Best practices in lighting design to comply with California’s Building Energy Efficiency Standards (Title 24)
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LEARNING OBJECTIVES

• Effectively apply the mandatory and prescriptive nonresidential California Building Energy Efficiency Standards (Energy Code) requirements specific to lighting for the 2022 cycles

• Understanding the lighting-related requirements in the 2022 Energy Code

• Identifying current lighting technologies, including LED luminaires, that are available to fulfill Energy Code requirements

• Accessing resources through utility and lighting technology training centers for continued professional development

• Understand how to participate in the 2025 Energy Code update process
CALIFORNIA LIGHTING TECHNOLOGY CENTER, UC DAVIS

CLTC’s Mission: To stimulate, facilitate and accelerate the development, application and commercialization of energy-efficient lighting, daylighting & building management technologies in partnership with utilities, manufacturers, occupants, builders, designers, researchers, academicians and government agencies.

Mission-driven Activities:
• Research & Development
• Demonstration & Outreach
• Education & Training
2022 TITLE 24, PART 6  NONRESIDENTIAL LIGHTING

### FOUNDING ORGANIZATIONS

UC Davis  pier  NEMA  

### UTILITIES

Pacific Gas and Electric Company  SDG&E  SMUD  

### MANUFACTURERS

Acuity Brands  GE Lighting  kuraray  LUTRON  SORAA  

### LARGE END-USERS

CSU  The California State University  

DGS  Department of General Services  

Entech Solar  IDEAL  

CREE  INTERMATIC  LEVITON  

ARTISTIC LIGHTING TECHNOLOGIES  Daintree Networks  

FLOWLIGHTING TECHNOLOGIES  FLOWLIGHTING TECHNOLOGIES  

ECHO  EL EVERLAST LIGHTING  

enlighted  ELK  FUJITSU  

HONDA  The Power of Dreams  

Qualcomm  VISA LIGHTING  

LAI'S  WattStopper  

LOWELL  LUMENETIX  

Microsight  

Universal Lighting Technologies  

MICROSOFT  STACK  

OSRAM SYLVANIA  

Philips  VELUX  

Lumenetix  

kuray  

Extended Lighting Systems  

Konica Minolta  

KONICA MINOLTA  

LUNA  

LUNERA  

LACCD  

LA  

STACK  

STACK  

STACK  

STACK  

U.S. Army  

U.S. Air Force  

U.S. Navy  

Walmart  

Walmart  

Walmart  

Walmart
NONRESIDENTIAL LIGHTING DESIGN GUIDE

Provides a simplified and practical approach to lighting standards compliance and design.

Topics include:
• Explanation of the code
• Technical guidelines
• Steps to compliance
• Lighting design examples

2022 version in review, coming soon online for download!

cltc.ucdavis.edu
2019 LIGHTING EDUCATION VIDEOS

CLTC developed a series of lighting education videos in support of the 2019 Energy Code.

Videos cover four key topics:

• Lighting Controls Technologies & Requirements
• Lighting Alterations
• Lighting Controls Acceptance Testing
• High Efficacy Lighting

Videos were funded by Southern California Edison in collaboration with RMS Energy Consulting, LLC and the California Energy Commission.

Available online! cltc.ucdavis.edu

*2022 updates in progress*
LIGHTING & ENERGY EFFICIENCY

• Light Sources
  • One-time, long-term change
  • Reduction of baseline
    • Light source efficacy
    • Luminaire efficacy
    • Application efficacy

• Light Controls
  • Continuous, real-time change
  • Fluctuations from baseline
    • Occupancy/vacancy
    • Daylight harvesting
    • Demand response (DR)
    • Tuning
    • Personal control
ADAPTIVE SYSTEMS

• automatically adjust their light output...
  • Total luminous flux
  • Spectral power distribution
  • Candle power distribution

• based on sensor input from the space...
  • Occupancy/vacancy
  • Daylight
  • DR signals

• to optimize space and building performance.
  • Comfort
  • Energy savings
  • Peak demand reduction
CONTROL STRATEGIES

• During **occupancy**, focus on **comfort**
  - Adjust fenestration for daylight penetration
  - Adjust electric lighting for daylight contribution
  - Offer manual control options
  - Adjust electric lighting for demand response
  - Adjust HVAC

• During **vacancy**, focus on **energy efficiency**
  - Adjust fenestration for cooling/heating loads
  - Turn electric lighting off or dim down
  - Adjust electric lighting for demand response
  - Adjust HVAC
Select the Appropriate
SOURCE + LUMINAIRE + CONTROLS
(for the application)
WHY THE ENERGY CODE?

EFFICIENCY BEFORE GENERATION

The California Energy Commission has found energy efficiency and demand response as the preferred means of meeting the energy needs of a growing population.

As a result, Californians use 31 percent less energy compared to the average American.
WARREN-ALQUIST ACT – ENERGY CODE DEVELOPMENT OBLIGATIONS

- Technically feasible
- Cost-effective
- Performance-based and prescriptive compliance path
# California’s Policy Goals

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Goal</th>
<th>Now</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Buildings</td>
<td>New Construction De-Carbonization/Reduced GHG&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing Homes (reduction relative existing stock)&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Buildings</td>
<td>New Construction De-Carbonization/Reduced GHG&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing De-Carbonization/Reduced GHG&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Buildings</td>
<td>New Construction &amp; Major Retrofit ZNE&lt;sup&gt;2&lt;/sup&gt;</td>
<td>50%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing ZNE (by square footage)&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>SB 350</td>
<td>Increase energy efficiency in existing buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Buildings</td>
<td>New and enhanced codes &amp; standards, code simplification, increased compliance, asset ratings, purchase agreements, etc.&lt;sup&gt;3&lt;/sup&gt;</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>GHG Emissions</td>
<td>Statewide GHG Emissions (all sources)&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td>1990 Levels</td>
<td>40% Below 1990</td>
</tr>
<tr>
<td>Water Efficiency</td>
<td>25 percent reduction in urban water use&lt;sup&gt;5&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. California’s Long Term Energy Efficiency Strategic Plan
2. Executive Order B-18-12
3. Assembly Bill 758; Existing Buildings Action Plan
4. Assembly Bill 32 for 2020; Executive Order B-30-15 for 2030 and 2050
5. Executive Order B-29-15
ENERGY CODE TIMELINE

The 2022 Energy Code is effective now! Any application for a Building Permit submitted on or after January 1, 2023 must meet the 2022 Energy Code.

The 2025 Energy Code is currently being researched and developed. If you are interested in following the Codes and Standards Enhancement (CASE) process, please participate in public events and docketing of comments on the California Energy Commission’s website.

https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards
http://title24stakeholders.com/
https://caenergyalliance.org/emerging-initiatives

Note: This presentation is not intended to be used in lieu of California’s Building Energy Efficiency Standards. Please visit www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency to download the official 2022 Energy Code, Reference Appendices and Nonresidential Compliance Manual.
What's New for 2022?

- Encouraging electric heat pump technology and use
- Establishing electric-ready requirements when natural gas is installed
- Expanding solar photovoltaic (PV) system and battery storage standards
- Strengthening ventilation standards to improve indoor air quality

2022 Energy Code: Better for the Environment and You

Heat pumps use less energy and produce fewer emissions than traditional HVACs and water heaters.

Electric-ready building sets up owners to use cleaner electric heating, cooking, and electric vehicle (EV) charging when they're ready to invest in those technologies.

Using battery storage allows onsite energy to be available when needed and reduces the grid's reliance on fossil fuel power plants.

Better ventilation can reduce illness from poor air quality and reduce disease transmission.
COMPLIANCE OVERVIEW
Primary responsibility for compliance and enforcement rests with the local enforcement agency, typically associated with a city or county government.

A building permit must be obtained from the local jurisdiction before construction of:

- A nonresidential building
- An outdoor lighting system
- Additions to existing buildings
- Significant alterations to existing lighting systems
- Signage
LOCAL ORDINANCES

State law allows local jurisdictions to adopt building energy efficiency standards that are more stringent than the Energy Code, through an approval process with the California Energy Commission. Examples of areas where the Local Ordinances are more stringent:

- Shorter timeframes
- Additional energy conservation measures
- More stringent energy budgets
- CALGreen or GreenPoint Rated

Current local ordinances, or “reach codes,” are listed on the Energy Commission website:
## 2022 APPROVED LOCAL ORDNANCES

<table>
<thead>
<tr>
<th>Local Ordinances</th>
<th>Date Approved</th>
<th>Topic</th>
<th>Ordinance Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encinitas</td>
<td>January 25, 2023</td>
<td>Residential Retrofit Efficiency Improvements; PV for High-Rise and Nonresidential Additions</td>
<td>2022-13</td>
</tr>
<tr>
<td>Piedmont</td>
<td>January 25, 2023</td>
<td>All Electric SF NC, Residential Retrofit Efficiency Improvements, PV for Some Additions</td>
<td>766 N.S.</td>
</tr>
</tbody>
</table>
THE CORE COMPLIANCE PROCESS

MANDATORY REQUIREMENTS

• Required controls that must be installed
• Functionality that a lighting system must be capable of
• Specify if a device needs to be certified by the Energy Commission

PRESCRIPTIVE OR PERFORMANCE REQUIREMENTS

• Maximum lighting power allowance for a building or an area
• Some methods allow for trade-offs between building systems, so a very efficient lighting system may allow for a greater HVAC load
THE PERFORMANCE APPROACH

Performance Approach:

- More flexible than prescriptive
- Based on an energy simulation model of the building
- Requires an approved computer software program
- Uses energy budgets to determine compliance
- Typically used for flexibility and ability to find the most cost-effective solution
## 2022 APPROVED COMPLIANCE PROGRAMS

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Compliance Software Versions</th>
<th>Contact Information</th>
<th>Additional Information</th>
</tr>
</thead>
</table>
| California’s Building Energy Code Compliance Software (CBECC) | CBECC 2022.2.1 was approved 1/16/23 for demonstrating performance compliance with the nonresidential and multifamily provisions of the 2022 Energy Code. Permit applications made on or after 1/16/23 must use CBECC 2022.2.1 or 2022.2.0.  
**Latest Version**  
- Download CBECC 2022.2.1  
**Non-Current Versions**  
- Download CBECC 2022.2.0  
- Download CBECC 2022.1.0 | California Energy Commission  
Building Standards Office  
715 P Street, MS 37  
Sacramento, CA 95814  
ATTN: R.1 WebDept  
916-897-3440  
cbecc@energy.ca.gov | See the CBECC Website for:  
- SketchUp and OpenStudio SketchUp Plugin  
- Prototype Models & Tutorials  
- FAQ/Training  
- Software Archive  
- Quick Start Guide  
- User Manual  
- 2022 Compliance Software Approval and Expiration Dates.  
Support: cbecc.com@energy.ca.gov |
| EnergyPro | EnergyPro 9.0 was approved 12/14/22 for demonstrating performance compliance with the nonresidential and multifamily provisions of the 2022 Energy Code.  
**EnergyPro 2022 Resolutions/Approvals**  
- EnergyPro 9.0 Resolution | EnergySoft, LLC  
1025 5th Street, Suite A  
Novato, CA 94945-2413  
415-897-6400 | See the EnergySoft website for:  
- Software Download  
- Training and FAQ’s  
- Support: support@energysft.com  
2022 Compliance Software Approval and Expiration Dates |
THE PRESCRIPTIVE APPROACH

INDOOR LIGHTING

The prescriptive lighting power requirements are determined by one of three methods:

• Complete building method
• Area category method
• Tailored method

The allowed lighting varies according to building occupancy and task.
THE PRESCRIPTIVE METHODS

COMPLETE BUILDING METHOD
Usable when at least 90% of the building is one primary type of use or sometimes for a single tenant space within a building. A single allowed lighting power value governs the entire building.

AREA CATEGORY METHOD
Applicable for any permit situation, including tenant improvements. Lighting power values are assigned to each major function areas of a building (offices, lobbies, etc.). The allowed lighting power is the weighted average of these areas.

TAILORED METHOD
Applicable when additional flexibility is needed to accommodate special task lighting needs in specific task areas. Lighting power allowances are determined room-by-room and task-by-task, with the area category method used for other areas in the building.
## COMPLETE BUILDING ALLOWANCES

Lighting Power Density Updates from 2019 to 2022 for the Complete Building Method

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>2022</th>
<th>Δ</th>
<th>Type of Building</th>
<th>2022</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly</td>
<td>0.65</td>
<td>↓ 0.05</td>
<td>Office</td>
<td>0.60</td>
<td>↓ 0.05</td>
</tr>
<tr>
<td>Bank or Financial Institution</td>
<td>0.65</td>
<td>—</td>
<td>Parking Garage</td>
<td>0.13</td>
<td>—</td>
</tr>
<tr>
<td>Grocery Store</td>
<td>0.90</td>
<td>↓ 0.05</td>
<td>Performing Arts Theater</td>
<td>0.75</td>
<td>↓ 0.05</td>
</tr>
<tr>
<td>Gymnasium</td>
<td>0.60</td>
<td>↓ 0.05</td>
<td>Religious</td>
<td>0.70</td>
<td>—</td>
</tr>
<tr>
<td>Healthcare</td>
<td>0.90</td>
<td>—</td>
<td>Restaurant</td>
<td>0.65</td>
<td>↓ 0.05</td>
</tr>
<tr>
<td>Industrial or Manufacturing Facility</td>
<td>0.60</td>
<td>—</td>
<td>Retail Store</td>
<td>0.90</td>
<td>—</td>
</tr>
<tr>
<td>Library</td>
<td>0.70</td>
<td>—</td>
<td>School</td>
<td>0.60</td>
<td>↓ 0.05</td>
</tr>
<tr>
<td>Motion Picture Theater</td>
<td>0.60</td>
<td>↓ 0.1</td>
<td>Sports Arena</td>
<td>0.75</td>
<td>—</td>
</tr>
<tr>
<td>Museum</td>
<td>0.65</td>
<td>New</td>
<td>All other buildings</td>
<td>0.40</td>
<td>—</td>
</tr>
</tbody>
</table>

*Based on Table 140.6-B in the Energy Code*
## 2022 Lighting Power Density Values for Area Category Method

### Table 140.6-C: Area Category Method — Lighting Power Density Values (W/ft²)

<table>
<thead>
<tr>
<th>Primary Function Area</th>
<th>Allowed Lighting Power Density for General Lighting (W/ft²)</th>
<th>Additional Lighting Power¹</th>
<th>Additional Allowance (W/ft², unless noted otherwise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor Area</td>
<td>0.70</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td>Dining</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹⁰</td>
<td>0.10</td>
</tr>
<tr>
<td>Lobby, Main Entry</td>
<td>0.85</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transition Lighting OFF at night¹²</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹⁰</td>
<td>0.10</td>
</tr>
<tr>
<td>Lounge or Waiting Area</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹⁰</td>
<td>0.10</td>
</tr>
<tr>
<td>Multipurpose Room</td>
<td>0.85</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹⁰</td>
<td>0.10</td>
</tr>
<tr>
<td>Religious Worship Area</td>
<td>1.00</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹⁰</td>
<td>0.10</td>
</tr>
<tr>
<td>Restroom</td>
<td>1.00</td>
<td>Decorative or Display</td>
<td>0.20</td>
</tr>
<tr>
<td>Stairwell</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td>0.30</td>
</tr>
</tbody>
</table>
COMPLIANCE FORMS

CC: Certificate of Compliance  
CA: Certificate of Acceptance  
CI: Certificate of Installation  
CV: Certificate of Verification  
O: Outdoor  
I: Indoor  
S: Signs  
E: Used by Enforcement Authority  
A: Used by Acceptance Tester

NR CA – LTI – 02 – A

NR: Nonresidential  
CF: Residential  
LT: Lighting  
CXR: Commissioning Review  
ELC: Electrical  
ENV: Envelope  
MCH: Mechanical  
PLB: Plumbing  
PRC: Process  

Number in Sequence
## Certificates of Compliance

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRCC-LTI-E</td>
<td>Indoor Lighting</td>
</tr>
<tr>
<td>NRCC-LTO-E</td>
<td>Outdoor Lighting</td>
</tr>
<tr>
<td>NRCC-LTS-E</td>
<td>Sign Lighting</td>
</tr>
<tr>
<td>NRCC-ELC-E</td>
<td>Electrical Power Distribution</td>
</tr>
</tbody>
</table>
CERTIFICATES OF INSTALLATION

NRCI-ELC-E  Electrical Power Distribution
NRCI-LTI-E  Indoor Lighting
NRCI-LTO-E  Outdoor Lighting
NRCI-LTS-E  Sign Lighting
ACCEPTANCE TESTING

Acceptance testing helps ensure building equipment and systems perform properly. It is not a replacement for commissioning.

Lighting controls acceptance testing is NOT the same as the commissioning requirements in §120.8.

1. **Review documents** to make sure that controls are properly documented
2. **Review the installation** and **perform testing** to ensure controls operate as required by the Energy Code
3. **Fill out** the Certificates of Acceptance and submit them to the enforcement agency in order to receive an occupancy permit

http://www.energy.ca.gov/title24/attcp/
WHO CAN BE AN ACCEPTANCE TEST TECHNICIAN (ATT)?

Including (but not limited to):
1. Electrical contractors
2. Certified General Electricians
3. Professional Engineers
4. Controls Installation & Setup Contractors
5. Certified Commissioning Professionals
6. HVAC Installers
7. Mechanical Contractors

Participation in the ATT program is limited to persons who have at least three years of verifiable professional experience and expertise in lighting controls and electrical systems.
CALCTP

California Advanced Lighting Controls Training Program

HOME

CALCTP SAVES ENERGY
Commercial buildings can enjoy up to 40 percent in energy savings by simply turning lights off in unoccupied offices, conference rooms and restrooms during business hours.

The expansion of advanced lighting controls is essential for the development of a highly reliable and efficient electric smart grid system.

ABOUT THE PROGRAM
The California Advanced Lighting Controls Training Program (CALCTP) is a statewide initiative aimed at increasing the use of lighting controls in commercial buildings and industrial facilities through education.

CALCTP is composed of two training programs: (1) an installation program and (2) an acceptance test technician program (Title 24 requirement).

CALCTP INSTALLATION PROGRAM
The CALCTP Installation Program educates, trains and certifies C-10 licensed electrical contractors and state-certified general electricians in the proper installation, programming and maintenance of advanced lighting controls systems.

Click here to find a CALCTP-Certified Installation Contractor in your area or click the Get Certified tab above for more information on becoming a certified technician.

CALCTP-ACT PROGRAM
The 2016 building Energy Efficiency Standards require certified technicians to conduct tests to perform installed lighting controls. CALCTP is a state-recognized

Fast Facts
Lighting comprises as much as 38% of the electricity expended in a commercial building.

https://www.calctp.org/
Title 24 Acceptance Testing Certification

NLCAA is approved by the California Energy Commission as an ATTCP to train, certify and oversee Acceptance Test Technicians and Employers.

Acceptance Test Technician

An Acceptance Test Technician is an installation technician that is certified to perform nonresidential acceptance testing for lighting controls.

Acceptance Test Employer

* Each Acceptance Test Technician must be employed by an ATE to participate in the program, even ATTs that are self-employed.

https://www.nlcaa.org/
ACCEPTANCE TESTING PROCESS

**PLAN REVIEW** *(installing contractor, engineer of record)*
Review plans and specifications to ensure they meet all Energy Code requirements. Typically done prior to signing a Certificate of Compliance.

**CONSTRUCTION INSPECTION** *(installing contractor, engineer of record)*
Check that the equipment installed is capable of complying with the Energy Code requirements. Construction inspection also assures that the equipment is installed correctly and is calibrated.

**FUNCTIONAL TESTING** *(Field Technician)*
Acceptance tests are performed to ensure that all equipment performs as required by the Energy Code.

**OCCUPANCY**
Once all required Certificates of Acceptance are submitted, the enforcement agency releases a Certificate of Occupancy.
## Certificates of Acceptance

<table>
<thead>
<tr>
<th>Certificate Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRCA-LTI-02-A</td>
<td>Shut-off Lighting Controls</td>
</tr>
<tr>
<td>NRCA-LTI-03-A</td>
<td>Automatic Daylighting Controls</td>
</tr>
<tr>
<td>NRCA-LTI-04-A</td>
<td>Demand Responsive Lighting Controls</td>
</tr>
<tr>
<td>NRCA-LTI-05-A</td>
<td>Institutional Tuning PAF</td>
</tr>
<tr>
<td>NRCA-LTO-02-A</td>
<td>Outdoor Lighting Acceptance Tests</td>
</tr>
</tbody>
</table>
MANDATORY DEVICE REQUIREMENTS

Certain lighting products must be certified to the Energy Commission as meeting California’s Appliance Efficiency Regulations; others are regulated only under the Energy Code.

- Regulated under the Appliance Efficiency Regulations:
  - Fluorescent lamp ballasts
  - Ceiling fan light kits
  - Lamps
  - Emergency lighting
  - Torchieres and metal halide luminaires
  - Power supplies

- Regulated under Section 110.9 of the Energy Code only:
  - Lighting control devices
    - Time-switch lighting controls
    - Daylighting controls
    - Dimmers
    - Occupant sensing controls
  - Track lighting integral current limiter
  - Supplementary overcurrent protection panels for use with line-voltage track lighting
  - Field-assembled lighting control systems

www.cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx
MODERNIZED APPLIANCE EFFICIENCY DATABASE SYSTEM (MAEDBS)
ADDITIONS, ALTERATIONS & REPAIRS

- Alterations to indoor lighting systems that include 10 percent or more of the luminaires serving an enclosed space must meet one of the following requirements:

- If the project includes less than 10 percent of the luminaires in the enclosed space, or the enclosed space has just one luminaire, the project is exempt for these requirements.

- Option 1: Comply with the indoor lighting power and lighting control requirements for new construction (middle column, Table 3).

- Option 2: Alterations using 80 percent or less of the indoor lighting power allowances for new construction must adhere to the lighting control requirements in the right column of Table 3.

- Option 3: Projects in small buildings, or tenant spaces (5,000 square feet or less) that include one-for-one luminaire alterations to 50 or more luminaires can retrofit with new luminaires that achieve at least 40 percent power reductions over pre-alteration luminaires. The project must include the lighting controls shown in the right column of Table 3.
## ADDITIONS, ALTERATIONS & REPAIRS

Control Requirements for Indoor Lighting System Alterations

<table>
<thead>
<tr>
<th>Control Specifications</th>
<th>Trigger</th>
<th>Projects Complying with Section 141.0(b)2ii</th>
<th>Projects Complying with Sections 141.0(b)2lii or 141.0(b)2liii</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual Area Controls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130.1(a)1 – Be readily accessible.</td>
<td>Required</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>130.1(a)2 – Be located in the same enclosed area with the lighting fixture it controls.</td>
<td>Required</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>130.1(a)3 – Provide separate control of general, display, ornamental and special effects lighting.</td>
<td>Only required for new or completely replaced circuits</td>
<td>Only required for new or completely replaced circuits</td>
<td></td>
</tr>
<tr>
<td><strong>Multi-Level Controls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>130.1(b) – Allow level of lighting to adjust up and down.</td>
<td>Enclosed areas 100 ft² or larger with connected lighting load that exceeds 0.5 watts per ft². Healthcare buildings are exempt.</td>
<td>Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>130.1(c)1 – Be controlled by an occupant sensing control, automatic time-switch control or other control capable of automatically shutting OFF all lighting when the space is typically unoccupied; provide separate controls as specified in 130.1(c)1B-D; and include a manual-ON mode for automatic time-switch controls.</td>
<td>Required; 130.1(c)1D only required for new or completely replaced circuits</td>
<td>Required; 130.1(c)1D only required for new or completely replaced circuits</td>
<td></td>
</tr>
<tr>
<td>130.1(c)2 – Countdown timer switches may be used to comply with shut-OFF control requirements in closets less than 70 ft² and server aisles in server rooms.</td>
<td>Required</td>
<td>Required</td>
<td></td>
</tr>
</tbody>
</table>
| 130.1(c)3 – Manual override for automatic time
2022 ENERGY CODE TRIGGERS—OUTDOOR

NEW CONSTRUCTION

• Luminaires ≥ 6,200 lumens
  • Luminaire shielding requirements, BUG

• Controls
  • When not regulated by health or safety to always remain on

ALTERATIONS

• ≥ 10 percent (whichever is greater) of the fixtures changed, moved or replaced
  • Mandatory controls only

• ≥ 50 percent of the fixtures changed, moved or replaced
  • Mandatory controls AND
  • Prescriptive requirements

• Reduced wattage method:
  • Mandatory controls

Exceptions: Alterations where less than 5 luminaires are replaced
ELECTRICAL POWER DISTRIBUTION SYSTEMS

Mandatory requirements that apply to:
• All nonresidential,
• High-rise residential and
• Hotel/motel buildings.

Requirements include:
• Service metering
• Disaggregation of electrical loads
• Voltage drop
• Receptacle control
• Demand response
SERVICE METERING

The building owner or occupant must have access to read a meter with:
1. Display instantaneous demand in kW
2. Measure kWh usage over time
3. Larger services over 250kVA require additional capabilities

“Smart meters” usually meet the requirements as long as the data is accessible to the building owner or occupant.

<table>
<thead>
<tr>
<th>Metering Functionality</th>
<th>Electrical Services rated 50 kVA or less</th>
<th>Electrical Services rated more than 50 kVA and less than or equal to 250 kVA</th>
<th>Electrical Services rated more than 250 kVA and less than or equal to 1000 kVA</th>
<th>Electrical Services rated more than 1000 kVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instantaneous (at the time) kW demand</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Historical peak demand (kW)</td>
<td>Not required</td>
<td>Not required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Tracking kWh for a user-definable period</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>kWh per rate period</td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
<td>Not required</td>
</tr>
</tbody>
</table>
**DISAGGREGATION OF ELECTRICAL LOADS**

Measurement devices must be able to monitor the electrical energy usage of load types per Table 130.5-B:

<table>
<thead>
<tr>
<th>Electrical Load Type</th>
<th>Electrical Services rated 50kVA or less</th>
<th>Electrical Services rated more than 50kVA and less than or equal to 250kVA</th>
<th>Electrical Services rated more than 250kVA and less than or equal to 1000kVA</th>
<th>Electrical Services rated more than 1000kVA</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 50kVA</td>
<td>All HVAC in aggregate and each HVAC load rated at least 50kVA</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 25kVA</td>
<td>Not required</td>
<td>All plug load in aggregate</td>
<td>All plug load separated by floor, type or area</td>
<td>All plug load separated by floor, type or area</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>
</tbody>
</table>
VOLTAGE DROP

The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet cannot exceed five percent.

Exceptions are voltage drops permitted by California Electrical Code
• Section 647.4 – Sensitive Electronic Devices
• Section 695.6 – Fire Pump Transformers
• Section 695.7 – Fire Pump Power Wiring

The California Electrical Code is available online here: http://www.bsc.ca.gov/Codes.aspx
CIRCUIT CONTROLS FOR 120-VOLT RECEPTACLES

Plug loads are a large and increasing electrical load in most office buildings.

All of the following spaces must have both controlled and uncontrolled 120-volt receptacles:

- Office areas
- Lobbies
- Conference room
- Kitchens in office spaces
- Copy rooms
- Hotel/motel guest rooms

The controlled outlets must be clearly marked. Each uncontrolled receptacle should have a controlled receptacle within 6 feet of it.
INDOOR LIGHTING CONTROLS

Mandatory Measures
MANDATORY LIGHTING CONTROLS

1. **Area Controls** 130.1(a)
   Manual controls that control lighting in each area separately

2. **Multi-level Controls** 130.1(b)
   “Dimmability.” Allow occupants to choose the appropriate light level for each area

3. **Shut-off Controls** 130.1(c)
   Automatically shut off lighting or reduce light levels when illumination is not needed

4. **Automatic Daylighting Controls** 130.1(d)
   Adjust electric lighting in response to the presence of daylight

5. **Automated Demand Response** 130.1(e), 110.12
   Receive and automatically respond to demand response (DR) signals

6. **Control Interactions** 130.1(f)
   Defines interactions of all mandatory lighting controls
MANUAL ON/OFF CONTROLS

An “area” is a space enclosed by ceiling-height partitions. All lighting in each area must be controlled separately from luminaires in other areas by manual on/off lighting controls that are:

1. Readily accessible
2. Located in the same room or area as the lighting they control and with the lighting in view
3. Able to provide any required dimming or multi-level controls steps in addition to on/off
4. General lighting is separately controlled from all other lighting systems in same area
5. Track, display, ornamental, and special effect lighting systems are controlled separately

Section 100.1
EXCEPTIONS

May use a manual control that is NOT accessible to unauthorized personnel for the following spaces:

• Restrooms with more than 2 stalls
• Parking areas
• Stairwells and corridors
• Areas of the building intended for access or use by the public

Section 130.1(a)1
EGRESS LIGHTING

Up to 0.1 W/ft² of lighting in any area within a building may be continuously illuminated consistent with California Building Code Section 1008.

Exception to Section 130.1(a)
MULTI-LEVEL LIGHTING CONTROLS

The Energy Code sets a minimum number of control steps and illuminance uniformity requirements for most major luminaire types (see Table 130.1-A). These requirements are required in addition to any mandatory manual, daylight, shut-off or demand response controls.

Dimmable luminaires shall be controlled by a dimmer control that is capable of achieving the required multi-level steps and ON/OFF functionality.

The criteria in 130.1(b) applies to general lighting for enclosed area that:

- Are at least 100 square feet in size
- Have a connected lighting load over 0.5 W/ft²
- Have more than one dedicated LED luminaire or a luminaire with more than two lamps

Exceptions: Restrooms and healthcare facilities.

Section 130.1(b)
**TABLE 130.1-A**

Multi-level Lighting Controls and Uniformity Requirements for General Lighting

<table>
<thead>
<tr>
<th>Luminaire Type</th>
<th>Minimum Required Control Steps (percent of full rated power(^1))</th>
<th>Uniform Level of Illuminance Achieved By:</th>
<th>Common Use Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED luminaires and LED source systems</td>
<td></td>
<td>Continuous Dimming 10–100%</td>
<td>Commercial applications, including recessed, downlight, accent and decorative</td>
</tr>
<tr>
<td>Line-voltage sockets except GU-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-voltage incandescent systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluorescent Luminaires</td>
<td>Continuous Dimming 20–100%</td>
<td></td>
<td>Downlights</td>
</tr>
<tr>
<td>GU-24 sockets rated for fluorescent ≤ 20W</td>
<td>Minimum one step between 30–70%</td>
<td>Continuous dimming; stepped dimming; or switching alternate lamps in a luminaire; or separately switching circuits in multi-circuit track with a minimum of two circuits.</td>
<td>Downlights, recessed</td>
</tr>
<tr>
<td>Pin-based compact fluorescent ≤ 20W</td>
<td>Minimum one step between 30–70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear and U-bent fluorescent ≤ 13W</td>
<td>Minimum one step between 30–70%</td>
<td>Continuous dimming; stepped dimming; or switching alternate lamps in a luminaire; or separately switching circuits in multi-circuit track with a minimum of two circuits.</td>
<td>Accent and decorative</td>
</tr>
<tr>
<td>Track Lighting</td>
<td>Minimum one step in each range</td>
<td>Stepped dimming; continuous dimming; or switching alternate lamps in each</td>
<td></td>
</tr>
</tbody>
</table>
EXCEPTION

• Classrooms with a connected general lighting load of 0.6 watts per square feet or less shall have at least one control step between 30–70 percent of full rated power.

Note: Classrooms must still meet the uniformity requirements in Table 130.1-A.
SHUT-OFF CONTROLS

Automatic shut-off controls turn lights off when space is unoccupied. All lighting must be controlled by one or more of the following:

1. Occupant sensing control
2. Automatic time-switch control
3. Building Energy Management System
4. Other control mechanism capable of automatically shutting off all lights for vacant periods

A single control may not monitor more than 5,000 square feet.

Section 130.1(c)
SHUT-OFF CONTROLS

When the following rooms are unoccupied, all the lighting should automatically be turned off by an occupant sensing control after 20 minutes of being unoccupied:

1. Offices 250 square feet or smaller
2. Multipurpose rooms smaller than 1,000 square feet
3. Conference rooms of any size
4. Classrooms of any size
5. Restrooms of any size

Section 130.1(c)
SHUT-OFF CONTROLS

When multi-level controls are required:

- Partial-on occupancy or vacancy sensors shall be used

When multi-level controls are not required:

- Lighting is turned 100 percent off with occupancy controls

Section 130.1(c)
SHUT-OFF CONTROLS

Countdown timer switches may only be used in:
1. Closets smaller than 70 square feet (Max timeout 10 minutes)
2. Aisles in server rooms smaller than 500 square feet (Max timeout 30 minutes)

If time-based controls are used, occupants there after hours must be able to activate lighting as needed:
• Manual switch
• Temporary override
• Occupancy-based controls

Section 130.1(c)
FULL OR PARTIAL-OFF OCCUPANCY CONTROLS

Adaptive controls in secondary spaces:
• Stairwells/corridors,
• Aisleways and open areas in warehouses, and
• Library book stacks 10 feet or longer

Controls must be capable of:
• Partially reducing lighting power during hours of operation by at least 50 percent when vacant
• Providing 100 percent of light when someone is detected in the space

Section 130.1(c)
FULL OR PARTIAL-OFF OCCUPANCY CONTROLS

- In office spaces greater than 250 square feet, full or partial off occupancy controls are now required where:
  - Occupancy control zones 600 square feet or less
  - Reduce lighting power of each control zone by at least 80% when unoccupied
  - Max 20 minute timeout
  - Turn all lighting in office space off when all control zones have been unoccupied for at least 20 minutes
  - Be able to provide any amount of light when someone is detected in the space, not to exceed 20% full power in control zones adjacent to the specific control zone where occupancy is detected

Exception: Under-shelf or furniture-mounted task lighting controlled by a local switch & either a time switch or an occupancy sensor.

Section 130.1(c)
PARTIAL-OFF OCCUPANCY CONTROLS

Partial-off occupancy controls are required in:

• Stairwells and common area corridors that provide access to guest rooms
  • Reduce by at least 50% full power

• Parking garages, parking areas, & loading and unloading areas
  • General lighting must have occupant sensing controls with at least one control step between 20 and 50 percent of design lighting power
  • No more than 500 watts of rated lighting power may be controlled together

Section 130.1(c)7B
CASE STUDY: ADAPTIVE CORRIDOR LIGHTING

LATHAM SQUARE (OAKLAND, CA)

• In January 2012, CLTC installed bi-level lighting controls on 12 floors of the Latham Square office building
• 174 86W luminaires retrofitted to 64W luminaires via retrofit kit
• Occupancy rate of corridors: 8 percent
• Average energy savings: 86 percent

SHUT-OFF CONTROLS EXCEPTIONS

Spaces that are exempt from automatic shut-off controls requirements:

1. Buildings with lighting in continuous use 24 hours/day, 365 days/year
2. Areas where partial on/off controls are required instead of shut-off controls (such as stairwells and corridors)
3. Electrical equipment rooms
4. Emergency egress lighting
5. Healthcare facilities

Section 130.1(c)
AUTOMATIC DAYLIGHTING CONTROLS

Automatic daylight controls adjust electric lighting power when ample daylight is available. “Ample daylight” is defined by the standards as 150 percent of the designed light level for electric lighting.

Automatic daylighting controls are required for luminaires that:
1. Provide general lighting
2. Are at least half in a skylit or sidelit area
3. Are in an area where the total installed general lighting power is at least 120 watts
4. Are located in an area which has at least 24 square feet of glazing for buildings, or 36 square feet of combined openings/glazing in parking garages

Section 130.1(d)
AUTOMATIC DAYLIGHTING CONTROLS

Automatic daylighting controls requirements for primary and secondary daylighting zones:

1. For spaces required to install multi-level controls, lighting must be adjusted via continuous dimming or the number of control steps provided by the multi-level controls.

2. Controlled lighting and daylight must equal or exceed the controlled electric lighting level without daylight.

3. For areas other than parking garages, when there is ample daylight detected, the general lighting power in that space must be reduced by at least 90 percent.

4. For parking garages, when illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in primary and secondary sidelit zones is zero.

Section 130.1(d)
AUTOMATIC DAYLIGHTING CONTROLS

Exceptions:

1. Areas under skylights where it is documented that existing adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 A.M. and 4 P.M.

2. Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang and the ratio of the overhang projection to the overhang rise is greater than 1.5 for South, East and West orientations, or greater than 1 for North orientations.

3. Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

Section 130.1(d)
PARKING GARAGES

Parking garages are considered interior nonresidential spaces, except for the top level of each multi-tier garage.

- Parking garage areas with at least 36 square feet of glazing or opening must have automatic daylighting controls.

Luminaires in the following areas do not need to use photocontrols:

- **Daylight transition zone**: The pathway vehicles use to enter a parking garage.
- **Dedicated ramps**: Driveways specifically meant to move vehicles between the floors of a parking garage and which have no adjacent parking.
- **Some sidelit zones**: If the primary sidelit zone uses less than 60 watts of lighting power, the combined primary and secondary sidelit zones do not require daylight controls.

Section 130.1(d)
DEMAND RESPONSE

When the demand for electricity threatens to exceed supply, the power grid becomes less stable and the risk of outages increases.

Demand response (DR) programs allow end users to temporarily reduce their electricity use in response to a notice or automated signal sent from a utility, independent system operator (ISO) or other power provider.

This flexibility helps reduce peak demand and maintain grid stability. Currently, participating customers also receive financial incentives.

Section 130.1(e)
DEMAND RESPONSE

What is a DR-capable system?
A DR system reduces electricity demand in response to a notice or automated signal from utilities, independent system operators or other power providers.

Manual DR
• Requires occupant to manually adjust lighting systems in response to a phone call, e-mail, system notification, etc.

Automatic DR
• The removal of human interaction from the process allows faster reaction to DR events.
• An electronic DR message will be broadcasted to energy management control systems when an electricity grid experiences high period of high demand or limited supply.
DEMAND RESPONSIVE CONTROLS

• Buildings with at least 4,000 watts of general lighting load must be capable of responding to a DR signal by automatically reducing lighting power.

• For compliance testing, lighting controls must be able to demonstrate a lighting power reduction at least 15 percent below the total installed lighting power while maintaining the uniformity requirements listed in Table 130.1-A.

• Spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced are not required to install demand responsive controls and do not count toward the 4,000 watt threshold (example: healthcare facilities).

• If building is required to have ADR for lighting based on trigger/building type, it also needs to enable ADR capabilities for controlled receptacles.
DEMAND RESPONSIVE CONTROLS

- Demand responsive controls must be either a certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), or be certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b VEN.

- Use of wired or wireless bi-directional communication pathways are allowed. This allowance is ideal for cloud-based systems that offer demand response capabilities.
CONTROL INTERACTIONS

The mandatory lighting controls section defines the interactions of all mandatory indoor lighting controls (manual ON/OFF, multi-level lighting, shut-off controls, automatic daylighting controls and demand responsive controls).

The section outlines how each system should operate in order to ensure that all functions of the mandatory lighting controls are permitted or incorporated by the system as a whole.

Section 130.1(f)
CONTROL INTERACTIONS

1. For general lighting, the manual area control must permit the amount of light provided while the lighting is on to be set or adjusted by the controls specified in Section 130.1(b), (c), (d) and (e).

2. The manual area control must permit the shut-off control to turn the lighting down or off.

3. The multi-level lighting control must permit the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.
4. The multi-level lighting control must permit the demand responsive control to adjust the lighting during a demand response event and to return it to the level set by the multi-level control after the event.

5. The shut-off control must permit the manual area control to turn the lighting on. If the on request occurs while an automatic time-switch control would turn the lighting off, then the on request must be treated as an override request consistent with Section 130.1(c)3.
CONTROL INTERACTIONS

6. The automatic daylighting control must permit the multi-level lighting control to adjust the level of lighting.

7. For lighting controlled by multi-level lighting controls and by occupancy sensing controls with an automatic-on function, the controls shall provide a partial-on function that is capable of automatically activating between 50–70 percent of controlled lighting power.
DAYLIGHTING CONTROLS

Mandatory Measures
DAYLIGHT HARVESTING FOR COMMERCIAL BUILDINGS GUIDE

This publication provides guidance towards meeting and exceeding Energy Code for daylight harvesting.

Topics include daylight performance for:

- Building siting
- Architectural and interior design
- Construction, commissioning and operation

2019 version available online for download!  
cltc.ucdavis.edu

Printed copies are available at:  
amazon.com

2022 update is in progress!
INDOOR DAYLIGHTING CONTROLS

• General lighting in the areas under skylights and directly adjacent to windows must have daylighting controls. Each zone is controlled separately.
• Lighting in daylit zones should have multi-level steps, per Table 130.1-A
• Light levels provided at night should be available at all other times
• When sufficient daylight is available, controls must reduce lighting power by at least 90 percent
DAYLIT ZONES

Areas within a building that are close enough to a source of daylight that daylight harvesting is possible are considered within a “daylit zone.”

- **Skylit Zone:** An area illuminated by one or more skylights
- **Primary Sidelit Zone:** A daylit area directly adjacent to one or more windows
- **Secondary Sidelit Zone:** An area not directly adjacent to a window that still receives some daylight through its proximity to the window

Daylit zones must be marked on building floor plans.
CALCULATING A SKYLIT ZONE

CALCULATION STEPS:

1. Define the approximate shape of the opening of the skylight
2. Determine the ceiling height (CH)
3. Multiply the CH by 0.7
4. Add this value in all directions around the skylight (starting at the edge of the rough opening)
5. Subtract any area that has a permanent obstruction taller than half the distance from the floor to the bottom of the skylight

Width and length = Opening of skylight + (0.7 x ceiling height from opening)
CALCULATING A SKYLIT ZONE

TOP VIEW

0.7 x CH
CALCULATING PRIMARY SIDELIT ZONES

Calculation Steps
1. Determine the window head height for each window
2. The **depth** of the zone is one window head height (HH) into the area adjacent to the window
3. The **width** of the zone is the width of the window plus half the window head height on each size of the window
4. Subtract any area on a plan that is blocked by a permanent obstruction that is six feet or taller.

\[
\text{Depth} = \text{Window head height (1HH)}
\]

\[
\text{Width} = \text{Window width plus 0.5 window height}
\]
CALCULATING THE SECONDARY SIDELIT ZONES

Calculation Steps

1. Add one additional window head height to the same dimensions determined for primary sidelit zones

2. Subtract any area that is blocked by a permanent obstruction that is six feet or taller
AUTOMATIC DAYLIGHTING CONTROLS

Using the office lobby floor plan in your workbook, calculate and draw:

1. Primary sidelit zones
2. Secondary sidelit zones

Assume the following:

- Window head height: 10 feet
- Doors are glass (count as windows)
AUTOMATIC DAYLIGHTING CONTROLS

Notes:
1. Window head height: 10 feet
2. Doors are glass (count as windows)
ROOFTOP MONITORS

The standards define skylights as glazing having a slope less than 60 degrees from horizontal. Because rooftop monitors have a slope greater than 60 degrees, they are therefore considered windows.

To the right is the daylit zone for a rooftop monitor with a window 4 feet high projecting over a 10 foot tall roof.
NEW CONSTRUCTION OF LARGE SPACES

Large enclosed spaces, such as large open offices, are required to have a minimum amount of daylight available when using the prescriptive method of compliance.

The minimum requirements apply to both conditioned and unconditioned spaces that are:

1. In Climate Zones 2–15
2. Have a floor area greater than 5,000 square feet
3. Have a ceiling height greater than 15 feet
4. Have a general lighting system with a power density greater than 0.5 W/ft²

Section 140.3(c)
NEW CONSTRUCTION OF LARGE SPACES

Buildings that meet the prior criteria must have:

- At least 75 percent of the floor space of the building in a primary sidelit zone or a skylit zone
- Area of installed skylights is at least 3 percent of skylight zone area

Section 140.3(c)
PRESCRIPTIVE APPROACH

1. Actual and Allowed LPD
2. Complete Building Method
3. Area Category Method
4. Tailored Method
5. Reduced Wattage Method for Alterations

This section contains exercises for lighting power adjustments, Complete Building Method, and Area Category Method. The exercises are designed to follow the forms and Certificates of Compliance for Nonresidential Indoor Lighting.
THE COMPLIANCE PROCESS

There are two major steps to Energy Code compliance:

1. Meet all mandatory requirements by installing required controls and devices and ensuring that they have all of the required functionality.

2. Meet all prescriptive or performance requirements by ensuring that the actual lighting power installed in a space is less than the allowed lighting power for that space.
ACTUAL LIGHTING POWER

The actual indoor lighting power of the proposed building area is the total wattage of all planned, permanent and portable lighting systems, adjusted by the following:

1. Reduction of wattage through controls beyond what the Energy Code require (Power Adjustment Factors)

2. Lighting wattage exclusions
## LIGHTING POWER ADJUSTMENT FACTORS

### Table 140.6-A: Lighting Power Adjustment Factors (PAF)

<table>
<thead>
<tr>
<th>Type of Control</th>
<th>Type of Area</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylighting Continuous Dimming plus OFF Control</td>
<td>Luminaires in skylit day/night zone or primary sidelite day/night zone or secondary sidelite day/night zone.</td>
<td>0.10</td>
</tr>
<tr>
<td>Occupant Sensing Controls in Offices Larger than 250 ft²</td>
<td>One sensor controlling an area that is:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No larger than 125 ft²</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>From 126 to 250 ft²</td>
<td>0.20</td>
</tr>
<tr>
<td>Institutional Tuning</td>
<td>Luminaires in non-day/night 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></td>
<td>Luminaires in day/night areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Demand Responsive Control</td>
<td>General lighting luminaires not in the scope of Section 110.12(c). Luminaires that qualify for other PAFs in this table may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Clerestory Fenestration</td>
<td>Luminaires in day/night areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Horizontal Slats</td>
<td>Luminaires in day/night areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Light Shelves</td>
<td>Luminaires in day/night areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Based on Table 140.6-A in the Energy Code
ACTUAL LIGHTING POWER: REDUCTION THROUGH CONTROLS

If you exceed the mandatory controls requirements by installing a control where it is not required, you are eligible for a Power Adjustment Factor (PAF). This will result in a lower calculated lighting power use for the installed system.

\[(\text{Controlled W}) \times (\text{PAF from 140.6-A}) = \text{Lighting Power Reduction}\]

*For example, a 480 square foot open office plan with an occupancy control is eligible for a PAF for 0.2. Given that the controlled lighting in that space totaled 100 watts:

\[(100W) \times (0.2) = 20W \text{ of excluded lighting power (80W total)}*
LIGHTING WATTAGE EXCLUSIONS

Wattage of many lighting applications may be excluded, including:

- Theme parks, dance floors, theatres, religious worship, dressing rooms, temporary exhibits, surgical lighting,
- Studio lighting for film or photography and for a videoconferencing studio
- Equipment that is for sale and for demonstration
- Lighting installed by the manufacturer in vending machines, scientific and industrial equipment, refrigerated cases, walk-in freezers, and food preparation equipment
- Lighting for plant growth or maintenance that comply with CEH requirements

Section 140.6(a)3
CONTROLLED ENVIRONMENT HORTICULTURE

What are controlled environment horticulture spaces? How is horticulture lighting efficacy measured?

- **CONTROLLED ENVIRONMENT HORTICULTURE (CEH) SPACE**
  A building space dedicated to plant production by manipulating indoor environmental conditions, such as through electric lighting, mechanical heating, mechanical cooling, or dehumidification.

- **INDOOR GROWING**
  A type of a CEH space in a building with a Skylight Roof Ratio less than 50 percent. Growing plants in a warehouse with or without skylights is an example of indoor growing.

- **GREENHOUSE**
  A window unit that consists of a three-dimensional, five-sided structure generally protruding from the wall in which it is installed.

- **HORTICULTURAL LIGHTING**
  Consists of luminaires used for plant growth and maintenance. Horticultural luminaires may have either plug-in or hard-wired connections for electric power.

- **NEW METRICS**
  - *Photosynthetic photon flux (PPF)*
    The rate of flow of photons between 400 to 700 nanometers in wavelength from a radiation source as defined by ANSI/ASABE S640.
  
  - *Photosynthetic photon efficacy (PPE)*
    PPF divided by input electric power in units of micromoles per second per watt, or micromoles per joule as defined by ANSI/ASABE S640.
CEH REQUIREMENTS

Indoor growing or greenhouse buildings that meet the CEH definition and have 40kW or more of horticulture lighting must meet the following control requirements:

- Time-switch lighting controls and acceptance testing
- Multi-level controls, if required by Section 130.1(b)

AND

Indoor growing buildings horticulture lighting must have a PPE of **1.9** micromoles per joule or greater for wavelengths between 400 to 700 nm

Greenhouse building horticulture lighting must have a PPE of **1.7** micromoles per joule or greater for wavelengths between 400 to 700 nm

Section 120.6(h)2, Section 120.6(h)6
ALLOWED LIGHTING POWER

The **allowed** indoor lighting power for each building or area is calculated using one of the following methods:

- Complete Building Method
- Area Category
- Tailored Method

Each of these methods involves multiplying the square footage of a space by the allowed wattage per square foot for that space.
ADDITIONAL POWER ALLOTMENTS

Additional lighting power is allowed under the area category method for:

- Specialized task work lighting
- Ornamental, precision, accent, display, decorative lighting
- White board and chalk board lighting
# LIGHTING POWER DENSITY VALUES

<table>
<thead>
<tr>
<th>Primary Function Area</th>
<th>Allowed Lighting Power Density for General Lighting (W/ft²)</th>
<th>Qualified Lighting Systems</th>
<th>Additional Lighting Power¹</th>
<th>Additional Allowance (W/ft², unless noted otherwise)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridor Area</td>
<td>0.70</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td>Dining</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Lobby, Main Entry</td>
<td>0.85</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transition Lighting OFF at night¹¹²</td>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Lounge or Waiting Area</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Multipurpose Room</td>
<td>0.85</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Religious Worship Area</td>
<td>1.00</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunable white or dim-to-warm¹</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Restroom</td>
<td>1.00</td>
<td>Decorative or Display</td>
<td></td>
<td>0.20</td>
</tr>
<tr>
<td>Stairwell</td>
<td>0.80</td>
<td>Decorative or Display</td>
<td></td>
<td>0.30</td>
</tr>
</tbody>
</table>

¹¹² Transition to warm color temperature means the room is not illuminated.
PREScriptive APPROACH IN PRACTICE

The following example will show the steps to determine whether the actual lighting power of a project will comply with the allowed lighting power budget using the area category method:

1. Calculate the **lighting power allowance**
2. Calculate the **total installed lighting power** for all planned lighting from a lighting schedule
3. Apply **power adjustment factors** earned by specifying lighting controls that go beyond Energy Code requirements
4. Determine the **adjusted lighting power** using answers from steps one through three
5. Compare the adjusted installed lighting power to the allowed lighting power

This section concludes with an example calculation of allowed lighting power using the complete building method to compare results with the area category method.
PREScriptive APPROACH IN PRACTICE

FORMS REFERENCE
This example includes notes on what sections of the Certificate of Compliance for Nonresidential Indoor Lighting (NRCC-LTI-E) are necessary for this scenario.

This form can be downloaded from the Energy Commission’s website:

Note: The form included in this module has been adapted for the purpose of the exercises. Please download the complete form on the California Energy Commission website.
J.S.H. ASSOCIATES

J.S.H. Associates is a 1,944-square-foot (gross) office building.

Office Information

- Open Office: 498 ft\(^2\)
- Private Office: 222 ft\(^2\)
- Conference Room: 252 ft\(^2\)
- Main Lobby: 228 ft\(^2\)
- Kitchen: 156 ft\(^2\)
- Corridors: 278.5 ft\(^2\)
- Restroom 1: 51 ft\(^2\)
- Restroom 2: 51 ft\(^2\)
- Copy Room: 89.25 ft\(^2\)

Total: 1,826 square feet
**INDOOR LIGHTING SCHEDULE**

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>LUMINAIRE</th>
<th>Quantity</th>
<th>System Wattage</th>
<th>Total Watts</th>
<th>Efficacy (lm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2 x 2 LED RECESSED TROFFER</td>
<td>15</td>
<td>26</td>
<td>525</td>
<td>90-100</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>1 x 4 1-LAMP FLUORESCENT RECESSED TROFFER</td>
<td>4</td>
<td>28</td>
<td>112</td>
<td>89</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2 x 4 2-LAMP FLUORESCENT RECESSED TROFFER</td>
<td>2</td>
<td>54</td>
<td>108</td>
<td>89</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>8&quot; LED SUSPENDED LUMINAIRE</td>
<td>1</td>
<td>85</td>
<td>85</td>
<td>84</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>6&quot; LED RECESSED DOWNLIGHT</td>
<td>12</td>
<td>12</td>
<td>144</td>
<td>90</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>LED WALL SCONCE</td>
<td>6</td>
<td>8</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>LED PENDANT</td>
<td>3</td>
<td>10</td>
<td>30</td>
<td>76</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>LED SUSPENDED LUMINAIRE</td>
<td>2</td>
<td>22.5</td>
<td>45</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>LED EXIT SIGN</td>
<td>2</td>
<td>2</td>
<td>Exempt per $140.66/3</td>
<td>100</td>
</tr>
</tbody>
</table>

**TOTAL INSTALLED LIGHTING WATTS:** 1,097 W

**PORTABLE LIGHTING**

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>LUMINAIRE</th>
<th>Quantity</th>
<th>System Wattage</th>
<th>Total Watts</th>
<th>Efficacy (lm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td></td>
<td>45° LED UNDERCABINET TASK LIGHTING</td>
<td>10</td>
<td>12.2</td>
<td>122</td>
<td>62.2</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>LED TASK LIGHT</td>
<td>1</td>
<td>6.5</td>
<td>6.5</td>
<td>—</td>
</tr>
</tbody>
</table>

**TOTAL PORTABLE LIGHTING WATTS** 126.5 W

**DAYLIGHTING DEVICES**

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>LUMINAIRE</th>
<th>Quantity</th>
<th>System Wattage</th>
<th>Total Watts</th>
<th>Efficacy (lm/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LIGHT SHELF</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**TOTAL WATTS:** 1,226.5 W
AREA CATEGORY METHOD
NRCC-LTI-E: Indoor Lighting
Section B. Project Scope

This dynamic form streamlines the compliance process. Start with filling out ‘Section B. Project Scope’ in the NRCC-LTI-E form.

<table>
<thead>
<tr>
<th>Scope of Work</th>
<th>Conditioned Spaces</th>
<th>Unconditioned Spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Project Consists of (check all that apply):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑ New Lighting System</td>
<td>Calculation Method</td>
<td>Area (ft²)</td>
</tr>
<tr>
<td>□ New Lighting System - Parking Garage</td>
<td>Area Category Method</td>
<td>1826</td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Area of Work (ft²)</strong></td>
<td></td>
<td>1826</td>
</tr>
</tbody>
</table>
# COMPLIANCE RESULTS

**NRCC-LTI-E: Indoor Lighting**

Section C. Compliance Results

This section is auto-populated based on your inputs within each respective section of the form. We will use this table as a visual reference throughout our exercise in determining compliance of the office space.

<table>
<thead>
<tr>
<th>Allowed Lighting Power per §140.6(b)/§170.2(e) (Watts)</th>
<th>Adjusted Lighting Power per §140.6(a)/§170.2(e) (Watts)</th>
<th>Compliance Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Complete Building §140.6(c)1</td>
<td>05 Total Allowed (Watts)</td>
<td>09 05 Must be &gt;= 08 §140.6/§170.2(e)</td>
</tr>
<tr>
<td>02 Area Category §140.6(c)2/§170.2(e)4</td>
<td>06 Total Designed (Watts)</td>
<td>COMPLIES with Exceptional Conditions or COMPLIES or DOES NOT COMPLY</td>
</tr>
<tr>
<td>03 Area Category Additional §140.6(c)2G/§170.2(e)4Av (+)</td>
<td>07 Adjustments</td>
<td>COMPLIES or DOES NOT COMPLY or NOT APPLICABLE</td>
</tr>
<tr>
<td>04 Tailored §140.6(c)3/§170.2(e)4B (+)</td>
<td>08 Total Adjusted (Watts)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(See Table I)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(See Table J)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(See Table K)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(See Table F)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(See Table P)</td>
<td></td>
</tr>
</tbody>
</table>

**Conditioned:**

**Unconditioned:**

Controls Compliance (See Table H for Details)

Rated Power Reduction Compliance (See Table Q for Details)
1. INSTALLED LIGHTING POWER

Required Forms:
NRCC-LTI-E: Indoor Lighting
F. Indoor Lighting Fixture Schedule

The installed lighting power includes all planned permanent and portable lighting. Complete the lighting schedule in “F. Indoor Lighting Fixture Schedule” to determine the total to use for compliance purposes.
# Indoor Lighting Fixture Schedule

This table includes all planned permanent and portable lighting other than dwelling unit/hotel/motel room lighting. Multifamily dwelling unit and hotel/motel room lighting is documented in Table T. If using Table T to document lighting in multifamily common use areas providing shared provisions for living, eating, cooking or sanitation, those luminaires are not included here.

### Designed Wattage: Conditioned Spaces

<table>
<thead>
<tr>
<th>Name or Item Tag</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2x2 LED RECESSED TROFFER</td>
<td>Cree CR22</td>
<td>No</td>
<td>NA</td>
<td>35</td>
<td>Mfr. Spec</td>
<td>15</td>
<td>No</td>
<td>525</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>1 x 4 1-LAMP FLUORESCENT RECESSED TROFFER</td>
<td>Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast</td>
<td>No</td>
<td>NA</td>
<td>28</td>
<td>Mfr. Spec</td>
<td>4</td>
<td>No</td>
<td>112</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>2 x 4 2-LAMP FLUORESCENT RECESSED TROFFER</td>
<td>Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast</td>
<td>No</td>
<td>NA</td>
<td>24</td>
<td>Mfr. Spec</td>
<td>2</td>
<td>No</td>
<td>108</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>8” LED SUSPENDED LUMINAIRE</td>
<td>Visa Linea</td>
<td>No</td>
<td>NA</td>
<td>85</td>
<td>Mfr. Spec</td>
<td>1</td>
<td>No</td>
<td>85</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>6” LED RECESSED DOWNLIGHT</td>
<td>Cree CR6</td>
<td>No</td>
<td>NA</td>
<td>42</td>
<td>Mfr. Spec</td>
<td>12</td>
<td>No</td>
<td>114</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>LED WALL SCONCE</td>
<td>Tech Lighting Mura</td>
<td>No</td>
<td>NA</td>
<td>12</td>
<td>Mfr. Spec</td>
<td>6</td>
<td>No</td>
<td>48</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>LED PENDANT</td>
<td>Philips Metro</td>
<td>No</td>
<td>NA</td>
<td>40</td>
<td>Mfr. Spec</td>
<td>3</td>
<td>No</td>
<td>30</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>LED SUSPENDED LUMINAIRE</td>
<td>Philips Ledino Cinta Suspension Light</td>
<td>No</td>
<td>NA</td>
<td>22.5</td>
<td>Mfr. Spec</td>
<td>2</td>
<td>No</td>
<td>45</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>LED EXIT SIGN</td>
<td>Cline Lighting Exit Sign and Emergency Lights</td>
<td>No</td>
<td>NA</td>
<td>2</td>
<td>Mfr. Spec</td>
<td>2</td>
<td>No</td>
<td>—</td>
<td>Exempt</td>
<td>Exempt</td>
</tr>
<tr>
<td>45” LED UNDERCABINET TASK LIGHTING</td>
<td>Finelite Edge Undercabinet</td>
<td>No</td>
<td>NA</td>
<td>12.2</td>
<td>Mfr. Spec</td>
<td>10</td>
<td>No</td>
<td>122</td>
<td>Pass</td>
<td>Pass</td>
</tr>
<tr>
<td>LED TASK LIGHT</td>
<td>Koncept Z Bar Mini Task Light</td>
<td>No</td>
<td>NA</td>
<td>6.5</td>
<td>Mfr. Spec</td>
<td>1</td>
<td>No</td>
<td>6.5</td>
<td>Pass</td>
<td>Pass</td>
</tr>
</tbody>
</table>

**Total Designed Watts: Conditioned Spaces** 1,225.5
# Compliance Results

<table>
<thead>
<tr>
<th>Allowance</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Building $140.6(c)$</td>
<td>(See Table I)</td>
<td>(See Table J)</td>
<td>(See Table K)</td>
<td>Total Allowed (Watts)</td>
<td>(See Table F)</td>
<td>(See Table P)</td>
<td>Total Adjusted (Watts)</td>
<td>*Includes Adjustments</td>
<td></td>
</tr>
<tr>
<td>Conditioned:</td>
<td></td>
<td></td>
<td></td>
<td><strong>1,225.5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unconditioned:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Compliance Results</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>05 Must be &gt;= 08 $140.6(a)$/170.2(e)</td>
<td></td>
</tr>
</tbody>
</table>

- **Adjusted Lighting Power per $140.6(a)$/$170.2(e)$ (Watts)**
- **Total Designed (Watts)**
- **Total Adjusted (Watts)**
- **Complies with Exceptional Conditions or COMPLIES or DOES NOT COMPLY**
- **COMPLIES or DOES NOT COMPLY or NOT APPLICABLE**

- **Controls Compliance (See Table H for Details)**
- **Rated Power Reduction Compliance (See Table Q for Details)**
2. LIGHTING POWER ALLOWANCE

NRCC-LTI-E: Indoor Lighting
Section I. Lighting Power Allowance for Area Category Methods

1. Determine the allowed lighting power of each area according to Table 140.6-C.
2. Determine the square feet of each area type.
3. Calculate the wattage allowance by multiplying the square feet of each area type by the additional watts allowed.
4. Total the allowed watts.
J.S.H. ASSOCIATES: 1,944 SQUARE FEET OFFICE BUILDING

- RESTROOM #1: 51 ft²
- RESTROOM #2: 51 ft²
- COPY ROOM: 89.25 ft²
- CORRIDOR: 278.5 ft²
- KITCHEN: 156 ft²
- OPEN OFFICE: 498 ft²
- PRIVATE OFFICE: 222 ft²
- CONFERENCE ROOM: 252 ft²
- MAIN ENTRY LOBBY: 228 ft²
## LIGHTING POWER ALLOWANCE: AREA CATEGORY METHOD

### I. LIGHTING POWER ALLOWANCE: COMPLETE BUILDING OR AREA CATEGORY METHODS

Each area complying using the Complete Building or Area Category Methods per 140.6(b) are included in this table. Column 06 indicates if additional lighting power allowances per 140.6(c) or adjustments per 140.6(a) are being used.

<table>
<thead>
<tr>
<th>01</th>
<th>02</th>
<th>03 (W/ft²)</th>
<th>04 (ft²)</th>
<th>05 (Watts)</th>
<th>06</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Complete Building or Area Category Primary Function Area</td>
<td></td>
<td></td>
<td></td>
<td>Additional Allowance / Adjustment</td>
</tr>
<tr>
<td>Area Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Area Category</td>
</tr>
<tr>
<td>Open Plan Office</td>
<td>Office (&gt;250 square feet)</td>
<td>0.6</td>
<td>486</td>
<td>258.8</td>
<td>Yes</td>
</tr>
<tr>
<td>Private Office</td>
<td>Office (&lt;250 square feet)</td>
<td>0.65</td>
<td>222</td>
<td>144.3</td>
<td>Yes</td>
</tr>
<tr>
<td>Conference Room</td>
<td>Convention, Conference, Multipurpose and Meeting Center</td>
<td>0.75</td>
<td>252</td>
<td>189</td>
<td>No</td>
</tr>
<tr>
<td>Main Lobby</td>
<td>Main Entry Lobby</td>
<td>0.7</td>
<td>228</td>
<td>159.6</td>
<td>Yes</td>
</tr>
<tr>
<td>Kitchen</td>
<td>Kitchen/ Food Preparation</td>
<td>0.95</td>
<td>156</td>
<td>140.19</td>
<td>No</td>
</tr>
<tr>
<td>Corridors</td>
<td>Corridor</td>
<td>0.4</td>
<td>278.2</td>
<td>111.4</td>
<td>No</td>
</tr>
<tr>
<td>Restroom #1</td>
<td>Restroom</td>
<td>0.65</td>
<td>51</td>
<td>33.15</td>
<td>No</td>
</tr>
<tr>
<td>Restroom #2</td>
<td>Restroom</td>
<td>0.65</td>
<td>51</td>
<td>33.15</td>
<td>No</td>
</tr>
<tr>
<td>Copy Room</td>
<td>Copy Room</td>
<td>0.5</td>
<td>89.25</td>
<td>44.63</td>
<td>No</td>
</tr>
</tbody>
</table>

**TOTALS:** 1,825.75 1,162.23

See Tables J, or P for detail
ADDITIONAL LIGHTING WATTAGE ALLOWANCE

NRCC-LTI-E: Indoor Lighting
J. Additional Lighting Allowance: Area Method

1. Determine the allowed lighting power of each area according to Table 140.6-C.
2. Determine the square feet of the office primary function area. For whiteboard lighting, determine the linear feet of the whiteboard.
3. Calculate the wattage allowance by multiplying the square feet of each area type by the additional watts allowed.
4. Choose the smaller of either the newly calculated allowed watts or the total design watts of the luminaire.
5. Total the additional allowed watts.
## ADDITIONAL LIGHTING ALLOWANCE: AREA CATEGORY METHOD

### J. ADDITIONAL ALLOWANCE: AREA CATEGORY METHOD QUALIFYING LIGHTING SYSTEM

All areas indicated in Table 1 as using an additional allowance using the Area Category Method have been included in this table to calculate the additional allowance per Table 140.6-C.170.2-M.

<table>
<thead>
<tr>
<th>Conditioned Spaces</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Description</td>
<td>Primary Function Area</td>
<td>Applicable Qualifying Lighting System from Table 140.0-C</td>
<td>Allowed Density (W/ft² or W/lf or W/unit)</td>
<td>Ltg Area, Length or ATM/Mirror (ft², ft or #)</td>
<td>Extra Allowance (Watts)</td>
<td>Luminaire Name or Item Tag</td>
<td>Watts per Luminaire</td>
<td>Number of Luminaire(s)</td>
<td>Total Design Watts</td>
<td></td>
</tr>
<tr>
<td>Open Plan Office</td>
<td>Office (250 square feet)</td>
<td>PortableOfficeLighting</td>
<td>0.2</td>
<td>498</td>
<td>99.6</td>
<td>45° LED UNDERCABINET TASK LIGHTING</td>
<td>12.2</td>
<td>10</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Total Design Watts</td>
<td>Calculated Allowance (Watts):</td>
<td>Total Additional Allowance for this area:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>122</td>
<td>99.6</td>
<td>99.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Office</td>
<td>Office (250 square feet)</td>
<td>PortableOfficeLighting</td>
<td>0.2</td>
<td>222</td>
<td>44.4</td>
<td>LED TASK LIGHT</td>
<td>6.5</td>
<td>1</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Total Design Watts</td>
<td>Calculated Allowance (Watts):</td>
<td>Total Additional Allowance for this area:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>44.4</td>
<td>44.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Lobby</td>
<td>Main Entry Lobby</td>
<td>DecorativeDisplay</td>
<td>0.25</td>
<td>228</td>
<td>57</td>
<td>LED SUSPENDED LUMINAIRE</td>
<td>22.5</td>
<td>1</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>Total Design Watts</td>
<td>Calculated Allowance (Watts):</td>
<td>Total Additional Allowance for this area:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.5</td>
<td>57</td>
<td>22.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Additional Allowance (Watts) CONDITIONED SPACES</td>
<td>128.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TOTAL LIGHTING POWER ALLOWANCE

NRCC-LTI-E: Indoor Lighting

C. Compliance Results (Column 5)

The adjusted installed lighting power is auto-calculated by the dynamic form by adding the additional lighting wattage allowance to the general lighting power allowance.

\[ 1,162.23W + 128.6W = 1,290.83W \] total allowed lighting power
## Compliance Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
<th>Value</th>
<th>Result</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditioned</td>
<td>1,162.23</td>
<td>128.6</td>
<td>1,290.83</td>
<td>1,225.5</td>
</tr>
<tr>
<td>Unconditioned</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Controls Compliance (See Table H for Details)*

*Rated Power Reduction Compliance (See Table Q for Details)*

*COMPLIES with Exceptional Conditions or COMPLIES or DOES NOT COMPLY*

*COMPLIES or DOES NOT COMPLY or NOT APPLICABLE*
3. LIGHTING CONTROL CREDITS

Required Forms:
NRCC-LTI-E: Indoor Lighting
H. Indoor Lighting Controls (Not Including PAFs),
I. Lighting Power Allowance: Area Category Method

Our project is eligible for two PAFs.

1. **Light Shelf PAF**: The lighting power installed in the daylit area adjacent to clerestory fenestration with light shelves is multiplied by the PAF factor. In our example, the light shelf is in the conference room. The daylit zone is determined to encompass the whole conference room, which has one 8 foot long pendant that is 85 watts and four downlights that are 12 watts each.

2. **Occupancy Controls**: To calculate the occupant sensing control in large open plan offices PAF, the factor of 0.2 is multiplied by the total wattage of the general luminaires installed in the large open plan office (420W, from the 12 LED recessed troffers).
Table 140.6-A: Lighting Power Adjustment Factors (PAF)

<table>
<thead>
<tr>
<th>Type of Control</th>
<th>Type of Area</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylighting Continuous Dimming plus OFF Control</td>
<td>Luminaires in skylit daylit zone or primary sidelit daylit zone or secondary sidelit daylit zone.</td>
<td>0.10</td>
</tr>
<tr>
<td>Occupant Sensing Controls in Offices Larger than 250 ft²</td>
<td>One sensor controlling an area that is: No larger than 125 ft² From 126 to 250 ft²</td>
<td>0.30 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></td>
<td>Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Demand Responsive Control</td>
<td>General lighting luminaires not in the scope of Section 110.12(c). Luminaires that qualify for other PAFs in this table may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Clerestory Fenestration</td>
<td>Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Horizontal Slats</td>
<td>Luminaires in daylit areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.05</td>
</tr>
<tr>
<td>Light Shelves</td>
<td>Luminaires in daylit areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.</td>
<td>0.10</td>
</tr>
</tbody>
</table>

*Based on Table 140.6-A in the Energy Code*
### P. ADDITIONAL LIGHTING ALLOWANCE: LIGHTING CONTROL CREDIT (POWER ADJUSTMENT FACTOR (PAF))

This table includes all areas indicated in Table I or Table K as using a PAF credit described in 140.6(a)(1) / 170.2(e)(8).

<table>
<thead>
<tr>
<th>Conditioned Spaces</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Plan Office</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Conference Room</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Conference Room</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All spaces applying PAF 5, 6 or 7 include a daylight design meeting requirements in 140.3(e). See Table 5.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luminaire Controlled for PAF Credit</td>
<td>Luminaire Name or Item Tag</td>
<td>Luminaire Design Watts</td>
<td>Number of Luminaire</td>
<td>Lighting Controlled (Watts)</td>
<td></td>
</tr>
<tr>
<td>2x2 LED RECESSED TROFFER</td>
<td>35</td>
<td>12</td>
<td>420</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>8&quot; LED SUSPENDED LUMINAIRE</td>
<td>85</td>
<td>1</td>
<td>85</td>
<td>8.5</td>
<td></td>
</tr>
<tr>
<td>6&quot; LED RECESSED DOWNLIGHT</td>
<td>12</td>
<td>4</td>
<td>48</td>
<td>4.8</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>09</th>
<th>09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Power Adjustment (Watts)</td>
<td>CONDITIONED SPACES</td>
</tr>
</tbody>
</table>

1. Footnotes: PAFs outlined in Table 140.6-4-170.2(c), include 13) Daylight continuous dimming plus OFF; 2A) Occupant sensors in offices with one sensor per <= 125 ft²; 2B) Occupant sensors in offices with one sensor per 126–250 ft²; 3A) Institutional tuning, non-daylit areas and 3B) Institutional tuning, daylit areas; 4) Demand response; 5) Clerestory fenestration; 6) Horizontal slats; 7) Light shelves.

2. Luminaires that qualify for PAF 5, 6 or 7 can be used in conjunction with PAF 1.
4. ADJUSTED LIGHTING POWER

Required Forms:
NRCC-LTI-E: Indoor Lighting
C. Compliance Results (Column 8)

The adjusted installed lighting power is auto-calculated in ‘Section C. Compliance Results’ of NRCC-LTI-E by subtracting the lighting control credits from the total installed lighting.

\[ 1,225.5W - 97.3W = 1,128.2W \] total adjusted installed lighting power
5. COMPARE ADJUSTED INSTALLED LIGHTING POWER TO ALLOWED LIGHTING POWER

Required Forms:
NRCC-LTI-E: Indoor Lighting
C. Compliance Results (Column 9)

<table>
<thead>
<tr>
<th>Lighting in conditioned and unconditioned spaces must not be combined for compliance per 140.6(e)(1) / 170.2(e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Building 140.6(c)(1)</td>
</tr>
<tr>
<td>Area Category 140.6(c)(2) / 170.2(e)(a)</td>
</tr>
<tr>
<td>Area Category Additional 140.6(c)(2G) / 170.2(e)(a)</td>
</tr>
<tr>
<td>Tailored 140.6(c)(3) / 170.2(e)(a)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total Allowed (Watts)</td>
</tr>
<tr>
<td>01                                                      02                                                       03                                                      04                                                      05</td>
</tr>
<tr>
<td>1,162.23                                                128.6                                                   =                      1,290.83</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Controls Compliance (See Table H for Details)</td>
</tr>
<tr>
<td>COMPLIES</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Adjusted Lighting Power per 140.6(e)(1) / 170.2(e)</td>
</tr>
<tr>
<td>06                                                      07                                                      08                                                      09</td>
</tr>
<tr>
<td>2 Greatest                                              1.225.5                                                 97.3                                                   =                      1128.2</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total Adjusted (Watts) *Includes Adjustments</td>
</tr>
<tr>
<td>05 must be &gt;= 08 140.6(e)(1)</td>
</tr>
<tr>
<td>COMPLIES</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Rate of Power REDUCTION Compliance (See Table G for Details)</td>
</tr>
<tr>
<td>COMPLIES</td>
</tr>
</tbody>
</table>

✔ Our lighting plan is compliant.
COMPLETE BUILDING METHOD
COMPLETE BUILDING METHOD

The Complete Building Method may only be used on projects involving entire buildings with one primary type of use or in mixed-use buildings or tenant spaces where 90 percent of the spaces have one primary use.

This is the simplest way to comply with the standards, and many will attempt this method first before trying one of the two more complex methods.

(Table 140.6-B) X (floor area of entire building) = Allowed Lighting Power
LIGHTING POWER ALLOWANCE

Required Forms:
NRCC-LTI-E: Indoor Lighting Power Allowance
I. Lighting Power Allowance: Complete Building Method

1. Determine the allowed lighting power density of an office building according to Table 140.6-B.
2. Multiply the allowed lighting power density by the area of the space.
### LIGHTING POWER ALLOWANCE

Table 140.6-B: Complete Building Method Lighting Power Density Values (W/ft²)

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>Allowed Lighting Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly Building</td>
<td>0.65</td>
</tr>
<tr>
<td>Bank or Financial Institution Building</td>
<td>0.65</td>
</tr>
<tr>
<td>Grocery Store Building</td>
<td>0.90</td>
</tr>
<tr>
<td>Gymnasium Building</td>
<td>0.60</td>
</tr>
<tr>
<td>Healthcare Facility</td>
<td>0.90</td>
</tr>
<tr>
<td>Industrial or Manufacturing Facility Building</td>
<td>0.60</td>
</tr>
<tr>
<td>Library Building</td>
<td>0.70</td>
</tr>
<tr>
<td>Motion Picture Theater Building</td>
<td>0.60</td>
</tr>
<tr>
<td>Museum Building</td>
<td>0.65</td>
</tr>
<tr>
<td>Office Building</td>
<td>0.60</td>
</tr>
<tr>
<td>Parking Garage Building</td>
<td>0.13</td>
</tr>
<tr>
<td>Performing Arts Theater Building</td>
<td>0.75</td>
</tr>
<tr>
<td>Religious Facility Building</td>
<td>0.70</td>
</tr>
<tr>
<td>Restaurant Building</td>
<td>0.65</td>
</tr>
<tr>
<td>Retail Store Building</td>
<td>0.9</td>
</tr>
<tr>
<td>School Building</td>
<td>0.60</td>
</tr>
<tr>
<td>Sports Arena Building</td>
<td>0.75</td>
</tr>
<tr>
<td>All other buildings</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Note: Our lighting plan is NOT compliant using the Complete Building Method, use the Area Category Method for this project.
TAILORED METHOD
TAILORED METHOD

This is the most granular of the three methods.

- Allowances for each area (just like area category)
- Allowances for display and task lighting within an area

Allowed lighting power is determined by the occupancy type and the physical characteristics (e.g., ceiling height) of a space.

See Table 140.6-D for details.
TAILORED METHOD ALLOWANCES

The Tailored Method adds additional lighting power allowances for:

- Wall displays
- Floor displays
- Task lighting
- Ornamental/special effects lighting
- Very valuable display cases

These lighting power allowances cannot be used in any space other than the display or task area. Any wattage not covered by these allowances must be deducted from the general lighting allowance for that area.
OUTDOOR LIGHTING

Mandatory & Prescriptive Measures
HOW TO COMPLY?

There are two major steps for exterior spaces to comply with the Energy Code:

1. **Meet all mandatory requirements**
   The mandatory requirements set forth required controls that must be installed and functionality requirements for exterior lighting systems.

2. **Meet all prescriptive or performance requirements**
   The prescriptive requirements set a maximum lighting power allowance for exterior spaces. A space complies with these requirements if the *actual* lighting power installed in the space is less than the *allowed* lighting power for that space.
Any alteration that increases the connected lighting load must meet all mandatory and prescriptive measures that are required.

*Local government agencies may adopt and enforce Energy Code for newly constructed buildings, additions, alterations and repairs that exceed those of the Energy Code, provided that the Energy Commission has reviewed and approved the local standards.*

---

**ADDITIONS AND ALTERATIONS**

<table>
<thead>
<tr>
<th>Greater than or equal to 50% replaced</th>
<th>Mandatory Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>§130.0, 130.2, 130.4</td>
</tr>
<tr>
<td></td>
<td>+ Prescriptive Requirements</td>
</tr>
<tr>
<td></td>
<td>LPD allowances of §140.7</td>
</tr>
<tr>
<td></td>
<td><em>(Or meet reduced power requirement!)</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Greater than or equal to 10% replaced</th>
<th>Mandatory Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>§130.0, 130.2, 130.4</td>
</tr>
</tbody>
</table>

| Less than 10% replaced or less than 5 luminaires replaced | No measures required |

Section 141.0(b)2L
BACKLIGHT, UPLIGHT AND GLARE RATINGS

The BUG system is used to evaluate luminaire performance in relation to lighting trespass, sky glow and high-angle brightness. This is necessary in order to reduce light pollution, which has a negative effect on people, wildlife and the surrounding environments.

**Backlight**
Upplight includes all illumination that is in the space between the ground and 80 degrees above ground. Backlighting causes light trespass, which occurs when light is cast in unwanted areas due to poor control.

**Uplight**
Uplight is defined as excess lighting directed into the night sky. This causes light pollution, also known as artificial sky glow.

**Glare**
Glare is any overlapping light between the uplight and backlight zones. It can be mildly offensive or hazardous and visually disabling.

Section 130.2(b)
BUG RATING ZONES

Section 130.2(b)
LUMINAIRES THAT MUST COMPLY WITH BUG REQUIREMENTS

Outdoor luminaires using lamps or light sources rated 6,200 lumens or greater must comply with backlight, uplight and glare limitations unless they are in the following areas:

1. Signs
2. Building façades, public monuments, statues, vertical surfaces of bridges
3. Lighting not permitted by a health or life safety statute, ordinance or regulation to be a cutoff luminaire
4. Temporary outdoor lighting
5. Replacement of select existing pole mounted luminaires
6. Luminaires that illuminate the public right of way on publicly maintained roadways, sidewalks & bikeways
7. Outdoor lighting attached to high-rise residential or hotel/motel building and separately controlled from the inside of a dwelling unit or guest room

Section 130.2(b)
LIGHTING ZONES

**Lighting Zone 0: Underdeveloped areas in parks and preserves**

*Ambient Illumination: Dark Sky*

Where no continuous lighting is intended. Sites may utilize a single luminaire of 15 watts or less at entrances to parking lots, trail heads or other areas in order to safely illuminate site facilities.

**Lighting Zone 1: Rural Areas**

*Ambient Illumination: Dark*

The local entity with authority over the property will know if the property is a government designated park, recreation area or wildlife preserve. If the park is within a rural or urban area, it can be considered a part of lighting zone two or three.

*Example applications include: single or dual family homes, parks, agricultural zone designations.*
LIGHTING ZONES

Lighting Zone 2: Urban Clusters
Ambient Illumination: Low
Rural areas include any population, housing and territory that contain less than 2,500 people.

Example applications include: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.

Lighting Zone 3: Urban Areas
Ambient Illumination: Medium
An urban area is a densely settled core of census tracts that contain at least 2,500 people.

Example applications include: high intensity commercial corridors, entertainment centers, and heavy industrial or manufacturing zone districts.

Lighting Zone 4: Special Use District
Ambient Illumination: High
This zone may be created by a local government through application to the California Energy Commission and is used for special area types that require a particularly high amount of light.
**BUG RATINGS AND REQUIREMENTS**

BUG ratings are determined by the amount of light in each angular component per backlight, uplight and glare. Each BUG zone has a maximum number of lumens that is allowed—called the maximum zonal lumen limit.

# Bug Ratings and Requirements

## Backlight Ratings (Maximum Zonal Lumens)

<table>
<thead>
<tr>
<th>Secondary Solid Angle</th>
<th>Maximum Zonal Lumens per Outdoor Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LZ0 (B0)</td>
</tr>
<tr>
<td><strong>Backlight High (BH)</strong></td>
<td></td>
</tr>
<tr>
<td>60 to 80 degrees</td>
<td>110</td>
</tr>
<tr>
<td><strong>Backlight Medium (BM)</strong></td>
<td></td>
</tr>
<tr>
<td>30 to &lt; 60 degrees</td>
<td>220</td>
</tr>
<tr>
<td><strong>Backlight Low (BL)</strong></td>
<td></td>
</tr>
<tr>
<td>0 to &lt; 30 degrees</td>
<td>110</td>
</tr>
</tbody>
</table>

## Uplight Ratings (Maximum Zonal Lumens)

<table>
<thead>
<tr>
<th>Secondary Solid Angle</th>
<th>Maximum Zonal Lumens per Outdoor Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LZ0 (U0)</td>
</tr>
<tr>
<td><strong>Uplight High (UH)</strong></td>
<td></td>
</tr>
<tr>
<td>100 to 180 degrees</td>
<td>0</td>
</tr>
<tr>
<td><strong>Uplight Low (UL)</strong></td>
<td></td>
</tr>
<tr>
<td>90 to &lt; 100 degrees</td>
<td>0</td>
</tr>
</tbody>
</table>
# Bug Ratings and Requirements

### Glare Ratings (Maximum Zonal Lumens)

#### Glare Rating for Asymmetrical Luminaire Types (Type I, Type II, Type III, Type IV)

<table>
<thead>
<tr>
<th>Secondary Solid Angle</th>
<th>Maximum Zonal Lumens per Outdoor Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L20 (G0)</td>
</tr>
<tr>
<td>Forward Very High (FVH) 80 to 90 degrees</td>
<td>10</td>
</tr>
<tr>
<td>Backlight Very High (BVH) 80 to 90 degrees</td>
<td>10</td>
</tr>
<tr>
<td>Forward High (FH) 60 to &lt; 80 degrees</td>
<td>660</td>
</tr>
<tr>
<td>Backlight High (BH) 60 to &lt; 80 degrees</td>
<td>110</td>
</tr>
</tbody>
</table>

#### Glare Rating for Quadrilateral Symmetrical Luminaire Types (Type V, Type V Square)

<table>
<thead>
<tr>
<th>Secondary Solid Angle</th>
<th>Maximum Zonal Lumens per Outdoor Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L20 (G0)</td>
</tr>
<tr>
<td>Forward Very High (FVH) 80 to 90 degrees</td>
<td>10</td>
</tr>
<tr>
<td>Backlight Very High (BVH) 80 to 90 degrees</td>
<td>10</td>
</tr>
<tr>
<td>Forward High (FH) 60 to &lt; 80 degrees</td>
<td>660</td>
</tr>
<tr>
<td>Backlight High (BH) 60 to &lt; 80 degrees</td>
<td>660</td>
</tr>
</tbody>
</table>
ALL OUTDOOR SPACES

1. Outdoor lighting must be **controlled independently** from other electrical loads.

2. All **outdoor lighting** must be controlled by a **photo control or astronomical time switch** that turns off all lighting when daylight is available.

3. Automatic scheduling controls are required for all outdoor lighting and may be installed in combination with motion sensing controls or other outdoor lighting controls.

Section 130.2(c)
LUMINAIRES MOUNTED 24 FEET AND BELOW

Where the bottom of a luminaire is mounted at 24 feet above grade or lower, the following automatic lighting controls are required:

1. A motion sensor or other control system that automatically reduces lighting power by at least 50 percent but no more than 90 percent when no occupants are detected
2. Controls must automatically turn on lights when an area becomes occupied
3. No more than 1,500 watts of lighting power may be controlled together
4. Maximum timeout of 15 minutes when there is no motion in the area, after which the system returns to dimmed or OFF mode

The following luminaires are exempt:
1. Luminaires 40 watts or less

Section 130.2(c)
LUMINAIRES MOUNTED 24 FEET AND BELOW

These requirements do not apply to the following spaces, as listed in Section 140.7(a):

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways, and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children’s playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8.
8. Lighting of stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
9. Landscape lighting.
10. In theme parks: outdoor lighting only for themes and special effects.
11. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multi-scene or theatrical cross-fade control station accessible only to authorized operators.

Section 130.2(c)
LUMINAIRES MOUNTED 24 FEET AND BELOW

These requirements do not apply to the following spaces, as listed in Section 140.7(a):

12. Outdoor lighting systems for qualified historic buildings, as defined in the California Historic Building Code (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.

13. Lighting subject to a health or life safety statute, ordinance, or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent when necessary to comply with the applicable law.
LIGHTING POWER ALLOWANCES

The allowed lighting power for a space is determined by measuring the area of the installation and multiplying by the lighting power allowance for that space.

The actual lighting power is the total watts of all non-exempt lighting systems (including ballast, driver or transformer losses).
LIGHTING POWER ALLOWANCES

When determining allowed lighting power, the number of luminaires, their mounting heights and their layout affect the size of the illuminated area and thus the allowed lighting power for a space.

The illuminated area is any hardscape area within a square around each luminaire or pole, less any obstructions.

The size of this square is **10 times the luminaire mounting height**, with the luminaire in the middle of the square.
LIGHTING POWER ALLOWANCES

There are three major areas that are considered when determining the allowed lighting power for a space:

**Area Wattage Allowance (AWA)**
The Area Wattage Allowance is determined for the total illuminated hardscape area.

**Linear Wattage Allowance (LWA)**
The Linear Wattage Allowance is determined for the total perimeter length of the hardscape. The total hardscape perimeter does not include areas that are not illuminated.

**Initial Wattage Allowance (IWA)**
The Initial Wattage Allowance may be used once per project site. The IWA provides additional wattage for small sites or for unusual hardscape geometries.
# LIGHTING POWER ALLOWANCES

## General Hardscape Lighting Power Allowances

<table>
<thead>
<tr>
<th>Type of Power Allowance</th>
<th>Lighting Zone 0&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Lighting Zone 1&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Lighting Zone 2&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Lighting Zone 3&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Lighting Zone 4&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Wattage Allowance (AWA)</td>
<td>0.016 W/ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.019 W/ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.021 W/ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.024 W/ft&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Linear Wattage Allowance (LWA)</td>
<td>No allowance&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.13 W/lf</td>
<td>0.15 W/lf</td>
<td>0.20 W/lf</td>
<td>0.29 W/lf</td>
</tr>
<tr>
<td>Initial Wattage Allowance (IWA)</td>
<td>150W</td>
<td>200W</td>
<td>250W</td>
<td>320W</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumens as specified in Section 130.2(b).

<sup>2</sup> Reserved.

<sup>3</sup> Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm — as mandated by local, state or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna — shall be allowed a 2.0 lighting power allowance multiplier.

*Based on Table 140.7-A from the Energy Code*
PLANTERS AND LANDSCAPE AREAS

Planters and small landscape areas are included within the general hardscape area as long as the width or length of the inclusion is less than 10 feet, and the inclusion is bordered on at least three sides.

Landscape areas that are greater than 10 feet in both width and length are excluded from the general hardscape area calculation, but the perimeter of these exclusions may be included in the linear wattage allowance (LWA) calculation.
CALCULATE THE TOTAL POWER ALLOWANCE FOR AREA:

An outdoor, asphalt parking lot 15,000 ft² in size is located in a commercial area categorized as Lighting Zone 3. The project team is planning to install three 200W luminaires (29,000 lumens each) that are mounted at a height of 25' in a 5' by 50' island in the middle of the lot paired with an astronomical timer and auto-scheduling controls. It is important to note for the hardscape calculation that the parking lot has 20' by 20' landscaped areas in each corner and the 10' by 15' driveway is included.
### OUTDOOR LIGHTING FIXTURE SCHEDULE

For new or altered lighting systems demonstrating compliance with 140.7 / 170.2(c)6 all new luminaires being installed and any existing luminaires remaining or being moved within the spaces covered by the permit application are included in the Table below. For altered lighting systems using the Existing Power method per 141.0(b)2, only new luminaires being installed and replacement luminaires being installed as part of the project scope are included (i.e. existing luminaires remaining or existing luminaires being moved are not included). Outdoor lighting attached to multifamily buildings and controlled from the inside of a dwelling unit are included in Table II, and are not included here. All other multifamily outdoor lighting is included here.

#### Designed Wattage:

<table>
<thead>
<tr>
<th>Name or Item Tag</th>
<th>Complete Luminaire Description</th>
<th>Watts per Luminaire</th>
<th>How Is Wattage Determined</th>
<th>Total Number Luminaires</th>
<th>Luminaire Status</th>
<th>Excluded per 140.7(a)/170.2(c)6A</th>
<th>Design Watts</th>
<th>Cutoff Req, 6,200 initial lumen output</th>
<th>Total Design Watts</th>
<th>Field Inspector</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 W LED</td>
<td>29,000 lm output</td>
<td>□ Linear</td>
<td></td>
<td>200</td>
<td>Mfr. Spec</td>
<td>New</td>
<td>600</td>
<td>Provided</td>
<td>600</td>
<td>Pass</td>
</tr>
</tbody>
</table>

1. **NOTES**: Selections with “□” require a note in the space below explaining how compliance is achieved.
   - EX: Luminaire is lighting a status, EXCEPTION 2 to 130.2(b).

2. **FOOTNOTES**: Authority having jurisdiction may ask for Luminaire cut sheets to confirm wattage used for compliance per 130.0(c) / 160.5(b).

3. For linear luminaires, wattage should be indicated as W/l instead of Watts/luminaire. Total linear feet should be indicated in column 03 instead of number of luminaires.

4. Select “New” for new luminaires in a new outdoor lighting project, or for added luminaires in an alteration. Select “Altered” for replacement luminaires in an alteration. Select “Existing to Remain” for existing luminaires within the project scope that are not being altered and are remaining. Select “Existing Reinstalled” for existing luminaires which are being removed and reinstalled as part of the project scope.

5. **Compliance with mandatory shielding requirements is required for luminaires with initial lumen output ≥ 6,200 unless exempted by 130.2(b)/160.5(c).**
## NRCC-LTO-E: BUG CUTOFF & CONTROLS

### G. SHIELDING REQUIREMENTS (BUG)

This table includes fixtures of >=6,200 initial lumens indicated on Table F as needing to comply with Shielding Requirements. Maximum lumens can be found in Title 24, Part 11, Section 5.106.8.

<table>
<thead>
<tr>
<th>Name or Item Tag</th>
<th>Complete Luminaire Description</th>
<th>Backlight Rating¹</th>
<th>Max Allowable Backlight Rating²</th>
<th>Uplight Rating¹</th>
<th>Max Allowable Uplight Rating²</th>
<th>Glare Rating (Lumens)²</th>
<th>Field Inspector</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 W LED</td>
<td>29,000 lm output</td>
<td>Back hemisphere is 1 - 2 MH from prop line</td>
<td>B4</td>
<td>B3</td>
<td>Area Lighting</td>
<td>U0</td>
<td>U0</td>
</tr>
</tbody>
</table>

¹FOOTNOTES: Mounting Height is labeled MH in this table.
²Authority Having Jurisdiction may ask for Luminaire cut sheets or other documentation to confirm luminaire type, uplight ratings and glare ratings used for compliance per 130.2(b)/160.5(c)
³BUG ratings with a lower number than the 'Max Allowable' are compliant. Ex. If Max Allowable is Bug Rating B4, then B0, B1, B2 and B3 are all compliant.

### H. OUTDOOR LIGHTING CONTROLS

This table demonstrates compliance with controls requirements for all new or altered luminaires installed as part of the permit application. For alteration projects, luminaires which are existing to remain (e untouched) and luminaires which are removed and reinstalled (wiring only) do not need to be included in this table even if they are within the spaces covered by the permit application.

Outdoor lighting for nonresidential buildings, parking garages and common service areas in multifamily buildings must be documented separately from outdoor lighting attached to multifamily buildings and controlled from the inside of a dwelling unit.

<table>
<thead>
<tr>
<th>Mandatory Controls for Nonresidential Occupancies, Parking Garages &amp; Common Areas in Multifamily Buildings</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking Lot: “200 W LED”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Inspector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹FOOTNOTE: Text has been abbreviated, please refer to Table 160.5-A to confirm compliance with the specific light source technologies listed.
²Authority having jurisdiction may ask for cut sheets or other documentation to confirm compliance of light source.
³Recessed luminaires marked for use in fire-rated installations, and recessed luminaires installed in non-insulated ceilings are excepted from ii and iii.
CALCULATE THE TOTAL POWER ALLOWANCE FOR AREA:

1. Calculate the illuminated hardscape area, remembering to subtract any landscape areas over 10’ x 10’. The illuminated area for each 25’ pole is 250’ x 250’, so it extends beyond the actual hardscape of the parking lot and encompasses the 150 ft² entrance. Because the lot is not adjacent to other hardscapes on the site, use the 15,000 ft² area of the lot itself, add the 15’ x 10’ entrance and subtract the four 400 ft² landscaped corners of the lot. This calculated value should be input in column 03 of Section I in NRCC-LTO-E.

2. The general hardscape lighting allowance is automatically determined by the form by multiplying the illuminated hardscape area (Step 1) by the AWA for asphalt sites in LZ3 (found in Table 140.7-A).

3. Calculate the perimeter length and input this value in column 06. The linear wattage allowance is automatically determined by the form by multiplying the hardscape perimeter length by the LWA (listed by lighting zone in Table 140.7-A).

4. The power allowances determined in steps 2 and 3 are added together and displayed in column 09.

5. The IWA is added only once for the entire site. The IWA for a site in LZ3 is listed in Table 140.7-A as 250W.
NRCC-LTO-E: WATTAGE ALLOWANCES

### I. LIGHTING POWER ALLOWANCE (per 140.7 / 170.2(e))

This table includes areas using allowance calculations per 140.7 / 170.2(e). General Hardscape Allowance is per Table 140.7-4/Table 170.2-R while “Use it or lose it” allowances are per Table 140.7-B/Table 170.2-S. Indicate which allowances are being used to expand sections for user input. Luminaires that qualify for one of the “Use it or lose it” allowances shall not qualify for another “Use it or lose it” allowance. Outdoor lighting attached to multifamily buildings and controlled from the inside of a dwelling unit are included in Table N, and are not included here. All other multifamily outdoor lighting is included here.

Calculated General Hardscape Lighting Power Allowance per Table 140.7-4 for Nonresidential & Hotel/Motel

<table>
<thead>
<tr>
<th>Area Description</th>
<th>Illuminated Area (ft²)</th>
<th>Allowed Density (W/ft²)</th>
<th>Area Allowance (Watts)</th>
<th>Perimeter Length (lf)</th>
<th>Allowed Density (W/lf)</th>
<th>Linear Allowance (Watts)</th>
<th>Total General AWA + LWA (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Lot</td>
<td>18550</td>
<td>0.021</td>
<td>284.55</td>
<td>520</td>
<td>0.2</td>
<td>104</td>
<td>388.55</td>
</tr>
</tbody>
</table>

Initial Wattage Allowance for Entire Site (Watts): 250

Instances of Initial Wattage Allowance (LZ 0 only):

Total General Hardscape Allowance (Watts): 638.54
## OUTDOOR LIGHTING COMPLIANCE RESULTS

### C. COMPLIANCE RESULTS

Results in this table are automatically calculated from data input and calculations in Tables F through N. Note: if any cell on this table says "COMPLIES with Exceptional Conditions" refer to Table D. Exceptional Conditions for guidance or see applicable Table referenced below.

<table>
<thead>
<tr>
<th>Calculations of Total Allowed Lighting Power (Watts) 140.7 / 170.2(e)6 or 141.0(b)[2L] / 180.2(b)[48v]</th>
<th>Compliance Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 General Landscape Allowance 140.7(d)(1) 170.2(e)6 (See Table J)</td>
<td>02 Per Application 140.7(d)(2) 170.2(e)6 (See Table J)</td>
</tr>
<tr>
<td>638.54</td>
<td>+</td>
</tr>
</tbody>
</table>

**Shielding Compliance (See Table G for Details)**

**Controls Compliance (See Table H for Details)**

COMPLIES

COMPLIES
SIGNAGE

Mandatory Measures
SIGN LIGHTING REQUIREMENT OVERVIEW

Both indoor and outdoor signs are addressed by the Energy Code.

- Control requirements are established for all illuminated signs (§130.3)
- Lighting power requirements are established for internally illuminated and externally illuminated signs (§140.8).

Sign lighting requirements are the same throughout the state and are independent of outdoor lighting zones. Additionally, sign requirements are the same in conditioned and unconditioned spaces.

- Minimum control requirements,
- maximum allowable power levels and
- minimum efficacy requirements.

The Energy Code do not allow trade-offs between sign lighting power allowances and other end uses, including outdoor lighting, indoor lighting, HVAC, building envelope or water heating.

Section 130.3(a)
REQUIRED CONTROLS

Outdoor sign lighting must be automatically controlled by one of the following two options:
1. A photocontrol and an automatic time-switch, or
2. An astronomical time-switch

All outdoor sign lighting that is on during the day and night must be equipped with a dimmer that provides the ability to automatically reduce the lighting power of the sign at least 65 percent at night.

Indoor signs must be equipped with:
1. An astronomical time-switch, or
2. An automatic time-switch

Section 130.3(a)
DEMAND RESPONSE FOR EMCS

An Electronic Message Center (EMC) is an electronically controlled sign that produces pixelated images using any type of light source or lighting system.

An EMC that has a connected lighting power load larger than 15 kW must have a control installed that can reduce lighting power at least 30 percent in response to a demand response (DR) signal.

Sections 130.3(a)3, 110.12(d)
ENERGY COMPLIANCE

Signs must also:

1. Comply with an allowed lighting power maximum
   or

2. Use one of several approved and compliant light sources
INTERNALLY ILLUMINATED SIGNS

Internally illuminated signs may use no more than 12 W/ft² of the illuminated sign area. For double-faced signs, only the area of one of the faces needs to be counted.

Section 140.8(a)1
EXTERNALLY ILLUMINATED SIGNS

Externally illuminated signs may use up to 2.3 W/ft² of illuminated sign area. If both faces are lit, then both must be counted.
COMPLIANT LIGHT SOURCES

The sign must comply to the allowed lighting power requirements if it is equipped only with one or more of the following light sources:

1. High pressure sodium (HPS) lamps
2. Metal halide (MH) lamps that are pulse start or ceramic with a minimum ballast efficiency of 88 percent OR pulse start MH lamps using no more than 320 watts (but not 250 watt or 175 watt lamps) with a minimum ballast efficiency of 80 percent
3. Neon or cold cathode lamps with a minimum transformer or power supply efficiency of at least 75 percent for a rated output current less than 50 mA OR a minimum efficiency of 68 percent when the rated output current is 50 mA or greater
4. Fluorescent lighting systems that only use lamps with a minimum CRI of 80 OR use electronic ballasts with a fundamental output frequency greater than 20 kHz
5. LEDs with a power supply efficiency of at least 80 percent
6. CFLs that do not use a medium screw-base socket

Section 140.8(b)
NRCC-LTS-E

STATE OF CALIFORNIA
Sign Lighting

CALIFORNIA ENERGY COMMISSION

**DOCUMENTATION AUTHOR’S DECLARATION STATEMENT**

I certify that this Certificate of Compliance documentation is accurate and complete.

<table>
<thead>
<tr>
<th>Documentation Author Name</th>
<th>Documentation Author Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>Signature Date</td>
</tr>
<tr>
<td>Address</td>
<td>CEA/ HERS Certification Identification (if applicable)</td>
</tr>
<tr>
<td>City/State/Zip</td>
<td>Phone:</td>
</tr>
</tbody>
</table>

**RESPONSIBLE PERSON’S DECLARATION STATEMENT**

I certify the following under penalty of perjury, under the laws of the State of California:

1. The information provided on this Certificate of Compliance is true and correct.
2. I am eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design or system design identified on this Certificate of Compliance (responsible designer).
3. The energy features and performance specifications, materials, components, and manufactured devices for the building design or system design identified on this Certificate of Compliance conform to the requirements of Title 24, Part 1 and Part 6 of the California Code of Regulations.
4. The building design features or system design features identified on this Certificate of Compliance are consistent with the information provided on other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with this building permit application.
5. I will ensure that a completed signed copy of this Certificate of Compliance shall be made available with the building permit(s) issued for the building, and made available to the enforcement agency for all applicable inspections. I understand that a completed signed copy of this Certificate of Compliance is required to be included with the documentation the builder provides to the building owner at occupancy.

<table>
<thead>
<tr>
<th>Responsible Designer Name</th>
<th>Responsible Designer Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>Date Signed</td>
</tr>
<tr>
<td>Address</td>
<td>License:</td>
</tr>
<tr>
<td>City/State/Zip</td>
<td>Phone:</td>
</tr>
</tbody>
</table>
IN CLOSING
RESOURCES

FOR MORE INFORMATION:
California Energy Commission: Building Energy Efficiency Standards
www.energy.ca.gov/title24/

Nonresidential Compliance Manual

Energy Code Ace Tools & Forms
energycodeace.com

Southern California Edison
www.sce.com

San Diego Gas and Electric
www.sdge.com

Pacific Gas and Electric Company
www.pge.com

IES–Illuminating Engineering Society
www.iesna.org

California Lighting Technology Center, UC Davis
cltc.ucdavis.edu/title24
WHEN IN DOUBT...

The California Energy Commission provides contacts for energy efficiency programs related to the Energy Code:

**Energy Efficiency Program Contact Information**

Contact information for hotlines and call centers supporting the California Energy Commission’s energy efficiency programs.

**Energy Standards (Title 24) Hotline**

916-654-5106  
800-772-3300, toll-free in California  
[Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)
2022 ENERGY CODE

THANK YOU!

For more information & resources about the Energy Code:
cltc.ucdavis.edu/title24