2013 Building Energy Efficiency Standards (California Energy Code)

Energy Code Navigation and Compliance
2013 Building Energy Efficiency Standards

- 25 percent more efficient than previous standards for residential construction
- 30 percent more efficient for nonresidential construction.
- The Standards take effect on July 1, 2014
Building Energy Efficiency Standards

- 2008 Standards, 169 pages
- Proposed 2013 Standards (15 Day Language), 349 pages
- 2013 Standards, 252 pages
• Residential Compliance Manual, 550 pages
• Non-Residential Compliance Manual, 1056 pages
• Reference Appendices, 561 pages
Reference Appendices

Joint Appendices
- Weather/Climate Data
- Technical Specifications
- Data Registry Requirements
- Qualifications

Residential Appendices
- Residential HERS Verification, Testing, and Documentation Procedures
- Residential HERS Testing Protocols

Nonresidential Appendices
- Nonresidential HERS Verification, Testing, and Documentation Procedures
- Nonresidential HERS Testing Protocols
This compliance manual is an aid to help plans examiners, inspectors, owners, designers, builders, and energy consultants comply with and enforce California’s 2013 Building Energy Efficiency Standards.
Standards Reduce Home Energy Use

Typical energy use for each Standards update
Northern CA Inland Climate

- Water Heating
- Space Cooling
- Space Heating

kBTU/sf-yr

- 70s
- 1978
- 1984
- 1988
- 1992
- 1998
- 2001
- 2005
- 2008
- 2013
Policy Drivers for the 2013 Standards

- Zero Net Energy Buildings
  - Newly constructed homes to be ZNE by 2020
  - Newly constructed commercial buildings to be ZNE by 2030
- Energy Efficiency 1st in the Loading Order
- Reduce Greenhouse Gas Emissions

- 2006 AB32 California Global Warming Solutions Act
- 2008 Energy Action Plan
- 2008 AB32 Scoping Plan
- 2008 CA Long Term Energy Efficiency Strategic Plan
- 2010 Governor Brown’s Clean Energy Jobs Plan
- 2010 Clean Energy Future Initiative
- 2012 Governor Brown’s Executive Order
2013 Standards: Residential Energy Savings

- 23.6 GWh/yr; 1.1 Mtherms/yr; 35 MW
- Single Family: 25% better than current Standards
- Multi-Family: 14% better than current Standards

Single Family Savings by End Use

<table>
<thead>
<tr>
<th>End Use</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>25%</td>
</tr>
<tr>
<td>Hot Water Heating</td>
<td>8%</td>
</tr>
<tr>
<td>Space Cooling</td>
<td>42%</td>
</tr>
<tr>
<td>Space Heating</td>
<td>11%</td>
</tr>
</tbody>
</table>

Multi-Family Savings by End Use

<table>
<thead>
<tr>
<th>End Use</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>14%</td>
</tr>
<tr>
<td>Hot Water Heating</td>
<td>0.5%</td>
</tr>
<tr>
<td>Space Cooling</td>
<td>21%</td>
</tr>
<tr>
<td>Space Heating</td>
<td>17%</td>
</tr>
</tbody>
</table>
Residential

• Solar-ready roofs to allow homeowners to add solar photovoltaic panels at a future date
• More efficient windows to allow increased sunlight, while decreasing heat gain
• Insulated hot water pipes, to save water and energy and reduce the time it takes to deliver hot water
• Whole house fans to cool homes and attics with evening air reducing the need for air conditioning load
• Air conditioner installation verification to insure efficient operation
2013 Standards: Nonresidential Energy Savings

- 30% more energy efficiency compared to current Standards
- 372 GWh/yr; 6.7 Mtherms/yr; 84 MW

Nonresidential Savings Attribution

- Newly Constructed: 53%
- Process Energy: 32%
- Alterations: 15%
Nonresidential

• High performance windows, sensors and controls that allow buildings to use "daylighting"
• Efficient process equipment in supermarkets, computer data centers, commercial kitchens, laboratories, and parking garages
• Advanced lighting controls to synchronize light levels with daylight and building occupancy, and provide demand response capability
• Solar-ready roofs to allow businesses to add solar photovoltaic panels at a future date
• Cool roof technologies
Administrative Regulations

- PERMIT, CERTIFICATE, INFORMATIONAL, AND ENFORCEMENT REQUIREMENTS FOR DESIGNERS, INSTALLERS, BUILDERS, MANUFACTURERS, AND SUPPLIERS.

- NONRESIDENTIAL LIGHTING CONTROLS ACCEPTANCE TEST TRAINING AND CERTIFICATION

- NONRESIDENTIAL MECHANICAL ACCEPTANCE TEST TRAINING AND CERTIFICATION

- DETERMINATION OF OUTDOOR LIGHTING ZONES
Compliance Forms

- Residential-96 forms
- Non-Residential-95 forms
- Consider requiring the document author to list the forms required for final inspection.
Compliance Forms

- Residential forms - 5 pages
- Non-Residential forms – 6 pages

Keep lists handy to help determine which forms are necessary at final inspection.
Good News! Simplified forms

HVAC Change-out
- One page CF1R for HVAC alterations.
- Climate Zones 1 and 3-7 ALT-02-E
- Climate Zones 2 and 8-15 ALT-03-E
Good news! No forms required for minor projects

• **10-103 (a) 1 C** - For alterations to existing residential buildings for which HERS field verification is not required such as:
  • Water heater
  • Window replacements
  • Additions less than 300 square feet
**The Most Useful Table in the Standards**

**TABLE 100-A**

Covered Processes added to the code and table (Section 140.9)

- Computer Rooms
- Commercial Kitchens
- Kitchen Ventilation

### TABLE 100-A: APPLICATION OF STANDARDS

<table>
<thead>
<tr>
<th>Occupancies</th>
<th>Application</th>
<th>Mandatory</th>
<th>Prescriptive</th>
<th>Performance</th>
<th>Additions/Alterations</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>140.9</td>
<td>140.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelope</td>
<td>110.6, 110.7</td>
<td>110.8, 120.7</td>
<td>140.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC</td>
<td></td>
<td></td>
<td></td>
<td>140.3(c)</td>
<td></td>
</tr>
<tr>
<td>Outdoor Lighting</td>
<td>110.5</td>
<td>120.5</td>
<td>120.8</td>
<td>140.4</td>
<td></td>
</tr>
<tr>
<td>Water Heating</td>
<td>110.3, 120.3, 120.7</td>
<td>140.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor Lighting</td>
<td>110.8, 120.8, 120.1, 130.4</td>
<td>140.6(c), 140.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building Electrical</td>
<td>120.5</td>
<td>140.6</td>
<td>N.A.</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>Solar Ready Buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pool and Spa Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Covered Processes

- Envelope: Ventilation, Process Loads
- Indoor and Outdoor: 140.9

#### Low-Rise Residential

<table>
<thead>
<tr>
<th>Occupancies</th>
<th>Application</th>
<th>Mandatory</th>
<th>Prescriptive</th>
<th>Performance</th>
<th>Additions/Alterations</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>150.0</td>
<td>140.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVAC</td>
<td></td>
<td></td>
<td></td>
<td>140.1(b)</td>
<td>120.9, 140.9</td>
</tr>
<tr>
<td>Outdoor Lighting</td>
<td>110.9</td>
<td>120.9</td>
<td>120.8</td>
<td>140.9</td>
<td></td>
</tr>
<tr>
<td>Water Heating</td>
<td>110.3, 120.3, 120.7</td>
<td>150.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor Lighting</td>
<td>110.9, 120.9</td>
<td>150.9(c)</td>
<td>150.9(b)</td>
<td>150.2</td>
<td></td>
</tr>
<tr>
<td>Building Electrical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar Ready Buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Nonresidential, high-rise and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.
Frequent Questions

• Refrigerant Charge on Mini-Split Systems
• Accurate CF6R Duct Testing Results
• Electric Water Heater
• SLA Compliance Requirements (HERS) / Building Envelope Sealing
• Compliance Requirements for Unpermitted Work
• Documentation Requirements for HVAC Sample Group (Untested)
• Electrical Resistance Heat
• Conditioning Enclosed Patio or Garage
• Screw Base Conversion Kits
• Insulating existing attic
• Replacement Windows
• High Efficacy Lighting in Kitchens
• Occupancy vs. Vacancy Switch in Bathroom
• Recirculation Pump Installation
• Whole house fan installation
Frequent Questions

Refrigerant Charge for Mini-split and Package systems

2008 Standards
- CF1R
- CF6R

2013 Standards
- CF1R
- CF2R (formerly CF6R)
- CF3R (formerly CF4R)
- Refrigerant charge verification required
- Weigh-in method requires HERS verification
Frequent Questions

Accurate CF6R Duct Testing Results

How many HVAC contractors own duct testing equipment?

Why is it important?

• Energy Efficiency
• Indoor Air Quality
• Health and Safety
Frequent Questions

Owner wants an Electric Water Heater because of Carbon Monoxide concerns.

Coming in 2016
Frequent Questions

Specified Leakage Area (2008) Compliance Requirements (HERS)

• Checklist is not an acceptable substitution for testing.
• All homes utilizing the SLA credit shall be tested.

Building Envelope Sealing (2103)
Compliance Requirements for Unpermitted Work

- Efficiency based on manufacture date.
- Duct Testing
- Refrigerant Charge
- CF1R
- CF6R (CF2R)
- CF4R (CF3R)
Frequent Questions

Documentation Requirements for HVAC Sample Group (Untested)

• All projects require CF4R (CF3R) regardless of whether they were tested or not.
Frequent Questions

Electrical Resistance Heat

- Exception allows electric resistance heat with conditions:
Frequent Questions

Electrical Resistance Heat

• Capacity not to exceed 2kW or 7,000 Btu/hr and
• Controlled by a time-limiting device not exceeding 30 minutes.
Frequent Questions

Building heating and cooling loads shall be determined using an approved method.

“Like for like” does not require calculation of heating and cooling loads.

150.0 Mandatory Features only applies to new construction.
Frequent Questions

Installing a gas fireplace or conditioning (heat or cooling) an enclosed patio or garage.

- Conditioning the space triggers envelope compliance.
Frequent Questions

Screw Base Conversion Kits

• Screw base equals low efficacy

• Change for 2016
Frequent Questions

Replacement Windows

2008 Standards
• U-Factor .40
• SHGC .40

2013 Standards
• U-Factor .32
• SHGC .25
Frequent Questions

Permit required to insulate an existing attic?

- Minimum R-30 except CZ 1 and 16 R-38.
- Existing recessed cans
- Combustion air openings
- Existing appliance vents
- Attic ventilation
Frequent Questions

High Efficacy Lighting in Kitchens

• 2- 60 watt low efficacy, 120 watts total.
• 5-26 watt fluorescent 130 watts total.

Owner wants to install 5 LED luminaires (60 watts total)

• Fluorescent 26 watts each
• LED 12 watts each
Frequent Questions

Occupancy vs. Vacancy Switch

• Residential Occupancy sensor - auto on and auto off.

• Residential Vacancy sensor — manual on and auto off.
Recirculation Pump Installation (retrofit)

2008 Standards:
- Remote pump OK
- Recirculation system requires all pipes to be insulated (typically impractical).

2103 Standards
- Both pumps OK
- Exception allows only exposed pipes to be insulated
Whole House Fan Installation

A whole house fan should not be installed if a natural draft or fan assisted gas appliance located inside the combustion appliance zone or attic without providing an interlock device.
Residential
**Prescriptive**

**TABLE 150.1-A, Component Package A**

<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><strong>Roofs/Ceilings</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.025</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>0.18</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td><strong>Walls</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.070</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td></td>
</tr>
<tr>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td><strong>Insulation</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td>0.125</td>
<td></td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td><strong>Building Envelope</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.070</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td></td>
</tr>
<tr>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td><strong>Floors</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td><strong>Slab Perimeters</strong></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>
<td></td>
</tr>
<tr>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td><strong>Raised</strong></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>
<td></td>
</tr>
<tr>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
<td>U</td>
<td>R</td>
</tr>
<tr>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td>0.092</td>
<td></td>
</tr>
<tr>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td><strong>Radiant Barrier</strong></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>
<td></td>
</tr>
<tr>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td><strong>Low-sloped</strong></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>
<td></td>
</tr>
<tr>
<td>Aged Solar Reflectance</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Thermal Emissivity</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Steep Sloped</strong></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>
<td></td>
</tr>
<tr>
<td>Aged Solar Reflectance</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Thermal Emissivity</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td><strong>Maximum U-factor</strong></td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Maximum SHGC</strong></td>
<td>NR</td>
<td>0.25</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
<td>NR</td>
<td>0.23</td>
</tr>
<tr>
<td><strong>Maximum Total Area</strong></td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Maximum West Facing Area</strong></td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
<td>NR</td>
<td>5%</td>
</tr>
</tbody>
</table>
Residential - Prescriptive Measures

- Insulation is expressed in assembly U-factor
- Wall insulation requires continuous insulation as well as stud bay insulation
Residential - Prescriptive Measures

High Performance Windows – Reducing the U-Factor down to 0.32 and SHGC down to 0.25. (Section 150.1(c)3A)

![Table and Diagram](image)
Duct Insulation – Raise minimum from R-4.2 to R-6.0 in climate zones 6, 7, and 8. (Section 150.1(c)(9))

<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>Roof/Ceilings</td>
<td>U0.025 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
<td>U0.031 R10</td>
</tr>
<tr>
<td>Walls</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>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
<tr>
<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></td>
<td></td>
</tr>
</tbody>
</table>
• Night Ventilation — Whole house fan as a minimum; allows Smart Vents and Night Breeze as alternatives in CZs 8-14. (Section 150.1(c)12)
# Whole House Fan Comparison

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model</th>
<th>cfm</th>
<th>watts</th>
<th>cfm/watt</th>
<th>cost</th>
<th>insulation</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airscape</td>
<td>1.7 WHF</td>
<td>1712</td>
<td>157</td>
<td>10.9</td>
<td>$869.00</td>
<td>R7</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2536</td>
<td>197</td>
<td>12.9</td>
<td></td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>Airscape</td>
<td>2.5 WHFe</td>
<td>1530</td>
<td>44</td>
<td>34.8</td>
<td>$1,329.00</td>
<td>R10</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4410</td>
<td>699</td>
<td>6.3</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Airscape</td>
<td>4.4 WHFe</td>
<td>2132</td>
<td>102</td>
<td>20.9</td>
<td>$1,649.00</td>
<td>R10</td>
<td>32.5</td>
</tr>
<tr>
<td>Tamarack</td>
<td>HV 1000</td>
<td>1150</td>
<td>78</td>
<td>14.8</td>
<td>$579.00</td>
<td>R38</td>
<td>Not Reported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1150</td>
<td>140</td>
<td>8.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tamarack</td>
<td>HV 1600</td>
<td>1600</td>
<td>140</td>
<td>11.4</td>
<td>$859.00</td>
<td>R38</td>
<td>Not Reported</td>
</tr>
<tr>
<td>Quiet Cool</td>
<td>QCES 1250</td>
<td>1265</td>
<td>36</td>
<td>35.1</td>
<td>$660.00</td>
<td>R4.2</td>
<td>44</td>
</tr>
<tr>
<td>Quiet Cool</td>
<td>QCES 2000</td>
<td>2035</td>
<td>88.8</td>
<td>22.9</td>
<td>$920.00</td>
<td>R4.2</td>
<td>46</td>
</tr>
<tr>
<td>Quiet Cool</td>
<td>QCES 2850</td>
<td>2850</td>
<td>177.6</td>
<td>16</td>
<td>$1,100.00</td>
<td>R4.2</td>
<td>48</td>
</tr>
<tr>
<td>Master Flow</td>
<td>4500*</td>
<td>4500</td>
<td>276</td>
<td>16.3</td>
<td>$234.00</td>
<td>None</td>
<td>Not Reported</td>
</tr>
<tr>
<td>Master Flow</td>
<td>6000*</td>
<td>6000</td>
<td>480</td>
<td>12.5</td>
<td>$298.00</td>
<td>None</td>
<td>Not Reported</td>
</tr>
<tr>
<td>Master Flow</td>
<td>1600*</td>
<td>1600</td>
<td>348</td>
<td>4.6</td>
<td>$438.00</td>
<td>Not Reported</td>
<td>Not Reported</td>
</tr>
</tbody>
</table>

* Does not comply with the California Green Building Standards Code (not insulated to R.4)
Adding the Radiant Barrier requirements in CZs 3, and 5-7. *(Section 150.1(c)2)*

- All climate zones except 1 and 16
- High performance attics in 2016
Residential - Prescriptive Measures

• Increase wall insulation to R15+4 in all CZs (Section 150.1(c)1B)

• More to come in 2016
A building with a controlled ventilation or unvented crawlspace may omit raised floor insulation if:

• The foundation walls are insulated and
• A Class I or Class II vapor retarder is placed over the entire floor of the crawlspace; and
• Controlled Crawl Space ventilation
  • Drainage
  • Ground Water and Soils
  • Ventilation
  • Foam Plastic Insulating Materials
  • Direct Earth Contact
  • Fire Safety
  • Vapor retarder
Residential - Mandatory Requirements

- Hot water pipe insulation - Requires insulation on pipes ¾ inch and larger. *(Section 150.0(j)2Aii and Section 150.0(j)4)*

---

**TABLE 120.3-A PIPE INSULATION THICKNESS**

<table>
<thead>
<tr>
<th>FLUID TEMPERATURE RANGE (°F)</th>
<th>CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)</th>
<th>INSULATION MEAN RATING TEMPERATURE (°F)</th>
<th>NOMINAL PIPE DIAMETER (in inches)</th>
<th>INSULATION THICKNESS REQUIRED (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>&lt; 1</td>
<td>1 to &lt; 1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.5 to &lt; 4</td>
<td>4 to &lt; 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8 and larger</td>
<td></td>
</tr>
<tr>
<td>Space heating, Hot Water systems (steam, steam condensate and hot water) and Service Water Heating Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 350</td>
<td>0.32-0.34</td>
<td>250</td>
<td>4.5</td>
<td>5.0</td>
</tr>
<tr>
<td>251-350</td>
<td>0.29-0.31</td>
<td>200</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>201-250</td>
<td>0.27-0.30</td>
<td>150</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>141-200</td>
<td>0.25-0.29</td>
<td>125</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>105-140</td>
<td>0.22-0.28</td>
<td>100</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Space cooling systems (chilled water, refrigerant and brine)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-60</td>
<td>0.21-0.27</td>
<td>75</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Below 40</td>
<td>0.20-0.26</td>
<td>50</td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

---
All domestic hot water system piping conditions listed below, whether buried or unburied, must be insulated per TABLE 120.3-A

i. The first 5 feet (1.5 meters) of hot and cold water pipes from the storage tank.

ii. All piping with a nominal diameter of 3/4 inch (19 millimeter) or larger.

iii. All piping associated with a domestic hot water recirculation system regardless of the pipe diameter.

iv. Piping from the heating source to storage tank or between tanks.

v. Piping buried below grade.

vi. All hot water pipes from the heating source to the kitchen fixtures.

All domestic hot water pipes that are buried below grade must be installed in a water proof and non-crushable casing or sleeve that allows for installation, removal, and replacement of the enclosed pipe and insulation.
Water Heating System.

Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:

A. A 120V electrical receptacle that is within 3 feet from the water heater and accessible to the water heater with no obstructions; and

B. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and

C. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance, and

D. A gas supply line with a capacity of at least 200,000 Btu/hr.
Residential - Mandatory Requirements

- Lighting – Improving and clarifying the mandatory lighting requirements for all residential buildings including kitchens, bathrooms, dining rooms, utility rooms, garages, hall ways, bedrooms, and outdoor lighting.  
  (Section 150.0(k))
Lighting Kitchen

• A minimum of 50 percent of the total rated wattage of permanently installed lighting in kitchens shall be high efficacy.

• Permanently installed lighting that is internal to cabinets shall use no more than 20 watts of power per linear foot.
Lighting installed in bathrooms shall meet the following requirements:

- A minimum of one high efficacy luminaire shall be installed in each bathroom and
- All other lighting installed in each bathroom shall be high efficacy or controlled by vacancy sensors.
Lighting in Garages, Laundry Rooms, and Utility Rooms

- Shall be high efficacy luminaires and controlled by vacancy sensors.
Shall be high efficacy, or shall be controlled by either dimmers or vacancy sensors.
Residential Outdoor Lighting

Shall be high efficacy, or may be low efficacy if it meets all of the following:

i. Controlled by a manual ON and OFF switch

ii. Controlled by a motion sensor

iii. Controlled by one of the following methods:
   • Photocontrol
   • Astronomical time clock
   • Energy management control system
Residential - Mandatory Requirements

- Duct sealing in all CZs.  
  (Section 150.0(m)11)
Residential -Mandatory Requirements

New System
• 6% leakage

Existing System
• 15% leakage
• 10% leakage to the exterior
• Seal all accessible leaks (use theatrical smoke)
• No more 60% improvement
Residential - Mandatory Requirements

- Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
Appropriate uses for cloth back duct tape
Appropriate uses for cloth back duct tape (cont.)
Residential - Mandatory Requirements

- Return duct design or fan power and airflow testing (Residential HVAC Quality Installation Improvements). (Section 150.0(m)13)
Performance or Prescriptive

Airflow across coil

• 350 cfm per ton

Fan watt draw

• $\leq .58$ watts per cfm

OR

Use Table 150.0 C & D
Problems with low air flow

- Low airflow can cause frost on the coil further restricting airflow
- Insufficient airflow will not allow phase change from liquid to vapor
- Liquid refrigerant in compressor will result in damage to compressor
# Minimum Efficiencies

**Building HVAC Requirements – Cooling Equipment**

### Table 4-6 – Minimum Cooling Efficiencies for Central Air Conditioners and Heat Pumps

<table>
<thead>
<tr>
<th>Appliance</th>
<th>SEER Eff Before 1/1/2015</th>
<th>SEER Eff 1/1/2015</th>
<th>EER Eff 1/1/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Air Conditioners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System &lt;45,000 Btu/h</td>
<td>13.0</td>
<td>14</td>
<td>12.2</td>
</tr>
<tr>
<td>Split System ≥45,000 Btu/h</td>
<td>13</td>
<td>14</td>
<td>11.7</td>
</tr>
<tr>
<td>Single Package</td>
<td>13.0</td>
<td>14</td>
<td>11.0</td>
</tr>
<tr>
<td>Central Air Source Heat Pumps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>13.0</td>
<td>14</td>
<td>NR</td>
</tr>
<tr>
<td>Single Package</td>
<td>13.0</td>
<td>14</td>
<td>NR</td>
</tr>
<tr>
<td>Space Constrained Air Conditioners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>12</td>
<td>12</td>
<td>NR</td>
</tr>
<tr>
<td>Single Package</td>
<td>12</td>
<td>12</td>
<td>NR</td>
</tr>
<tr>
<td>Space Constrained Heat Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>12</td>
<td>12</td>
<td>NR</td>
</tr>
<tr>
<td>Single Package</td>
<td>12</td>
<td>12</td>
<td>NR</td>
</tr>
<tr>
<td>Through-The-Wall Air Conditioner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>10.9</td>
<td>10.9</td>
<td>NR</td>
</tr>
<tr>
<td>Single Package</td>
<td>10.6</td>
<td>10.8</td>
<td>NR</td>
</tr>
<tr>
<td>Through-The-Wall Heat Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Split System</td>
<td>10.9</td>
<td>10.9</td>
<td>NR</td>
</tr>
<tr>
<td>Single Package</td>
<td>10.6</td>
<td>10.5</td>
<td>NR</td>
</tr>
<tr>
<td>Small Duct, High Velocity Air Conditioner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>13</td>
<td>13</td>
<td>NR</td>
</tr>
<tr>
<td>Small Duct, High Velocity Heat Pump</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>13</td>
<td>13</td>
<td>NR</td>
</tr>
</tbody>
</table>

Source: California Appliance Efficiency Regulations Table C-2 Title-20

NR = No Requirement

### Table 4-1 – Minimum Efficiency for Gas and Oil-Fired Central Furnaces

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Rated Input (Btu/hr)</th>
<th>AFUE Effective Before 1/1/15</th>
<th>AFUE Effective 1/1/15</th>
<th>Minimum Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weatherized gas central furnaces with single phase electrical supply</td>
<td>&lt; 225,000</td>
<td>78</td>
<td>78</td>
<td>—</td>
</tr>
<tr>
<td>Non-weatherized gas and oil central furnaces with single phase electrical supply</td>
<td>&lt; 225,000</td>
<td>90</td>
<td>90</td>
<td>—</td>
</tr>
<tr>
<td>Weatherized oil central furnaces with single phase electrical supply</td>
<td>&lt; 225,000</td>
<td>78</td>
<td>78</td>
<td>—</td>
</tr>
<tr>
<td>Non-weatherized oil central furnaces with single phase electrical supply</td>
<td>&lt; 225,000</td>
<td>83</td>
<td>83</td>
<td>—</td>
</tr>
<tr>
<td>Gas central furnaces</td>
<td>≥ 225,000</td>
<td>—</td>
<td>—</td>
<td>80</td>
</tr>
<tr>
<td>Oil central furnaces</td>
<td>≥ 225,000</td>
<td>—</td>
<td>—</td>
<td>81</td>
</tr>
</tbody>
</table>
Solar Ready Measure – 250 square feet of solar ready zone on single family roofs. (Section 150.0(r))

7 exceptions to the requirement and one exception to exception 7
Solar Photovoltaic can be used as a compliance option to comply under the performance path.
Occupant Controlled Smart Thermostat as a tradeoff against the solar ready zone.

110.10(b)1A EXCEPTION 6)

- Single family residences with a solar zone no less than 150 square feet and
- All thermostats are capable of receiving and responding to Demand Response Signals
Single family homes shall comply with the Whole House Fan (WHF) requirements shown in TABLE 150.1-A. When a WHF is required, comply with Subsections below:

A. Air Flow CFM is at least 2 CFM/ft² of floor area and
B. 1 square foot of attic vent free area for each 375 CFM and
C. Provide homeowners with a one page “How to operate your whole house fan” informational sheet.
Residential - Additions and Alterations

- Simplified rules for both the prescriptive and performance paths for additions, alterations, and existing plus additions plus alterations. *(Section 150.2(a) and (b))*

Exceptions for:
- ASHRAE 62.2 Whole house ventilation
- Roofing requirements
- Insulating inaccessible piping
- Ducting
- Ventilation Cooling
- Fenestration
Residential items to get on the plans

- Water Heater requirements
- No dryer duct within 5’ of HVAC condenser
- Energy Code Measures for additions less than 300 sq. ft.
- Whole house fan venting and interlock requirements
- Lighting requirements
- Return duct and grill sizing
- Below grade hot water pipes installed in sleeve
Non-Residential Buildings
Acceptance Testing

Building Envelope
Mechanical Systems
Lighting Control
Outdoor Lighting Controls
Sign Lighting
Refrigerated Warehouse Refrigeration System
Commercial Kitchen Exhaust System
Parking Garage Ventilation System
Compressed Air System
Acceptance Testing Technicians

Industry Certification Threshold.

Acceptance Test Technician and Employer certification requirements shall take effect when the Energy Commission finds that each of the following conditions are met:

• There shall be no less than 300 Acceptance Test Technicians certified to perform the acceptance tests

• The Certification Provider(s) shall provide reasonable access to certification for technicians representing the majority of the affected industry groups
# Lighting Control Acceptance Forms

## Certificate of Acceptance - Data_Field Definitions and Calculations (Page 2 of 9)

1. **Separate Controls of Luminaires in Daylight Zones:**
   - Are luminaires controlled by automatic daylighting controls only in daylight zones? (Y/N)
   - Separately circuited for daylight zones by windows and daylight zones under skylights? (Y/N)

2. **Daylighting control device certification:**
   - Daylighting control has been certified in accordance with Sections 13.3.2-1 to 13.3.2-7. (Y/N)
   - Construction inspection PASS/FAIL: If all responders on this Construction Inspection page are complete and all Yes/No questions have a Yes (Y) response, the tests PASS. If any questions on this page are incomplete or there are any No (N) responses, the tests FAIL.

## Functional Performance Testing — Continuous Dimming Systems NA-7.6.2.2

Power estimation using amp-meter measurement, or alternate option — watt-meter measurement

Complete all tests on page 8 of 10 (No Daylight Test, Full Daylight Test, Partial Daylight Test) and fill out Pass/Fail section on Page 8 of 10.

### Applicable Control System

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## System Information

- Control Loop Type: Open Loop or Closed Loop? (Y or N)
- Voluntary: (Y or N)
- If voluntary, enter footcandle value or “Unknown” (U)
- Power estimation method: Measured Amps Multiplied by Volts, Volts-Amps (VA), alternate option is Measured Watts (W)

### Step 1: Identify Reference Location (Location where minimum daylight illumination is measured to be used by the control system)

1. Method Used: Illuminance or Distance? (Y or N)
   - Calculate daylight control system and drive electric lights to highest light level for the following:
     - Highest light level factor = enter measured footcandles (% or from control) electric light does not include daylight Illuminance
     - Full load lowest light level factor = enter measured Amps times Volts, Volts-Amps (VA) or measured Watts
     - Footcandles of measured lighting systems
   - Is this Footcandle (Ft) or Test Standard (Lumen Maintenance) (TT)

### Step 2: No Daylight Test (controls enabled & daylight less than 1 at reference location)

- Reference Footcandles (Footcandles) as measured at Reference Location (see Step 1). Enter footcandles
- Enter “Y” if either of the following statements are true:
  - (Reference Footcandles 1) / (Highest light level factor) > 75% when line 1 = F075067 or (Reference Footcandles 1) / (Highest footcandles) > 80% (Y/N)

### Step 3: Full Daylight Test (conducted when daylight greater than reference Illuminance line 1)

- Enter measured Amps Multiplied by Volts, Volts-Amps (VA) or measured Watts (W)
  - System power reduction factor: enter “1” (line m) (line h) enter as percent:
    - Is System Power Reduction (line m) > 15% when line i = IO, or > 25% when line i = IT (Y/N)
  - With uncontrolled lights also on, no lamps are dimmed outside of daylight zone by control system’s controller or formula (Y/N)
  - Dimmed lamps have stable output (no appreciable visual flicker) (Y/N)
Increased low slope cool roof requirements.
Reflectance from 0.55 to 0.63 for new and alterations
(140.3 (a) 1Aia1)
Both solar reflectance and thermal emittance are measured from 0 to 1; the higher the value, the "cooler" the roof.

- Solar reflectance: The fraction of solar energy that is reflected by the roof surface.
- Thermal emittance: The fraction of thermal energy that is emitted from the roof surface.
Air Barrier/Leakage Rates

• All joints, penetrations and other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weather stripped, or otherwise sealed to limit infiltration and exfiltration. (110.7)

• Consistent with air leakage requirements in IECC. (140.3(a)9B)
Buildings shall have a continuous air barrier that is designed and constructed to control air leakage into, and out of, the building’s conditioned space. The air barrier shall be sealed at all joints for its entire length and shall be composed of materials that have an air permeance not exceeding 0.004 cfm/ft², at 75 Pascal's.

### Air Barrier/Leakage Rates (Materials)

<table>
<thead>
<tr>
<th>MATERIALS AND THICKNESS</th>
<th>MATERIALS AND THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Plywood – min. 3/8 inches thickness</td>
<td>9. Built up roofing membrane</td>
</tr>
<tr>
<td>2. Oriented strand board – min. 3/8 inches thickness</td>
<td>10. Modified bituminous roof membrane</td>
</tr>
<tr>
<td>3. Extruded polystyrene insulation board – min. ½ inches thickness</td>
<td>11. Fully adhered single-ply roof membrane</td>
</tr>
<tr>
<td>4. Foil-back polyisocyanurate insulation board – min. ½ inches thickness</td>
<td>12. A Portland cement or Portland sand parget, or a gypsum plaster, each with min. 5/8-inches thickness</td>
</tr>
<tr>
<td>5. Closed cell spray foam with a minimum density of 2.0 pcf and a min. 2.0 inches thickness</td>
<td>13. Cast-in-place concrete, or-precast concrete</td>
</tr>
<tr>
<td>6. Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf, and a min. 5½ inches thickness</td>
<td>14. Fully grouted concrete block masonry</td>
</tr>
<tr>
<td>7. Exterior or interior gypsum board min. 1/2 inches thickness</td>
<td>15. Sheet steel or sheet aluminum</td>
</tr>
<tr>
<td>8. Cement board – min. 1/2 inches-thickness</td>
<td>***</td>
</tr>
</tbody>
</table>

_TABLE 140.3-A: MATERIALS DEEMED TO COMPLY WITH SECTION 140.3(a)9A_
Air Barrier/Leakage Rates (Assemblies)

• **Assemblies of materials and components** that have an average air leakage not exceeding 0.04 cfm/ft², under a pressure differential of 0.3 in. w.g (1.57 psf) (0.2 L/m² at 75 pa), when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680, or ASTM E283; or

• **EXCEPTION to Section 140.3(a)9B**: The following materials shall be deemed to comply with Section 140.3(a)9B if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions:
  
  i. Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.
  
  ii. Concrete masonry walls with integral rigid board insulation.
  
  iii. Structurally Insulated Panels.
  
  iv. Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with min. 1/2 inches thickness
The entire building has an air leakage rate not exceeding 0.40 cfm/ft² at a pressure differential of 0.3 in w.g. (1.57 psf) (2.0 L/ m² at 75 pa), when the entire building is tested, after completion of construction.
Increased fenestration requirements to reduce solar gains and increase visual light transmittance for daylighting; 0.36 U-factor, 0.25 SHGC, VT 0.42 for fixed windows. (Section 140.3(a)5B,C & D)
Vertical Windows shall:

- Have a west-facing area no greater than 40% of the gross west-facing wall area, or 6 feet x the west-facing display perimeter, whichever is greater and
  A total area no greater than

- 40% of the gross wall area, or 6 feet x the display perimeter, whichever is greater; and

- Area weighted U-factor per Tables 140.3 B, C or D
### Tables 140.3 B, C and D

**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</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>Area-Weighted Performance Rating</td>
<td>Max U-factor</td>
<td>0.36</td>
<td>0.46</td>
<td>0.41</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>
</tr>
<tr>
<td></td>
<td>Area-Weighted Performance Rating</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>49%</td>
<td></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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area-Weighted Performance Rating</strong></td>
<td>Max U-factor</td>
<td>0.58</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>Max SHGC</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>Area-Weighted Performance Rating</td>
<td>Min VT</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Maximum SRR%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>
Added mandatory minimum wall and roof insulation requirements. *(Section 110.8(e) & (f))*

- In contact with roof
- No openings between roof and ceiling
- Not on top of suspended ceiling
Demising walls require R-13 insulation between studs

Similar to CALGreen which requires STC of 40
Lighting Controls

Lighting control devices moving from Title 24 to Title 20
Lighting control systems shall now be acceptance tested for Title 24.
(Section 110.9(b) & Section 130.4(a))
**Lighting Controls (Indoor)**

- Advanced multi-level lighting controls
- Increasing from one intermediate level to three intermediate levels or continuous dimming
- Controls to allow precise and non-interruptive adjustment of lighting to match the available daylighting
- Provide dimming and demand response function throughout the building. *(Section 130.1(b) & Section 130.1(a) 2C)*
Lighting Controls (Indoor)

Separately Switched Lighting Systems 131(a):
Area Controls General Lighting shall be separately switched from all other lighting in a space
Floor and wall display, window display, and case display lighting shall be switched separately
Lighting Controls (Indoor)

All interior Lighting shall turn off automatically when space is unoccupied using:

- Occupancy sensor
- Automatic time switch
- Other signal device
- Separate controls per floor
- Separate controls per 5000 sqft
- Separate controls for display lighting
Lighting Controls (Indoor)

• All spaces shall have Occupancy Sensors
• All spaces shall have local switches
• All fixtures shall have dimming ballasts
Lighting Controls (Indoor)

Occupancy sensors must be installed in the following areas to shut off the lighting:

- Offices less than 250 sq.ft.
- Multipurpose rooms less than 1000 sq. ft.
- Classrooms any size
- Conference rooms any size
- Controls must allow the lights to be manually shut off in compliance with 130.1(a) regardless of the sensors status
Automatic Lighting Controls
Warehouse and Libraries

Require the installation of occupancy sensors in warehouse aisle ways and open spaces, and library stack aisles. *(Section 130.1(c)6A & B)*

Reduce lighting by at least 50% when the space is not occupied.
Require the installation of occupancy sensors in corridors and stairwells in lodging and multifamily buildings.

Reduce lighting by at least 50% when the space is not occupied.

Capable of turning the lighting fully on and automatically activated from path of egress (Section 130.1(c)6C)
Lighting Controls (Parking Garage)

Occupancy sensor capable of reducing power at least one step between 20% and 50% and fully ON activated from designated egress paths.

Automatic daylighting controls required
Hotel and motel guest rooms shall be controlled so that lights are off within 30 minutes of being vacated using

- Occupancy Sensors
- Automatic Controls or
- Captive Card key
- Exemption for 1 high efficacy luminaire separately switched and within 6’ of the door.
Retrofit Lighting

- Retrofits will be required to comply with the Standards
- EXEMPT:
  - Spaces in which less than 10% of the lighting is being changed out.
  - Buildings in which fewer than 40 ballasts are being replaced
Demand Response

Lighting power in buildings larger than 10,000 sq. ft. shall be capable of automatic reduction to a minimum of 15% below installed lighting power.

(Section 130.1(e))
Sign Lighting, Indoors

- All indoor signs to be controlled by automatic or astronomical switch control
Sign Lighting, Outdoors

- Photocontrol in addition to automatic or astronomical switch controls.
- If on night and day, then 65% reduction of power at night.
- Ability to reduce power 30% when receiving a demand response signal.
Lighting Acceptance Testing

- Shut Off Controls
- Automatic Daylighting Controls
- Demand Responsive Controls
- Outdoor Lighting
Outdoor Lighting

Photocontrol or astronomical time switch.

Outdoor lighting independently controlled

<24’ mounting height:

• Motion sensors
• Capable of reducing power
• Auto ON when occupied
• No more than 1500 watts controlled together

(Section 130.2(c)3B)
Outdoor Lighting

Existing outdoor lighting cutoff (shielding) requirements, changed to the new IES standard: Backlight, Uplight, Glare (BUG) requirements. (Section 130.2(b))
### Outdoor Lighting (CALGreen)

#### TABLE 5.106.8

**MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS**

<table>
<thead>
<tr>
<th>Allowable Rating</th>
<th>Lighting Zone 1</th>
<th>Lighting Zone 2</th>
<th>Lighting Zone 3</th>
<th>Lighting Zone 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Allowable Backlight Rating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminaire greater than 2 mounting heights (MH) from property line</td>
<td>No Limit</td>
<td>No Limit</td>
<td>No Limit</td>
<td>No Limit</td>
</tr>
<tr>
<td>Luminaire back hemisphere is 1 – 2 MH from property line</td>
<td>B2</td>
<td>B3</td>
<td>B4</td>
<td>B4</td>
</tr>
<tr>
<td>Luminaire back hemisphere is 0.5 – 1 MH from property line</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B3</td>
</tr>
<tr>
<td>Luminaire back hemisphere is less than 0.5 MH from property line</td>
<td>B0</td>
<td>B0</td>
<td>B1</td>
<td>B2</td>
</tr>
<tr>
<td><strong>Maximum Allowable Uplight Rating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For area lighting</td>
<td>U0</td>
<td>U0</td>
<td>U0</td>
<td>U0</td>
</tr>
<tr>
<td>For all other outdoor lighting, including decorative luminaires</td>
<td>U1</td>
<td>U2</td>
<td>U3</td>
<td>U4</td>
</tr>
<tr>
<td><strong>Maximum Allowable Glare Rating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luminaire greater than 2 MH from property line</td>
<td>G1</td>
<td>G2</td>
<td>G3</td>
<td>G4</td>
</tr>
<tr>
<td>Luminaire front hemisphere is 1 – 2 MH from property line</td>
<td>G0</td>
<td>G1</td>
<td>G1</td>
<td>G2</td>
</tr>
<tr>
<td>Luminaire front hemisphere is 0.5 – 1 MH from property line</td>
<td>G0</td>
<td>G0</td>
<td>G1</td>
<td>G1</td>
</tr>
<tr>
<td>Luminaire back hemisphere is less than 0.5 MH from property line</td>
<td>G0</td>
<td>G0</td>
<td>G0</td>
<td>G1</td>
</tr>
</tbody>
</table>

1. IESNA Lighting Zones 0 and 1 are not applicable; refer to Lighting Zones as defined in the California Energy Code and Chapter 10 of the California Administrative Code.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for the purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
3. If the nearest property line is less than or equal to two mounting heights from the back hemisphere of the luminaire distribution, the applicable reduced Backlight rating shall be met.
4. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet U-value limits for “all other outdoor lighting”.
5. If the nearest property line is less than or equal to two mounting heights from the front hemisphere of the luminaire distribution, the applicable reduced Glare rating shall be met.
Skylit Daylit Zones and Primary Sidelit Daylit Zones

• Controlled independently by automatic daylighting controls
• Zones shown on plans
• Skylit and Sidelit Zones controlled separately.
• Multilevel lighting per Table 130.1 A.
• 65% min of full power when lighting is 150% of design
Skylit Zones

Figure 5-5 – Skylit Daylit Zone Diagram 1

Figure 5-6 – Skylit Daylit Zone Diagram 2
Primary Sidelit Zones

– Primary Sidelit Daylit Zone Diagram 1
Secondary Sidelit Zones

Diagram 1: Secondary Sidelit Daylit Zone Diagram
An EMCS may be installed to comply with the requirements of lighting controls if it meets the following minimum requirements:

A. Provides all applicable functionality for each specific lighting control or system; and

B. Complies with all applicable Lighting Control Installation Requirements; and

C. Complies with all applicable application requirements for each specific lighting control or system for which it is installed.
Disaggregation of Electrical Circuits

- Power systems designed to permit disaggregation of electrical energy uses.
120 volt circuit controls

- Controlled and uncontrolled receptacles provided in each:
  - Office
  - Copy room
  - Lobby
  - Kitchenette in office
  - Conference room
  - Hotel and Motel guest rooms
Demand Responsive Controls and Equipment

Added requirements for demand responsive controls and equipment.

- Capable of receiving and automatically responding to messaging protocols to enable demand response.
  Section 130.5(e)
Packaged units down to 6 tons must be VAV with the ability to modulate cooling capacity to 20% of maximum.

Economizers must also be able to modulate cooling capacity to match VAV units. *(Section 140.4(c) & (e))*
Integrated Economizers

Cooling systems over 54,000 btu/hr shall include:

• Economizers must also be capable to modulate outside air and return air dampers to provide 100% of supply air; or

• Water economizer capable of providing 100% of cooling load.

(Section 140.4 (e))
Each space—conditioning zone shall have controls that prevent the systems from reheating or recooling conditioned air. (Section 140.4(d))
Added acceptance tests for HVAC sensors and controls, including those for demand controlled ventilation. (Section 120.5(a))
Mechanical System Acceptance

1. Outdoor air ventilation systems
2. Constant volume, single zone unitary air conditioning and heat pump unit controls
3. Duct systems
4. Air economizers
5. Demand control ventilation systems required by Section 120.1(c)3
6. Supply fan variable flow controls
7. Hydronic system variable flow controls
8. Boiler or chillers that require isolation controls per Section 140.4(k)2 or 140.4(k)3
9. Hydronic systems with supply water temperature reset controls
10. Automatic demand shed controls
11. Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion Units
12. Automatic fault detection and diagnostics (FDD) for air handling units and zone terminal units
13. Distributed Energy Storage DX AC Systems
14. Thermal Energy Storage (TES) Systems
15. Supply air temperature reset controls
16. Water-cooled chillers served by cooling towers with condenser water reset controls
17. Energy Management Control System when installed
HVAC motors for fans that are less than 1 hp and more than 1/12 hp shall be electronically commutated motors (ECM) and have a minimum efficiency of 70%.

(Section 140.4(c)4)
Western Cooling Efficiency Challenge

Added credit for evaporative systems that meet the Western Cooling Efficiency Challenge (WCEC program to acknowledge high energy and water efficiency in evaporative systems). (Section 140.4)
HVAC manufactures to develop climate-appropriate rooftop packaged air conditioning equipment that will reduce electrical demand and energy use in Western climates by at least 40% compared to DOE 2010 standards.
Retail food stores with 8,000 square feet or more of conditioned area, and that utilize either refrigerated display cases, or walk-in coolers shall meet the requirements of Section 120.6(b).

- Condensers serving refrigeration systems
- Compressor Systems
- Refrigerated Display Cases
- Refrigeration Heat Recovery

Acceptance Testing Required
Mandatory Requirements for Refrigerated Warehouses

Refrigerated Warehouses ≥3,000 square feet shall meet the requirements of Section 120.6(a).

- Exterior surfaces of refrigerated warehouses shall be insulated per TABLE 120.6-A.
- Electric resistance heat shall not be used for the purposes of underslab heating.
- High efficiency motors (ECM)
- Passageways between freezers and higher-temperature spaces, and passageways between coolers and nonrefrigerated spaces, shall have an infiltration barrier.

Acceptance Testing Required

<table>
<thead>
<tr>
<th>SPACE</th>
<th>SURFACE</th>
<th>MINIMUM R-VALUE (F/ft²·ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freezers</td>
<td>Roof/Ceiling</td>
<td>R-40</td>
</tr>
<tr>
<td></td>
<td>Wall</td>
<td>R-36</td>
</tr>
<tr>
<td></td>
<td>Floor</td>
<td>R-35</td>
</tr>
<tr>
<td></td>
<td>Floor with all heating from productive refrigeration capacity&lt;sup&gt;1&lt;/sup&gt;</td>
<td>R-20</td>
</tr>
<tr>
<td>Coolers</td>
<td>Roof/Ceiling</td>
<td>R-28</td>
</tr>
<tr>
<td></td>
<td>Wall</td>
<td>R-28</td>
</tr>
</tbody>
</table>

<sup>1</sup> All underslab heating is provided by a heat exchanger that provides refrigerant subcooling or other means that result in productive refrigeration capacity on the associated refrigerated system.
Prescriptive Requirements for Commercial Kitchens. (Section 140.9(b))

Kitchen Exhaust System:
- Replacement air requirements
- Flow Rates

Kitchen Ventilation:
- Limitations on conditioned air used for make-up air

Kitchen Exhaust System Acceptance Required
Mandatory Requirements for Enclosed Parking Garages (Section 120.6(c))

Mechanical ventilation systems for enclosed parking garages with a design exhaust rate greater than or equal to 10,000 cfm shall conform to all of the following:

1. Modulate fan airflow rates to 50 percent or less of design capacity provided acceptable contaminant levels are maintained.
2. No more than 30 percent of design wattage at 50 percent of design airflow.
3. One CO sensor per 5,000 square feet
4. CO concentration at all sensors is maintained at 25 ppm or less at all times.
5. Ventilation rate at least 0.15 cfm/ft² when the garage is scheduled to be occupied.
6. Maintain the garage at negative or neutral pressure relative to other occupiable spaces
7. CO sensors shall be certified and calibrated and monitored
8. Meet the Acceptance Requirements for Code Compliance
Commissioning

Summary of Commissioning Requirements. The following items shall be completed:

1. Owner’s or owner representative’s project requirements;
2. Basis of design;
3. Design phase design review;
4. Commissioning measures shown in the construction documents;
5. Commissioning plan;
6. Functional performance testing;
7. Documentation and training; and
8. Commissioning report.
Prior to the Design Phase, the energy-related expectations and requirements of the building shall be documented before the design phase of the project begins. This documentation shall include the following:

1. Energy efficiency goals;
2. Ventilation requirements;
3. Project program, including facility functions and hours of operation, and need for after hours operation; and
4. Equipment and systems expectations.
For all Nonresidential buildings, the Design Review Kickoff Certificate(s) of Compliance, and Construction Document Design Review Checklist Certificate(s) of Compliance shall be completed and signed by a licensed professional engineer.

- < 10,000 square feet, the licensed professional engineer may be the engineer of record.
- > 10,000 square feet but less than 50,000 square feet, the licensed professional engineer shall be a qualified in-house engineer or a third party engineer.
- > 50,000 square feet and all buildings with complex mechanical systems serving more than 10,000 square feet, the licensed professional engineer shall be a third party
Beginning on January 1, 2015, contingent upon approval of data registry(s) by the Commission, all nonresidential buildings, high-rise residential buildings, and hotels and motels, the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) for registration and retention to a data registry approved by the Commission. The submittals to the approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.
What is coming in 2016?

• High Performance Attics

• Lighting
  • No more heaters to illuminate buildings
  • Think LED

• Advanced Wall Framing
  • Framing methods
  • Exterior foam
  • Windows

• Water Heating
  • Heat Pump Water Heaters
  • Tankless and Condensing Water Heaters

• Additional Compliance Options
  • Photovoltaic
  • More Flexibility using Component Package
Questions?

Greg Mahoney
gmahoney@cityofdavis.org