2013 Title 24, Part 6
Energy Standards

Brief Introduction to 2013 Title 24
Part 6 Requirements for
Nonresidential Alterations.
When, Where and Why

- **When (current schedule):**
  - Any projects that apply for permit on or after January 1, 2014 will be subject to the 2013 Standards.
  - Exception: Nonresidential Registry January 1, 2015
  - Appliance efficiency update 2015

- **Where can you find? CEC website**
  - Standards, Residential and Nonresidential Manuals:
    - [http://www.energy.ca.gov/title24/2013standards/supporting_docs.html](http://www.energy.ca.gov/title24/2013standards/supporting_docs.html)

- **Why?**
  - Net Zero goals:
    - Residential: 2020
    - Nonresidential: 2030
### Overview: Occupancy Groups Covered

Nonresidential Standards cover the following occupancy groups:

<table>
<thead>
<tr>
<th>Occupancy Group</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Assembly</td>
<td>Theaters, churches, etc.</td>
</tr>
<tr>
<td>B Businesses</td>
<td>Office buildings</td>
</tr>
<tr>
<td>E Educational facilities</td>
<td>K-12 schools</td>
</tr>
<tr>
<td>F Factories, low &amp; moderate hazard</td>
<td></td>
</tr>
<tr>
<td>H High hazard facilities</td>
<td></td>
</tr>
<tr>
<td>M Mercantile</td>
<td>Grocery store, department store</td>
</tr>
<tr>
<td>R Residential</td>
<td>Apartment buildings with four or more habitable stories, hotels/motels, long-term care facilities</td>
</tr>
<tr>
<td>S Storage, low &amp; moderate hazard</td>
<td></td>
</tr>
<tr>
<td>U Utility</td>
<td>Garages, towers</td>
</tr>
</tbody>
</table>
Mandatory, Prescriptive, Performance: Defining the Difference

Two Ways to Comply with the Standards

Prescriptive Approach

- ENV: some tradeoff
- MECH: no tradeoff
- LTG: some tradeoff

No tradeoffs between ENV, MECH, and LTG

Performance Approach

- Standard Design
- Proposed Design

Tradeoffs

- ENV ↔ MECH ↔ LTG *

* See notes for restrictions

Compliance Documentation

Some prescriptive requirements likely ‘traded away’ via performance method
Look for features that were improved to compensate for the “tradeoff”
Envelope: What’s New?

New Construction

- Mandatory
  - Insulation requirements

- Prescriptive:
  - Cool roof revised, roof insulation trade-off Table 140.3 for aged solar reflectance
  - Fenestration:
    - Dynamic glazing, window films and VT (visual light transmittance)

Alterations

- Mandatory
  - Insulation requirements

- Prescriptive:
  - Cool roof: trade-off Table 141.0-B
  - Fenestration: Different prescriptive requirements from new construction.
Low sloped exposed to roof deck:
CZ 1, 3-9: R-8
CZ 2, 10-16: R-14
Highrise & hotel/motel: All CZ R-14

Metal building: R-13; U-factor = 0.113
Metal framed: R-13; U-factor = 0.217
Wood framed: R-11; U-factor = 0.110
Spandrel wall: R-4; U-factor = 0.280
Demising (framed): R-13

Raised mass: None
Other: Wood framed with R-11
U-factor = 0.071
Heated slab: CZ 1-15 = R-5
CZ 6 = R-10
### NR Envelope “Alterations”: Prescriptive

#### Continuous insulation or U-factor:

- CZ1, 3-9 = R-8 (0.082), CZ2, 10-16 = R-14 (0.055), unless Table 141.0-B Trade-off used

#### 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)

| Climate Zone | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Metal Building | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 | 0.113 | 0.061 |
| Wood Framed and Other | 0.098 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 | 0.062 |
| Mass Light | 0.196 | 0.179 | 0.278 | 0.227 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 | 0.440 |
| Mass Heavy | 0.233 | 0.659 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 | 0.650 |
| Wood Framed and Other | 0.102 | 0.059 | 0.110 | 0.059 | 0.102 | 0.110 | 0.059 | 0.102 | 0.110 | 0.059 | 0.102 | 0.110 | 0.059 | 0.102 | 0.110 | 0.059 |
| Mass | 0.092 | 0.082 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 | 0.269 |
| Other | 0.048 | 0.039 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 | 0.071 |
| Aged Solar Reflectance | 0.43 | 0.43 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| Thermal Emittance | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Aged Solar Reflectance | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| Thermal Emittance | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |

#### Cool Roof

- Cool Roof: 50% or more than 2,000 sf. Table 141-0-B Roof insulation trade-off for Aged Solar Reflectance.
- Exception: Aged Solar Reflectance of 0.63 if U-factor = Table 141.0-B Trade-off

#### Fenestration

- Exception: 150 sf or less altered, 50 sf or less added

- CZ 1-2, 4, 6-16: U-factor = 0.47
- CZ 3 and 5: U-factor = 0.58
- CZ 2, 4, 6-15: SHGC = 0.31
- CZ 1, 3, 5, 16: SHGC = 0.41

Minimum VT per Table 140.3-B, C and D
NR Envelope “Alterations”: Performance

<table>
<thead>
<tr>
<th>Altered Component</th>
<th>Standard Design Without 3rd Party Verification</th>
<th>Standard Design WITH 3rd Party Verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>Table 141.0-C (CZ 1, 3-9 = U-factor of 0.082; CZ 2, 10-16 = U-factor of 0.055)</td>
<td></td>
</tr>
<tr>
<td>Cool Roof</td>
<td>Prescriptive (NR Bldg: low slope = 0.63 /steep sloped = 0.20) or Aged Solar Reflectance of 0.63 if U-factor = Table 141.0-B Trade-off</td>
<td></td>
</tr>
<tr>
<td>Wall</td>
<td>Metal Building = U-factor of 0.113; metal framed U = 0.217; wood framed and other U = 0.110 and spandrel/curtain walls U = 0.28</td>
<td></td>
</tr>
<tr>
<td>Floor</td>
<td>Raised framed floors U=0.071; raised mass NR bldg =no minimum</td>
<td></td>
</tr>
<tr>
<td>Fenestration:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New windows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowed area to be smaller of either:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Proposed area OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Larger of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Existing area OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Prescriptive allowance of 40%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Window Film</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CZ 1-2, 4, 6-16: U-factor = 0.47</td>
<td>U-factor = 0.47</td>
</tr>
<tr>
<td></td>
<td>CZ 3 and 5: U-factor = 0.58</td>
<td>U-factor = 0.58</td>
</tr>
<tr>
<td></td>
<td>CZ 2, 4, 6-15: SHGC = 0.31</td>
<td>SHGC = 0.31</td>
</tr>
<tr>
<td></td>
<td>CZ 1, 3, 5, 16: SHGC = 0.41</td>
<td>SHGC = 0.41</td>
</tr>
<tr>
<td></td>
<td>U-factor = 0.40 / SHGC = 0.35</td>
<td>U-factor = 0.40 / SHGC = 0.35</td>
</tr>
<tr>
<td>HVAC and ducts</td>
<td>Prescriptive alteration requirements Section 141.0 (b)2C, D and E</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>Prescriptive alteration requirements Section 141.0 (b)2F through K</td>
<td></td>
</tr>
<tr>
<td>Service Water heating</td>
<td>Per Section 140.5 without solar water heating requirements (High rise and Hotel/Motel)</td>
<td></td>
</tr>
<tr>
<td>All others</td>
<td>Proposed efficiency levels</td>
<td></td>
</tr>
</tbody>
</table>
Mechanical
The Blueprint is your guide to information, training, and resources for the 2013 Building Energy Efficiency Standards. The California Energy Commission has partnered with the Statewide Codes & Standards Program to provide training and resources for building officials. California’s building energy code can help save energy, keep our air cleaner, and offset the need to build new power plants. We understand it can be quite technical and difficult to navigate new standards, especially when time and resources are limited.

The Statewide Codes & Standards Program offers free energy code training, tools and resources for building department personnel, as well as others who need to understand and meet the requirements of Title 24, Part 5. Designed to improve compliance with the state’s building energy code, the program aims to advance the adoption and effective implementation of energy efficiency measures and building practices to lock in long-term energy savings. The program recognizes that codes and standards are one of the most effective pathways to ensuring sustained market transformation. The key to making them work well is in the enforcement efforts of building department professionals. Program offerings are designed for code officials, field inspectors and building officials.

The California Statewide Codes & Standards Program is funded by California utility customers under the auspices of the California Public Utilities Commission and implemented by Pacific Gas and Electric Company. San Diego Gas and Electric, Southern California Edison, and Southern California Gas, in support of the California Energy Commission.

Fall 2013 Classroom Trainings Offered

- Title 24 Residential or Nonresidential Standards Essentials for Plan Examiners & Building Inspectors
- Residential Lighting: Title 24 & Technology Update
- Retail Lighting: Title 24 & Technology Update
- Title 24 Standards Essentials for Supermarket Refrigeration
- Title 24 Standards Essentials for Residential AC Quality Installation Contractors
- Title 24 Standards Essentials for Small Commercial AC Quality Installation Contractors

Courses are offered at utility energy training centers and at special locations upon request. For more information please email wendy@caenergy.com. For scheduled classes, check these energy center websites to register:

- http://www.pge.com/pec
- http://www.edge.com/etc

Mechanical

1. Added requirements for Fan Control and Integrated Economizers. 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. (§140.4(c) & (e))

2. Reduced ability for HVAC systems to reheat conditioned air. (§140.4(d))

3. Increased chiller efficiency requirements, consistent with ASHRAE 90.1-2010. (§140.4(j))

4. Increased cooling tower energy efficiency and WATER Savings. (§140.4(k2))

5. Added requirements for commercial boiler combustion controls. (§140.4(k3))

6. Added acceptance tests for HVAC sensors and controls, including those for demand controlled ventilation. (§120.5(a))

7. Added efficiency requirements for small motors. (§140.4(c)4)

8. Added credit for evaporative systems that meet the Western Cooling Efficiency Challenge (WCEC program to acknowledge high energy and water efficiency in evaporative systems).

9. Moving Fault Detection and Diagnostics (FDD) protocols for air temperature, economizers, damper modulation, and excess outdoor air to mandatory measures from the current compliance option. (§120.2(f))
Mechanical: Mandatory Measures

<table>
<thead>
<tr>
<th>HVAC Dry System Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROJECT NAME:</strong></td>
</tr>
<tr>
<td><strong>Equipment Tags and System Description</strong></td>
</tr>
</tbody>
</table>

### MANDATORY MEASURES

- **Heat Equipment Efficiency**
- **Cooling Equipment Efficiency**
- **HVAC or Heat Pump Thermostats**
- **Furnace Standby Loss Control**
- **Low leakage AHUs**
- **Ventilation**
- **Demand Control Ventilation**
- **Occupant Sensor Ventilation Control**
- **Shutoff and Reset Controls**
- **Outdoor Air and Exhaust Damper Control**
- **Isolation Zones**
- **Automatic Demand Shed Controls**
- **Economizer FDO**
- **Duct Insulation**

#### T-24 Sections
- 110.1 or 110.2(a)
- 110.1 or 110.2(a)
- 110.2(b), 110.2(c)
- 110.2(d)
- 110.2(f)
- 120.1(b)
- 120.1(c)
- 120.1(c)5, 120.2(e)3
- 120.2(e)
- 120.2(f)
- 120.2(g)
- 120.2(h)
- 120.2(i)
- 120.4

- **Title 20 efficiencies to be updated 1/1/2015. Many added and updated equipment types.**
- **If using in performance calculations, must meet HERS verification requirements.**
- **Required in:**
  - Multipurpose rooms less than 1,000 sf,
  - Classrooms greater than 750 sf,
  - Conference, convention, auditorium and meeting centers greater than 750 sf.
- **VAV systems:** dynamic controls to maintain outside air rates within 10% of required rate at full and reduced supply airflow conditions.
- **Constant volume:** measured outside air rates within 10% of required outside air.
- **Features added:** Facility operators can disable, and manually control adjustment of set points globally from single point in EMCS, and upon receipt of a demand response signal conduct a centralized demand shed.

Air cooled unitary DX units with economizers and cooling capacity 54,000 BTUH or higher, must include fault detection and diagnostic system.
### Prescriptive Measures

<table>
<thead>
<tr>
<th>Prescriptive Measures</th>
<th>140.4(a &amp; b)</th>
<th>140.4(c)</th>
<th>140.4(d)</th>
<th>140.4(e)</th>
<th>140.4(f)</th>
<th>140.4(g)</th>
<th>140.4(h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment is sized in conformance with 140.4 (a &amp; b)</td>
<td></td>
<td></td>
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<tr>
<td>Supply Fan Pressure Control</td>
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<tr>
<td>Simultaneous Heat/Cool</td>
<td></td>
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<tr>
<td>Economizer</td>
<td></td>
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<tr>
<td>Heat and Cool Air Supply Reset</td>
<td></td>
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<tr>
<td>Electric Resistance Heating</td>
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<tr>
<td>Duct Leakage Sealing and Testing</td>
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</tr>
</tbody>
</table>

Fan less than 1 hp or less, and 1/12HP or greater shall be electronically-commutated motors or have efficiency of 70% rated at full load conditions (brushless DC motors).

Required when total cooling capacity over 54,000 BTUH (Or trade off with higher efficiency per Table 140-1-A, which is 65% for CZ4).

Dew Point, Fixed Enthalpy, Electronic Enthalpy and Differential Enthalpy Controls not allowed (only Fixed and Differential Dry Bulb and Fixed Enthalpy/drybulb).

### Air Economizer Construction

If cooling fan system over 45,000 BTUH, factory warranty, testing, minimized air and return damper leakage, fixed controls to have adjustable setpoint, calibration, high limit sensor location correct, relief air to not over-pressurize building.

### Minimum compressor unloading

100% open for mechanical cooling, not close until leaving temp less than 45°F

- DX Constant volume system: 2 stage control ≥75,000 BTUH
- DX Variable volume system: 3 stage control ≥65,000 & <240,000 BTUH
- 4 stage control ≥240,000 BTUH
15% of total roof area excluding skylights, EXCEPT:

- Covered occupancy:
  - Hotel/motel and high rise residential: 11 stories or more
  - All other nonresidential: 4 or more stories
  - Roof used for vehicular traffic parking, heliport
- PV system = 1 watt per sq. ft. of roof area
- Solar hot water system with solar savings fraction:
  - 20% = CZ1 through 9
  - 35% = CZ 10-16
- 50% potential solar zone area provided
- High Rise Residential:
  - Demand response thermostats
  - High efficacy lights at kitchen, bathrooms (with vacancy sensor), utility rooms, garages and outside (with occupancy and photo sensor)
  - Every room has a switched receptacle
Covered Processes
Covered Processes

The 2013 Standards now cover some specific process energy applications, such as supermarket refrigeration, refrigerated warehouses, commercial kitchen ventilation requirements, laboratory exhaust, parking garage ventilation, compressed air, and computer rooms.

Definitions for Covered Processes and Exempt Processes were added. Covered Processes are defined as processes for which there are listed requirements. All other processes are Exempt Processes. Specific requirements for Covered Processes are in separate sections (§120.6 Mandatory and §140.9 Prescriptive).

It should be noted that the HVAC equipment efficiencies in §110.1 and §110.2 also apply to Covered Processes. In the 2013 Standards, the Covered Processes include:

1. Increased mandatory requirements for refrigerated warehouses. (§120.6(a))
2. Added mandatory requirements for commercial supermarket refrigeration (§120.6(b))
3. Added mandatory ventilation control requirements for parking garages (§120.6(c))
4. Added mandatory requirements for process boilers (§120.6(d))

5. Added mandatory requirements for storage and unloading for compressed air systems (§120.6(e))
6. Added prescriptive requirements for HVAC systems serving computer rooms (§140.9(a))
7. Added prescriptive ventilation control requirements for commercial kitchens (§140.9(b))
8. Added prescriptive requirements for variable air volume for laboratory exhaust systems. (§140.9(c))
5. Computer Rooms

**Prescriptive:**
Economizers

A. Integrated air economizer capable of providing 100% of the expected system cooling load at outside temperatures of 55°F and below; OR

B. Integrated water economizer capable of providing 100% of the expected system cooling load at outside temperatures of 40°F and below.

*Exception: Individual computer room under 5 tons in a building that has no economizers.*

2. Reheat: Controls that prevent reheating, recooling, and simultaneous provisions of heating and cooling to the same zone.

3. Humidification: Non-adiabatic humidification (steam, infrared) prohibited. Only adiabatic humidification permitted (direct evaporation, ultrasonic)

4. Fan power: Not to exceed 27 w/kBtuh of net sensible cooling capacity.

5. Fan control: 2-speed or variable speed control that will result in fan motor demand of no more than 50% of design wattage at 66% of design fan speed.

6. Containment: if air-cooled, design load exceeding 175 kW/room, air barriers to prevent discharge air to recirculate back to computer inlets through cooling system.
Lighting
Lighting

WHAT’S NEW IN THE 2013 CODE?
Changes to mandatory Title 24 lighting requirements

California’s new Building Energy Efficiency Standards take effect in 2014. They improve the energy efficiency of homes by 25 percent and make nonresidential buildings 30 percent more efficient than the previous 2008 standards. This brief guide offers an overview of important requirements and major updates to the lighting code.

NON-RESIDENTIAL INDOOR LIGHTING REQUIREMENTS

All indoor luminaires in non-residential buildings must have manual on/off controls, and each area must be independently controlled. Dimmer switches must allow manual control functionality, with some exceptions such as public restrooms with two or more stalls, which do not need a publicly accessible switch.

MULTI-LEVEL LIGHTING CONTROLS

For areas larger than 10000 square feet, controlled luminaries must:
- Incorporate multi-level lighting controls or continuous dimming, depending on the lamp type
- Meet the uniformity requirements in Table 300.8-4
- Have at least one of the following types of controls for each luminaire:
  - Manual continuous dimming and on/off control (Section 300.8-1a)
  - Luminance maintenance (Section 300.8-2)
  - Tuning (Section 300.8-3)
  - Automatic daylight controls (Section 300.8-4)
  - Demand-response controls (Section 300.8-6)

Classrooms are one of the rare exceptions to the multi-level requirements. Instead, if they have a connected general lighting load ≤0.7 WW/lf, they must have at least one control step between 50% and 70% of full rated power.

Lighting: Mandatory Multi Level Controls

### Table 130.1 - A

<table>
<thead>
<tr>
<th>Luminaire Type</th>
<th>Minimum Required Control Steps (Percent of Full Rated Power)</th>
<th>Uniform Level of Illuminance Shall Be Achieved by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line-voltage sockets except GU-24</td>
<td></td>
<td>Continuous dimming 10–100%</td>
</tr>
<tr>
<td>Low-voltage incandescent systems</td>
<td></td>
<td>Continuous dimming 20–100%</td>
</tr>
<tr>
<td>LED luminaires and LED source systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GU-24 rated for LED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GU-24 sockets rated for fluorescent &gt; 20W</td>
<td>Minimum one step between 30–70%</td>
<td>• Stepped dimming or • Continuous dimming or • Switching alternate lamps in a luminaire</td>
</tr>
<tr>
<td>Pin-based compact fluorescent &lt; 20W</td>
<td>Minimum one step in each range:</td>
<td>• Stepped dimming or • Continuous dimming or • Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire, illuminating the same area and in the same manner</td>
</tr>
<tr>
<td>Linear fluorescent and U-bent fluorescent &lt; 13W</td>
<td>Minimum one step between 20–40%, 50–70%, 80–85%, 100%</td>
<td>• Stepped dimming or • Continuous dimming or • Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner</td>
</tr>
<tr>
<td>Track Lighting</td>
<td>Minimum one step between 30–70%</td>
<td>• Stepped dimming or • Continuous dimming or • Separately switching circuits in multi-circuit track with a minimum of two circuits</td>
</tr>
<tr>
<td>HID &gt; 20W</td>
<td>Minimum one step between 50–70%</td>
<td>• Stepped dimming or • Continuous dimming or • Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner</td>
</tr>
<tr>
<td>Induction &gt; 25W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other light sources</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Classrooms are one of the rare exceptions to the multi-level requirements. Instead, if they have a connected general lighting load ≤ 0.7 W/ft², they must have at least one control step between 30% and 70% of full-rated power.*
**Lighting: Mandatory Automatic Daylighting**

**AUTOMATIC DAYLIGHTING CONTROLS**

Under Section 140.3 (c) of the 2008 code, just 50% of the floor area in buildings over 8,000 ft² was required to be in daylighting zones. **Section 140.3 (c)** of the 2013 code requires that floor plans have 75% of their total area in daylighting zones, and it applies the rule more broadly, to buildings > 5,000 ft².

In these daylighting zones, controls requirements have also become more stringent. Before, only sky-lit spaces ≥ 2,500 ft² and side-lit spaces ≤ 250 ft² had to have daylighting controls. **Section 130.1 (d)** of the new code replaces the old size criterion with one for energy use. It requires multi-level automatic daylighting controls in:

- All sky-lit or side-lit zones where the installed general lighting power is ≥ 120 W

New daylighting controls requirements for parking garages are addressed on page 4 of this guide.
Parking Garage Mandatory: Lighting

1. General lighting to be controlled by occupancy sensing controls having at least one control step between 20% and 50% of design lighting power.
2. Combined total of 36 sf or more openings, luminaires for general lighting in primary and secondary sidelite zones to be controlled independently by multi level (continuous dimming or on/off) automatic controls.
3. When primary sidelit zone illuminance level greater than 150% of that provided by electric lighting, controls must reduce controlled power to zero.
Lighting: Mandatory Occupant-Sensing

SECONDARY SPACES
Under the 2013 code, occupant-sensing controls must automatically reduce lighting power by 50% in these areas when they are unoccupied:

- Corridors and stairwells
- Warehouse aisles and open areas
- Library book stack aisles ≥ 10ft in length and accessible from only one end and those ≥ 20ft in length and accessible from both ends
Lighting: Mandatory Demand Responsive

The 2008 code only required DR capability in retail buildings with sales floor areas \( \geq 50,000 \text{ ft}^2 \). The 2013 code expands this considerably, requiring that all non-residential buildings \( \geq 10,000 \text{ ft}^2 \) be capable of automatically responding to a DR signal, so that:

- Total energy use for lighting can automatically drop to a level at least 15% below the building's maximum total lighting power.

- Lighting is reduced in a manner consistent with requirements for uniform illumination levels (listed in Table 130.1-A).

- Non-habitable spaces must not be used to comply with this requirement, and spaces with a lighting power density \( \leq 0.5 \text{ W} / \text{ ft}^2 \) are not counted toward the building's total lighting power. Designers are still responsible for specifying automated controls that are compatible with the local utility's DR protocol.
### Lighting “Alterations”:

**<10%**

#### Alterations include:
- Existing lighting system is:
  1. Modified
  2. Replaced
  3. Moved
Per Table 141.0-E.

Exception: Qualify as Luminaire Modification-in-Place

#### Luminaire Modification-in-place:
- Replacing lamps and ballasts with like type that preserves original luminaire listing.
- Changing # or type of light source including: socket renewal, removal or relocation of sockets, wiring.
- Changing the optical system of the luminaire.
- Replacement of whole luminaire.

Cannot be part or result of any general remodeling of the enclosed space in which they are located; or changes to panelboard or branch circuit wiring.

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### Table 141.0-F Requirements for Luminaire Alterations

<table>
<thead>
<tr>
<th>Existing lighting system is</th>
<th>Resulting Lighting Power for Each Enclosed Space</th>
<th>Applicable Mandatory Control Provisions for Each Enclosed Space</th>
<th>Multi-level Lighting Control Requirements for Each Altered Luminaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered: that do not change the area of the enclosed space or the space type</td>
<td>Existing lighting power is permitted</td>
<td>Existing provisions are permitted</td>
<td>Existing controls are permitted</td>
</tr>
<tr>
<td>Sum total ≤ 10% of existing luminaire</td>
<td>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c)</td>
<td>Two level lighting control or §130.1(b)</td>
</tr>
<tr>
<td>Sum total ≥ 10% of existing luminaire</td>
<td>&gt; 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c), (d)</td>
<td>§130.1(b)</td>
</tr>
</tbody>
</table>

1. Affected luminaires include any luminaire that is changed, replaced, removed, relocated; or, connected to, altered or revised wiring, except as permitted by EXCEPTIONS 1 and 2 to Section 141.0(b) in:
2. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illumination.
3. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are altered.

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### Table 141.0-F Requirements for Luminaire Modifications-in-Place

<table>
<thead>
<tr>
<th>Affected luminaires per Building Space per annum</th>
<th>Resulting Lighting Power per Each Enclosed Space</th>
<th>Applicable mandatory control provisions for each enclosed space</th>
<th>Applicable multi-level lighting control requirements for each modified luminaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum total ≤ 40 Luminaire Modifications-in-Place</td>
<td>Existing lighting power is permitted</td>
<td>Existing provisions are permitted</td>
<td>Existing controls are permitted</td>
</tr>
<tr>
<td>Sum total ≥ 40 Luminaire Modifications-in-Place</td>
<td>≤ 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.1(a), (c)</td>
<td>Two level lighting control or §130.1(b)</td>
</tr>
<tr>
<td></td>
<td>&gt; 85% of allowed lighting power per Section 140.6 Area Category Method</td>
<td>§130.0(d)</td>
<td>§130.1(b)</td>
</tr>
</tbody>
</table>

1. Control requirements only apply to enclosed spaces for which there are Luminaire Modifications-in-Place.
2. Multi-level controls are required only for luminaires for which there are Luminaire Modifications-in-Place.
3. Two level lighting control shall have at least one control step between 30 and 70% of design lighting power in a manner providing reasonably uniform illumination.
4. Daylight controls in accordance with Section 130.0(d) are required only for luminaires that are modified-in-place.
Electrical
### B. Disaggregation of Electrical Circuits (continued)

**Table 130.6-B: Minimum Requirements for Separation of Electrical Load**

Table 130.6-B sets the upper limit on how many load(s) of each type can be supplied by each feeder. A feeder may not supply loads of more than one type unless the service is rated at 50 kVA or less. For instance, on the fifth row of the table, one feeder on a service >50 kVA could be used to supply all the plug loads on a floor of a building, provided that there are no areas in which more than 25 kVA of plug load is supplied to a space less than 5000 ft².

<table>
<thead>
<tr>
<th>Load Type</th>
<th>Services rated 50 kVA or less</th>
<th>Services rated more than 50 kVA and less than or equal to 250 kVA</th>
<th>Services rated more than 250 kVA and less than or equal to 1000 kVA</th>
<th>Services rated more than 1000 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting including exit and egress lighting and exterior lighting</td>
<td>Not required</td>
<td>All lighting in aggregate</td>
<td>All lighting disaggregated by floor, type or area</td>
<td>All lighting disaggregated by floor, type or area</td>
</tr>
<tr>
<td>HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers, and circulation pumps associated with HVAC</td>
<td>Not required</td>
<td>All HVAC in aggregate</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50 kVA</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50 kVA</td>
</tr>
<tr>
<td>Domestic and service water system pumps and related systems and components</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Plug load including appliances rated less than 25 kVA</td>
<td>Not required</td>
<td>All plug load in aggregate</td>
<td>All plug loads separated by floor, type or area</td>
<td>All plug loads separated by floor, type or area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 ft²</td>
<td>Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 ft²</td>
<td>Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 ft²</td>
</tr>
<tr>
<td>Elevators, escalators, moving walks, and transit systems</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Other individual non-HVAC loads or appliances rated 25 kVA or greater</td>
<td>Not required</td>
<td>All</td>
<td>Each</td>
<td>Each</td>
</tr>
<tr>
<td>Industrial and commercial load centers 25 kVA or greater including theatrical lighting installations and commercial kitchens</td>
<td>Not required</td>
<td>All</td>
<td>Each</td>
<td>Each</td>
</tr>
<tr>
<td>Renewable power source (net or total)</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
<td>Each group</td>
</tr>
<tr>
<td>Loads associated with renewable power source</td>
<td>Not required</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
<tr>
<td>Charging stations for electric vehicles</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
<td>All loads in aggregate</td>
</tr>
</tbody>
</table>
Electrical: Mandatory 120 Volt Circuit Control

D. Circuit Controls for 120-Volt Receptacles

- Controlled 120 volt receptacles shall be provided in each private office, open office area, reception lobby, conference room, kitchenette in office spaces, and copy room. Controlled receptacles shall meet the following requirements.

- In open office areas, controlled circuit receptacles are not required if, at time of final permit, workstations are installed, and each workstation is equipped with an occupant sensing control that is permanently mounted in each workstation, and which controls a hardwired, nonresidential-rated power strip. Plug-in strips and other plug-in devices that incorporate an occupant sensor shall not be used for this exception.

- Receptacles that are only for the following purposes are exempt:
  - Receptacles specifically for refrigerators and water dispensers in kitchenettes.
  - Receptacles located a minimum of six feet above the floor that are specifically for clocks.
  - Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.
If you need any further information, please feel free to contact me directly. I wish I could be there in person today, and I thank Francesca Wahl for presenting this material today.

Gina Rodda: Senior Analyst gina@gabelenergy.com

510-428-0803

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