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

Fenestration consumes 32% of that primary energy:
NFRC—Introduction & Overview

Facts:

In the USA, on average, Only ~30% of all non-residential buildings (somewhat higher % in residential) use high performance windows;
NFRC Ratings

- Heat loss rating \((U\text{-factor})\)
- Solar Heat Gain rating \((SHGC)\)
- Visible Transmittance rating \((VT)\)
- Air Leakage rating
- Condensation Resistance rating \((CR)\)
NFRC Ratings

- **U-factor (thermal transmission)**
  - NFRC 100

- **VT (Visible Transmittance)**
  - NFRC 200

- **SHGC (Solar Heat Gain)**
  - NFRC 200
NFRC Ratings

Air Leakage (Air infiltration, no exfiltration)
NFRC 400

CR (Condensation Resistance)
NFRC 500
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
NFRC Ratings: Development & Basis

CAD drawing file, section view, curtain wall wall
NFRC Ratings: Development & Basis

Based on LBNL’s WINDOW & THERM

THERM simulation file, profile view, curtain wall
Residential Certification

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

**World's Best Window Co.**

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

### ENERGY PERFORMANCE RATINGS

<table>
<thead>
<tr>
<th>U-Factor (U.S./I-P)</th>
<th>Solar Heat Gain Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.35</td>
<td>0.32</td>
</tr>
</tbody>
</table>

### ADDITIONAL PERFORMANCE RATINGS

<table>
<thead>
<tr>
<th>Visible Transmittance</th>
<th>Air Leakage (U.S./I-P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.51</td>
<td>0.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condensation Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
</tr>
</tbody>
</table>

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](http://www.nfrc.org)
Non-Residential Certification

CMA Label Certificate Site-Built Label Certificate
Non-Residential Certification

Overview of the *Component Modeling Approach* (‘CMA’) Program
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

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
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*
Non-Res. Certification: CMAST

Overview of the 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
NFRC CMA Label Certificate (page 2):
# NFRC CMA Label Certificate (page 2):

### PRODUCT LISTING

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

**NFRC CERTIFIED PRODUCT RATING INFORMATION:**

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

| Product Code | Total Area | Name | Framing Ref | Glazing Ref | Spacer Ref | U-factor | SHGC | VT
|--------------|------------|------|-------------|-------------|-----------|----------|------|----
| P-PL-016     | 54.89      | PL-200  | PL-2250     | PA-PL2210   | GA-TT-001 | 0.53     | 0.56 | 0.65
| P-PL-035     | 59.57      | PL-3400 | PL-3401     | PA-PL3401   | GA-TT-001 | 0.56     | 0.57 | 0.65
| P-PL-021     | 63.75      | PL-2600 | PL-2650     | PA-PL2610   | GA-TT-001 | 0.52     | 0.54 | 0.63
| P-PL-022     | 55.65      | PL-3100 | PL-3150     | PA-PL3120   | GA-TT-001 | 0.51     | 0.51 | 0.63
| P-PL-026     | 58.99      | PL-2800 | PL-2850     | PA-PL2810   | GA-TT-001 | 0.49     | 0.50 | 0.63

### FRAME, GLAZING and SPACER ASSEMBLIES:

#### FRAMING LISTING:

- **Framing Ref:** PA-PL2210  
  **Supplier ID:** Single Cavity Thermally Broken Aluminum

- **Framing Ref:** PA-PL2610  
  **Supplier ID:** Pre-glazed Thermally Broken Aluminum

- **Framing Ref:** PA-PL3401  
  **Supplier ID:** Vertical Sliding Thermally Broken Aluminum

- **Framing Ref:** PA-PL3120  
  **Supplier ID:** Fixed Thermally Broken Aluminum

#### GLAZING LISTING:

- **Glazing Ref:** GA-TT-001  
  **Supplier ID:** 1" Double Glazed, 1/4" Helvac, 1/4" Clear, Argon (60%), 1/2" gap

- **Glazing Ref:** GA-TT-002  
  **Supplier ID:** 1" Triple Glazed, 1/4" Clear, Coated film, 1/4" SC, Argon (60%), 3/8" gap

- **Glazing Ref:** GA-TT-003  
  **Supplier ID:** 1" Double Glazed, 1/4" Bronze, 1/4" SG Low-e, Argon (60%), 1/2" gap

#### SPACER LISTING:

- **Spacer Ref:** SA-AM-001  
  **Supplier ID:** 250P Mill Finish Aluminum Low profile (1/2"

- **Spacer Ref:** SA-AM-002  
  **Supplier ID:** TSA Polymer Spacers (5/8"

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NFRC CMA Label Certificate (optional pages): (project-specific sizes)
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
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.

*Why is CMA the preferred method?*
Non-Res. Certification

NFRC Site-Built Label Certificate
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
NFRC & Code Compliance

• NE State *Energy Code Requirements*
  • Residential: 2009 IECC
  • Commercial: ASHRAE 90.1-2007
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*
NFRC & Code Compliance

• Two ways to comply:
  – Default
  – NFRC
NFRC & Code Compliance

- 2009 IECC window
- Defaults
- Punitive!
- Project not likely complaint
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
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
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
NFRC & Code Compliance

Clipped from:
www.reca-codes.org
3. Energy Code Requirements

<table>
<thead>
<tr>
<th>Zone 5</th>
<th>Fenestration U-Factor</th>
<th>Skylight U-Factor</th>
<th>Glazed Fenestration SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
</tr>
</tbody>
</table>
### NFRC & Code Compliance

#### Table 402.1.1

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR&lt;sup&gt;b&lt;/sup&gt;</th>
<th>SKYLIGHT&lt;sup&gt;b&lt;/sup&gt; U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC&lt;sup&gt;d, e&lt;/sup&gt;</th>
<th>CEILING R-VALUE</th>
<th>WOOD FRAME W. R-VALU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.2</td>
<td>0.75</td>
<td>0.30</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>0.65&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.75</td>
<td>0.30</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>0.50&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.65</td>
<td>0.30</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>4 except Marine</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
<td>38</td>
<td>13</td>
</tr>
<tr>
<td>5 and Marine 4</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
<td>38</td>
<td>20 or 13</td>
</tr>
<tr>
<td>6</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
<td>49</td>
<td>20 or 13</td>
</tr>
<tr>
<td>7 and 8</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
<td>49</td>
<td>21</td>
</tr>
</tbody>
</table>

**IECC 09**

All NE is $U \leq 0.35$; no SHGC requirement
NFRC & Code Compliance

4. Check for Compliance

Compare requirements to NFRC ratings:

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
</tr>
</tbody>
</table>

**U-factor is “OK”**
4. Check for Compliance

Compare requirements...

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>FENESTRATION U-FACTOR</th>
<th>SKYLIGHT U-FACTOR</th>
<th>GLAZED FENESTRATION SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.35</td>
<td>0.60</td>
<td>NR</td>
</tr>
</tbody>
</table>

Also check the Code Compliance Certificate! (see 401.3)
NFRC & Code Compliance

4. Check for Compliance

Approved!

Courtesy of Hoffman Estates, IL
2014 Revision Underway!

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>U-factor</th>
<th>SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>≤ 0.30</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td>= 0.31</td>
<td>≥ 0.35</td>
</tr>
<tr>
<td></td>
<td>= 0.32</td>
<td>≥ 0.40</td>
</tr>
<tr>
<td>North-Central</td>
<td>≤ 0.32</td>
<td>≤ 0.40</td>
</tr>
<tr>
<td>South Central</td>
<td>≤ 0.35</td>
<td>≤ 0.30</td>
</tr>
<tr>
<td>Southern</td>
<td>≤ 0.60</td>
<td>≤ 0.27</td>
</tr>
</tbody>
</table>
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*
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.
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

•
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
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).
NFRC and Compliance

• IECC 09 defaults

### Table 303.1.3(1)
**DEFAULT GLAZED FENESTRATION U-FACTOR**

<table>
<thead>
<tr>
<th>FRAME TYPE</th>
<th>SINGLE PANE</th>
<th>DOUBLE PANE</th>
<th>SKYLIGHT Single</th>
<th>SKYLIGHT Double</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>1.20</td>
<td>0.80</td>
<td>2.00</td>
<td>1.30</td>
</tr>
<tr>
<td>Metal with Thermal Break</td>
<td>1.10</td>
<td>0.65</td>
<td>1.90</td>
<td>1.10</td>
</tr>
<tr>
<td>Nonmetal or Metal Clad</td>
<td>0.95</td>
<td>0.55</td>
<td>1.75</td>
<td>1.05</td>
</tr>
<tr>
<td>Glazed Block</td>
<td></td>
<td></td>
<td>0.60</td>
<td></td>
</tr>
</tbody>
</table>

### Table 303.1.3(2)
**DEFAULT DOOR U-FACTORS**

<table>
<thead>
<tr>
<th>DOOR TYPE</th>
<th>U-FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsulated Metal</td>
<td>1.20</td>
</tr>
<tr>
<td>Insulated Metal</td>
<td>0.60</td>
</tr>
<tr>
<td>Wood</td>
<td>0.50</td>
</tr>
<tr>
<td>Insulated, nonmetal edge, max 45% glazing, any glazing double pane</td>
<td>0.35</td>
</tr>
</tbody>
</table>

### Table 303.1.3(3)
**DEFAULT GLAZED FENESTRATION SHGC**

<table>
<thead>
<tr>
<th></th>
<th>SINGLE GLAZED</th>
<th>DOUBLE GLAZED</th>
<th>GLAZED BLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Tinted</td>
<td>0.80</td>
<td>0.70</td>
<td>0.60</td>
</tr>
<tr>
<td>Clear Tinted</td>
<td>0.70</td>
<td>0.60</td>
<td>0.60</td>
</tr>
</tbody>
</table>
### 3. Energy Code Requirements for IECC 2009

#### TABLE 502.3
**BUILDING ENVELOPE REQUIREMENTS: FENESTRATION**

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical fenestration (40% maximum of above-grade wall)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U-factor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Framing materials other than metal with or without metal reinforcement or cladding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U-factor</strong></td>
<td>1.20</td>
<td>0.75</td>
<td>0.65</td>
<td>0.40</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>Metal framing with or without thermal break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curtain wall/storefront <strong>U-factor</strong></td>
<td>1.0</td>
<td>0.70</td>
<td>0.60</td>
<td>0.50</td>
<td>0.45</td>
<td>0.45</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Entrance door <strong>U-factor</strong></td>
<td>1.20</td>
<td>1.10</td>
<td>0.90</td>
<td>0.85</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>All other <strong>U-factor</strong></td>
<td>1.20</td>
<td>0.75</td>
<td>0.65</td>
<td>0.55</td>
<td>0.55</td>
<td>0.55</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>SHGC-all frame types</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SHGC: PF &lt; 0.25</strong></td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>SHGC: 0.25 ≤ PF &lt; 0.5</strong></td>
<td>0.33</td>
<td>0.33</td>
<td>0.33</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>SHGC: PF ≥ 0.5</strong></td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Skylights (3% maximum)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U-factor</strong></td>
<td>0.75</td>
<td>0.75</td>
<td>0.65</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>SHGC</strong></td>
<td>0.35</td>
<td>0.35</td>
<td>0.35</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>
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.
No NFRC ratings, use defaults:

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Glazing Type</th>
<th>Unlabeled Vertical Fenestration</th>
<th>Clear Glass</th>
<th>Tinted Glass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>U-Factor</td>
<td>SHGC</td>
</tr>
<tr>
<td>All frame types</td>
<td>Single glazing</td>
<td>1.25</td>
<td>0.82</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Glass block</td>
<td>0.60</td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td>Wood, vinyl, or fiberglass frames</td>
<td>Double glazing</td>
<td>0.60</td>
<td>0.59</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Triple glazing</td>
<td>0.45</td>
<td>0.52</td>
<td>0.57</td>
</tr>
<tr>
<td>Metal and other frame types</td>
<td>Double glazing</td>
<td>0.90</td>
<td>0.68</td>
<td>0.66</td>
</tr>
<tr>
<td></td>
<td>Triple glazing</td>
<td>0.70</td>
<td>0.60</td>
<td>0.59</td>
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</table>
NFRC & Code Compliance

3. Energy Code Requirements for ASHRAE 90.1-07

<table>
<thead>
<tr>
<th>Opaque Elements</th>
<th>Nonresidential</th>
<th>Residential</th>
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<th></th>
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<tr>
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<td>Assembly Max.</td>
<td>Insulation Min. R-Value</td>
<td>Assembly Max.</td>
<td>Insulation Min. R-Value</td>
<td>Assembly Max.</td>
<td>Insulation Min. R-Value</td>
<td>Assembly Max.</td>
<td>Insulation Min. R-Value</td>
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<tr>
<td>Fenestration</td>
<td>Max. U</td>
<td>SHGC</td>
<td>Max. U</td>
<td>SHGC</td>
<td>Max. U</td>
<td>SHGC</td>
<td>Max. U</td>
<td>SHGC</td>
</tr>
<tr>
<td>Vertical Glazing, % of Wall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Nonmetal framing (all)</td>
<td>U-0.35</td>
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<td></td>
<td></td>
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<tr>
<td>Metal framing (curtainwall/storefront)</td>
<td>U-0.45</td>
<td>SHGC-0.40 all</td>
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<td></td>
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</tr>
<tr>
<td>Metal framing (entrance door)</td>
<td>U-0.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal framing (all other)</td>
<td>U-0.55</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Skylight with Curb, Glass, % of Roof</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0%-2.0%</td>
<td>U’all-1.17</td>
<td>SHGC’all-0.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1%-5.0%</td>
<td>U’all-1.17</td>
<td>SHGC’all-0.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skylight with Curb, Plastic, % of Roof</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>0%-2.0%</td>
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<td>SHGC’all-0.77</td>
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<td>2.1%-5.0%</td>
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<td>SHGC’all-0.62</td>
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</tr>
<tr>
<td>Skylight without Curb, All. % of Roof</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>0%-2.0%</td>
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<tr>
<td>2.1%-5.0%</td>
<td>U’all-0.69</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The following definitions apply: c.i. = continuous insulation (see Section 5.2); NR = no insulation.
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:

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Framing Ref</th>
<th>Glazing Ref</th>
<th>Spacer Ref</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-EFC-4207</td>
<td>SFTestBB</td>
<td>FA-EFC-6689</td>
<td>GA-SOU-5331</td>
<td>SA-PPG-2524</td>
<td>0.30</td>
<td>0.30</td>
<td>0.20</td>
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</tbody>
</table>

FRAME, GLAZING and SPACER ASSEMBLIES:

GLAZING LISTING:

<table>
<thead>
<tr>
<th>Glazing Ref</th>
<th>Supplier ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA-SOU-5331</td>
<td>Southwall Technologies</td>
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</tr>
</tbody>
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SPACER LISTING:

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<thead>
<tr>
<th>Spacer Ref</th>
<th>Supplier ID</th>
<th>Description</th>
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<tbody>
<tr>
<td>SA-PPG-2524</td>
<td>PPG Industries</td>
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FRAMING LISTING:

<table>
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<tr>
<th>Framing Ref</th>
<th>Supplier ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA-EFC-6689</td>
<td>EFCO Corporation</td>
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***NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE***

PRODUCT LISTING:

<table>
<thead>
<tr>
<th>ID</th>
<th>Qty</th>
<th>Total Area</th>
<th>Name</th>
<th>EnergyPlus Report File</th>
<th>Fenestration Performance at Actual Size*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>in²</td>
<td></td>
<td></td>
<td>Width</td>
</tr>
<tr>
<td>P-EFC-4207</td>
<td>125</td>
<td>2168966.60</td>
<td>SFTestBB</td>
<td></td>
<td>120.00</td>
</tr>
</tbody>
</table>

* 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.
# 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

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<th>Glazing Ref</th>
<th>Spacer Ref</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
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</thead>
<tbody>
<tr>
<td>P-EFC-4207</td>
<td>SFTestBB</td>
<td>FA-EFC-6689</td>
<td>GA-SOU-5321</td>
<td>SA-PPG-2524</td>
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<td>0.30</td>
<td>0.20</td>
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#### FRAME, GLAZING and SPACER ASSEMBLIES:

**GLAZING LISTING:**

<table>
<thead>
<tr>
<th>Glazing Ref</th>
<th>Supplier ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA-SOU-5321</td>
<td>Southwall Technologies</td>
<td></td>
</tr>
</tbody>
</table>

**SPACER LISTING:**

<table>
<thead>
<tr>
<th>Spacer Ref</th>
<th>Supplier ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-PPG-2524</td>
<td>PPG Industries</td>
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</tbody>
</table>

**FRAMING LISTING:**

<table>
<thead>
<tr>
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<th>Supplier ID</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>FA-EFC-6689</td>
<td>EFCO Corporation</td>
<td></td>
</tr>
</tbody>
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### NON-RESIDENTIAL FENESTRATION CALCULATION REPORT / BID REPORT ACCORDING TO NFRC CMA PROCEDURES – ACTUAL PRODUCT SIZE

#### PRODUCT LISTING:

<table>
<thead>
<tr>
<th>ID</th>
<th>Qty</th>
<th>Total Area</th>
<th>Name</th>
<th>EnergyPlus Report File</th>
<th>Width</th>
<th>Height</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
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</thead>
<tbody>
<tr>
<td>P-EFC-4207</td>
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<td>144.00</td>
<td>0.24</td>
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</table>

*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.*
4. Check for Compliance

a. Determine fenestration used on project:

Excellent reference is the NFRC ‘Bid Report’
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

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<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Framing Ref</th>
<th>Glazing Ref</th>
<th>Spacer Ref</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-POL-1234</td>
<td>2011 Polaris Curtain Wall</td>
<td>FA-PO CW-001</td>
<td>GA-SOU-3331</td>
<td>SA-PPG-2524</td>
<td>0.40</td>
<td>0.29</td>
<td>0.40</td>
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<tr>
<td>P-POL-1234</td>
<td>2011 Polaris Store Front</td>
<td>FA-PO SF-001</td>
<td>GA-SOU-3331</td>
<td>SA-PPG-2524</td>
<td>0.45</td>
<td>0.30</td>
<td>0.39</td>
</tr>
<tr>
<td>P-POL-1234</td>
<td>2011 Polaris Casement</td>
<td>FA-PO CS-001</td>
<td>GA-SOU-3331</td>
<td>SA-PPG-2524</td>
<td>0.44</td>
<td>0.30</td>
<td>0.38</td>
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</tbody>
</table>
4. Check for Compliance
   b. Compare requirements to NFRC ratings:

   **PRODUCT LISTING:**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
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<tr>
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<td>2011 Polaris Curtain Wall</td>
<td>0.40</td>
<td>0.29</td>
<td>0.40</td>
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<td>0.30</td>
<td>0.39</td>
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<td>P-POL-1234</td>
<td>2011 Polaris Casement</td>
<td>0.44</td>
<td>0.30</td>
<td>0.38</td>
</tr>
</tbody>
</table>

   U-factor is “OK”

   **ASHRAE 90.1-07**
NFRC & Code Compliance

4. Check for Compliance
   b. Compare requirements to NFRC ratings:

   **PRODUCT LISTING:**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>U</th>
<th>SHGC</th>
<th>VT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-POL-1234</td>
<td>2011 Polaris Curtain Wall</td>
<td>0.40</td>
<td>0.29</td>
<td>0.40</td>
</tr>
<tr>
<td>L-1234</td>
<td>2011 Polaris Store Front</td>
<td>0.45</td>
<td>0.30</td>
<td>0.39</td>
</tr>
<tr>
<td>L-1234</td>
<td>2011 Polaris Casement</td>
<td>0.44</td>
<td>0.30</td>
<td>0.38</td>
</tr>
</tbody>
</table>

   Vertical Glazing, % of Wall
   - Nonmetal framing (all)\textsuperscript{b} U-0.35
   - Metal framing (curtainwall/storefront)\textsuperscript{c} U-0.45
   - Metal framing (entrance door)\textsuperscript{c} U-0.80
   - Metal framing (all other)\textsuperscript{c} U-0.55
   
   SHGC-0.40 all

   **ASHRAE 90.1-07**

   **Section of CMA Bid Report**
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
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
To Confirm NFRC Ratings

• Residential
  – Click here: http://search.nfrc.org/search/searchDefault.aspx

• Commercial
  – Click here: http://cmast.nfrc.org/Project/CertificateFind.aspx
Additional Resources

- NFRC Webpage: [www.nfrc.org](http://www.nfrc.org)
- CMA Webpage: [http://nfrc.org/sb_aboutprogram.aspx](http://nfrc.org/sb_aboutprogram.aspx)
- Labs and Agencies: [http://nfrc.org/labsagencies.aspx](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)