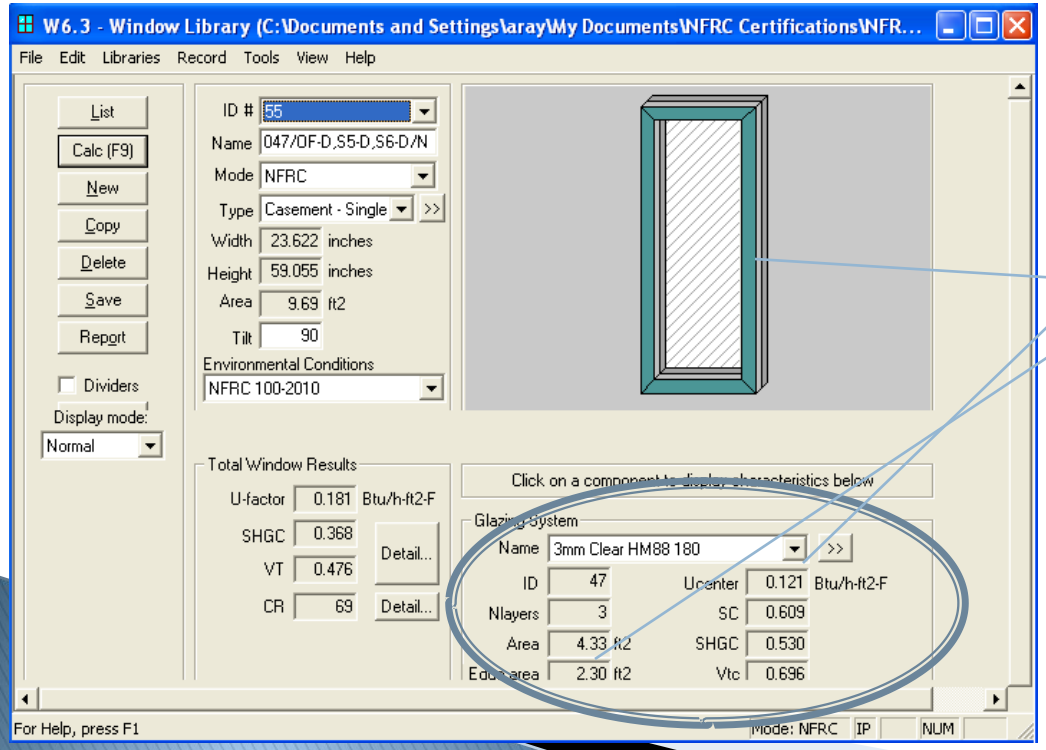
Alpen HP fixed 107	FRAME				Psi-spacer		Psi-opaque
	Frame height		U-frame		Ψ		
	mm	in	W/m2K	BTU/hr.ft2.F	W/mK	BTU/hr.ft.F	W/mK
Head	72	2.84	0.86	0.15	0.052	0.030	0.118
Sill	72	2.84	0.86	0.15	0.052	0.030	BTU/hr.ft.F
Left	72	2.84	0.86	0.15	0.052	0.030	0.068
Right	72	2.84	0.86	0.15	0.052	0.030	Grade B

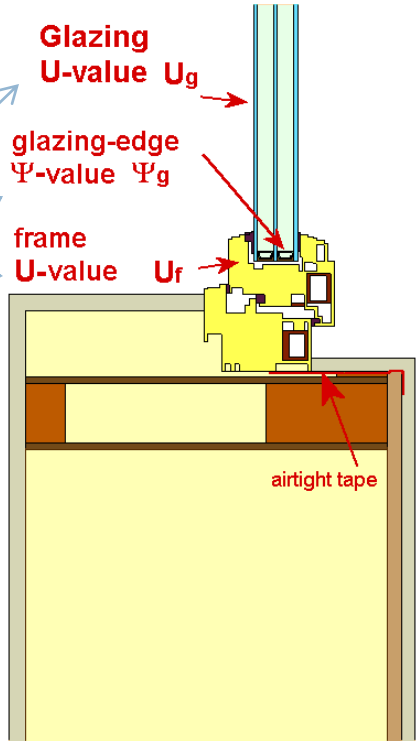
Valid through August 2015

- 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

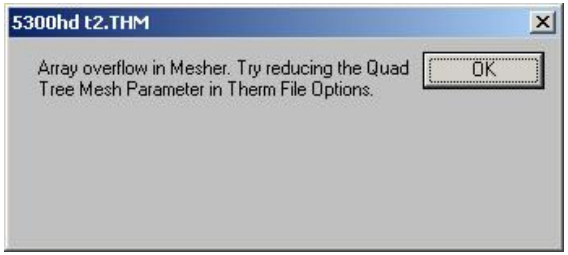
PHIUS CERTIFIED DATA FOR WINDOW PERFORMANCE PROGRAM

- Based on LBL WINDOW and THERM software familiar to US manufacturers and modelers
- Encouraging exploration of NFRC crossover program opportunities





PHIUS CERTIFIED DATA FOR WINDOW PERFORMANCE PROGRAM



"The thermal transmittance of the frame section, U_f, is defined as follows. In the calculation model, the glazing or opaque panel is replaced by an insulation panel with thermal conductivity λ = 0,035 W/(m·K); inserted into the frame with clearance b_1, not less than 5 mm, and an overlap b_2 not exceeding 15 mm. The visible length of the panel is at least 190 mm and the thickness d shall be the intended thickness of the glazing or opaque panel (see Figure C.1 Dimensions in mm). The opposite end of the panel is considered as an adiabatic boundary. The frame model shall contain all materials used in manufacturing the window except the glazing or opaque panel, which is replaced by the insulation panel.

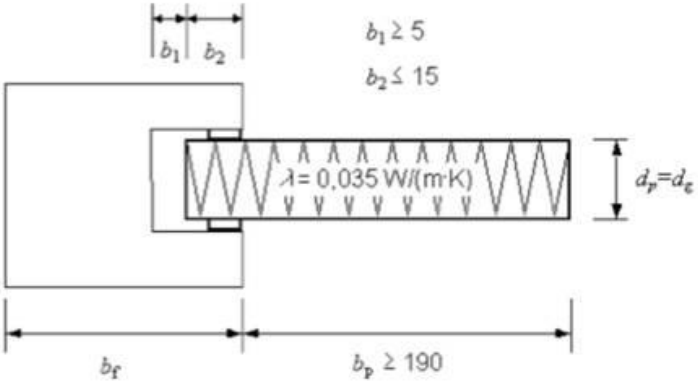


Figure C.1 — Profile section with panel installed

- 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**

PASSIVE HOUSE INSTITUTE US (PHIUS)

PHIUS Certified Data for Window Performance Program

ALPEN
CLEAR PERFORMANCE

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!

Product name: **Alpen HP fixed 107**

PHIUS
Passive House Institute US

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Alpen HP fixed 107	FRAME: Frame height mm	Frame height in	U-frame W/m2K	U-frame BTU/hr.ft2.F	Psi-spacer Ψ W/mK	Psi-spacer Ψ BTU/hr.ft.F	Psi-opaque W/mK
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Left	72	2.84	0.86	0.15	0.052	0.030	0.068
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Valid through August 2015

OTHER NOTEABLE WINDOW CERTIFICATION PROGRAMS

OTHER NOTABLE CERTIFICATIONS

- **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 it's 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?

CONCLUDING THOUGHTS: OPEN DIALOGUE

- 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?