WHAT’S NEW IN THE 2016 CODE?

CHANGES TO MANDATORY LIGHTING REQUIREMENTS IN CALIFORNIA’S 2016 BUILDING ENERGY EFFICIENCY STANDARDS

MAJOR CHANGES

Reduction to lighting power density values
Lighting power density allotments have been reduced for many indoor and outdoor spaces including spaces in auditoriums, libraries, and schools. Reductions affect building, area and tailored methods of compliance.

Updated power adjustment factors
The 2016 Standards contain two new power adjustment factors (PAF) that address institutional tuning and daylight harvesting. Three other PAF have been eliminated.

Multilevel lighting & occupancy controls
Multilevel lighting control requirements have been simplified. In addition, spaces that utilize certain types of occupancy controls are no longer required to also include multilevel control. Other occupancy control requirements are now to apply in practice.

Alterations
The line between maintenance and retrofit has been redrawn. More projects are now exempt from alteration requirements. Those that are required to comply now have more options including some with reduced control requirements.

INDOOR LIGHTING POWER REQUIREMENTS

LIGHTING POWER ALLOWANCES

<table>
<thead>
<tr>
<th>Primary Function Area</th>
<th>2015 (W/M²)</th>
<th>2016 (W/M²)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditorium Area</td>
<td>1.43</td>
<td>1.0</td>
<td>-0.43</td>
</tr>
<tr>
<td>Convention, Conference, Multipurpose</td>
<td>1.21</td>
<td>0.6</td>
<td>-0.61</td>
</tr>
<tr>
<td>Meeting Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining Area</td>
<td>0.89</td>
<td>0.5</td>
<td>-0.39</td>
</tr>
<tr>
<td>Directors, Mechanical, Telephone Rooms</td>
<td>0.56</td>
<td>0.2</td>
<td>-0.36</td>
</tr>
<tr>
<td>Exhibit, Museum Area</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.2</td>
</tr>
<tr>
<td>Financial Transaction Area</td>
<td>1.0</td>
<td>0.6</td>
<td>-0.4</td>
</tr>
<tr>
<td>Hotel Reception Area</td>
<td>1.4</td>
<td>0.9</td>
<td>-0.5</td>
</tr>
<tr>
<td>Kitchen, Food Preparation Areas</td>
<td>1.2</td>
<td>0.4</td>
<td>-0.8</td>
</tr>
<tr>
<td>Laundry Area</td>
<td>0.05</td>
<td>0.2</td>
<td>0.15</td>
</tr>
<tr>
<td>Library Area</td>
<td>1.1</td>
<td>0.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>Lobby Area</td>
<td>0.01</td>
<td>0.1</td>
<td>0.09</td>
</tr>
<tr>
<td>Make Up Lobby</td>
<td>0.001</td>
<td>0.001</td>
<td>0.00</td>
</tr>
<tr>
<td>Locker/Dressing Room</td>
<td>0.02</td>
<td>0.2</td>
<td>0.18</td>
</tr>
<tr>
<td>Lounge Area</td>
<td>0.99</td>
<td>0.9</td>
<td>0.09</td>
</tr>
<tr>
<td>Multi Use Area</td>
<td>0.09</td>
<td>0.05</td>
<td>-0.04</td>
</tr>
<tr>
<td>Transportation &amp; Utility Area</td>
<td>0.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- For many spaces, the allowed lighting power density has been reduced
- Indoors, buildings such as auditoriums, libraries, schools, restaurants and medical buildings are most affected
- For those using the tailored method to determine allowed lighting power, significant changes affect all space types

Footnotes: For Table 10.8.E.4, see Section 10.8.D.4 for an explanation of additional lighting power allowed for specialized tasks, ingredients, painting, scenic, display, copiers and/or similar equipment or activities. The workable of the added lighting power is based on the functions described in the footnotes. The actual design method must be added to the allowed lighting power only when using the Area Category Method of compliance.

Specialized work area: 0.5 W/M²
- Equipment lighting as described in Section 10.8.E.4 in accordance with Section 10.8.D.4.

Based on Table 10.3.A.1.C. in the standards.
WHAT'S NEW IN THE 2016 CODE

POWER ADJUSTMENT FACTORS

Two new PAFs have been added to the 2016 Standards:

Institutional Tuning
- Projects may gain a 10% lighting power allowance credit for implementing institutional tuning.
- The credit is reduced to 5% in daylit areas
- Institutional tuning sets the maximum output of a lighting system to 85% or less of full system output or load

Daylight Harvesting
- Addresses daylight harvesting control systems that fully extinguish all the lighting when sufficient daylight is available
- Projects may gain a 10% credit for this strategy when applied to luminaires in a skylit or primary sidelit daylit zone

Three PAFs included in the 2013 Standards have been eliminated because the control strategies are now mandatory under §130.1:

- Partial-ON occupancy sensors in spaces less than or equal to 250 ft²
- Manual dimming or multiscene programmable dimming controls
- Credits for a combination of these measures
POWER ADJUSTMENT FACTORS

Lighting Power Density Adjustment Factors (PAF)

<table>
<thead>
<tr>
<th>Type of Control</th>
<th>Type of Area</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylight Dimming plus OFF Control*</td>
<td>Luminaires in a light daylit zone or primary light daylit zone</td>
<td>0.10</td>
</tr>
<tr>
<td>Occupant Sensing Controls in Large Open Plan Offices</td>
<td>In open plan offices &gt;260 ft² with one sensor controlling an area that is:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No larger than 125 ft²</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>From 126 to 250 ft²</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>From 251 to 500 ft²</td>
<td>0.20</td>
</tr>
<tr>
<td>Institutional Tuning*</td>
<td>Luminaires in non-daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF:</td>
<td>0.10</td>
</tr>
<tr>
<td>Demand Responsive Control</td>
<td>All building types less than 10,000 sq. ft. Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF:</td>
<td>0.05</td>
</tr>
</tbody>
</table>

* New for 2016

WHAT’S NEW IN THE 2016 CODE

LIGHTING CONTROLS: MULTILEVEL LIGHTING CONTROLS

- If multilevel lighting is required, multilevel controls need only allow the user to activate all the required control steps
- If the lighting is dimmable, the multilevel control must be a dimmer that allows this function plus manual ON and OFF
- Exception: Public restrooms and areas that are required to utilize full or partial-OFF occupancy sensors are now exempt from multilevel requirements contained in §130.1(b)
OCCUPANCY CONTROLS

- Partial-ON and partial-OFF occupancy control strategies are now specified based on the areas where the controls are installed.

- Occupancy controls must shut OFF all the lighting in:
  - Offices 250 ft² or smaller
  - Multipurpose rooms less than 1000 ft²
  - All classrooms, and all conference rooms

- For spaces that also require multilevel lighting controls, sensors must act as a partial-ON device or a vacancy sensor
  - The partial-ON strategy may only automatically activate between 50 and 70% of the controlled lighting

OCCUPANCY CONTROLS

- For areas not required to have multilevel controls,
  - Sensor may be a traditional, auto-ON occupancy sensor, a vacancy sensor, or employ a partial-ON strategy
  - Language pertaining to the potential use of a partial-ON control strategy has been removed from §130.1(c)6 and §130.1(c)7
  - The term partial-OFF will be used throughout

- All other requirements contained in §130.1(c)6 and §130.1(c)7 are unchanged
What's New in 2016?

LIGHTING CONTROLS: DAYLIGHT HARVESTING & DEMAND RESPONSE

- All automatic daylighting control requirements are unchanged from 2013
- Demand response control requirements are also, essentially, unchanged from 2013, with only minor clarifications added to the 2016 code

EMERGENCY & EGRESS LIGHTING

- A small portion of lighting is allowed to operate continuously if it is noted for use along a building's means of egress
  - Up to 0.2 W/ft² of lighting in any area is now exempt from area control requirements if it meets the egress definition.
  - Multilevel control requirements still apply in accordance with §130.1(b). Up to 0.1 W/ft² is also exempt from automatic shutoff control requirements.
- A luminaire or lighting system is exempt from shut-OFF control requirements if it is designed only for emergency use, is connected to an emergency power supply, and functions only when normal power is absent
- If egress lighting falls within a daylit zone, automatic daylighting controls and demand response controls are still required
Acceptance tests added to Standards

- Institutional Tuning Controls documented on new form NRCA-LTI-05-A
- Daylight Dimming plus OFF PAFs documented on the existing, automatic daylighting controls compliance form, NRCA-LTI-03-A
- All lighting controls acceptance tests must be conducted by a Certified Lighting Controls Acceptance Test Technician
  - Technicians are required to recertify their credential to ensure they are up to date with the new 2016 requirements.

To learn more about Lighting Control Acceptance Testing, please visit energy.ca.gov/title24/attcp
What’s New in 2016?

**OVERVIEW**

- Indoor lighting alterations are now categorized into three types of projects, and outdoor requirements are now listed under §141.0(b)2L

- Exempt from lighting alterations requirements
  - Projects that may disturb asbestos during construction
  - Projects that address only two or fewer luminaires in an enclosed space

**WHAT’S NEW IN THE 2016 CODE**

**Indoor Lighting Alterations**

<table>
<thead>
<tr>
<th>Alteration</th>
<th>Scope of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Luminaires Altered</td>
<td>• Remove &amp; replace existing luminaires&lt;br&gt;• Replace existing luminaires, reduce with new&lt;br&gt;• Add new luminaires&lt;br&gt;• Adding, removing, or replacing ceiling or walls along with any redesign of the lighting system</td>
</tr>
<tr>
<td>Luminaire Component Modifications</td>
<td>• Lump and bottom driver replacement&lt;br&gt;• Permanently changing the light source type in an existing luminaire&lt;br&gt;• Changes to the luminaire’s electrical system</td>
</tr>
<tr>
<td>Lighting Wiring Alterations</td>
<td>• New circuits&lt;br&gt;• Replace, modify, or relocate wiring between a switch and a luminaire&lt;br&gt;• Replace, modify or relocate wiring between a panelboard and a luminaire&lt;br&gt;• Replacement of existing lighting control panels, panelboards, or branch circuits with new</td>
</tr>
</tbody>
</table>

**COMPLIANCE THRESHOLD**

- Indoor luminaire component modifications compliance threshold has been raised

- New threshold: Projects that address 70 luminaires or 10% per year are regulated under the Standards

- Thresholds for the replacement of existing luminaires or addition of new luminaires remains at 10%

- Most types of wiring alterations must comply with §141.0(b)2K regardless of their size

- Projects that only add lighting controls to an existing system are exempt
LIGHTING CONTROL REQUIREMENTS

- When existing luminaires replaced with new luminaires and no changes are made to walls or ceilings, a project may bypass additional multilevel and some occupancy control requirements by installing new products that achieve a **minimum of 35% power reduction** as compared to the luminaires they replaced.

- Alterations with over 85% of the power allowance must meet most control requirements in §130.1, but those with 85% or less are exempt from daylighting and demand response control requirements.

LIGHTING CONTROL REQUIREMENTS

- Lighting retrofit projects that are able to reduce the total input power to 85% or less of that allowed now must only include multilevel controls with one control step between 30% and 70% of full power.

- Now applies to the enclosed space and not to each luminaire.

- Projects may meet this requirement by switching alternate luminaires in the space, for example.
**LIGHTING WIRING ALTERATIONS**

- Controls requirements for lighting wiring alterations have been reduced in the new Standards.
- Projects are no longer required to meet the full suite of multilevel, automatic daylighting and demand response control.
- Area controls are always required and lighting wiring alterations must meet the lighting power allowances provided in §140.6.

**Under the 2016 Standards:**
- **Multilevel Controls** — only one control step for the enclosed space as a whole between 30 and 70%.
- **Automatic Daylighting Controls** — only required if alteration affects 10 or more luminaires in a primary sidelit or skylit daylit zone.
- **Demand Response Controls** — no longer required.

**LAMP & BALLAST/DRIVER REPLACEMENTS**

- Lamp replacements only or ballast/driver replacements only are both considered exceptions to §141.0(b)2J.
- A complete lamp and ballast/driver retrofit completed as a single project is considered a regulated alteration:
  - Must meet LPD requirements in §140.6.
  - Must meet controls requirements per §141.0(b)2J.
ACCEPANCE TESTING

- Indoor lighting alterations must comply with acceptance test requirements contained in §130.4
- When a project adds lighting controls to control 20 or fewer luminaires in total, the project is exempt

OUTDOOR LIGHTING REQUIREMENTS
ALLOWANCES LIGHTING POWER

- Lighting power allowances (LPA) for outdoor spaces have been reduced for hardscapes and building entrances or exits.
  - Reductions range from 11 – 56% for general hardscape lighting
  - Most significant reductions affecting linear and area wattage allowances for Zones 1 – 4.
  - In addition, ATM, tunnel and bridge lighting are no longer exempted from LPA calculations.
  - Values for all outdoor areas in Lighting Zones 0 – 4 are shown in Tables 140.7-A and 140.7-B of the Standards.

WHAT'S NEW IN THE 2016 CODE

In addition, Table 140.7-A has been modified to incorporate the new requirements of the recently revised Illuminating Energy Society of North America (IES) document RP-20-2014, Parking Lot Lighting Recommended Practice.

<table>
<thead>
<tr>
<th>Type of Power Allowance</th>
<th>Lighting Zone 0</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>Area Wattage Allowance (AWA)</td>
<td>No allowance</td>
<td>0.02 W/ft²</td>
<td>↓ 42%</td>
<td>0.03 W/ft²</td>
<td>↓ 53%</td>
</tr>
<tr>
<td>Linear Wattage Allowance (LWA)</td>
<td>0.15 W/ft²</td>
<td>↓ 40%</td>
<td>0.25 W/ft²</td>
<td>↓ 46%</td>
<td>0.35 W/ft²</td>
</tr>
<tr>
<td>Initial Wattage Allowance (IWA)</td>
<td>No change</td>
<td>400 W</td>
<td>520 W</td>
<td>520 W</td>
<td>640 W</td>
</tr>
</tbody>
</table>

1 For lighting Zone 2 and 3, where greater than 50% of the paved surface of a parking lot is finished with concrete, the AWA for that area shall be 0.020 W/ft² for Lighting Zone 2 and 0.040 W/ft² for Lighting Zone 3; and the LWA for both lighting zones shall be 0.04 W/ft². This does not extend beyond the parking lot, and does not include any other General Hardscape areas.

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WHAT’S NEW IN THE 2016 CODE
LIGHTING ZONE 0

Requirements for Lighting Zone 0 have been added:

• Lighting Zone 0 is designated specifically for undeveloped areas in parks and preserves, where no continuous lighting is intended

• While continuous lighting in Zone 0 is now explicitly prohibited, sites may utilize a single luminaire of 15 W or less at entrances to parking lots, trail heads, or other areas in order to safely illuminate site facilities

• Luminaires installed in Lighting Zone 0 cannot exceed the maximum zonal lumen limits for Uplight and Glare specified in Table 130.2-A and 130.2-B of the Standards.

LIGHTING CONTROLS

• Now includes more provisions for outdoor sales canopies and outdoor sales lots, which were previously exempted from occupancy-based dimming controls requirements contained in §130.2(c)3

• A photocontrol or astronomical time-switch is required to turn lights OFF during the day

• At night, a motion sensor or time-based control is also required
  • The specific types of allowed devices are dependent on the mounting height of the luminaire.

LIGHTING CONTROLS

• For outdoor luminaires
  • **Mounted 24 feet or less above the ground**, motion sensors or other occupancy-based controls are required as part of the nighttime control strategy. All incandescent luminaires must be controlled by a motion sensor.
  • **For all other luminaires mounted over 24 feet**, motion sensors are not explicitly required

  • The maximum dimming permitted as part of an active motion controlled lighting system has increased from 80% to 90%.
  • Outdoor lighting is no longer required to be separately circuited from other lighting, only separately controlled.
  • All outdoor lighting control provisions may be found in §130.2 of the Standards.

**WHAT'S NEW IN THE 2016 CODE**

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**Automated Lighting Controls for Outdoor Luminaires Mounted at 24 feet or Less from Grade**

<table>
<thead>
<tr>
<th>NEW CONSTRUCTION</th>
<th>ALTERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Regulated Projects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outdoor Entrance</th>
<th></th>
<th>Connected Lighting Load is Increased</th>
<th>Connected Lighting Load is Not Increased Greater of 5 Luminaires or 10% Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Photocontrol or outdoor astronomical time-switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch with Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outdoor Patio</th>
<th></th>
<th>Connected Lighting Load is Increased</th>
<th>Connected Lighting Load is Not Increased Greater of 5 Luminaires or 10% Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Photocontrol or outdoor astronomical time-switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch with Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>All Other General Area</th>
<th></th>
<th>Connected Lighting Load is Increased</th>
<th>Connected Lighting Load is Not Increased Greater of 5 Luminaires or 10% Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Photocontrol or outdoor astronomical time-switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch</td>
<td>Photocontrol or Outdoor Astronomical Time-Switch with Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
<td>Motion Sensor</td>
</tr>
<tr>
<td></td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
<td>Centralized, Time-based control system</td>
</tr>
</tbody>
</table>

*All outdoor luminaires at building facades must feature sensors.*
WHAT'S NEW IN THE 2016 CODE

ACCEPTANCE TEST REQUIREMENTS

• Acceptance test requirements and procedures for many types of outdoor automatic shut-OFF controls have been clarified and/or expanded
  • Specific functional tests for photocontrols, astronomical timeswitch controls and part-night controls are now available
  • Information on the updated requirements may be found in Nonresidential Appendix 7, Section 8 (NA7.8)
  • An alteration project where lighting controls are added to control 20 or fewer luminaires in total is now exempt from acceptance testing requirements contained in §130.4

OUTDOOR ALTERATIONS

• Requirements for outdoor lighting alterations are now more detailed and specific to the type of outdoor space
  • Only the altered or new luminaires must comply, and the minimum threshold for projects that do not increase the connected lighting load has been raised to the greater of five luminaires or 10%.
  • When 50% or more luminaires are being replaced, the project must comply with lighting power and other requirements contained in §140.7
    • Exception: If the new luminaires have at least 40% lower power consumption, the alteration is not required to comply with §140.7