Window Energy Ratings in Building Energy Codes

Great Plains Energy Code Conference
October 18, 2012

Ray McGowan-Senior Program Manager

Presentation Overview

1. NFRC— Introduction and Overview
2. NFRC Ratings
3. Residential Fenestration Certification
4. Commercial Fenestration Certification
5. How NFRC Facilitates Code Compliance
   a) **Residential compliance example**
   b) **Commercial compliance example**
6. Summary and Conclusions

National Fenestration Rating Council®

NFRC—Introduction & Overview

What is Fenestration?

- The arrangement, proportioning and design of windows and doors in a building
- An opening in a building's envelope, including windows, doors and skylights

National Fenestration Rating Council®

NFRC—Introduction & Overview

- Created by industry in 1989
- Created to provide standardized methods for rating *fenestration energy performance*
- Not a trade association, but a unique, educational non-profit public/private organization representing:
  - Fenestration and related building industry
  - State energy offices
  - Design professionals
  - Utilities, consumer organizations
- 800 participating manufacturers
- 250 voting members
- 8 million simulated products in database
- 8000 product lines

National Fenestration Rating Council®

NFRC—Introduction & Overview

Mission:

NFRC develops and administers energy-related rating and certification programs that serve the public by providing fair, accurate, and credible information on fenestration performance.

National Fenestration Rating Council®

NFRC—Introduction & Overview

NFRC *is* referenced by:

- IECC
- ASHRAE 90.1
- *ENERGY STAR*©
- USGBC's LEED program

NFRC Relevance

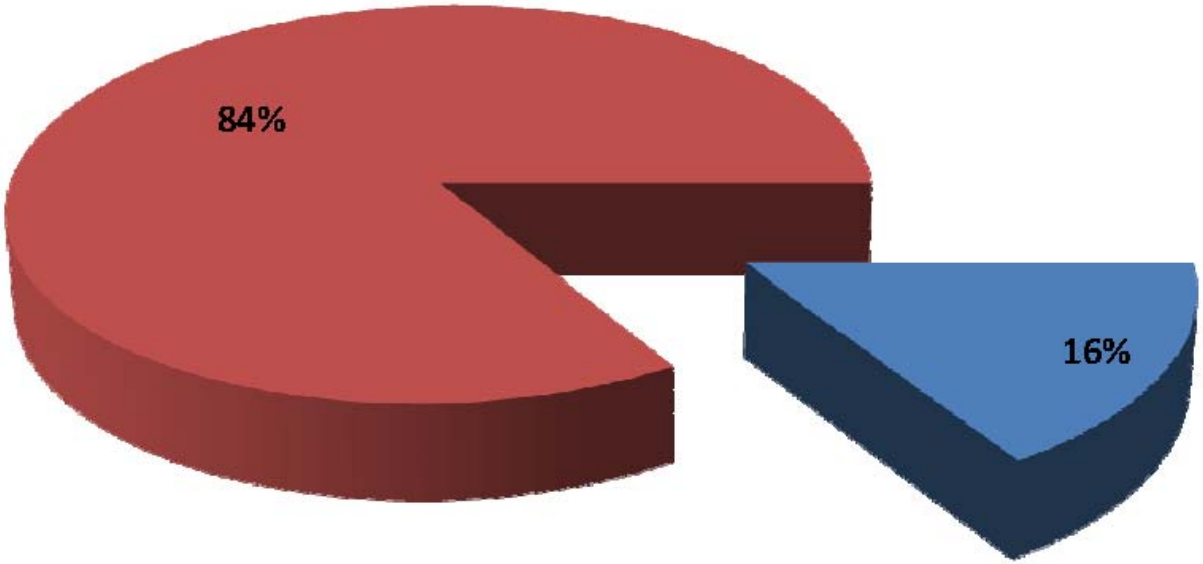
Just how important are energy-efficient windows, doors and skylights?

In the United States…

Courtesy of VELUX America

Aggregate Building Loads

Non-residential buildings consume ~15.5 quadrillion BTU of primary energy - 16% of all energy used in U.S.

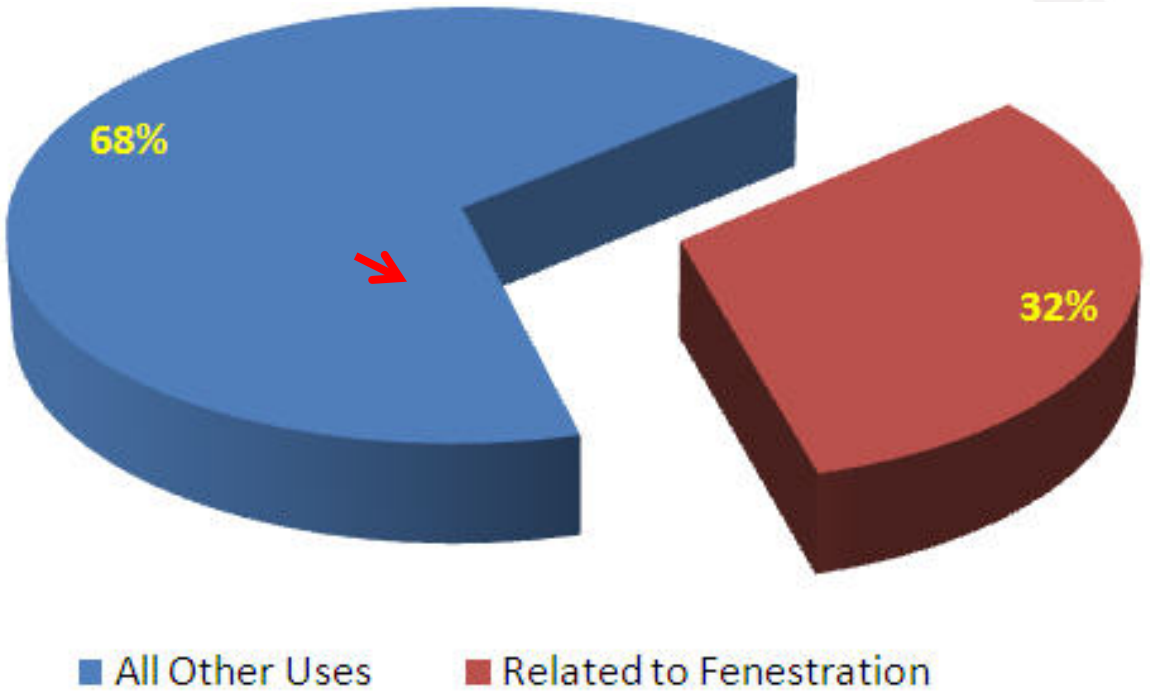


Energy used in commercial construction

All other uses

Aggregate Building Loads

Fenestration consumes 32% of that primary energy *:*



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NFRC—Introduction & Overview

<u>Facts:</u>

In the USA, on average, Only ~30% of all non-residential buildings *(somewhat higher % in residential)* use <u>high performance windows</u>;

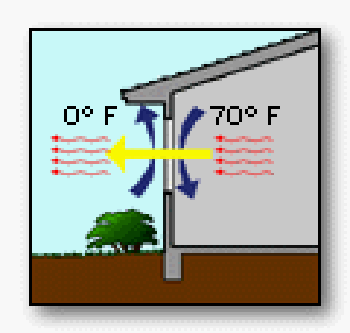
City Center Complex, Las Vegas, NV

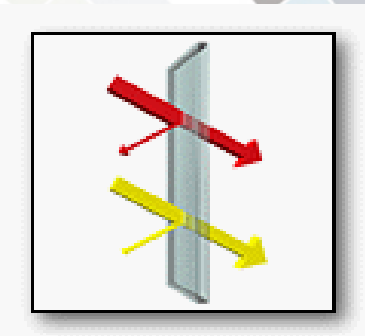
NFRC Ratings

- **Heat loss rating *(U-factor)***
- **Solar Heat Gain rating *(SHGC)***
- **Visible Transmittance rating *(VT)***
- **Air Leakage rating**
- **Condensation Resistance rating *(CR)***

National Fenestration Rating Council®

NFRC Ratings



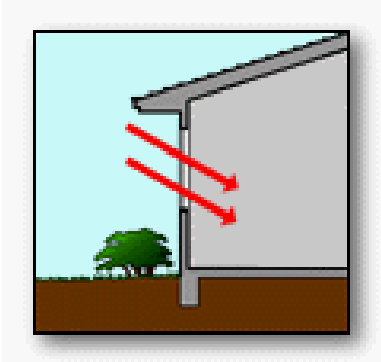


U-factor (thermal transmission)

NFRC 100

VT (Visible Transmittance)

NFRC 200



SHGC (Solar Heat Gain)
NFRC 200

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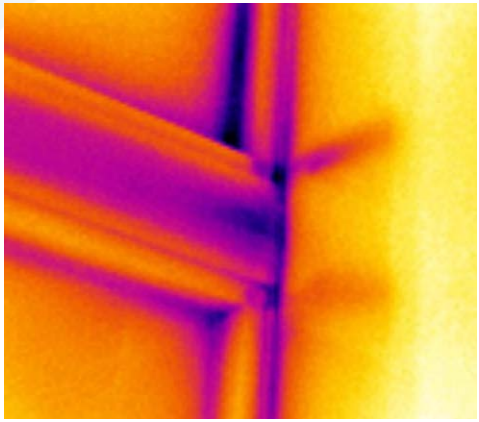
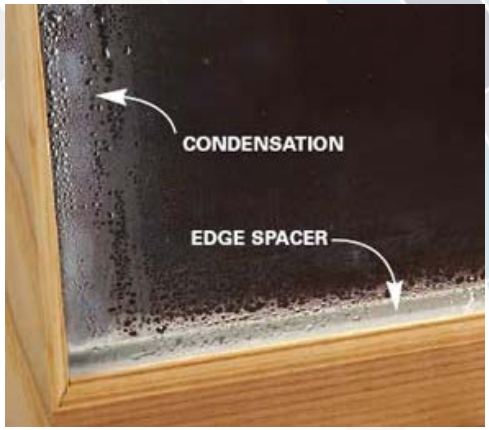
NFRC Ratings





Air Leakage (Air infiltration, no exfiltration)

NFRC 400

CR (Condensation Resistance)

NFRC 500

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NFRC Ratings

- **Generally, computer simulation is the basis of all ratings** *(not for air infiltration)*
- **Simulation performed at standardized sizes & environmental conditions**
- **Simulation generates a whole-product rating**
- **Simulated U-factors are validated by physical testing**

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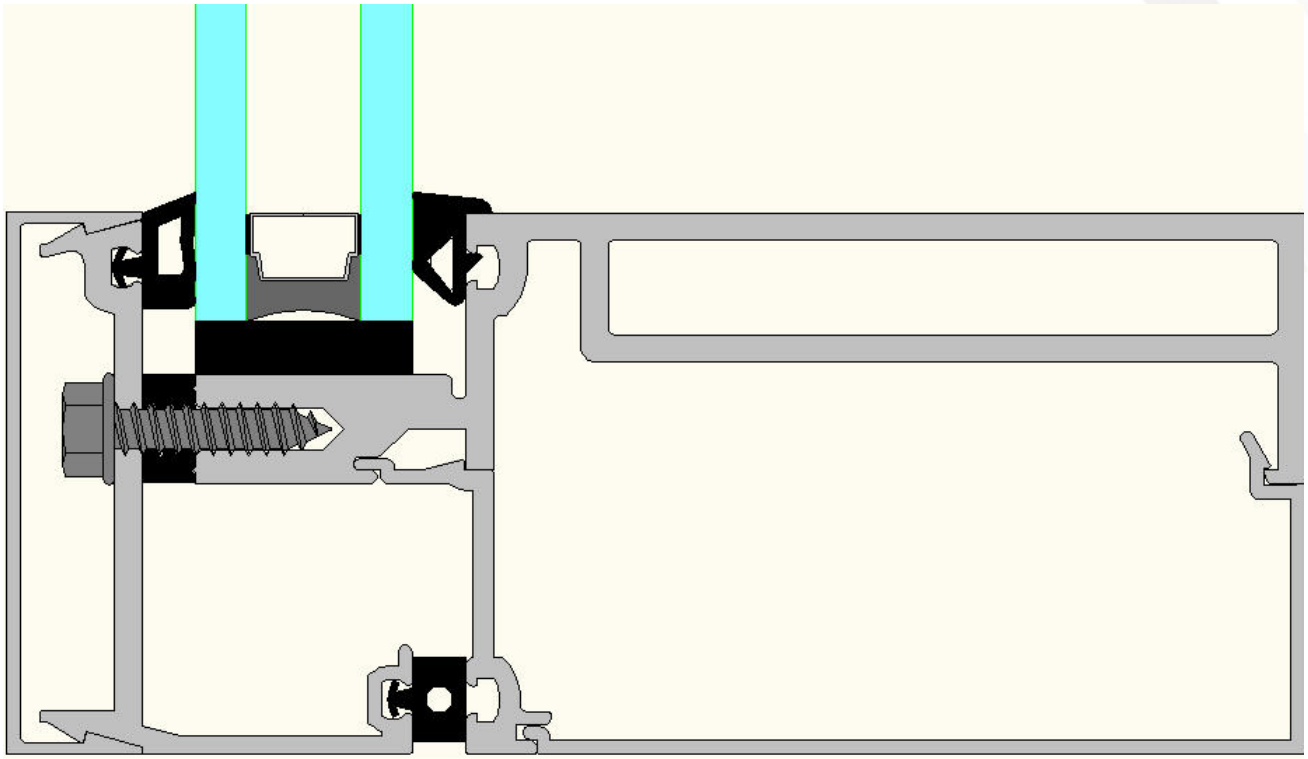
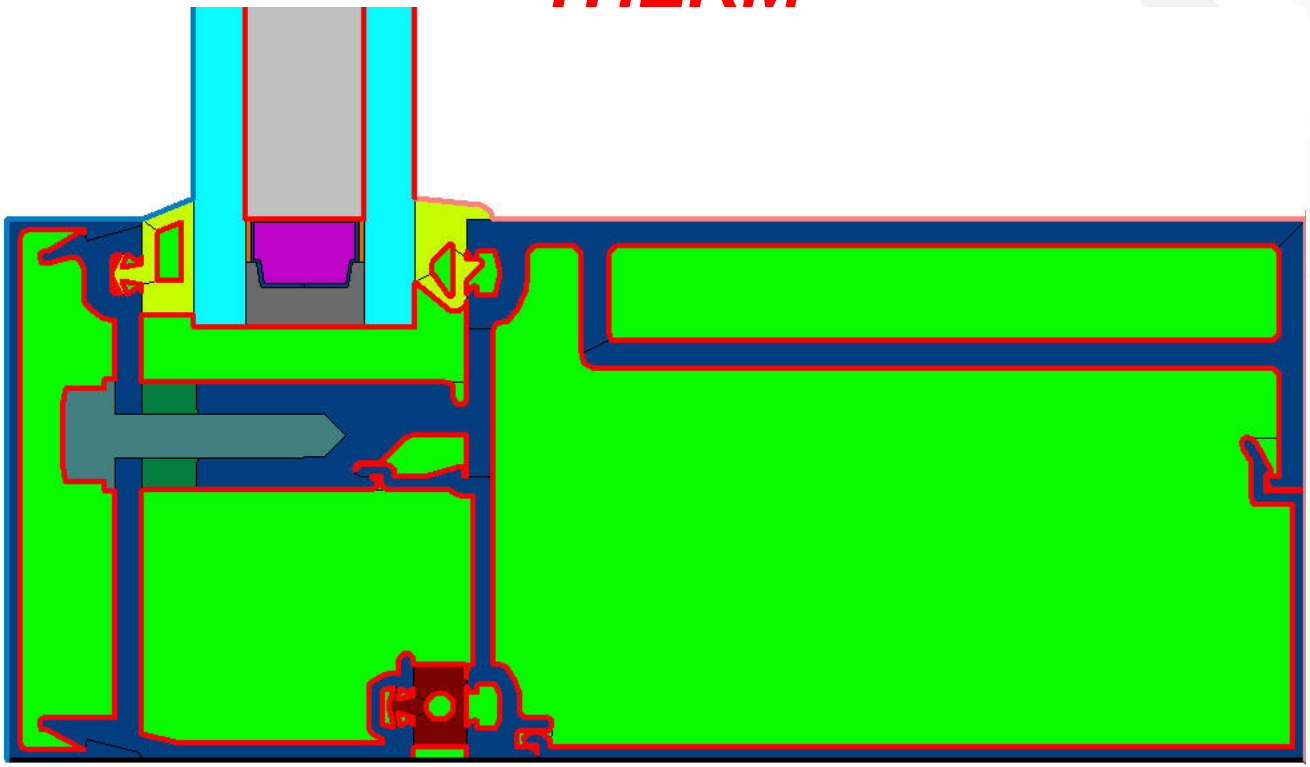
NFRC Ratings: *Development & Basis*



CAD drawing file, section view, curtain wall

NFRC Ratings: *Development & Basis*

Based on LBNL's WINDOW & THERM



THERM simulation file, profile view, curtain wall

National Fenestration Rating Council®

Residential Certification

- Certified products are *labeled* products
- Labeling indicates certification
- Labeling definitions in IECC and ASHRAE 90.1
  - Enable rating verification

National Fenestration Rating Council®

Residential Certification

NFRC
National Fenestration Rating Council®
CERTIFIED

World's Best Window Co.

Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: **Vertical Slider**

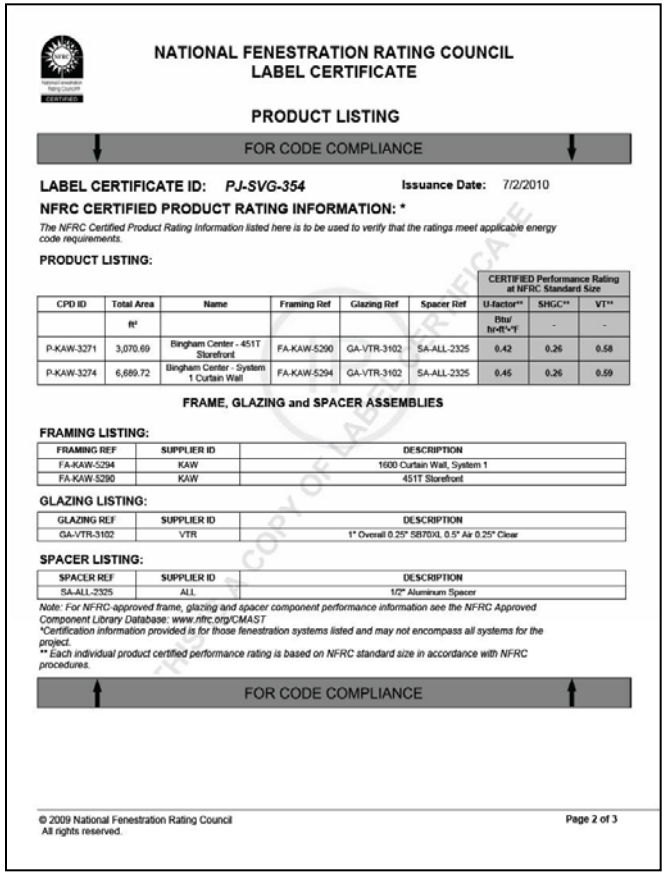
ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P) **0.35**	Solar Heat Gain Coefficient **0.32**
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance **0.51**	Air Leakage (U.S./I-P) **0.2**
Condensation Resistance **51**	—

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.
www.nfrc.org

Our 'residential' temporary label

NFRC
National Fenestration Rating Council®

Non-Residential Certification



NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: *PJ-SVG-354* Issuance Date: 7/2/2010

NFRC CERTIFIED PRODUCT RATING INFORMATION: *

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	CERTIFIED Performance Rating at NFRC Standard Size		
						U-factor**	SHGC**	VT**
	ft²					Btu/ hr·ft²·°F	-	-
P-KAW-3271	3,070.69	Bingham Center - 451T Storefront	FA-KAW-5290	GA-VTR-3102	SA-ALL-2325	0.42	0.26	0.58
P-KAW-3274	6,689.72	Bingham Center - System 1 Curtain Wall	FA-KAW-5294	GA-VTR-3102	SA-ALL-2325	0.45	0.26	0.59

FRAME, GLAZING and SPACER ASSEMBLIES

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-KAW-5294	KAW	1600 Curtain Wall, System 1
FA-KAW-5290	KAW	451T Storefront

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-VTR-3102	VTR	1" Overall 0.25" SB70XL 0.5" Air 0.25" Clear

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-ALL-2325	ALL	1/2" Aluminum Spacer

Note: For NFRC-approved frame, glazing and spacer component performance information see the NFRC Approved Component Library Database: www.nfrc.org/CMAST
**Certification information provided is for those fenestration systems listed and may not encompass all systems for the project.*
*** Each individual product certified performance rating is based on NFRC standard size in accordance with NFRC procedures.*

FOR CODE COMPLIANCE

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NFRC Label Certificate (for Site-Built Products)

World's Best Window Co.
Millennium 2000®
Vinyl-Clad Wood Frame
Double Glazing – Argon Fill – Low-E
Product Type: Vertical Slider

ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.35	0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./I-P)
0.51	0.2

PROJECT LOCATION
Street address:
City, state, zipcode:
Project name (optional): Designer (optional):

PRODUCT LINE INFORMATION
Operator type (per NFRC 100, Table 11):
Product line ID number: Individual product ID number:
How many of this individual product: Location in building:
Elevation drawing page: Fenestration (window & door) schedule page:

FRAME MATERIAL SUPPLIER
Company name, address:
City, state zipcode:
Contact person, phone & fax number:

GLAZING MATERIAL SUPPLIER
Company, name, address:
City, state, zipcode:
Contact person, phone & fax number:

GLAZING CONTRACTOR/INSTALLER
Company, name, address:
City, state, zipcode:
Contact person, phone & fax number:

CERTIFICATION AUTHORIZATION
Independent Certification and Inspection Agency (IA):
Date Certification Authorization Issued:

CMA Label Certificate Site-Built Label Certificate

National Fenestration Rating Council®

Non-Residential Certification

Overview of the *Component Modeling Approach* ('CMA') Program

National Fenestration Rating Council®

Non-Res. Certification: CMA

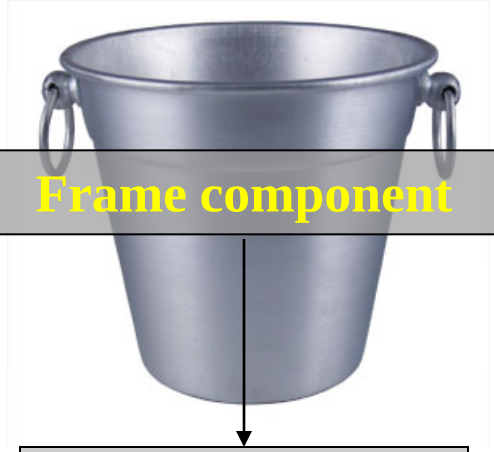
The CMA process: A New Approach

New concept: “build” virtual products & projects using predefined and certified components from online CMA database to issue project-specific label certificates

Non-Res. Certification: CMA

Glazing component

Glazing infill / Center of Glazing assembly



Frame component

Frame system / Frame assembly

Spacer component

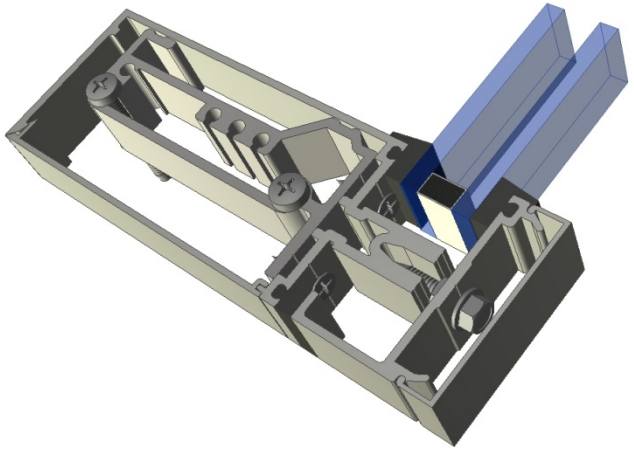
Spacer system / spacer assembly

PRODUCT CONFIGURATION

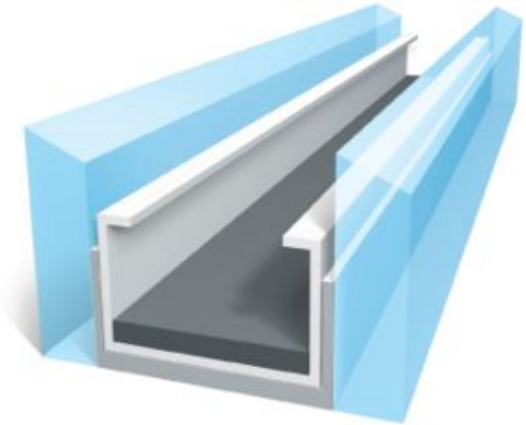
Overall product rating calculation

Non-Res. Certification: CMA

- The CMA process: The 3 'Buckets' are filled by the manufacturers & suppliers:
  - ☞ **Frame manufacturers**
  - ☞ **IGU spacer suppliers**
  - ☞ **Glass suppliers**



Courtesy of Kawneer

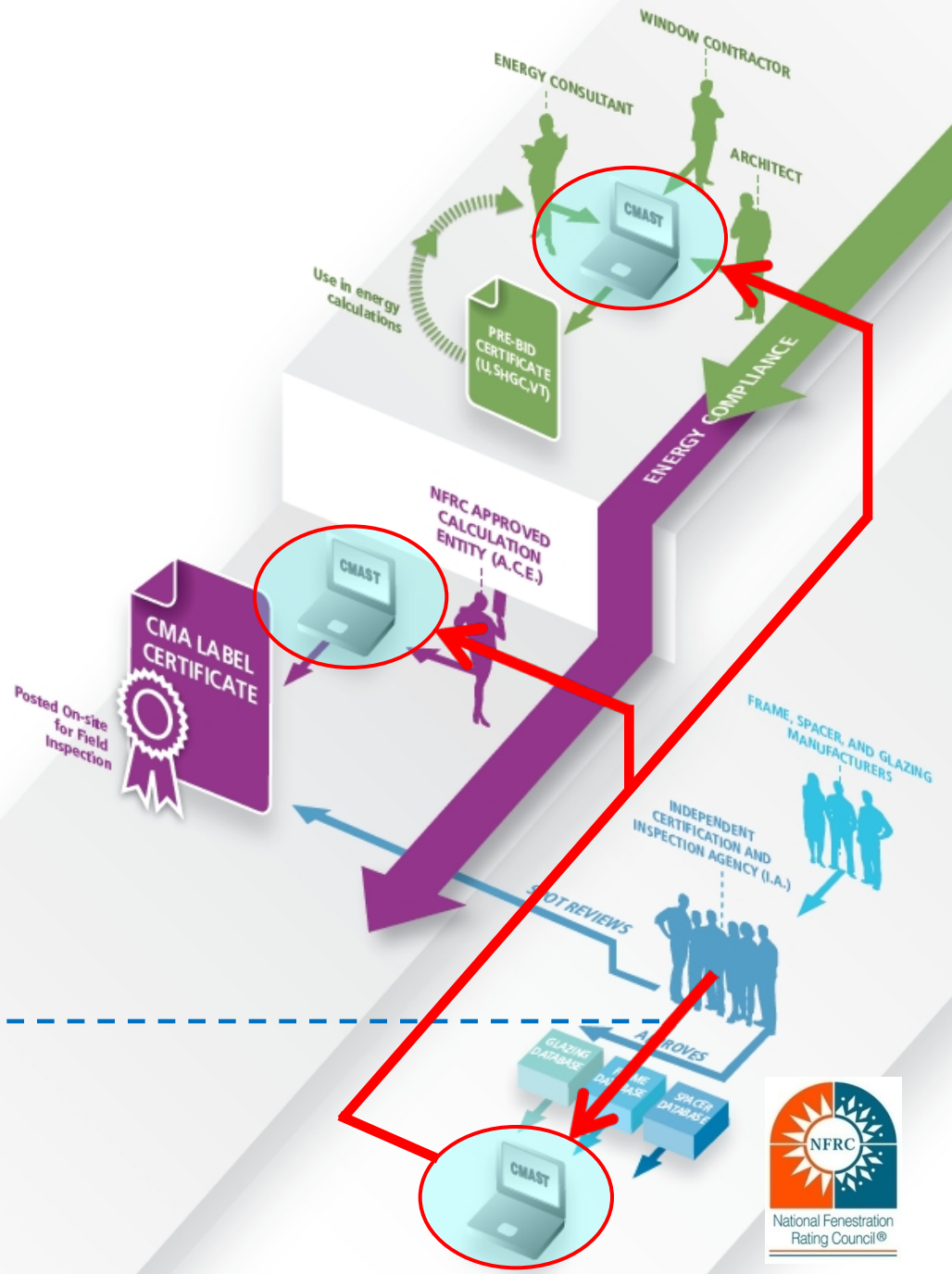


Courtesy of PPG

Courtesy of Guardian Glass

CMA F

- CMAST DEVELOPMENT
  - The IA reviews and approves all components before they are available for use in CMA
  - Once uploaded into the online CMAST database, components are available to ***all***



HESCHONG MAHONE GROUP

NFRC National Fenestration Rating Council®

Non-Res. Certification: CMAST

Overview of the *CMA* Software Tool('CMAST')

NFRC CMA Software Tool ~ CMAST

Non-Res. Certification: CMAST

- CMA software tool ("CMAST") can:
  - **Maintain libraries of component data**
  - **Define projects**
  - **Assemble components, and**
  - **Calculate whole product ratings**

National Fenestration Rating Council®

Product

Product Information

Server ID: P-KAW-6441 Client ID:

Product Name: ASHRAE-Kaw IR 501 UT

Manufacturer: Kawneer Company Inc.

Description: Kawneer IR 501 UT

Notes:

Frame Assembly: FA-KAW-9937: ASHRAE-Kawneer IR 501 UT

Product Type: GWCW - Glazed Wall System Curtain Wall

Width: 100.00 in. Height: 200.00 in.

Status: Design

NFRC Size:			Actual Size:		
78.74	X	78.74 in.	100.00	X	200.00 in.
U factor:		0.328			0.278 Btu/h·ft²·F
SHGC:		0.224			0.235
VT:		0.491			0.526

Component Selection for Individual Product

Framing

Frame Member:

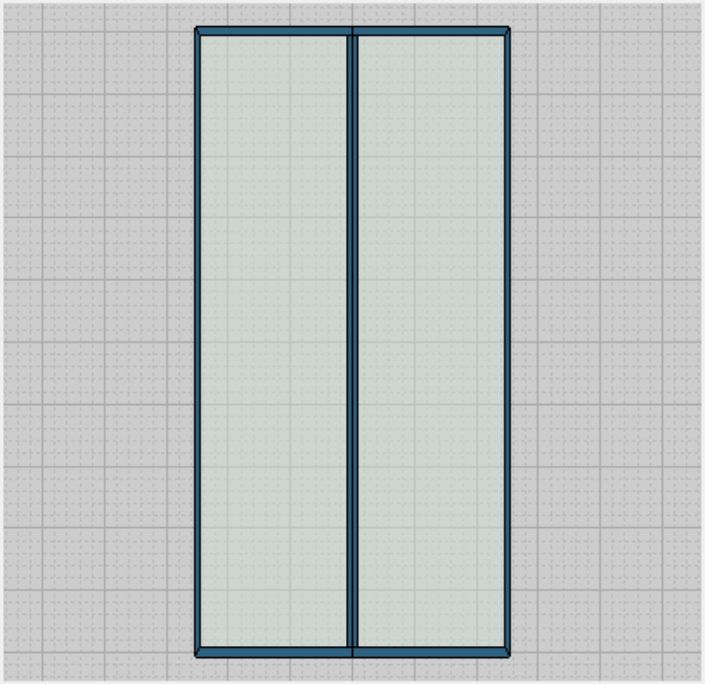
Insulated Glazing Unit

Center Of Glazing: GA-CGI-4146: ASHRAE

Spacer Edge Seal Assembly: SA-NFR-2185: Generic Spacer (

Dividers:

Configuration



Edit Dims

Visibility

Myself Only

Additional Persons & Companies

History | Calculate | EnergyPlus Report | Doe2 Report | OK | Cancel

National Fenestration Rating Council®

NFRC CMA Label Certificate

(cover page):

NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PROJECT INFORMATION

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

This is to be completed by an NFRC Approved Calculation Entity (ACE), based on information provided by the Specifying Authority and calculated in accordance with NFRC procedures.

PROJECT LOCATION:

Address: _____.
City: _____, **State,** _____, **Zip code:** _____.
Contact person:_____, **Title:** _____.
Phone: _____, **Facsimile:** _____, **Email:** _____.
Project name (optional): _____, **Designer (optional):** _____.

IDENTIFICATION OF SPECIFYING AUTHORITY:

Company name: _____, **ID:** _____.
Address: _____.
City: _____, **State,** _____, **Zip code:** _____.
Contact person:_____, **Title:** _____.
Phone: _____, **Facsimile:** _____, **Email:** _____.

FRAMING SUPPLIER:

Company name: _____, **ID:** _____.
Address: _____.
City: _____, **State,** _____, **Zip code:** _____.
Contact person:_____, **Title:** _____.
Phone: _____, **Facsimile:** _____, **Email:** _____.

GLAZING SUPPLIER:

Company name: _____, **ID:** _____.
Address: _____.
City: _____, **State,** _____, **Zip code:** _____.
Contact person:_____, **Title:** _____.
Phone: _____, **Facsimile:** _____, **Email:** _____.

IDENTIFICATION NAME OF APPROVED CALCULATION ENTITY (ACE):

_____, **ID:**_____.

IDENTIFICATION NAME OF INSPECTION AGENCY (IA):

_____, **ID:**_____.

Number of individual products listed on this label certificate: **5**

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NFRC CMA Label Certificate *(page 2):*

NATIONAL FENESTRATION RATING COUNCIL LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

NFRC CERTIFIED PRODUCT RATING INFORMATION:*

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	CERTIFIED Performance Rating at NFRC Standard Size		
						U-factor**	SHGC**	VT**
	ft^2					Btu/ $hr{\cdot}ft^2{\cdot}°F$	-	-
P-PL-010	88.89	PL-2200 / PL-2210	FA-PL2210	GA-TT-001	SA-AM-001	0.53	0.58	0.66
P-PL-005	192.67	PL-3400 / PL-3401	FA-PL3401	GA-TT-001	SA-AM-002	0.56	0.57	0.65
P-PL-012	382.22	PL-5700 / PL-5720	FA-PL5720	GA-TO-002	SA-AM-001	0.52	0.21	0.30
P-PL-002	60.00	PL-1100 / PL-1152	FA-PL1152	GA-TT-001	SA-AM-001	0.42	0.51	0.62
P-PL-022	525.00	PL-9900 / PL-9915	FA-PL9915	GA-TO-003	SA-AM-002	0.45	0.15	0.19

FRAME, GLAZING and SPACER ASSEMBLIES:

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-PL2210		Single Casement Thermally Broken Aluminum
FA-PL3401		Projecting (Awning) Thermally Broken Aluminum
FA-PL5720		Vertical Slider PVC reinforced with Steel
FA-PL1152		Vertical Slider Thermally Broken Aluminum
FA-PL9915		Fixed Thermally Broken Aluminum

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-TT-001		1" Double Glazed, 1/4" HC Low-e, 1/4" Clear, Argon (90%), 1/2" gap
GA-TT-002		1" Triple Glazed, 1/8"Clear, Coated film, 1/8"SC, Argon (90%), 3/8" gap
GA-TT-003		1" Double Glazed, 1/4" Bronze, 1/4" SC Low-e, Argon (90%), 1/2" gap

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-AM-001		250P Mill Finish Aluminum Low profile (1/2")
SA-AM-002		15A Polymer Spacer (3/8")

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National Fenestration Rating Council®

NFRC CMA Label Certificate *(page 2):*

NATIONAL FENESTRATION RATING COUNCIL LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***XYZ-001*** **Issuance Date:** mm/dd/yyyy

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PRODUCT LISTING:

CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	CERTIFIED Performance Rating at NFRC Standard Size		
						U-factor**	SHGC**	VT**
	ft^2					Btu/ $hr{\cdot}ft^2{\cdot}°F$	-	-
P-PL-010	88.89	PL-2200 / PL-2210	FA-PL2210	GA-TT-001	SA-AM-001	0.53	0.58	0.66
P-PL-005	192.67	PL-3400 / PL-3401	FA-PL3401	GA-TT-001	SA-AM-002	0.56	0.57	0.65
P-PL-012	382.22	PL-5700 / PL-5720	FA-PL5720	GA-TO-002	SA-AM-001	0.52	0.21	0.30
P-PL-002	60.00	PL-1100 / PL-1152	FA-PL1152	GA-TT-001	SA-AM-001	0.42	0.51	0.62
P-PL-022	525.00	PL-9900 / PL-9915	FA-PL9915	GA-TO-003	SA-AM-002	0.45	0.15	0.19

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FA-PL3401		Projecting (Awning) Thermally Broken Aluminum
FA-PL5720		Vertical Slider PVC reinforced with Steel
FA-PL1152		Vertical Slider Thermally Broken Aluminum
FA-PL9915		Fixed Thermally Broken Aluminum

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-TT-001		1" Double Glazed, 1/4" HC Low-e, 1/4" Clear, Argon (90%), 1/2" gap
GA-TT-002		1" Triple Glazed, 1/8"Clear, Coated film, 1/8"SC, Argon (90%), 3/8" gap
GA-TT-003		1" Double Glazed, 1/4" Bronze, 1/4" SC Low-e, Argon (90%), 1/2" gap

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-AM-001		250P Mill Finish Aluminum Low profile (1/2")
SA-AM-002		15A Polymer Spacer (3/8")

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NFRC CMA Label Certificate *(optional pages):*

(project-specific sizes)

NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

SUPPLEMENTAL PRODUCT INFORMATION

For Informational Purposes Only

Non-Certified Product Information at Actual Product Size

Reference NFRC Label Certificate ID: *XYZ-001* for Certified Ratings for Code Compliance:

Individual product performance at actual size is listed in the table below and has been determined in accordance with NFRC technical procedures; however, these are not certified ratings. Certified ratings are determined at NFRC model sizes for comparative purposes and are listed on the actual Label Certificate referenced above. The actual size performance calculations below are for information purposes and use in calculations and energy simulation programs to estimate energy use, and are not intended for use in code compliance.

PRODUCT LISTING:

					NON-CERTIFIED Performance at Actual Size				
CPD ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U-factor	SHGC	VT
		ft²			in.	in.	Btu/hr•ft²•°F	-	-
P-PL-010	2	48.00	PL-2200 / PL-2210	www.nfrc.org/CMAST/pl2200-2210.txt	48.00	72.00	0.48	0.59	0.66
P-PL-010	5	88.89	PL-2200 / PL-2210	www.nfrc.org/CMAST/pl2200-2210.txt	40.00	64.00	0.50	0.56	0.64
P-PL-005	6	192.67	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	68.00	68.00	0.49	0.58	0.65
P-PL-005	3	54.00	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	72.00	36.00	0.51	0.55	0.62
P-PL-005	5	167.22	PL-3400 / PL-3401	www.nfrc.org/CMAST/pl3400-3401.txt	86.00	56.00	0.48	0.59	0.67
P-PL-012	10	382.22	PL-5700 / PL-5720	www.nfrc.org/CMAST/pl5700-5720.txt	64.00	86.00	0.33	0.22	0.30
P-PL-002	3	60.00	PL-1100 / PL-1152	www.nfrc.org/CMAST/pl1100-1152.txt	48.00	60.00	0.52	0.53	0.60
P-PL-022*	21	525.00	PL-9900 / PL-9915	N/A	N/A	N/A	N/A	N/A	N/A

** This product and/or its glazing system is a test-only specimen, and fenestration performance is only available at the NFRC standard test size and not actual size. Therefore, EnergyPlus report files are not available for test-only specimens.*

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National Fenestration Rating Council®

Non-Res. Certification: CMA

- For commercial fenestration, NFRC offers both the *Site-Built Program* and *CMA Program*
- *Site-Built* is slated to be withdrawn
- *CMA* is the preferred method going forward

National Fenestration Rating Council®

Non-Res. Certification: CMA

- For commercial fenestration, NFRC offers both the *Site-Built Program* and *CMA Program*
- *Site-Built* is slated to be withdrawn
- *CMA* is the preferred method going forward

<u>Why</u> is CMA the preferred method?

Non-Res. Certification

NFRC Site-Built Label Certificate

NFRC Label Certificate
(for Site-Built Products)

World's Best Window Co.
Millennium 2000®
Vinyl-Clad Wood Frame
Double Glazing – Argon Fill – Low-E
Product Type: Vertical Slider

ENERGY PERFORMANCE RATINGS	
U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.35	0.32
ADDITIONAL PERFORMANCE RATINGS	
Visible Transmittance	Air Leakage (U.S./I-P)
0.51	0.2

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information. www.nfrc.org

PROJECT LOCATION
Street address: _____
City, state, zipcode: _____
Project name (optional): _____ Designer (optional): _____

PRODUCT LINE INFORMATION
Operator type (per NFRC 100, Table 1): _____
Product line ID number: _____ Individual product ID number: _____
How many of this individual product: _____ Location in building: _____
Elevation drawing page: _____ Fenestration (window & door) schedule page: _____

FRAME MATERIAL SUPPLIER
Company name, address: _____
City, state zipcode: _____
Contact person, phone & fax number: _____

GLAZING MATERIAL SUPPLIER
Company, name, address: _____
City, state, zipcode: _____
Contact person, phone & fax number: _____

GLAZING CONTRACTOR/INSTALLER
Company, name, address: _____
City, state, zipcode: _____
Contact person, phone & fax number: _____

CERTIFICATION AUTHORIZATION
Independent Certification and Inspection Agency (IA): _____
Date Certification Authorization Issued: _____

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NFRC & Code Compliance

Overview of this Section:

- Why the increased interest in compliance?
- State Energy Code requirements
- NE building energy codes
- Example #1: Residential Code compliance
- Example #2: Commercial Code compliance

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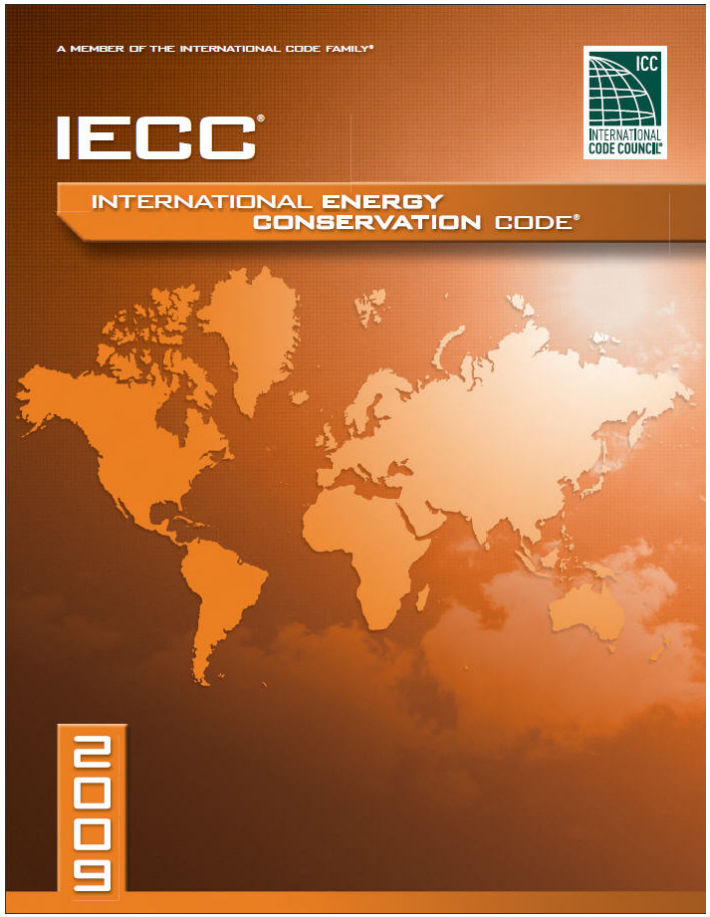
NFRC & Code Compliance

- NE State *Energy Code Requirements*
  - Residential: 2009 IECC
  - Commercial: ASHRAE 90.1-2007

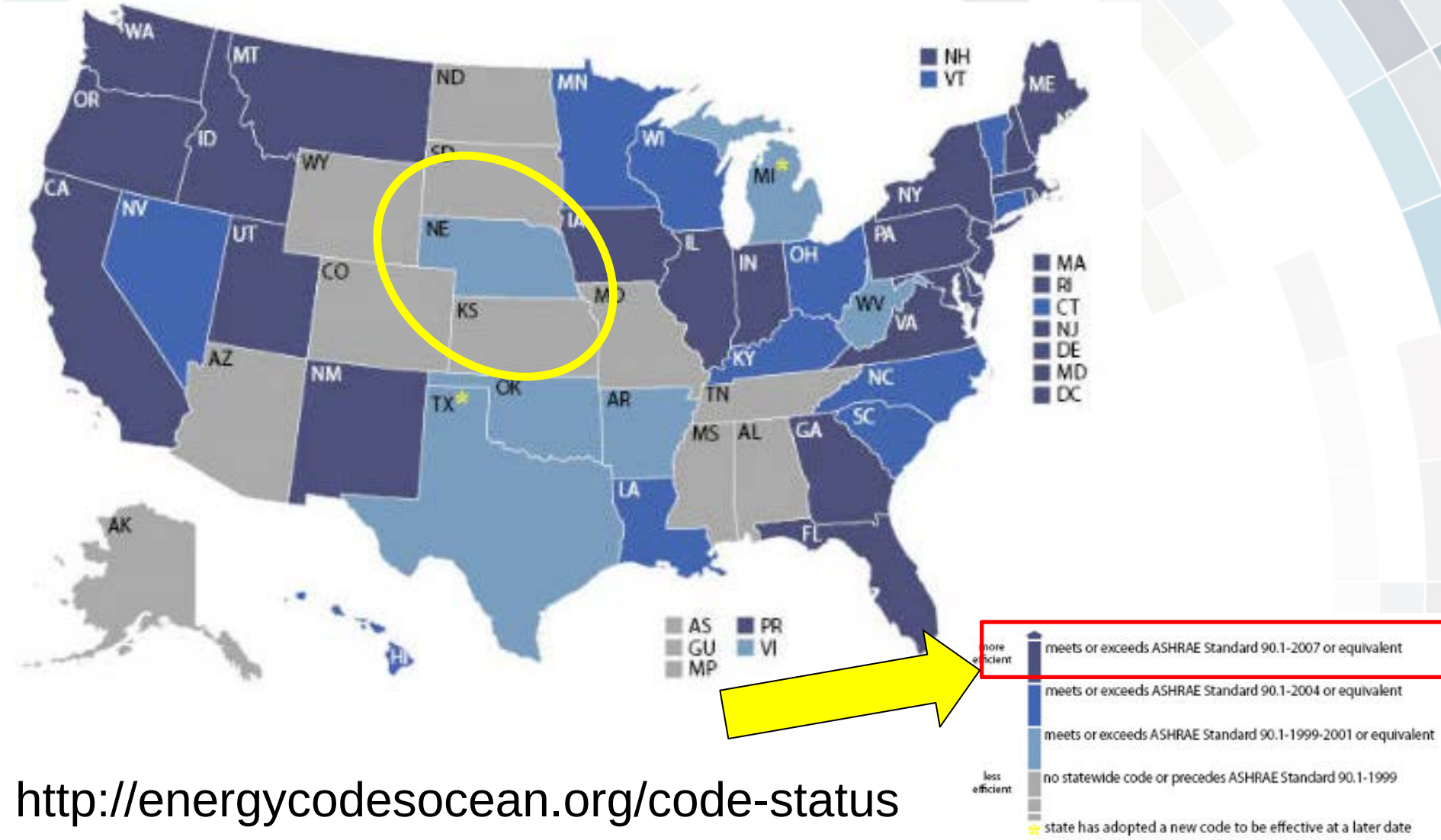
National Fenestration Rating Council®

NFRC & Code Compliance



2009 IECC

NFRC & Code Compliance



http://energycodesocean.org/code-status

NFRC & Code Compliance

Does the fenestration submitted for a residential permit comply with the Energy Code?

NFRC & Code Compliance

Process, Residential Energy Code Compliance:

1. Understand the *General* requirements
2. Determine *Compliance Path*
   a) **Prescriptive**
   b) **Performance**
3. Determine *Energy Code requirements*
4. Check submitted plans for *compliance*

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NFRC & Code Compliance

- Two ways to comply:
  - Default
  - NFRC

National Fenestration Rating Council®

NFRC & Code Compliance

- **2009 IECC window**
- **Defaults**
- **Punitive!**
- **Project not likely complaint**

TABLE 303.1.3(1)
DEFAULT GLAZED FENESTRATION *U*-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE 303.1.3(2)
DEFAULT DOOR *U*-FACTORS

DOOR TYPE	*U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

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NFRC & Code Compliance

1. General Requirements

Refer to Chapter 4 ~ *Residential Energy Efficiency*

- **Mandatory Requirements**
  - ✓ **Air Leakage (not to exceed 0.30 cfm/sq.ft)**
  - ✓ **Maximum Fenestration U-factor and SHGC**

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 303.1.3(3).

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NFRC & Code Compliance

2. Compliance Path

Refer to Chapter 4 ~ *Residential Energy Efficiency*

- **Prescriptive Requirements Path**
  - ✓**Determine climate zone for project**
  - ✓**402.1 Insulation and Fenestration criteria**

✓**Performance Requirements Path**

- ✓**Still must meet 402.1 minimums**

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NFRC & Code Compliance

2. Compliance Path

For this residential project, the builder chose the *Prescriptive Path* of compliance

NFRC & Code Compliance

2. Compliance Path

Refer to Chapter 4 ~ *Residential Energy Efficiency*

- **Prescriptive Requirements Path**
  - ✓**Determine climate zone for project (Sec. 301)**
  - ✓**Look up values: 402.1 Insulation and Fenestration criteria**

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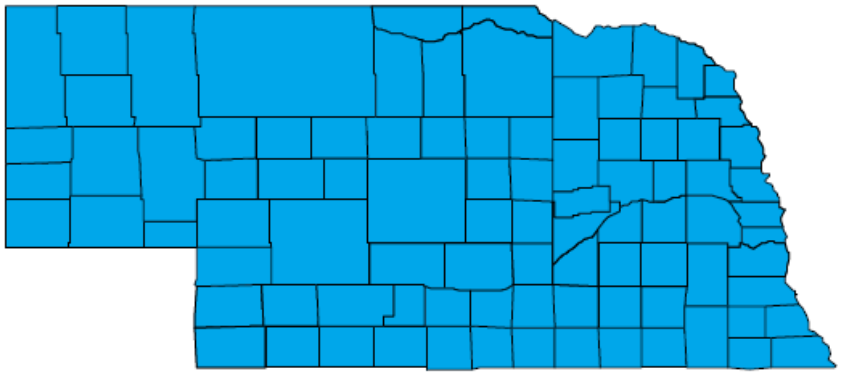
NFRC & Code Compliance



CLIMATE ZONE 5			
Adams	Deuel	Johnson	Red Willow
Antelope	Dixon	Kearney	Richardson
Arthur	Dodge	Keith	Rock
Banner	Douglas	Keya Paha	Saline
Blaine	Dundy	Kimball	Sarpy
Boone	Fillmore	Knox	Saunders
Box Butte	Franklin	Lancaster	Scotts Bluff
Boyd	Frontier	Lincoln	Seward
Brown	Furnas	Logan	Sheridan
Buffalo	Gage	Loup	Sherman
Burt	Garden	Madison	Sioux
Butler	Garfield	McPherson	Stanton
Cass	Gosper	Merrick	Thayer
Cedar	Grant	Morrill	Thomas
Chase	Greeley	Nance	Thurston
Cherry	Hall	Nemaha	Valley
Cheyenne	Hamilton	Nuckolls	Washington
Clay	Harlan	Otoe	Wayne
Colfax	Hayes	Pawnee	Webster
Cuming	Hitchcock	Perkins	Wheeler
Custer	Holt	Phelps	York
Dakota	Hooker	Pierce	
Dawes	Howard	Platte	
Dawson	Jefferson	Polk	

Clipped from:
www.reca-codes.org

National Fenestration Rating Council®

NFRC & Code Compliance

3. Energy Code Requirements

	Windows		
	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC
Zone 5	0.35	0.60	NR

National Fenestration Rating Council®

NFRC & Code Compliance

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIRE

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME W. *R*-VALU
1	1.2	0.75	0.30	30	13
2	0.65[j]	0.75	0.30	30	13
3	0.50[j]	0.65	0.30	30	13
4 except Marine	0.35	0.60	NR	38	13
5 and Marine 4	0.35	0.60	NR	38	20 or 13-
6	0.35	0.60	NR	49	20 or 13-
7 and 8	0.35	0.60	NR	49	21

IECC 09
Table 402.1.1

All NE is U $\leq$ 0.35; no SHGC requirement

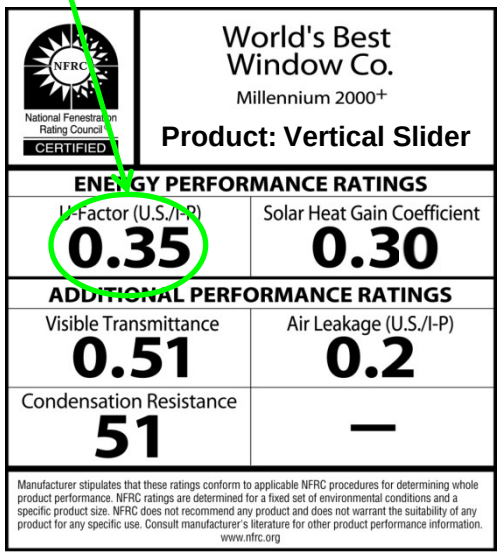
National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

Compare requirements to NFRC ratings:

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]
6	0.35	0.60	NR



U-factor is "OK"

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NFRC & Code Compliance

4. Check for Compliance

Compare requirements…

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]
6	0.35	0.60	NR

Also check the <u>Code Compliance Certificate</u>!

(see 401.3)

Residential Energy Code Compliance Certificate

Builder/Design Professional: _____ Phone: _____

Envelope Summary:

- List the R-Value for the following components:

Flat ceiling/roof: _____ Sloped/vault ceiling: _____
Exterior wall: _____ Above grade mass wall: _____
Attic kneewall: _____ Attic kneewall sheathing: _____
Basement stud wall: _____ Basement continuous: _____
Crawlspace stud wall: _____ Crawlspace continuous: _____
Foundation slab: _____ Floors over unconditioned space: _____
Cantilevered Floor: _____ Other insulation: _____

- Fenestration Components:

Window U-factor: _____ Window SHGC: _____
Skylight U-factor: _____ Skylight SHGC: _____
Glazed Door U-factor: _____ Opaque Door U-factor: _____ (<50% glazed)

- Building Envelope Tightness (BET):

BET test conducted by: _____ Phone: _____
Fan Flow at 50 Pascals= _____ CFM_{50} Total Conditioned Volume = _____ ft^3
ACH_{50} = CFM_{50} x 60 / Volume= _____ ACH_{50} (must be less than 7 ACH_{50})
Low Rise Multifamily Visual Inspection Option
(The visual inspection option may be conducted by a third-party instead of the BET test for R-2 buildings only.)
Visual inspection conducted by: _____ Phone: _____

Mechanical Summary:

Water Heater Energy Factor: _____ Ef Fuel type: ☐ Gas ☐ Electric ☐ Other
Number of Heating and Cooling Systems: _____
Heating System Type (choose one):
☐ Gas: _____ AFUE ☐ Air-Source Heat Pump: _____ HSPF
☐ Other: _____ Efficiency: _____
Cooling System Type (Standard DX, Heat Pump, Geothermal, etc.): _____
Cooling System Efficiency: _____ ☐ SEER ☐ EER ☐ Other
Heating/Cooling Load Calculations Performed by: _____ Phone: _____
Total Heating Load (Based on ACCA Man. J or other approved methodology): _____ Btu/h
Total Cooling Load (Based on ACCA Man. J or other approved methodology): _____ Btu/h
Cooling Sensible Load: _____ Btu/h Cooling Latent Load : _____ Btu/h
Total Air Handler CFM (based on design calculations): _____ CFM
Duct Tightness Test Conducted by: _____ Phone: _____
CFM_{25} per 100 ft^2 of conditioned floor area = CFM_{25} x 100 / Conditioned floor area served
If all ducts are not located within conditioned space, builder must verify that either the postconstruction duct leakage to outdoo (**PCO**) is ≤ 8 cfm/100 ft^2, the post construction total duct leakage (**PCT**) is ≤ 12 cfm/100 ft^2, or the rough-in test (**RIT**) with a handler installed is ≤ 6 cfm/100 ft^2. State which method was used to conduct the duct tightness test: duct blower (**DB**), modified blower door subtraction method (**MBDS**), or automated multipoint blower door (**AMBD**).

System	Method (DB, MBDS, AMBD)	Test (PCO, PCT, RIT)	CFM_{25}	Area served (ft^2)	Test Res
1					
2					
3					

*Note: This permanent certificate shall be posted on or in the electrical distribution panel. Certificate shall be completed by the builder or registered design professional. Where there is more than one value for each component, certificate shall list the value covering the largest area.

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NFRC & Code Compliance

4. Check for Compliance

Approved!

Courtesy of Hoffman Estates, IL

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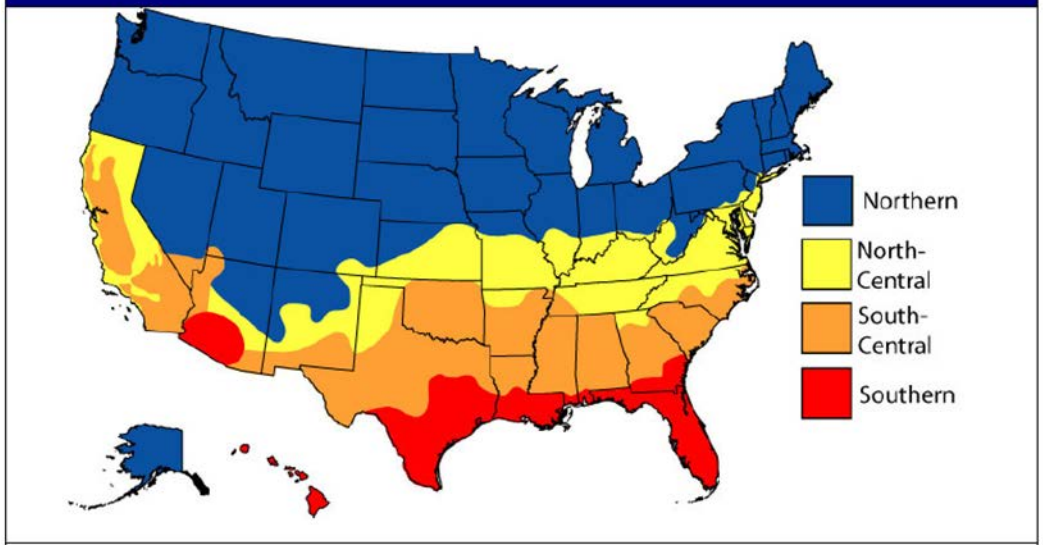
ENERGY STAR

Figure 1: Revised Draft ENERGY STAR Climate Zone Map



2014 Revision Underway!

Climate Zone	U-factor	SHGC
Northern	≤ 0.30 =0.31 = 0.32	NR ≥ 0.35 ≥ 0.40
North-Central	≤ 0.32	≤ 0.40
South Central	≤ 0.35	≤ 0.30
Southern	≤ 0.60	≤ 0.27

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NFRC & Code Compliance

Commercial Buildings

Does the fenestration submitted for a commercial permit in NE comply with the Energy Code?

NFRC & Code Compliance

Process, Non-Resid'l Energy Code Compliance:

1. Understand the *General* requirements
2. Determine *Compliance Path*
   a) **Prescriptive**
   b) **Performance**
3. Determine *Energy Code requirements*
4. Check submitted plans for *compliance*

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NFRC & Code Compliance

1. IECC 09 General Requirements

SECTION 501
GENERAL

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

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NFRC & Code Compliance

2. Compliance Path

Refer to Chapter 5 ~ *Commercial Energy Efficiency*

- **Prescriptive Requirements Path**
  - ✓**Determine climate zone for project**
  - ✓**Determine Glazing percentage**
  - ✓**Determine Insulation and Fenestration criteria**
  - ✓**Use appropriate Prescriptive table**
-

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NFRC & Code Compliance

2. Compliance Path

- For this commercial project, the architect & general contractor chose the *Prescriptive Path* of compliance
- Use IECC 2009, Chapter 5 first
- Comply with default or NFRC only

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NFRC and Compliance

IECC 09 requirement

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 303.1.3(3).

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NFRC and Compliance

- IECC 09 defaults

TABLE 303.1.3(1)
DEFAULT GLAZED FENESTRATION *U*-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE 303.1.3(2)
DEFAULT DOOR *U*-FACTORS

DOOR TYPE	*U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

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NFRC & Code Compliance

3. Energy Code Requirements for IECC 2009

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.0	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

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NFRC & Code Compliance

3. **Energy Code Requirements from ASHRAE 90.1-2007 referenced NFRC 100 and 200 only**

5.8.2.4 U-factor. U-factors shall be determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20 degrees above the horizontal.

5.8.2.5 Solar Heat Gain Coefficient. *SHGC* for the overall *fenestration area* shall be determined in accordance with NFRC 200.

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NFRC & Code Compliance

No NFRC ratings, use defaults:

TABLE A8.2 Assembly U-Factors, Assembly SHGCs, and Assembly Visible Light Transmittances (VLTs) for Unlabeled Vertical Fenestration

Frame Type	Glazing Type	Unlabeled Vertical Fenestration					
		Clear Glass			Tinted Glass		
		U-Factor	SHGC	VLT	U-Factor	SHGC	VLT
All frame types							
	Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
	Glass block	0.60	0.56	0.56	n.a.	n.a.	n.a.
Wood, vinyl, or fiberglass frames							
	Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
	Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types							
	Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
	Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

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NFRC & Code Compliance

3. Energy Code Requirements for ASHRAE 90.1-07

TABLE 5.5-5 Building Envelope Requirements For Climate Zone 5 (A, B, C)*

Opaque Elements	Nonresidential		Residential		
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assem Maxim
Fenestration	**Assembly Max. U**	**Assembly Max. SHGC**			
Vertical Glazing, % of Wall					
Nonmetal framing (all)[b]	U-0.35	SHGC-0.40 all			
Metal framing (curtainwall/storefront)[c]	U-0.45				
Metal framing (entrance door)[c]	U-0.80				
Metal framing (all other)[c]	U-0.55				
Skylight with Curb, Glass, % of Roof					
0%–2.0%	U_{all}–1.17	$SHGC_{all}$–0.49			
2.1%–5.0%	U_{all}–1.17	$SHGC_{all}$–0.39			
Skylight with Curb, Plastic, % of Roof					
0%–2.0%	U_{all}–1.10	$SHGC_{all}$–0.77			
2.1%–5.0%	U_{all}–1.10	$SHGC_{all}$–0.62			
Skylight without Curb, All, % of Roof					
0%–2.0%	U_{all}–0.69	$SHGC_{all}$–0.49			
2.1%–5.0%	U_{all}–0.69	$SHGC_{all}$–0.39			

*The following definitions apply: c.i. = continuous insulation (see Section 3.2), NR = no (insulat

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NFRC & Code Compliance

4. Check for Compliance

a. Determine fenestration used on project:

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

					Performance at NFRC Standard Size		
ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h·ft²·F	-	-
P-EFC-4207	SFTestBB	FA-EFC-6689	GA-SOU-3331	SA-PPG-2524	0.30	0.20	0.29

FRAME, GLAZING and SPACER ASSEMBLIES:

GLAZING LISTING:

Glazing Ref	Suplier ID	Description
GA-SOU-3331	Southwall Technologies	

SPACER LISTING:

Spacer Ref	Suplier ID	Description
SA-PPG-2524	PPG Industries	

FRAMING LISTING:

Framing Ref	Suplier ID	Description
FA-EFC-6689	EFCO Corporation	

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE

PRODUCT LISTING:

					Fenestration Performance at Actual Size*				
ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U	SHGC	VT
		in²			in.	in.	Btu/h·ft²·F	-	-
P-EFC-4207	125	2159999.60	SFTestBB		120.00	144.00	0.24	0.21	0.30

* *Individual product performance at actual size is listed in the above table and has been determined in accordance with NFRC technical procedures; however the actual size performance calculations above are for information purposes and use in area-weighted average calculations and energy simulation programs.*

Calculation/Bid Report
NFRC Label Certificate
IP

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

a. Determine fenestration used on project:

Excellent reference is the NFRC '*Bid Report*'

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

					Performance at NFRC Standard Size		
ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h·ft²·F	-	-
P-EFC-4207	SFTestBB	FA-EFC-6689	GA-SOU-3331	SA-PPG-2524	0.30	0.20	0.29

FRAME, GLAZING and SPACER ASSEMBLIES:

GLAZING LISTING:

Glazing Ref	Suplier ID	Description
GA-SOU-3331	Southwall Technologies	

SPACER LISTING:

Spacer Ref	Suplier ID	Description
SA-PPG-2524	PPG Industries	

FRAMING LISTING:

Framing Ref	Suplier ID	Description
FA-EFC-6689	EFCO Corporation	

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE

PRODUCT LISTING:

					Fenestration Performance at Actual Size*				
ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U	SHGC	VT
		in²			in.	in.	Btu/h·ft²·F	-	-
P-EFC-4207	125	2159999.60	SFTestBB		120.00	144.00	0.24	0.21	0.30

* *Individual product performance at actual size is listed in the above table and has been determined in accordance with NFRC technical procedures; however the actual size performance calculations above are for information purposes and use in area-weighted average calculations and energy simulation programs.*

Calculation/Bid Report
Not a label certificate
IPC

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

a. Determine fenestration used on project:

Excellent reference is the NFRC '*Bid Report*'

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

					Performance at NFRC Standard Size		
ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h·ft²·F	-	-
P-EFC-4207	SFTestBB	FA-EFC-6689	GA-SOU-3331	SA-PPG-2524	0.30	0.20	0.29

FRAME, GLAZING and SPACER ASSEMBLIES:

GLAZING LISTING:

Glazing Ref	Suplier ID	Description
GA-SOU-3331	Southwall Technologies	

SPACER LISTING:

Spacer Ref	Suplier ID	Description
SA-PPG-2524	PPG Industries	

FRAMING LISTING:

Framing Ref	Suplier ID	Description
FA-EFC-6689	EFCO Corporation	

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE

PRODUCT LISTING:

					Fenestration Performance at Actual Size*				
ID	Qty	Total Area	Name	EnergyPlus Report File	Width	Height	U	SHGC	VT
		in²			in.	in.	Btu/h·ft²·F	-	-
P-EFC-4207	125	2159999.60	SFTestBB		120.00	144.00	0.24	0.21	0.30

* *Individual product performance at actual size is listed in the above table and has been determined in accordance with NFRC technical procedures; however the actual size performance calculations above are for information purposes and use in area-weighted average calculations and energy simulation programs.*

Calculation/Bid Report
Not a label certificate
IPC

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

NFRC 'Bid Report'

NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES -- NFRC STANDARD SIZE

NOTE: This is NOT an NFRC Label Certificate. This document can NOT be used in place of NFRC Label Certificate and can be used only for Bid and Design Purposes

PRODUCT LISTING:

ID	Name	Framing Ref	Glazing Ref	Spacer Ref	U	SHGC	VT
					Btu/h-ft^2-F	-	-
P-POL-1234	2011 Polaris Curtain Wall	FA-PO CW-001	GA-SOU-3331	SA-PPG-2524	0.40	0.29	0.40
P-POL-1234	2011 Polaris Store Front	FA-PO SF-001	GA-SOU-3331	SA-PPG-2524	0.45	0.30	0.39
P-POL-1234	2011 Polaris Casement	FA-PO CS-001	GA-SOU-3331	SA-PPG-2524	0.44	0.30	0.38

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

b. Compare requirements to NFRC ratings:

PRODUCT LISTING:

ID	Name	U	SHGC	VT
		Btu/h-ft^2-F	-	-
P-POL-1234	2011 Polaris Curtain Wall	0.40	0.29	0.40
P-POL-1234	2011 Polaris Store Front	0.45	0.30	0.39
P-POL-1234	2011 Polaris Casement	0.44	0.30	0.38

Section of CMA Bid Report

Fenestration	Assembly Max. U	Assembly Max. SHGC
Vertical Glazing, % of Wall		
Nonmetal framing (all)[b]	U-0.35	
Metal framing (curtainwall/storefront)[c]	U-0.45	SHGC-0.40 all
Metal framing (entrance door)[c]	U-0.80	
Metal framing (all other)[c]	U-0.55	

ASHRAE 90.1-07

U-factor is "OK"

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

b. Compare requirements to NFRC ratings:

Fenestration	Assembly Max. U	Assembly Max. SHGC
Vertical Glazing, % of Wall		
Nonmetal framing (all)[b]	U-0.35	
Metal framing (curtainwall/storefront)[c]	U-0.45	SHGC-0.40 all
Metal framing (entrance door)[c]	U-0.80	
Metal framing (all other)[c]	U-0.55	

ASHRAE 90.1-07

PRODUCT LISTING:

ID	Name	U	SHGC	VT
		Btu/h-ft^2-F	-	-
P-POL-1234	2011 Polaris Curtain Wall	0.40	0.29	0.40
L-1234	2011 Polaris Store Front	0.45	0.30	0.39
L-1234	2011 Polaris Casement	0.44	0.30	0.38

Section of CMA Bid Report

SHGC is compliant

National Fenestration Rating Council®

NFRC & Code Compliance

4. Check for Compliance

Approved!

Courtesy of Duhaime.org

US Green Building Council's LEED Program

- Energy and Atmosphere section requires ASHRAE 90.1-2007 as mandatory minimum
  - NFRC 100 and 200 required by ASHRAE 90.1
  - LEED scores improve by beating this minimum
- All LEED projects require NFRC ratings
  - Poorly enforced
  - Recent activity indicating improved performance
- Improved daylighting improve LEED score also

Summary & Conclusions

- NFRC's *Residential Fenestration Rating & Certification Program* is:
  - **Well established, and in use for many years**
  - **Easy to understand**
  - **A great tool for proving code compliance; the temporary label makes for easy verification**
  - **Required for *ENERGY STAR*® rating of products**

National Fenestration Rating Council®

Summary & Conclusions

- NFRC's *Non-Residential (Component Modeling Approach) Program* is:
  - **Lowest-cost option to prove code compliance**
  - **Web-based for easy access**
  - **Faster turn-around versus site-built program**
  - **Bidding tool that can be used by broad community**
  - **Can deliver ratings for project and standard sizes**
  - **Can output electronic *EnergyPlus*® and *DoE2* files**
  - **Required for USGBC LEED projects**

National Fenestration Rating Council®

To Confirm NFRC Ratings

- **Residential**
  - **Click here: http://search.nfrc.org/search/searchDefault.aspx**
- Commercial
  - **Click here: http://cmast.nfrc.org/Project/CertificateFind.aspx**

National Fenestration Rating Council®

Additional Resources

- NFRC Webpage: www.nfrc.org
- CMA Webpage: http://nfrc.org/sb_aboutprogram.aspx
- Labs and Agencies: http://nfrc.org/labsagencies.aspx
- NFRC Staff, Residential Product Certification Program Support:

  Toni Stroud ***PCP Associate, Product Certification Program***

- NFRC Staff, Commercial Product Certification Program Support

  Jen Padgett ***CMA Technical Coordinator***

  Ray McGowan ***Sr. Program Manager***

- *Call (301) 589-1776 and ask for anyone*

THANK YOU!

Ray McGowan

Senior Program Manager

National Fenestration

Rating Council

(NFRC)