PRIMARY FUNCTIONS OF THE
CALIFORNIA ENERGY COMMISSION

Advancing State Energy Policy
Investing in Energy Innovation
Developing Renewable Energy
Preparing for Energy Emergencies

Achieving Energy Efficiency
Transforming Transportation
Overseeing Energy Infrastructure
Intergovernmental Collaboration
Goals for this Training

2019 Energy Code

• Envelope requirements
  o Nonresidential buildings
  o Additions and alterations

• Simplify compliance and enforcement
  o Plan review
  o Field inspection
The Warren-Alquist Act established the California Energy Commission (CEC) in 1974

- Authority to develop and maintain Building Energy Efficiency Standards
- Requires the CEC to update periodically, usually every three years
- Requires the Energy Code to be cost-effective over the economic life of the building
Nonresidential Buildings

Nonresidential, high-rise residential, hotel and motel buildings

- 2019 added I-1 and I-2
- Hotels and motels
- High-rise residential buildings

- Offices
- Retail and wholesale stores
- Restaurants
- Assembly and conference areas
- Industrial work buildings
- Commercial or industrial storage
- Schools and churches
- Theaters
- Hotels and motels
- Healthcare facilities
- Apartment and multi-family buildings, four or more stories
- Long-term care facilities, four or more stories
2019 Energy Savings

Nonresidential, high-rise residential, hotel and motels

- 30% more efficient than 2016 Standards
- Savings due mainly to lighting upgrades
- LED lighting first year savings of 480 GWh
Energy Code Requirements

Mandatory measures
• Minimum efficiency requirements must always be met
• Can never trade off

Prescriptive measures
• Predefined efficiency requirements
• May supersede mandatory measures
• Different requirements for newly constructed buildings, additions, and alterations
Compliance Approaches

Prescriptive Approach
- Simple approach, no trade-offs
- Mostly used for alterations
- Standard building baseline

Performance Approach
- Most flexible approach, allows for trade-offs
- Must meet all mandatory requirements
- Requires the use of CEC-approved software
- Proposed design ≤ standard design
- Mostly used for newly constructed buildings and additions
Certificate of Compliance - NRCCs

- Dynamic fillable form
- Demonstrates compliance at design phase
- Completed by designer, architect, energy consultant, engineer, etc.
- Submit with permit application, include with plans
- Plans examiner verifies NRCC matches specs on plans
2019 NRCC Dynamic Forms

Nonresidential Certificate of Compliance - NRCCs

- Auto-fill fields
- Automatic calculations
- Drop down selections
- Interactive instructions
- Add and delete table rows
- Condensed 47 forms into 10
Certificate of Installation

Nonresidential

Certificate of Installation - NRCIs

- Completed by installing contractor
- Confirms compliance at installation
- Left on-site for building inspector
- Identifies construction documents that show energy features were installed as proposed in the certificate of compliance
- Inspector verifies documented efficiency and components match installed equipment and systems
Certificate of Acceptance

Nonresidential

Certificate of Acceptance - NRCAs

- Completed by field technician
- Confirms compliance with acceptance requirements in Reference Nonresidential Appendix NA7
- Left on-site for building inspector
- Identifies construction documents that show energy features were installed as proposed in the certificate of compliance
- Inspector veriﬁes documented efﬁciency and components match installed equipment and systems
Envelope Defined

The building envelope is the exterior components, including demising partitions, which enclose conditioned space, separating it from unconditioned space or outside space.
Locating Envelope Requirements
Nonresidential

Title 24, Part 1 Administrative Code
Title 24, Part 6 Energy Code
Part 1 - Administrative Code
- Chapter 10
- Sections 10-101 – 10-115
- Administrative requirements

Part 6 - Energy Code
- Subchapters 1 - 9
- Sections 100.0 - 150.2
- Technical requirements
Part 1 Administrative Code

All Buildings § 10-101 to § 10-115

Regulations, definitions, permitting, compliance, enforcement, acceptance testing providers, local ordinances, interpretations, certification, labeling for fenestration and roofs, outdoor lighting zones, community shared solar, and battery storage

Relevant sections
§ 10-111 – Fenestration and door labels
§ 10-112 – Default tables
§ 10-113 – Roofing products
## Part 6 Energy Code

**All Buildings § 100.0 - Table 100.0-A**

### Nonresidential envelope relevant sections

- § 100.1 Definitions
- § 110.6 - § 110.8 All buildings
- § 120.7 Mandatory measures
- § 140.3 Prescriptive requirements
- § 141.0 Additions and alterations
Mandatory Requirements

All Buildings § 110.0 to § 110.12

Regulates the manufacture and installation of components and systems for all buildings

Relevant sections
§ 110.6 – Envelope
§ 110.7 – Air leakage
§ 110.8 – Insulation and roofing
Mandatory Requirements

Nonresidential § 120.1 to 120.9

Covers requirements for design and installation of building envelopes, ventilation, space conditioning, service water heating systems and equipment, covered processes

Relevant sections
§ 120.7 – Insulation
Performance and Prescriptive Requirements

Nonresidential §140.0 to 140.9

Performance and prescriptive compliance approaches

Relevant sections
§ 140.3 – Prescriptive building envelope
Additions, Alterations, Repairs

Nonresidential § 141.0

Requirements for additions, alterations, and repairs

Relevant sections
§ 141.0(a) – Additions
§ 141.0(b) – Alterations
Fenestration and Exterior Door Requirements
Nonresidential

Administrative § 10-111, § 10-112
Mandatory § 100.1, § 110.6
Prescriptive § 140.3(a), § 140.3(c), § 140.3(d)
Additions and Alterations § 141.0(a), § 141.0(b)
Fenestration Definitions

Fenestration - a transparent or translucent material plus any sash, frame, mullions, and dividers

U-factor - a measure of the heat transmission through the fenestration

Solar Heat Gain Coefficient (SHGC) - the fraction of solar radiation entering the space through the fenestration which is released as heat into the space

Visible Transmittance (VT) - the ratio of visible light that is transmitted through the fenestration, higher is better

Lower U-factor and SHGC are more efficient
Fenestration Definitions

Three types of fenestration

• Site-Built: plant-fabricated and field-assembled
  o Storefront or curtain wall system
  o Referred to as knock-down

• Field-Fabricated: field-made
  o Custom made at site for a specific application

• Manufactured: pre-assembled glazing and frame
  o Most commonly used in residential
Labeling and Certification Requirements § 10-111
- National Fenestration Rating Council (NFRC) is designated to administer certification program
- Temporary labels
  - NFRC manufactured window and door labels
  - Energy Commission default table values
- Label certificates
  - NFRC Component Modeling Approach (CMA)
  - NA6 Alternate Default Fenestration Procedure (NRCC-ENV-05)
- Permanent labels

Default Tables § 10-112
- Energy Commission calculates, maintains, and revises
# Fenestration Temporary Labels

## NFRC

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

<table>
<thead>
<tr>
<th>ENERGY PERFORMANCE RATINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-Factor (U.S./I-P)</td>
</tr>
<tr>
<td>Solar Heat Gain Coefficient</td>
</tr>
<tr>
<td>0.30</td>
</tr>
<tr>
<td>0.30</td>
</tr>
</tbody>
</table>

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

## CEC

2019 California Energy Commission Default Label
XYZ Manufacturing Co.

<table>
<thead>
<tr>
<th>Key Features:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Doors</td>
</tr>
<tr>
<td>□ Double-Pane</td>
</tr>
<tr>
<td>□ Skylight</td>
</tr>
<tr>
<td>□ Glass Block</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame Type</th>
<th>Product Type:</th>
<th>Product Glazing Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal</td>
<td>Operable</td>
<td>Clear</td>
</tr>
<tr>
<td>Non-Metal</td>
<td>Fixed</td>
<td>Tinted</td>
</tr>
<tr>
<td>Metal, Thermal Break</td>
<td>Greenhouse/Garden Window</td>
<td>Single-Pane</td>
</tr>
<tr>
<td>Air space 7/16 in. or greater</td>
<td>With built-in curb</td>
<td>To calculate VT see NA6</td>
</tr>
<tr>
<td>Meets Thermal-Break Default Criteria</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

California Energy Commission Default U-factor =
California Energy Commission Default SHGC =
California Energy Commission Calculated VT =

Product meets the air infiltration requirements of §110.6(a), U-factor criteria of §110.6(a)2, SHGC criteria of §110.6(a)3 and VT criteria of §110.6(a)4 of the 2019 Energy Standards for Residential and Nonresidential Buildings.
NFRC CMA Label Certificate

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): ____________

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:

<table>
<thead>
<tr>
<th>CPD ID</th>
<th>Total Area (ft²)</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-PL010</td>
<td>98.99</td>
<td>PL-2200 / PL-2210</td>
<td>FA-PL2210</td>
<td>GA-TT-001</td>
<td>SA-AM-001</td>
<td>0.53</td>
<td>0.58</td>
<td>0.66</td>
</tr>
<tr>
<td>P-PL005</td>
<td>192.67</td>
<td>PL-3400 / PL-3401</td>
<td>FA-PL3401</td>
<td>GA-TT-001</td>
<td>SA-AM-002</td>
<td>0.56</td>
<td>0.57</td>
<td>0.65</td>
</tr>
<tr>
<td>P-PL012</td>
<td>362.22</td>
<td>PL-5700 / PL-5720</td>
<td>FA-PL5720</td>
<td>GA-TO-002</td>
<td>SA-AM-001</td>
<td>0.52</td>
<td>0.21</td>
<td>0.30</td>
</tr>
<tr>
<td>P-PL002</td>
<td>60.00</td>
<td>PL-1100 / PL-1152</td>
<td>FA-PL1152</td>
<td>GA-TT-001</td>
<td>SA-AM-001</td>
<td>0.42</td>
<td>0.51</td>
<td>0.62</td>
</tr>
<tr>
<td>P-PL022</td>
<td>525.00</td>
<td>PL-9800 / PL-9915</td>
<td>FA-PL9915</td>
<td>GA-TO-003</td>
<td>SA-AM-002</td>
<td>0.45</td>
<td>0.15</td>
<td>0.19</td>
</tr>
</tbody>
</table>
Fenestration and Exterior Door Mandatory Requirements

All Buildings § 100.1, §110.6

• Exterior doors require U-factor rating
  o NFRC
  o Doors with 25% or more glazing treated as fenestration
• Reduced NA6 to 200 square feet
• Updated definitions
  o Fenestration Product
  o Clerestory
  o Door
  o Glazed Door
  o Overhang Projection
  o Overhang Rise
Fenestration and Exterior Door Mandatory Requirements

All Buildings § 110.6

Manufactured and site-built
- Certified by NFRC to meet requirements for air leakage, U-factor, SHGC, and VT

Site-built
- Less than 200 ft² may use alternate default fenestration procedure in Reference Nonresidential Appendix NA6
- Meet acceptance requirements in Reference Nonresidential Appendix NA7

Field-fabricated
- Must use U-factor in Table 110.6-A and SHGC in Table 110.6-B
- Exterior doors less than 25% glazing use U-factor in JA4.5 Table 4.5.1
- VT calculated using Reference Nonresidential Appendix NA6
- Must be caulked and weather-stripped
# Fenestration and Exterior Door Mandatory Requirements

All Buildings § 110.6

Methods for determining U-factor and SHGC

<table>
<thead>
<tr>
<th></th>
<th>Manufactured Windows</th>
<th>Manufactured Skylights</th>
<th>Manufactured Doors</th>
<th>Site-Built Fenestration and Doors</th>
<th>Field-Fabricated Fenestration and Doors</th>
<th>Glass Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFRC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>NFRC - CMA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Default Table 110.6-A, B</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Default Table JA 4.5.1</td>
<td>n/a</td>
<td>n/a</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>n/a</td>
</tr>
<tr>
<td>NA6 - less than 200 ft²</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>✓</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
## Fenestration Default U-factor

### All Buildings § 110.6

### TABLE 110.6-4 DEFAULT FENESTRATION PRODUCT U-FACTORS

<table>
<thead>
<tr>
<th>FRAME</th>
<th>PRODUCT TYPE</th>
<th>SINGLE PANE U-FACTOR</th>
<th>DOUBLE PANE U-FACTOR</th>
<th>GLASS BLOCK U-FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Metal</td>
<td>Operable</td>
<td>1.28</td>
<td>0.79</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>1.19</td>
<td>0.71</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Greenhouse/garden window</td>
<td>2.26</td>
<td>1.40</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Glazed Doors</td>
<td>1.25</td>
<td>0.77</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Skylight</td>
<td>1.98</td>
<td>1.30</td>
<td>N.A.</td>
</tr>
<tr>
<td>Metal, Thermal Break</td>
<td>Operable</td>
<td>N.A.</td>
<td>0.66</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>N.A.</td>
<td>0.55</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Greenhouse/garden window</td>
<td>N.A.</td>
<td>1.12</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Glazed Doors</td>
<td>N.A.</td>
<td>0.59</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Skylight</td>
<td>N.A.</td>
<td>1.11</td>
<td>N.A.</td>
</tr>
<tr>
<td>Nonmetal</td>
<td>Operable</td>
<td>0.99</td>
<td>0.58</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>1.04</td>
<td>0.55</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>Glazed Doors</td>
<td>0.99</td>
<td>0.53</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Greenhouse/garden windows</td>
<td>1.94</td>
<td>1.06</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Skylight</td>
<td>1.47</td>
<td>0.84</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

1. For all dual-glazed fenestration products, adjust the listed U-factors as follows:
   a. Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.
   b. Add 0.05 to any product with true divided lite (dividers through the panes).
2. Translucent or transparent panels shall use glass block values when not rated by NFRC 100.
3. Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.
4. Windows with window film applied that is not rated by NFRC 100 shall use the default values from this table.
## Fenestration Default SHGC

### All Buildings § 110.6

### Table 110.6-B Default Solar Heat Gain Coefficient (SHGC)

<table>
<thead>
<tr>
<th>FRAME TYPE</th>
<th>PRODUCT</th>
<th>GLAZING</th>
<th>FENESTRATION PRODUCT SHGC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single Pane(^2,3) SHGC</td>
</tr>
<tr>
<td>Metal</td>
<td>Operable</td>
<td>Clear</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Clear</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Operable</td>
<td>Tinted</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Tinted</td>
<td>0.68</td>
</tr>
<tr>
<td>Metal, Thermal Break</td>
<td>Operable</td>
<td>Clear</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Clear</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Operable</td>
<td>Tinted</td>
<td>N.A.</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Tinted</td>
<td>N.A.</td>
</tr>
<tr>
<td>Nonmetal</td>
<td>Operable</td>
<td>Clear</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Clear</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Operable</td>
<td>Tinted</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Fixed</td>
<td>Tinted</td>
<td>0.63</td>
</tr>
</tbody>
</table>

1. Translucent or transparent panels shall use glass block values when not rated by NFRC 200.
2. Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.
3. Windows with window film applied that is not rated by NFRC 200 shall use the default values from this table.
### Table 4.5.1 – Doors

<table>
<thead>
<tr>
<th>Description</th>
<th>U-factor (Btu/°F·ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsulated single-layer metal swinging doors or non-swinging doors, including single-layer uninsulated access hatches and uninsulated smoke vents:</td>
<td>1</td>
</tr>
<tr>
<td>Uninsulated double-layer metal swinging doors or non-swinging doors, including double-layer uninsulated access hatches and uninsulated smoke vents:</td>
<td>2</td>
</tr>
<tr>
<td>Insulated metal swinging doors, including fire-rated doors, insulated access hatches, and insulated smoke vents:</td>
<td>3</td>
</tr>
<tr>
<td>Wood doors, minimum nominal thickness of 1-3/4 in. (44 mm), including panel doors with minimum panel thickness of 1-1/8 in. (28 mm), and solid core flush doors, and hollow core flush doors:</td>
<td>4</td>
</tr>
<tr>
<td>Any other wood door:</td>
<td>5</td>
</tr>
<tr>
<td>Uninsulated single layer metal roll up doors including fire rated door</td>
<td>6</td>
</tr>
<tr>
<td>Insulated single layer metal sectional doors, minimum insulation nominal thickness of 1-3/8 inch; expanded polystyrene (R-4 per inch).</td>
<td>7</td>
</tr>
</tbody>
</table>

**Source:** ASHRAE 90.1-2007, Section A7.
Fenestration
Prescriptive Requirements
Nonresidential § 140.3(a)5

Exterior Vertical Windows
• Meet U-factor, SHGC, and VT requirements of Table 140.3-B, C, or D
  o Overhangs use relative SHGC calculation Equation 140.3-A
• Total fenestration area 40% or less of total wall area or 6 feet times total display perimeter, whichever is greater
• West fenestration area 40% or less of west wall area or 6 feet times total west-facing display perimeter, whichever is greater
## Fenestration and Exterior Door Prescriptive Requirements

### Nonresidential § 140.3(a)5

#### Exterior Vertical Windows

<table>
<thead>
<tr>
<th>Envelope</th>
<th>Fixed Window</th>
<th>Operable Window</th>
<th>Curtainwall or Storefront</th>
<th>Glazed Doors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>Max U-factor</td>
<td>0.36</td>
<td>0.46</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>Max RSHOC</td>
<td>0.25</td>
<td>0.22</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Min VT</td>
<td>0.42</td>
<td>0.32</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Maximum WWR%</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skylights</th>
<th>Glass, Curb Mounted</th>
<th>Glass, Deck Mounted</th>
<th>Plastic, Curb Mounted</th>
<th>Tubular Daylighting Devices (TDDs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max U-factor</td>
<td>0.58</td>
<td>0.46</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>Max SHGC</td>
<td>0.25</td>
<td>0.25</td>
<td>NR</td>
</tr>
<tr>
<td></td>
<td>Min VT (Min VTmin for TDDs)</td>
<td>0.49</td>
<td>0.49</td>
<td>0.64</td>
</tr>
</tbody>
</table>

| Maximum SRR% | 5% |

CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)
Fenestration Prescriptive Requirements
Nonresidential § 140.3(a)5C

Overhangs on Exterior Vertical Windows
- Relative SHGC calculation
- Recognizes external shading
- Multiple SHGC by overhang factor
- NCM Table 3-17 overhang factors
- Equation 140.3-A

\[
RSHGC = \text{SHGC}_{\text{ori}} \times \left[ 1 + \frac{aH}{V} + b\left(\frac{H}{V}\right)^2 \right]
\]

Example: East-facing window SHGC 0.71
- Overhang extends out 3 feet, 6 feet above the bottom of the glass \( H/V : 3 / 6 = 0.50 \)
- East-facing overhang factor Table 3-17 = 0.63
- \( \text{SHGC} \times \text{overhang factor} \)
- \( RSHGC : 0.63 \times 0.71 = 0.45 \)
Fenestration
Prescriptive Requirements

Nonresidential § 140.3(a)3, 6

Demising wall windows
  • Maximum U-factors
  • No SHGC requirements
  • No VT requirements

Tubular skylights added
  • Maximum U-factor 0.88
  • Minimum VT 0.38
  • No SHGC requirements

See Tables 140.3-B, C, or D
# Fenestration

## Prescriptive Requirements

CONTINUED: TABLE 140.3-B – PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE; NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS)

<table>
<thead>
<tr>
<th>Envelope Fenestration</th>
<th>All Climate Zones</th>
<th>Fixed Window</th>
<th>Operable Window</th>
<th>Curtainwall or Storefront</th>
<th>Glazed Doors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vertical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area-Weighted Performance Rating</td>
<td>Max U-factor</td>
<td>0.36</td>
<td>0.46</td>
<td>0.41</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Max RSHGC</td>
<td>0.25</td>
<td>0.22</td>
<td>0.26</td>
<td>0.23</td>
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<tr>
<td>Area-Weighted Performance Rating</td>
<td>Min VT</td>
<td>0.42</td>
<td>0.32</td>
<td>0.46</td>
<td>0.17</td>
</tr>
<tr>
<td>Maximum WWR%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40%</td>
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<td><strong>Skylights</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area-Weighted Performance Rating</td>
<td>Max U-factor</td>
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<td>0.88</td>
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<tr>
<td></td>
<td>Max SHGC</td>
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<td>0.25</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Area-Weighted Performance Rating</td>
<td>Min VT</td>
<td>(Min VT_{TDDR} for TDDs)</td>
<td>0.49</td>
<td>0.49</td>
<td>0.64</td>
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<tr>
<td>Maximum SRR%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>
Fenestration and Exterior Door Prescriptive Requirements
Nonresidential § 140.3(a)6, 7

Skylights
- Meet U-factor, SHGC, and VT requirements of Table 140.3-B, C, or D
- Not more than 5% of total roof area
- Haze value more than 90%

Exterior doors
- Meet U-factor of Table 140.3-B
- Less than 25% glazing

<table>
<thead>
<tr>
<th>Exterior Doors, Maximum U-factor</th>
<th>Non-Swinging</th>
<th>0.50</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>1.45</th>
<th>0.50</th>
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<tbody>
<tr>
<td></td>
<td>Swinging</td>
<td>0.70</td>
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<td>0.70</td>
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<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
</tr>
</tbody>
</table>
Daylighting
Prescriptive Requirements

Nonresidential § 140.3(c)

Large enclosed spaces greater than 5,000 ft² in climate zones 2-15
- Conditioned or unconditioned
- Ceilings greater than 15 feet height directly under roof

Requirements
- At least 75% of floor area within skylit daylit zone or primary sidelit daylit zone
- Shown on plans
- Daylighting controls per § 130.1(d)
- Skylight area at least 3% of floor area or calculate with higher VT to install less skylight area (minimum 1.5%)
- Haze value greater than 90%
- VT requirements of skylights per §140.3(a)6D
Daylighting
Prescriptive Requirements
Nonresidential § 140.3(c)
Skylit and Sidelit areas
Daylighting Prescriptive Requirements
Nonresidential § 140.3(d)

• New power adjustment factors (PAF)
  o Clerestory window
  o Horizontal slats
  o Light shelves
• Meet orientation and installation requirements in §140.3(d) to qualify
Fenestration Addition Requirements
Nonresidential § 141.0(a)

Addition - increase in conditioned floor area and volume

• Prescriptive
  o Added windows, skylights, doors
  o Must comply as new construction

• Performance
  o Addition alone complies
  o Option for existing, plus addition, plus alteration
Fenestration Alteration Requirements

Nonresidential § 141.0(b)2A

Replacing existing fenestration
  • Vertical windows
    o Meet U-factor, SHGC, and VT requirements in Table 141.0-A
    o If replacing 150 ft² or less of vertical glazing, meet U-factor only
  • Skylights
    o Meet U-factor, SHGC, and VT requirements in Table 140.3-B, C, or D

Additional fenestration to existing building
  • Vertical windows and skylights
    o Meet U-factor, SHGC, and VT requirements in Table 140.3-B, C, or D
    o If adding 50 ft² or less, only need to meet U-factor
Fenestration Alteration Requirements
Nonresidential § 141.0(b)2A

<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>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-factor</td>
<td>0.47</td>
<td>0.47</td>
<td>0.58</td>
<td>0.47</td>
<td>0.58</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td>0.47</td>
<td></td>
</tr>
<tr>
<td>RSHGC</td>
<td>0.41</td>
<td>0.31</td>
<td>0.41</td>
<td>0.31</td>
<td>0.41</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
<td>0.41</td>
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</tr>
<tr>
<td>VT</td>
<td>See TABLE 140.3-B, C, and D for all Climate Zones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Test Your Knowledge

When does an exterior door become fenestration?

When the door has 25% or more glass

- Now considered part of the total fenestration
- Glass area meets all fenestration requirements
- Solid area meets exterior door requirements

Photo courtesy of Marvin Windows and Doors
Air Leakage Requirements
Nonresidential

Mandatory § 110.7
Prescriptive § 140.3(a)9
Air Leakage Definitions

**Infiltration** - uncontrolled air leakage from outside to inside, through cracks, joints, windows, doors, partitions, or penetrations.

**Exfiltration** - uncontrolled air leakage from inside to outside, through cracks, joints, windows, doors, partitions, or penetrations.

**Air Barrier** - a system of materials joined and sealed together to control air flow through the building envelope that separates conditioned from unconditioned space, or that separates adjoining conditioned spaces of different occupancies or uses.
Air Leakage
Mandatory Requirements
All Buildings § 110.7

Limit infiltration and exfiltration
• Must caulk, gasket, weather-strip, or seal all joints, penetrations, openings

Most overlooked mandatory requirement.
Air Barrier
Prescriptive Requirements
Nonresidential § 140.3(a)9

Continuous air barrier
- Climate zones 10-16
- All joints sealed and materials installed per manufacturer
- Meet one of these:
  - Materials with maximum air permeance of 0.004 cfm/ft² or per Table 140.3-A
  - Assemblies average air leakage not to exceed 0.04 cfm/ft² or these materials
    - Concrete masonry walls with two coatings of paint or sealer, or with integral rigid board insulation
    - Structurally insulated panels (SIPS)
    - Portland cement, sand parge, stucco, or gypsum plaster with minimum ½”
  - Entire building air leakage not to exceed 0.40 cfm/ft²
    - Tested in accordance with ASTM E779
# Air Barrier

## Prescriptive Requirements

### Nonresidential § 140.3(a)9

**TABLE 140.3-A MATERIALS DEEMED TO COMPLY WITH SECTION 140.3(a)9A**

<table>
<thead>
<tr>
<th></th>
<th>MATERIALS AND THICKNESS</th>
<th></th>
<th>MATERIALS AND THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plywood – min. 3/8 inches thickness</td>
<td>9</td>
<td>Built up roofing membrane</td>
</tr>
<tr>
<td>2</td>
<td>Oriented strand board – min. 3/8 inches thickness</td>
<td>10</td>
<td>Modified bituminous roof membrane</td>
</tr>
<tr>
<td>3</td>
<td>Extruded polystyrene insulation board – min. ½ inches thickness</td>
<td>11</td>
<td>Fully adhered single-ply roof membrane</td>
</tr>
<tr>
<td>4</td>
<td>Foil-back polyisocyanurate insulation board – min. ½ inches thickness</td>
<td>12</td>
<td>A Portland cement or Portland sand parge, each with min. 5/8 inches thickness</td>
</tr>
<tr>
<td>5</td>
<td>Closed cell spray foam with a minimum density of 2.0 pcf and a min. 2.0 inches thickness</td>
<td>13</td>
<td>Cast-in-place concrete, or precast concrete</td>
</tr>
<tr>
<td>6</td>
<td>Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf, and a min. 5/2 inches thickness</td>
<td>14</td>
<td>Fully grouted concrete block masonry</td>
</tr>
<tr>
<td>7</td>
<td>Exterior or interior gypsum board min. 1/2 inches thickness</td>
<td>15</td>
<td>Sheet steel or sheet aluminum</td>
</tr>
<tr>
<td>8</td>
<td>Cement board – min. 1/2 inches thickness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Insulation Requirements
Nonresidential

Mandatory § 110.8, § 120.7
Prescriptive § 140.3(a)
Alterations § 140.1(b)
Energy Code Definitions

**Exterior wall** - separates conditioned space from outdoor space

**Demising wall** - separates conditioned space from enclosed unconditioned space

**Roof** - outside cover of a building, including the structural supports, decking, and top layer that is exposed to the outside

**Ceiling** - demising partition over conditioned space and under unconditioned space

**Floor** - exterior partition under conditioned space and above outdoor space

**Soffit** - demising partition under conditioned space and above unconditioned space
**Insulation Definitions**

**U-factor** - a measure of the heat transmission through a wall, roof, floor (all materials in assembly), or a given thickness of a material (insulation)

**R-value** - capacity of an insulating material to resist heat flow

*Lower U-factor is better
Higher R-value is better*
Insulation Mandatory Requirements

All Buildings § 110.8(a-c)

All Materials

• Certified to California Quality Standards for Insulation Materials by the California Department of Consumer Affairs
• Restricts use of formaldehyde foam
• Must have fire-retardant on exposed surfaces and be installed according to California Building Code
Heated slab floors
- Meet requirements in Table 110.8-A for R-value and climate zone
- Must be certified per § 110.8(a)
- Protect exposed material to wind, equipment, moisture, and UV
- Rigid plate to prevent intrusion of insects into foundation
- Requirements for direct contact with slab and grade (water absorption and vapor permeable)

Wet insulation systems above roofs waterproof membrane
- Meet effective R-value in Reference Joint Appendix JA4.2
## Insulation

### Mandatory Requirements

#### Nonresidential § 120.7

<table>
<thead>
<tr>
<th>Assembly Type</th>
<th>Maximum U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roof and Ceiling</strong></td>
<td></td>
</tr>
<tr>
<td>Metal building</td>
<td>0.098</td>
</tr>
<tr>
<td>Wood framed and other</td>
<td>0.075</td>
</tr>
<tr>
<td><strong>Walls</strong></td>
<td></td>
</tr>
<tr>
<td>Metal buildings</td>
<td>0.113</td>
</tr>
<tr>
<td>Metal-framed walls (includes demising)</td>
<td>0.151</td>
</tr>
<tr>
<td>Heavy mass walls</td>
<td>0.690</td>
</tr>
<tr>
<td>Light mass walls</td>
<td>0.440</td>
</tr>
<tr>
<td>Wood-framed walls and other</td>
<td>0.110</td>
</tr>
<tr>
<td>Wood-framed demising walls</td>
<td>0.099</td>
</tr>
<tr>
<td>Spandrel panel and opaque curtain walls</td>
<td>0.280</td>
</tr>
<tr>
<td><strong>Floor and Soffit</strong></td>
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</tr>
<tr>
<td>Raised mass</td>
<td>0.269</td>
</tr>
<tr>
<td>Other</td>
<td>0.071</td>
</tr>
</tbody>
</table>
# Insulation

## Prescriptive Requirements

### Nonresidential § 140.3(a)1-4

**TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

<table>
<thead>
<tr>
<th>Envelope Type</th>
<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>
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<th>9</th>
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<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof/Ceiling</td>
<td>Metal Building</td>
<td>0.041</td>
<td>0.041</td>
<td>0.041</td>
<td>0.041</td>
<td>0.041</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Wood Framed and Other</td>
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<td>0.034</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walls</td>
<td>Metal Building</td>
<td>0.061</td>
<td>0.061</td>
<td>0.061</td>
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<td>0.061</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metal-framed</td>
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</tr>
<tr>
<td></td>
<td>Mass, Light(^1)</td>
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<td>0.170</td>
<td>0.170</td>
<td>0.227</td>
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<tr>
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<td>Mass, Heavy(^1)</td>
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<td>0.160</td>
<td>0.184</td>
<td>0.211</td>
<td>0.690</td>
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<td>0.690</td>
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<td>0.690</td>
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<td>0.253</td>
<td>0.211</td>
<td>0.184</td>
<td>0.184</td>
<td>0.160</td>
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</tr>
<tr>
<td></td>
<td>Wood-framed and Other</td>
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<td>0.059</td>
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<td>0.042</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floors/Soffits</td>
<td>Raised Mass(^1)</td>
<td>0.045</td>
<td>0.045</td>
<td>0.058</td>
<td>0.058</td>
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<td>0.092</td>
<td>0.092</td>
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<td>0.069</td>
<td>0.058</td>
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<td>0.058</td>
<td>0.037</td>
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</tr>
<tr>
<td></td>
<td>Other</td>
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<td>0.034</td>
<td>0.039</td>
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<td>0.039</td>
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<td>0.034</td>
<td>0.034</td>
<td></td>
</tr>
</tbody>
</table>
Insulation
Mandatory Requirements
Nonresidential Alterations § 141.0(b)1A

Roofs
• Meet prescriptive requirements of 141.0(b)2Bi when roof is stripped to the deck or recover boards per Table 141.0-C

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Nonresidential Continuous Insulation R-value</th>
<th>U-factor</th>
<th>High-Rise Residential and Guest Rooms of Hotel/Motel Buildings Continuous Insulation R-value</th>
<th>U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R-8</td>
<td>0.082</td>
<td>R-14</td>
<td>0.055</td>
</tr>
<tr>
<td>2</td>
<td>R-14</td>
<td>0.055</td>
<td>R-14</td>
<td>0.055</td>
</tr>
<tr>
<td>3-9</td>
<td>R-8</td>
<td>0.082</td>
<td>R-14</td>
<td>0.055</td>
</tr>
<tr>
<td>10-16</td>
<td>R-14</td>
<td>0.055</td>
<td>R-14</td>
<td>0.055</td>
</tr>
</tbody>
</table>
# Insulation Mandatory Requirements

Nonresidential Alterations § 141.0(b)1B,C

Walls, floors, and soffits

<table>
<thead>
<tr>
<th></th>
<th>Assembly Type</th>
<th>Minimum R-value</th>
<th>Maximum U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Walls</strong></td>
<td>Metal buildings</td>
<td>R-13</td>
<td>0.113</td>
</tr>
<tr>
<td></td>
<td>Metal-framed walls</td>
<td>R-13</td>
<td>0.217</td>
</tr>
<tr>
<td></td>
<td>Wood-framed walls and others</td>
<td>R-11</td>
<td>0.110</td>
</tr>
<tr>
<td></td>
<td>Spandrel panel and curtain walls</td>
<td>R-4</td>
<td>0.280</td>
</tr>
<tr>
<td><strong>Floors and Soffits</strong></td>
<td>Raised framed floors</td>
<td>R-11</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>Raised mass floors in high-rise res, hotel and motel</td>
<td>R-6</td>
<td>0.111</td>
</tr>
</tbody>
</table>
Do metal-framed demising walls need insulation?

Yes, they need to meet mandatory requirements in § 120.7

- Metal-framed demising walls require the same U-factor as metal-framed exterior walls
Roof Requirements
Nonresidential

Administrative § 10-113
Mandatory § 110.8(i)
Prescriptive § 140.3(a)1
Additions and Alterations § 140.1(a), § 140.1(b)
Roofing Definitions

Low-sloped - rise to run less than 2:12
Steep-sloped - rise to run of 2:12 or greater

**Solar Reflectance (SR)** - ability to reflect solar energy from the sun back into the atmosphere

**Thermal Emittance (TE)** - the ability to release heat that has been absorbed

**Solar Reflectance Index (SRI)** - combines SR three-year aged value and TE in an equation

The higher the number, the cooler the roof.
Nonresidential Cool Roof Brochure

• A cool roof will reflect more sunlight and absorb less heat than a standard roof

• The roofing product must meet minimum solar reflectance and thermal emittance values for Energy Code compliance
Certification requirements

• Cool Roof Rating Council (CRRC) is responsible for certifying

Labeling requirements

• Solar Reflectance and Thermal Emittance must be listed
Roofing
Mandatory Requirements
All Buildings § 110.8(i)

Roofing products
• Meet aged solar reflectance and thermal emittance thresholds
• Certified and labeled per § 10-113
• Default values for non-certified products
• Solar reflectance index may be used as alternative to aged SR and TE values
• Liquid-applied roof coatings to meet Table 110.8-C requirements for coverage and thickness
Roofing
Prescriptive Requirements
Nonresidential § 140.3(a)1A

Roofing products
• Meet requirements in § 110.8
• Cool roof requirements by climate zone, roof slope, and building type per Tables 140.3-B, C, or D
  o Minimum aged solar reflectance
  o Minimum thermal emittance

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonresidential</td>
<td>140.3-B</td>
</tr>
<tr>
<td>High-rise residential, hotel and motel</td>
<td>140.3-C</td>
</tr>
<tr>
<td>Relocatable schools</td>
<td>140.3-D</td>
</tr>
</tbody>
</table>
### Roofing Prescriptive Requirements

**Nonresidential § 140.3(a)1**

**TABLE 140.3-C – PRESCRIPTIVE ENVELOPE CRITERIA FOR HIGH-RISE RESIDENTIAL BUILDINGS AND GUEST ROOMS OF HOTEL/MOTEL BUILDINGS**

<table>
<thead>
<tr>
<th>Envelope</th>
<th>Climate Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof/ Ceiling</td>
<td>1</td>
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<tr>
<td>Metal Building</td>
<td>0.041</td>
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<tr>
<td>Wood-Framed and Other</td>
<td>0.028</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Walls</th>
<th>1</th>
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<tbody>
<tr>
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<td>0.061</td>
<td>0.061</td>
<td>0.061</td>
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<tr>
<td>Wood-Framed</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
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<td>Mass, Light</td>
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<td>0.170</td>
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<td>Mass, Heavy</td>
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<td>0.184</td>
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<td>0.184</td>
<td>0.253</td>
<td>0.211</td>
<td>0.184</td>
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<td>Wood-Framed and Other</td>
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</thead>
<tbody>
<tr>
<td>Aged Solar Reflectance</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<td>NR</td>
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<tr>
<td>Thermal Emittance</td>
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<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
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<tr>
<th>Steep-Shaped</th>
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<tbody>
<tr>
<td>Aged Solar Reflectance</td>
<td>NR</td>
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<td>0.20</td>
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<td>Thermal Emittance</td>
<td>NR</td>
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<table>
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<tr>
<th>Exterior Doors, Maximum U-factor</th>
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<th>4</th>
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<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Swinging</td>
<td>0.50</td>
<td>1.43</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
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<tr>
<td>Swinging</td>
<td>0.70</td>
<td>0.70</td>
<td>0.70</td>
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<td>0.70</td>
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</tr>
</tbody>
</table>
Roofing
Prescriptive Requirements
Nonresidential § 140.3(a)1Aia

Exception for low-sloped roofs
• Aged solar reflectance insulation trade-off per Table 140.3

<table>
<thead>
<tr>
<th>Aged Solar Reflectance</th>
<th>Metal Building Climate Zone 1-16 U-factor</th>
<th>Wood Framed and Other Climate Zone 6 &amp; 7 U-factor</th>
<th>Wood Framed and Other All Other Climate Zones U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.62-0.56</td>
<td>0.038</td>
<td>0.045</td>
<td>0.032</td>
</tr>
<tr>
<td>0.55-0.45</td>
<td>0.035</td>
<td>0.042</td>
<td>0.030</td>
</tr>
<tr>
<td>0.45-0.36</td>
<td>0.033</td>
<td>0.039</td>
<td>0.029</td>
</tr>
<tr>
<td>0.35-0.25</td>
<td>0.031</td>
<td>0.037</td>
<td>0.028</td>
</tr>
</tbody>
</table>
Roofing
Addition Requirements
Nonresidential § 141.0(a)

Addition - increase in conditioned floor area and volume
  • Prescriptive
    • Added roof and ceiling assemblies must comply as new construction
  • Performance
    • Addition alone complies
    • Option for existing, plus addition, plus alteration
Roofing Alterations Requirements
Nonresidential § 141.0(b)2B

Replacement, recoated, or recovered
• Greater than 50% of roofing or more than 2,000 square feet roofing being altered, whichever is less
  o Meet requirements per §110.8(i)
  o Roofing products meet SR and TE requirements per Tables 140.3-B, C, or D
  o Low-sloped exposed roof deck insulated per Table 141.0-C
Roofing
Alterations Requirements
Nonresidential § 141.0(b)2B

Exception for low-sloped roof alterations
• Aged solar reflectance insulation trade-off per Table 141.0-B

<table>
<thead>
<tr>
<th>Aged Solar Reflectance</th>
<th>Climate Zone 1, 3-9 U-factor</th>
<th>Climate Zone 2, 10-16 U-factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.62-0.60</td>
<td>0.075</td>
<td>0.052</td>
</tr>
<tr>
<td>0.59-0.55</td>
<td>0.066</td>
<td>0.048</td>
</tr>
<tr>
<td>0.54-0.50</td>
<td>0.060</td>
<td>0.044</td>
</tr>
<tr>
<td>0.49-0.45</td>
<td>0.055</td>
<td>0.041</td>
</tr>
<tr>
<td>0.44-0.40</td>
<td>0.051</td>
<td>0.039</td>
</tr>
<tr>
<td>0.39-0.35</td>
<td>0.047</td>
<td>0.037</td>
</tr>
<tr>
<td>0.34-0.30</td>
<td>0.044</td>
<td>0.035</td>
</tr>
<tr>
<td>0.29-0.25</td>
<td>0.042</td>
<td>0.034</td>
</tr>
</tbody>
</table>
Low-sloped exposed roof deck insulated per Table 141.0-C

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Nonresidential</th>
<th>High-Rise Residential and Guest Rooms of Hotel/Motel Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous Insulation</td>
<td>U-factor</td>
</tr>
<tr>
<td></td>
<td>R-value</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>R-8</td>
<td>0.082</td>
</tr>
<tr>
<td>2</td>
<td>R-14</td>
<td>0.055</td>
</tr>
<tr>
<td>3-9</td>
<td>R-8</td>
<td>0.082</td>
</tr>
<tr>
<td>10-16</td>
<td>R-14</td>
<td>0.055</td>
</tr>
</tbody>
</table>
Reroof example 1

- 1,800 ft² of 5,000 ft² roof is replaced
  - No insulation or cool roof required on that portion of the roof. 1,800 ft² is 36% of 5,000 ft². It is less than 50% of the roof area and less than 2,000 ft²

Reroof example 2

- 1,800 ft² of 3,000 ft² roof is reroofed and roof deck is exposed
  - Reroofed section must be insulated and have a cool roof. 1,800 ft² is 60% of 3,000 ft²
Does an alteration to the roof of an unconditioned building trigger cool roof requirements?

No. Alterations to the roof of an unconditioned building do not trigger cool roof requirements.

- Building envelope requirements usually do not apply to unconditioned buildings.
- Daylighting requirements may apply.
Plan Check and Inspection
Summary of 2019 Changes
Nonresidential Envelope

- Addition of exterior door labeling requirements
  - 25% or more glass is fenestration
- Reduced site-built fenestration from 1,000 to 200 square feet
  - NA6 calculation using center of glass
- Windows in demising walls meet exterior U-factors
- New requirements for tubular skylights
- New specifications for advanced daylighting design
Plans Examiners

- Prescriptive or performance approach
  - Performance mandatory requirements for insulation
- Verify NRCC values match plans
- Verify required values wall, roof assemblies
- Verify required values windows and skylights
### 1. ENVELOPE DETAILS §120.7 & §140.3

#### 1. OPAQUE SURFACE ASSEMBLY SUMMARY

<table>
<thead>
<tr>
<th>Surface Name</th>
<th>Surface Type</th>
<th>Description of Assembly Layers</th>
<th>Area (ft²)</th>
<th>Framing Type</th>
<th>Cavity R-Value</th>
<th>Continuous R-Value</th>
<th>U-Factor / F-Factor / C-Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base_CZ12-SlabOnOrBelowGradeF073</td>
<td>UndergroundFloor</td>
<td>Slab Type = UnheatedSlabOnGrade Insulation Orientation = None Insulation R-Value = R0</td>
<td>5502</td>
<td>NA</td>
<td>0</td>
<td>NA</td>
<td>F-Factor: 0.730 N</td>
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<tr>
<td>Base_CZ12-NonresMetalFrameWallU062</td>
<td>ExteriorWall</td>
<td>Stucco - 7/8 in. Compliance Insulation R13.99 Air - Metal Wall Framing - 16 or 24 in. OC Gypsum Board - 1/2 in.</td>
<td>3030</td>
<td>Metal</td>
<td>0</td>
<td>14</td>
<td>U-Factor: 0.062 N</td>
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<tr>
<td>NACM_Interior Wall</td>
<td>InteriorWall</td>
<td>Gypsum Board - 5/8 in. Air - Metal Wall Framing - 16 or 24 in. OC Gypsum Board - 5/8 in.</td>
<td>2646</td>
<td>Metal</td>
<td>0</td>
<td>NA</td>
<td>U-Factor: 0.319 N</td>
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<tr>
<td>Base_CZ12-SteepNonresWoodFramingAndOtherRoofU034</td>
<td>Roof</td>
<td>Metal Standing Seam - 1/16 in. Compliance Insulation R28.63</td>
<td>6445</td>
<td>NA</td>
<td>0</td>
<td>29</td>
<td>U-Factor: 0.034 N</td>
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</tbody>
</table>

Mandatory assembly U-factors must be met.
Double-check window and wall sizes match plans
Field Inspectors

At rough frame
- Air sealing
- Window and skylight values
- Daylighting features
- Cool roof (if applicable)

At insulation stage
- Wall insulation values
- Raised floor insulation values

At final
- Ceiling insulation values
- Air barrier
- NRCI forms
- NRCA forms
Resources
Online Resource Center

Educational documents and training information for building communities and enforcement agencies to assist with building energy standards compliance.

LEARN MORE
Acceptance Test Technicians perform required tests for lighting controls and mechanical systems in nonresidential buildings. The California Energy Commission’s approved Acceptance Test Technician Certification Providers (ATTCP) train, certify, and oversee the technicians and their employers.
Home Energy Rating System Program - HERS

The Home Energy Rating System (HERS) Program tests and rates the energy performance of a home. The California Energy Commission’s HERS Program addresses construction defects and poor equipment installation, including HVAC systems and insulation. The Energy Commission has a list of approved HERS providers who train and certify raters.
Blueprint is the California Energy Commission’s quarterly e-newsletter that delves into the Building Energy Efficiency Standards and provides examples of projects. The newsletter provides updates, answers to frequently asked questions, clarifications to requirements, announcements, and educational resources and training.
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    o Blueprint
    o Building Standards
  • Respond to confirmation email

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Monday through Friday
8:00 a.m. to 12:00 p.m.
1:00 p.m. to 4:30 p.m.

Call
800-772-3300 in CA
916-654-5106 outside CA

Email
Title24@energy.ca.gov
Energy Code Ace

- Forms and resource tools
- Free training in person and online
- Checklists and trigger sheets for building departments
Thank you