



2022 ENERGY CODE

NONRESIDENTIAL LIGHTING

*Best practices in lighting design to comply with
California's Building Energy Efficiency Standards (Title 24)*

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IN PARTNERSHIP WITH UC DAVIS CLTC



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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



FOUNDING ORGANIZATIONS



UTILITIES



LARGE END-USERS



MANUFACTURERS



NONRESIDENTIAL LIGHTING DESIGN GUIDE

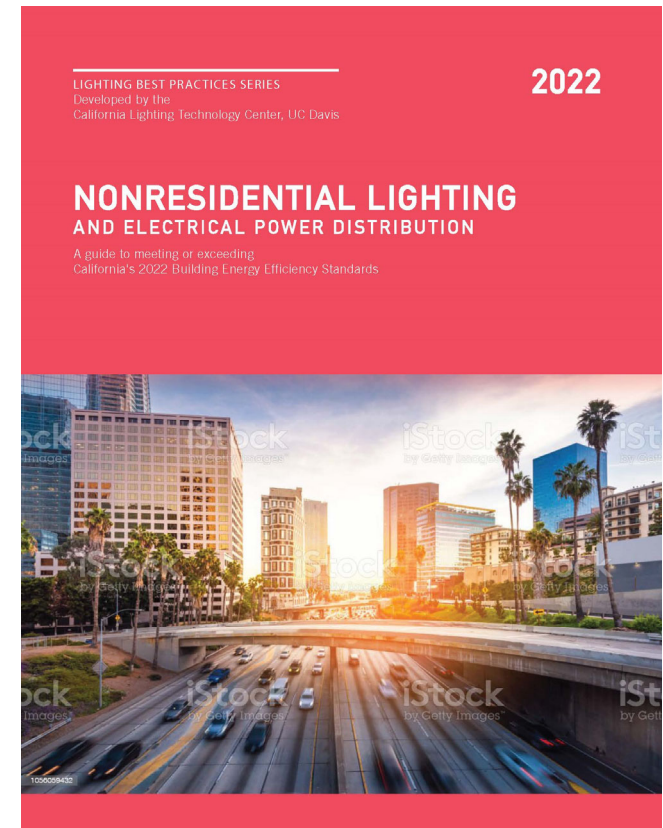
Provides a simplified and practical approach to lighting standards compliance and design.

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

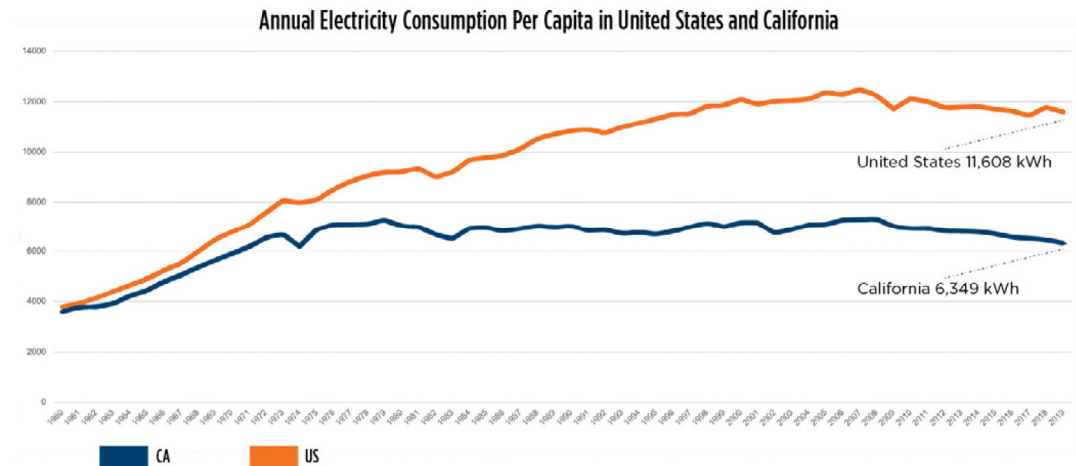
(for the application)

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 STATE ENERGY BUILDING



NO
SMOKING
IN THIS
AREA



WARREN-ALQUIST ACT – ENERGY CODE DEVELOPMENT OBLIGATIONS



- Technically feasible
- Cost-effective
- Performance-based and prescriptive compliance path

CALIFORNIA'S POLICY GOALS

Focus Area	Goal	Now	2020	2025	2030	2050
Residential Buildings	New Construction De-Carbonization/Reduced GHG ¹		100%			
	Existing Homes (reduction relative existing stock) ¹		40%			
Commercial Buildings	New Construction De-Carbonization/Reduced GHG ¹				100%	
	Existing De-Carbonization/Reduced GHG ¹				50%	
State Buildings	New Construction & Major Retrofit ZNE ²		50%	100%		
	Existing ZNE (by square footage) ²			50%		
SB 350	Increase energy efficiency in existing buildings				50%	
Existing Buildings	New and enhanced codes & standards, code simplification, increased compliance, asset ratings, purchase agreements, etc. ³	X	X	X	X	
GHG Emissions	Statewide GHG Emissions (all sources) ⁴		1990 Levels		40% Below 1990	80% Below 1990
Water Efficiency	25 percent reduction in urban water use ⁵	X				

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.

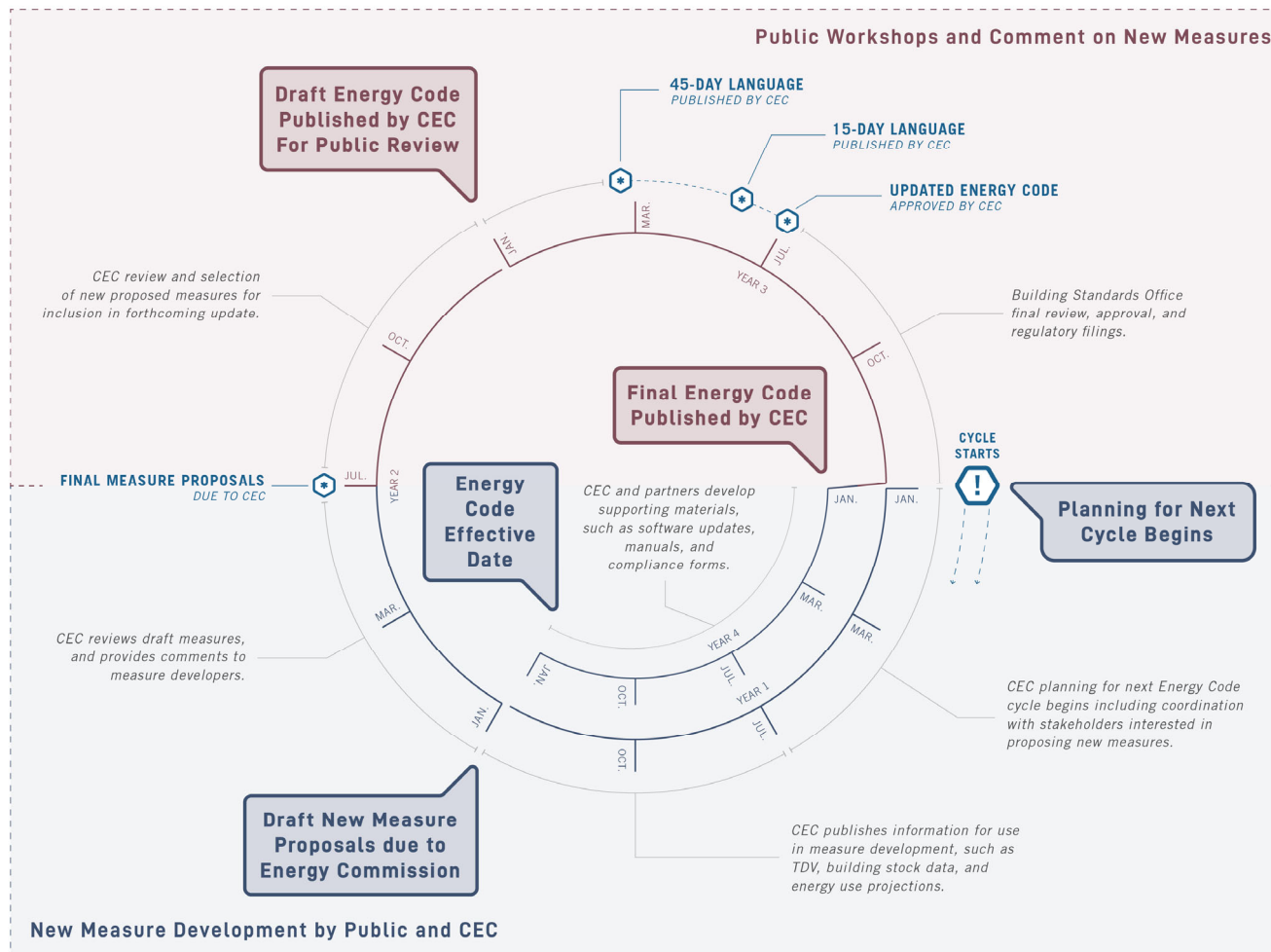
The *2025 Energy Code* is currently being researched and developed. If you are interested in following the Codes and Standards Enhancement (CASE) process, please participate in public events and docketing of comments on the California Energy Commission's website.

<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

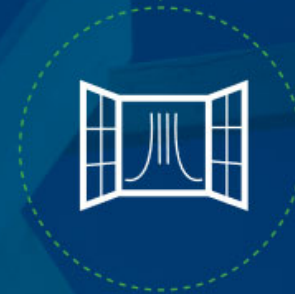
Heat pumps use less energy and produce fewer emissions than traditional HVACs and water heaters.



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

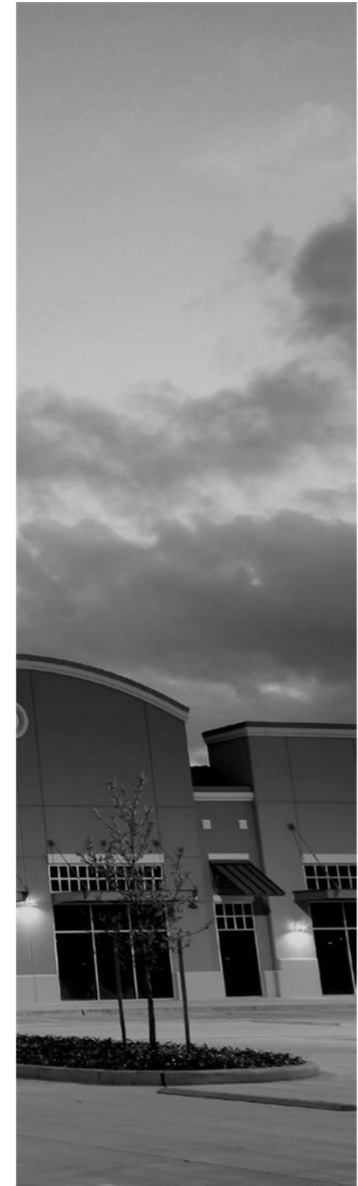
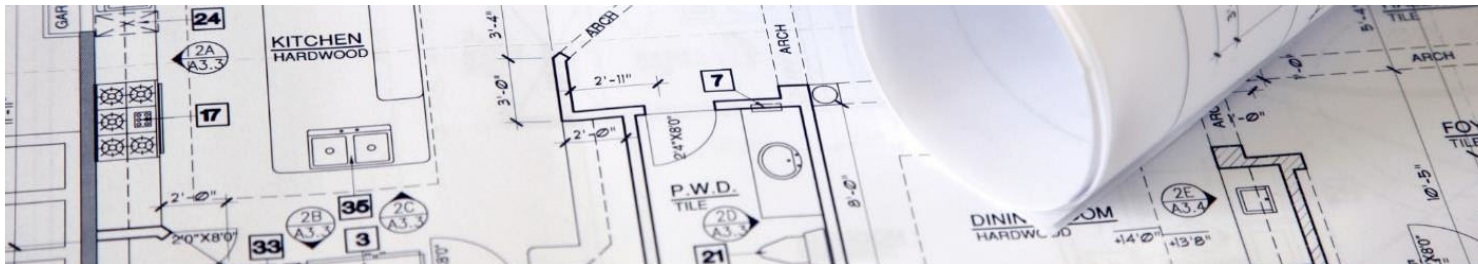


COMPLIANCE AND ENFORCEMENT

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

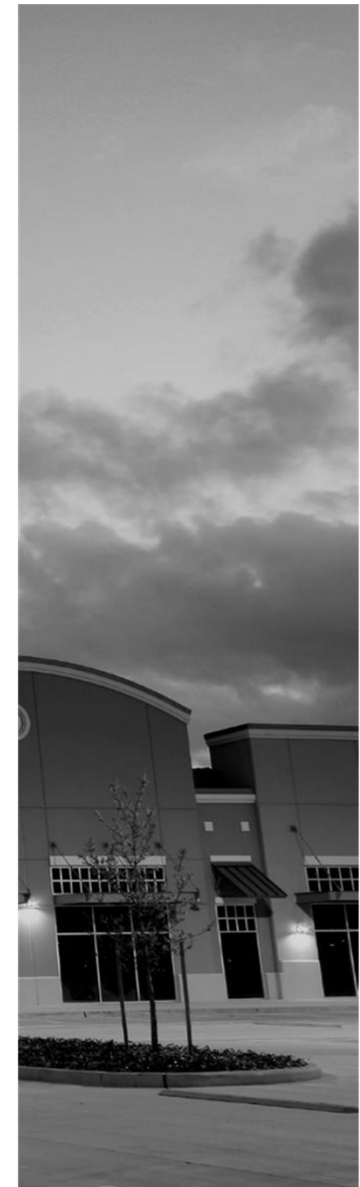
Current local ordinances, or “reach codes,” are listed on the Energy Commission website:

<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency-2>



2022 APPROVED LOCAL ORDINANCES

Local Ordinances	Date Approved	Topic	Ordinance Number
Encinitas	January 25, 2023	Residential Retrofit Efficiency Improvements; PV for High-Rise and Nonresidential Additions	2022-13
Piedmont	January 25, 2023	All-Electric SF NC, Residential Retrofit Efficiency Improvements, PV for Some Additions	766 N.S.



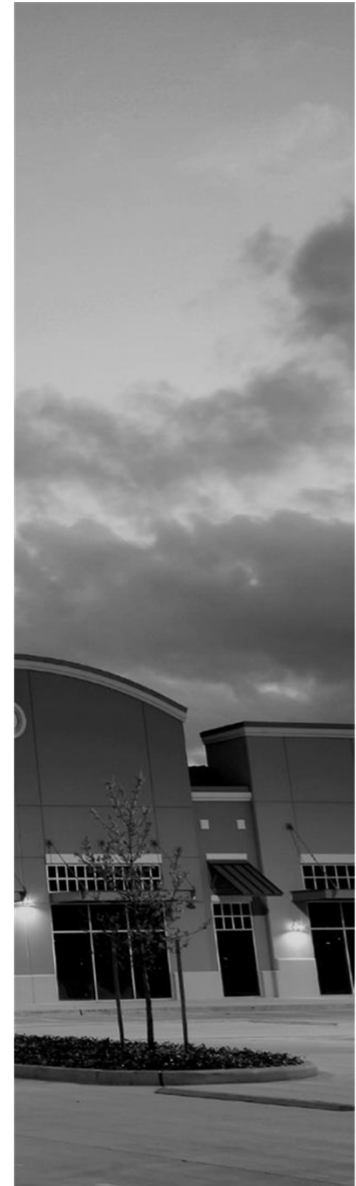
THE CORE COMPLIANCE PROCESS

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:

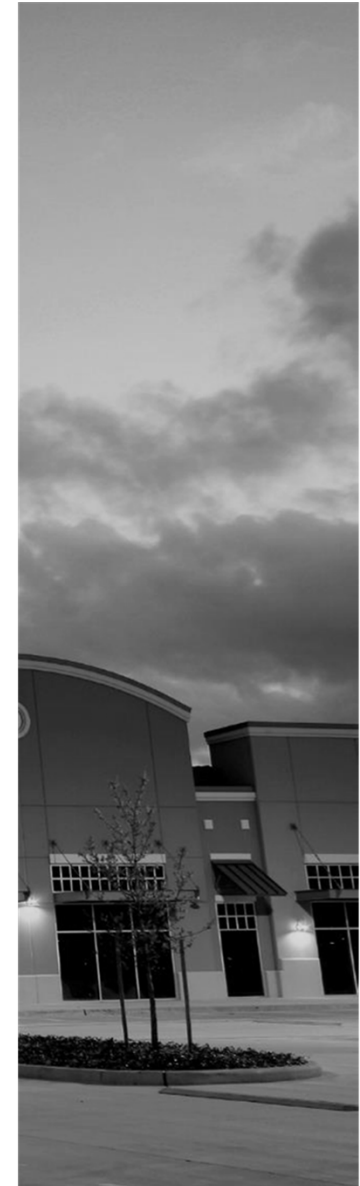
- More flexible than prescriptive
- Based on an energy simulation model of the building
- Requires an approved computer software program
- Uses energy budgets to determine compliance
- Typically used for flexibility and ability to find the most cost-effective solution



2022 APPROVED COMPLIANCE PROGRAMS

Program Name	Compliance Software Versions	Contact Information	Additional Information
California's Building Energy Code Compliance Software (CBECC)	<p>CBECC 2022.2.1 was approved 1/23/23 for demonstrating performance compliance with the nonresidential and multifamily provisions of the 2022 Energy Code.</p> <p>Permit applications made on or after 1/16/23 must use CBECC 2022.2.1 or 2022.2.0.</p> <p>Latest Version</p> <ul style="list-style-type: none"> • Download CBECC 2022.2.1 <p>Non-Current Versions</p> <ul style="list-style-type: none"> • Download CBECC 2022.2.0 • Download CBECC 2022.1.0 <p>CBECC 2022 Resolutions/Approvals</p> <ul style="list-style-type: none"> • CBECC 2022.2.1 Approval • CBECC 2022.2.0 Resolution • CBECC 2022.1.0 Resolution 	<p>California Energy Commission Building Standards Office 715 P Street, MS 37 Sacramento, CA 95814 ATTN: RJ Wichert 916-897-3450 cbecc@energy.ca.gov</p>	<p>See the CBECC Website for:</p> <ul style="list-style-type: none"> • SketchUp and OpenStudio SketchUp Plugin • Prototype Models & Tutorials • FAQ/Training • Software Archive • Quick Start Guide • User Manual • 2022 Compliance Software Approval and Expiration Dates. <p>Support: cbecc.com@energy.ca.gov</p>
EnergyPro	<p>EnergyPro 9.0 was approved 12/14/22 for demonstrating performance compliance with the nonresidential and multifamily provisions of the 2022 Energy Code.</p> <p>EnergyPro 2022 Resolutions/Approvals</p> <p>EnergyPro 9.0 Resolution</p>	<p>EnergySoft, LLC 1025 5th Street, Suite A Novato, CA 94945-2413 415-897-6400</p>	<p>See the EnergySoft website for:</p> <ul style="list-style-type: none"> • Software Download • Training and FAQ's • Support: support@energysoft.com <p>2022 Compliance Software Approval and Expiration Dates</p>

<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency-1>



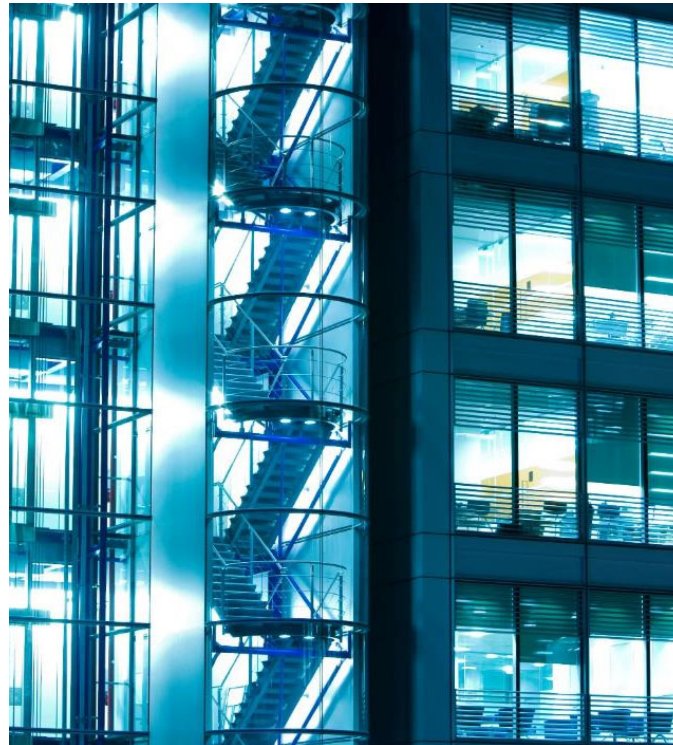
THE PRESCRIPTIVE APPROACH

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

Type of Building	Lighting Power Density (W/ft ²)		Type of Building	Lighting Power Density (W/ft ²)	
	2022	Δ		2022	Δ
Assembly	0.65	↓ 0.05	Office	0.60	↓ 0.05
Bank or Financial Institution	0.65	—	Parking Garage	0.13	—
Grocery Store	0.90	↓ 0.05	Performing Arts Theater	0.75	↓ 0.05
Gymnasium	0.60	↓ 0.05	Religious	0.70	—
Healthcare	0.90	—	Restaurant	0.65	↓ 0.05
Industrial or Manufacturing Facility	0.60	—	Retail Store	0.90	—
Library	0.70	—	School	0.60	↓ 0.05
Motion Picture Theater	0.60	↓ 0.1	Sports Arena	0.75	—
Museum	0.65	New	All other buildings	0.40	—

Based on Table 140.6-B in the Energy Code



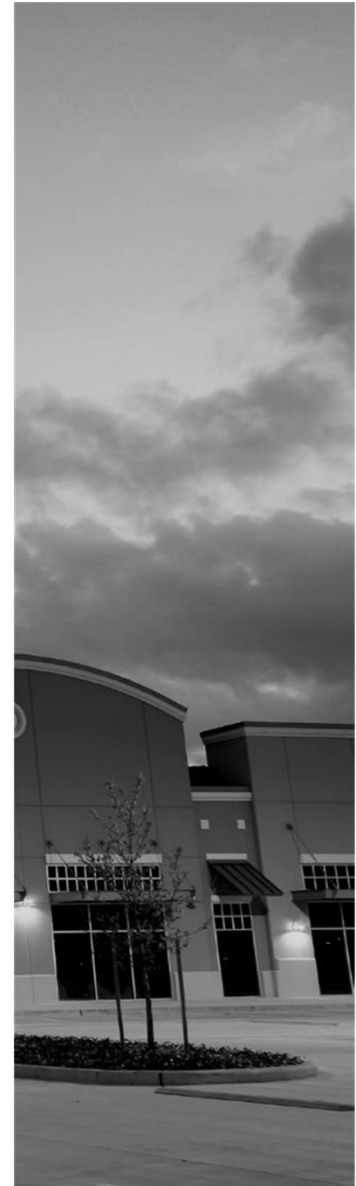
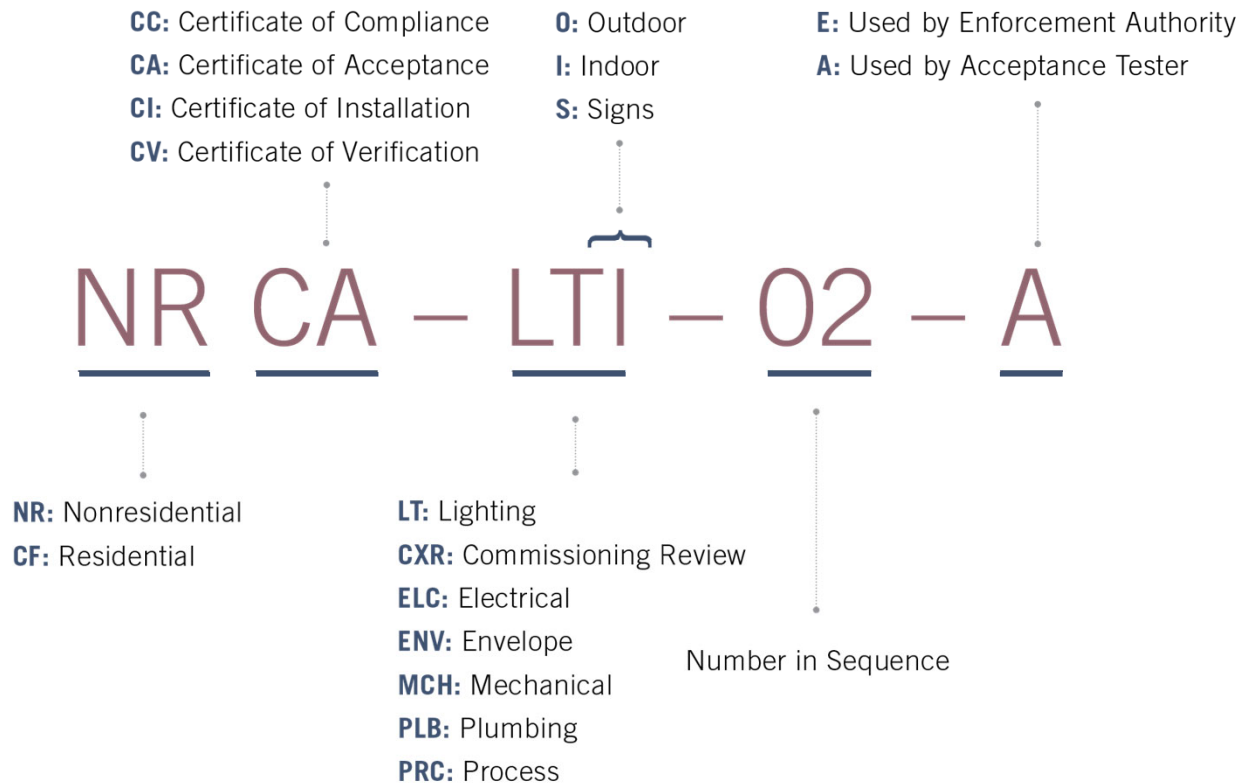
2022 LIGHTING POWER DENSITY VALUES FOR AREA CATEGORY METHOD

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

Primary Function Area		Allowed Lighting Power Density for General Lighting (W/ft²)	Additional Lighting Power¹	
			Qualified Lighting Systems	Additional Allowance (W/ft², unless noted otherwise)
Aging Eye/ Low-vision¹¹	Corridor Area	0.70	Decorative or Display	0.30
	Dining	0.80	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Lobby, Main Entry	0.85	Decorative or Display	0.30
			Transition Lighting OFF at night¹²	0.95
			Tunable white or dim-to-warm¹⁰	0.10
	Lounge or Waiting Area	0.80	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Multipurpose Room	0.85	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Religious Worship Area	1.00	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Restroom	1.00	Decorative or Display	0.20
	Stairwell	0.80	Decorative or Display	0.30



COMPLIANCE FORMS



CERTIFICATES OF COMPLIANCE

NRCC-LTI-E

Indoor Lighting

NRCC-LTO-E

Outdoor Lighting

NRCC-LTS-E

Sign Lighting

NRCC-ELC-E

Electrical Power Distribution



CERTIFICATES OF INSTALLATION

NRCI-ELC-E

Electrical Power Distribution

NRCI-LTI-E

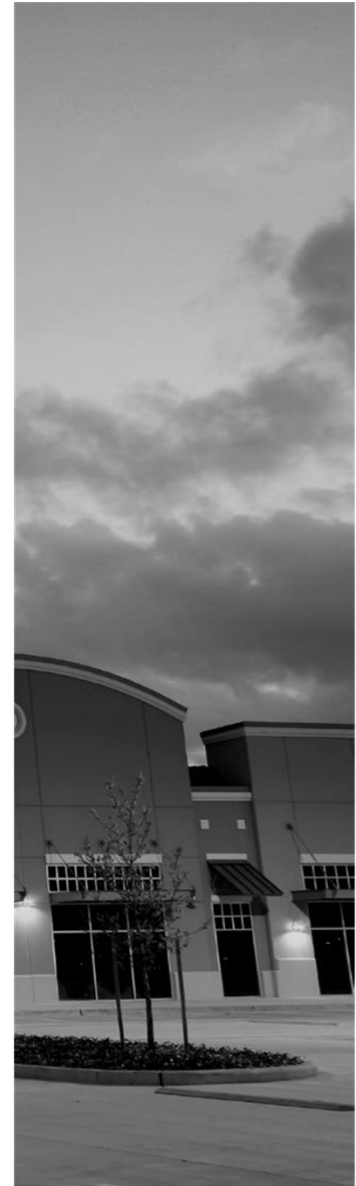
Indoor Lighting

NRCI-LTO-E

Outdoor Lighting

NRCI-LTS-E

Sign Lighting



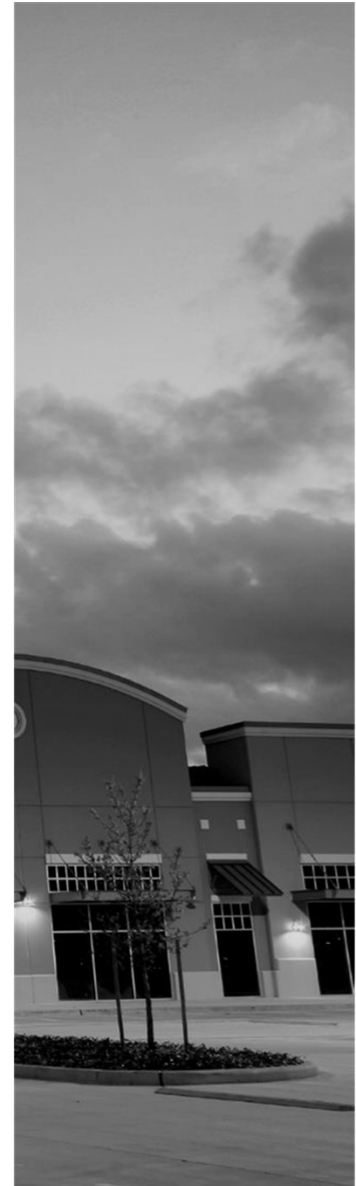
ACCEPTANCE TESTING

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

CALCTP California Advanced Lighting Controls Training Program

HOME WHAT IS CALCTP? GET CERTIFIED FIND ACCEPTANCE TECHNICIANS FIND INSTALLER CONTRACTORS ENGAGE CALCTP

HOME

First time logging in to the newly updated/revised CALCTP web site? You must reset your password! Please click here to learn how.

CALCTP values your health and safety. Please click [here](#) to read an advisory from the CEC related to COVID-19 and certified AT-Technicians.

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-AT PROGRAM

The 2016 Building Energy Efficiency Standards requires certified technicians to conduct tests to pass/fail installed lighting controls. CALCTP is a state recognized

Fast Facts

Lighting comprises as much as

38%


of the electricity expense in a commercial building.

<https://www.calctp.org/>



NLCAA

(562) 485-9144 contact@nlcaa.org

 National Lighting Contractors Association of America

Home About Us Courses Employers Technicians Resources Calendar Contact Us Create Account Login

Need an Acceptance Test Performed?

FIND A TESTING COMPANY

Have a Code Question

CODE@NLCAA.ORG

Help and Support NLCAA

CLICK HERE TO DONATE

Happy New Year!! Office hours 12/30 7-12pm 1/2 CLOSED

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.

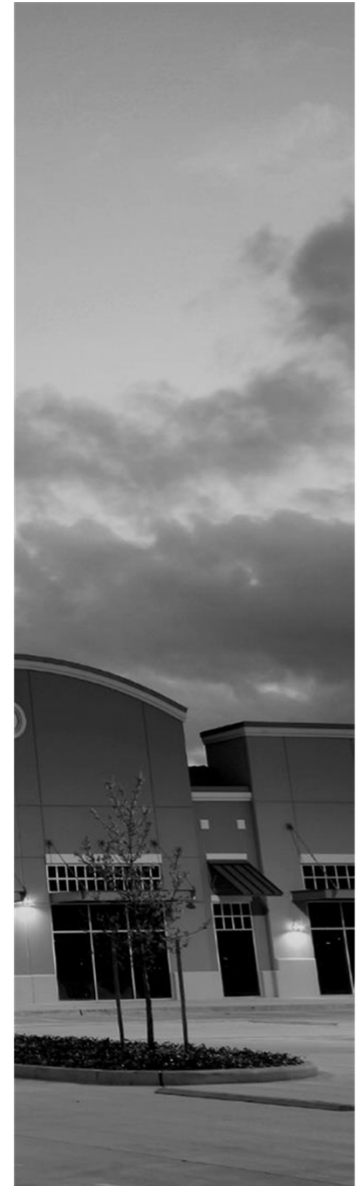
OCCUPANCY

- Once all required Certificated of Acceptance are submitted, the enforcement agency releases a Certificate of Occupancy.



CERTIFICATES OF ACCEPTANCE

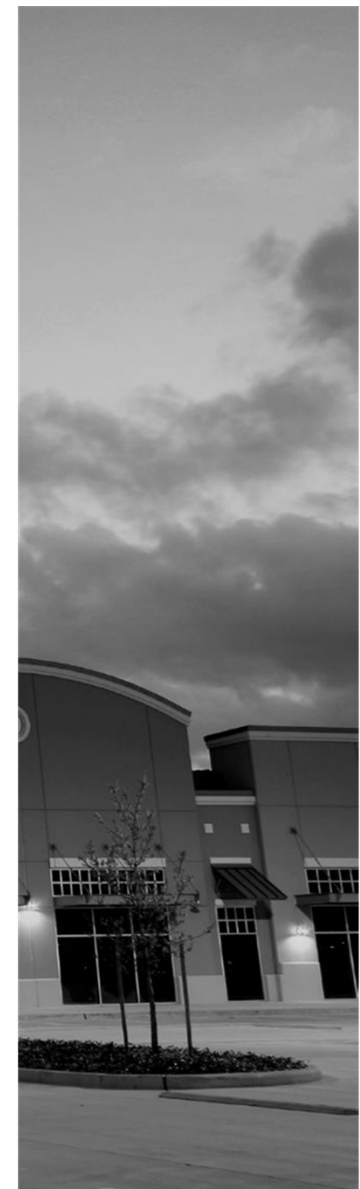
NRCA-LTI-02-A	Shut-off Lighting Controls
NRCA-LTI-03-A	Automatic Daylighting Controls
NRCA-LTI-04-A	Demand Responsive Lighting Controls
NRCA-LTI-05-A	Institutional Tuning PAF
NRCA-LTO-02-A	Outdoor Lighting Acceptance Tests



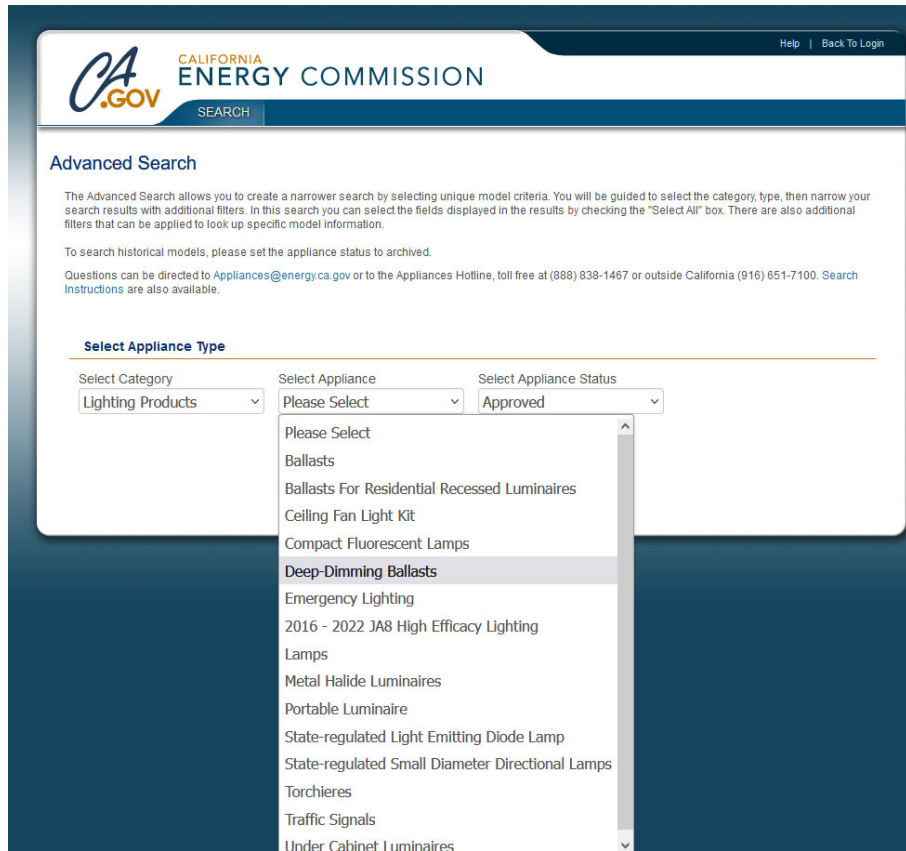
MANDATORY DEVICE REQUIREMENTS

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



MODERNIZED APPLIANCE EFFICIENCY DATABASE SYSTEM (MAEDBS)



The screenshot displays the 'Advanced Search' page of the MAEDBS system. At the top, the California Energy Commission logo and 'CA.GOV' are visible, along with a 'SEARCH' button and links for 'Help' and 'Back To Login'. The 'Advanced Search' section includes a brief explanation of the search functionality and contact information for the Appliances Hotline. Below this, the 'Select Appliance Type' section features three dropdown menus: 'Select Category' (set to 'Lighting Products'), 'Select Appliance' (set to 'Please Select'), and 'Select Appliance Status' (set to 'Approved'). The 'Select Appliance' dropdown is open, showing a list of appliance types, with 'Deep-Dimming Ballasts' highlighted. The list includes: Please Select, Ballasts, Ballasts For Residential Recessed Luminaires, Ceiling Fan Light Kit, Compact Fluorescent Lamps, Deep-Dimming Ballasts, Emergency Lighting, 2016 - 2022 JA8 High Efficacy Lighting Lamps, Metal Halide Luminaires, Portable Luminaire, State-regulated Light Emitting Diode Lamp, State-regulated Small Diameter Directional Lamps, Torchieres, Traffic Signals, and Under Cabinet Luminaires.

CA.GOV CALIFORNIA ENERGY COMMISSION

SEARCH

Help | Back To Login

Advanced Search

The Advanced Search allows you to create a narrower search by selecting unique model criteria. You will be guided to select the category, type, then narrow your search results with additional filters. In this search you can select the fields displayed in the results by checking the "Select All" box. There are also additional filters that can be applied to look up specific model information.

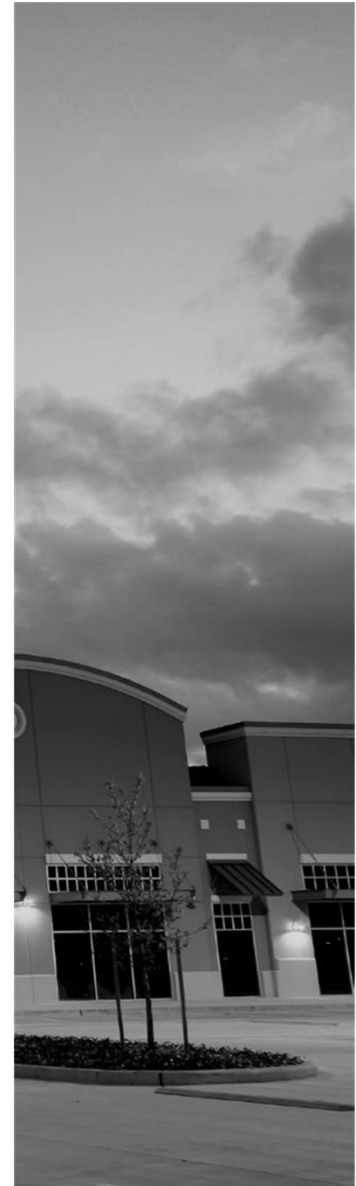
To search historical models, please set the appliance status to archived.

Questions can be directed to Appliances@energy.ca.gov or to the Appliances Hotline, toll free at (888) 838-1467 or outside California (916) 651-7100. [Search Instructions](#) are also available.

Select Appliance Type

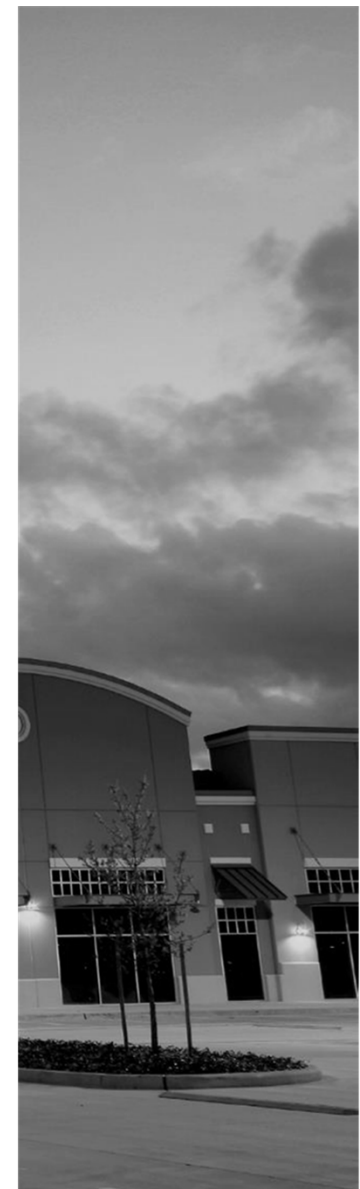
Select Category	Select Appliance	Select Appliance Status
Lighting Products	Please Select	Approved

- Please Select
- Ballasts
- Ballasts For Residential Recessed Luminaires
- Ceiling Fan Light Kit
- Compact Fluorescent Lamps
- Deep-Dimming Ballasts
- Emergency Lighting
- 2016 - 2022 JA8 High Efficacy Lighting Lamps
- Metal Halide Luminaires
- Portable Luminaire
- State-regulated Light Emitting Diode Lamp
- State-regulated Small Diameter Directional Lamps
- Torchieres
- Traffic Signals
- Under Cabinet Luminaires



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**.

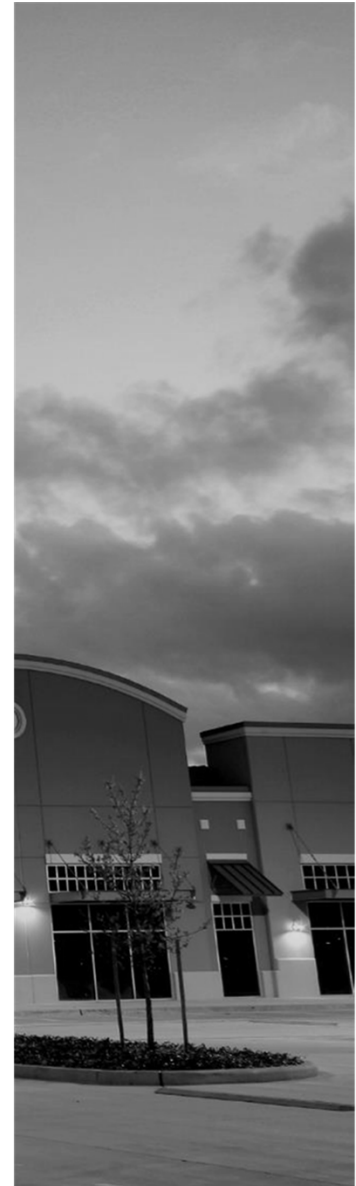


ADDITIONS, ALTERATIONS & REPAIRS

Control Requirements for Indoor Lighting System Alterations

Based on Table 141.0-F from the Energy Code

Control Specifications		Trigger	Projects Complying with Section 141.0(b)2Ii	Projects Complying with Sections 141.0(b)2Iii or 141.0(b)2Iiii
Manual Area Controls	130.1(a)1 – Be readily accessible.	Enclosed areas with ceiling-height partitions of any size. Healthcare buildings are exempt.	Required	Required
	130.1(a)2 – Be located in the same enclosed area with the lighting fixture it controls.		Required	Required
	130.1(a)3 – Provide separate control of general, display, ornamental and special effects lighting.		Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multi-Level Controls	130.1(b) – Allow level of lighting to adjust up and down.	Enclosed areas 100 ft ² or larger with connected lighting load that exceeds 0.5 watts per ft ² . Healthcare buildings are exempt.	Required	Not Required
	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.		Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
	130.1(c)2 – Countdown timer switches may be used to comply with shut-OFF control requirements in closets less than 70 ft ² and server aisles in server rooms.		Required	Required
	130.1(c)3 – Manual override for automatic time-			



2022 ENERGY CODE TRIGGERS—OUTDOOR

NEW CONSTRUCTION

- Luminaires $\geq 6,200$ 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



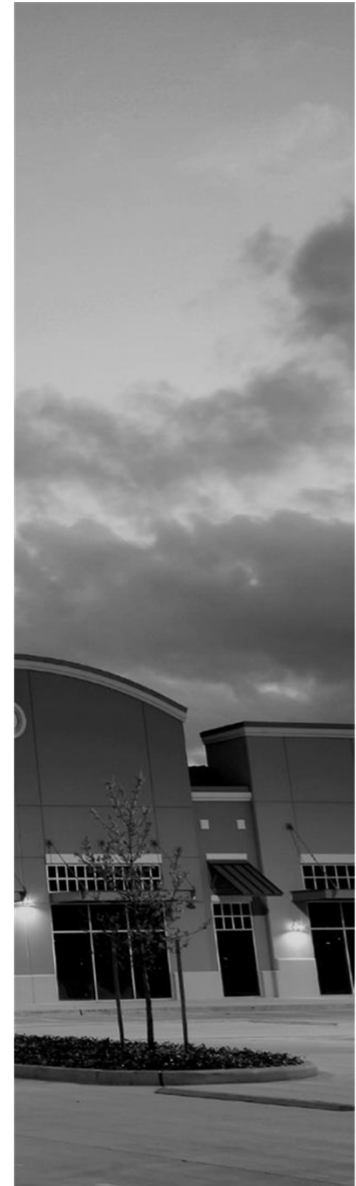
ELECTRICAL POWER DISTRIBUTION SYSTEMS

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 130.5-A: Minimum Requirements for Metering of Electric Load

Metering Functionality	Electrical Services rated 50 kVA or less	Electrical Services rated more than 50 kVA and less than or equal to 250 kVA	Electrical Services rated more than 250 kVA and less than or equal to 1000 kVA	Electrical Services rated more than 1000 kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Not required



DISAGGREGATION OF ELECTRICAL LOADS

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

Table 130.5-B: Minimum Requirements for Separation of Electrical Load

Electrical Load Type	Electrical Services rated 50kVA or less	Electrical Services rated more than 50kVA and less than or equal to 250kVA	Electrical Services rated more than 250kVA and less than or equal to 1000kVA	Electrical Services rated more than 1000kVA
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50kVA	All HVAC in aggregate and each HVAC load rated at least 50kVA
Domestic and service water system pumps and related systems and components	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Plug load including appliances rated less than 25kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25kVA connected load in an area less than 5,000 sq. ft.	All plug load separated by floor, type or area Groups of plug loads exceeding 25kVA connected load in an area less than 5,000 sq. ft.	All plug load separated by floor, type or area All groups of plug loads exceeding 25kVA connected load in an area less than 5,000 sq. ft.
Elevators, escalators, moving walks and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate



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>



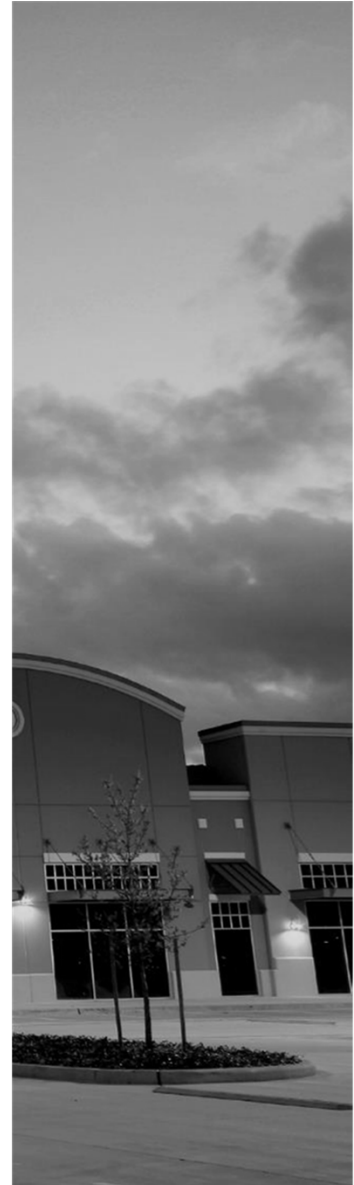
CIRCUIT CONTROLS FOR 120-VOLT RECEPTACLES

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 response 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:

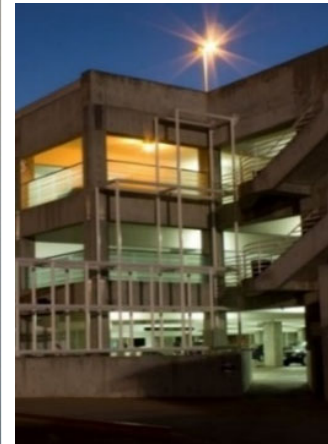
1. Readily accessible
2. Located in the same room or area as the lighting they control and with the lighting in view
3. Able to provide any required dimming or multi-level controls steps in addition to on/off
4. General lighting is separately controlled from all other lighting systems in same area
5.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



EXCEPTIONS

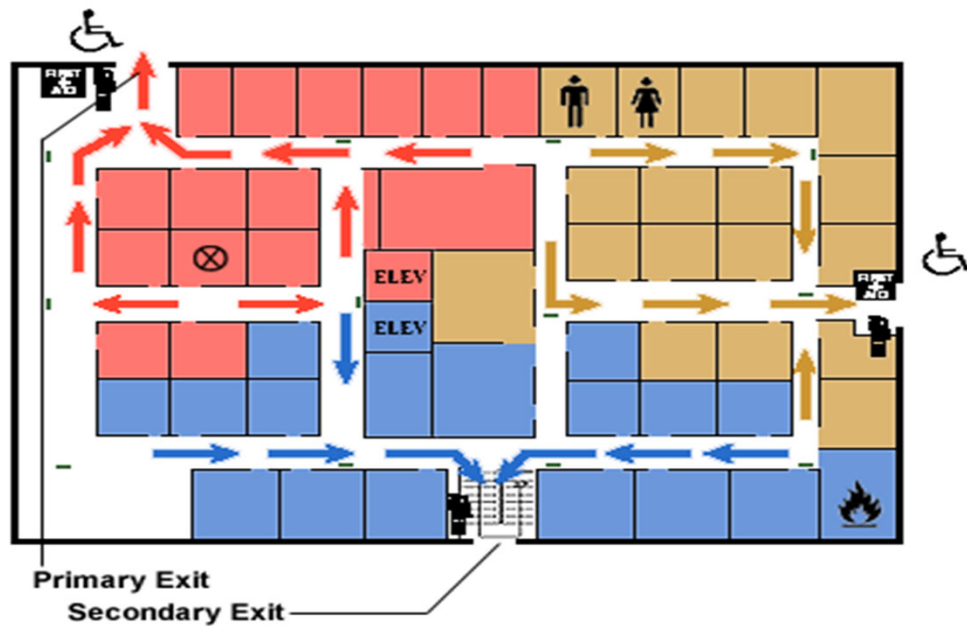
May use a manual control that is NOT accessible to unauthorized personnel for the following spaces:

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



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

Luminaire Type	Minimum Required Control Steps (percent of full rated power ¹)	Uniform Level of Illuminance Achieved By:	Common Use Cases
LED luminaires and LED source systems	Continuous Dimming 10–100%	Continuous Dimming 10–100%	Commercial applications, including recessed, downlight, accent and decorative
Line-voltage sockets except GU-24			
Low-voltage incandescent systems			
Fluorescent Luminaires	Continuous Dimming 20–100%		Downlights
GU-24 sockets rated for fluorescent ≤ 20W	Minimum one step between 30–70%	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.	Downlights, recessed
Pin-based compact fluorescent ≤ 20W ²			
Linear and U-bent fluorescent ≤ 13W			
Track Lighting	Minimum one step between 30–70%	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.	Accent and decorative
	Minimum one step in each range	Stepped dimming; continuous dimming; or switching alternate lamps in each	



EXCEPTION

- Classrooms with a connected general lighting load of **0.6** watts per square foot 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)



Photo: Lutron



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



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



Photo: Lutron



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



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



<https://cltc.ucdavis.edu/sites/default/files/files/publication/pier-lutron-latham-square-adaptive-corridors.pdf>

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)

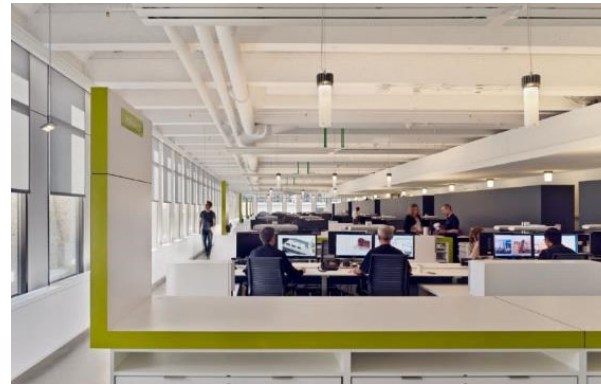


Photo: Lutron



Photo: Lutron



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

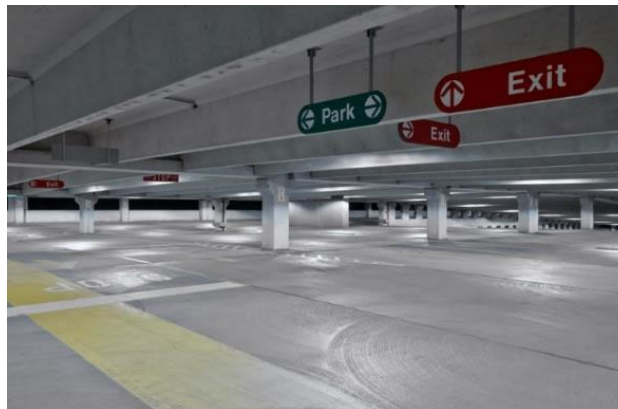
Parking garages are considered interior nonresidential spaces, except for the top level of each multi-tier garage.

- 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.

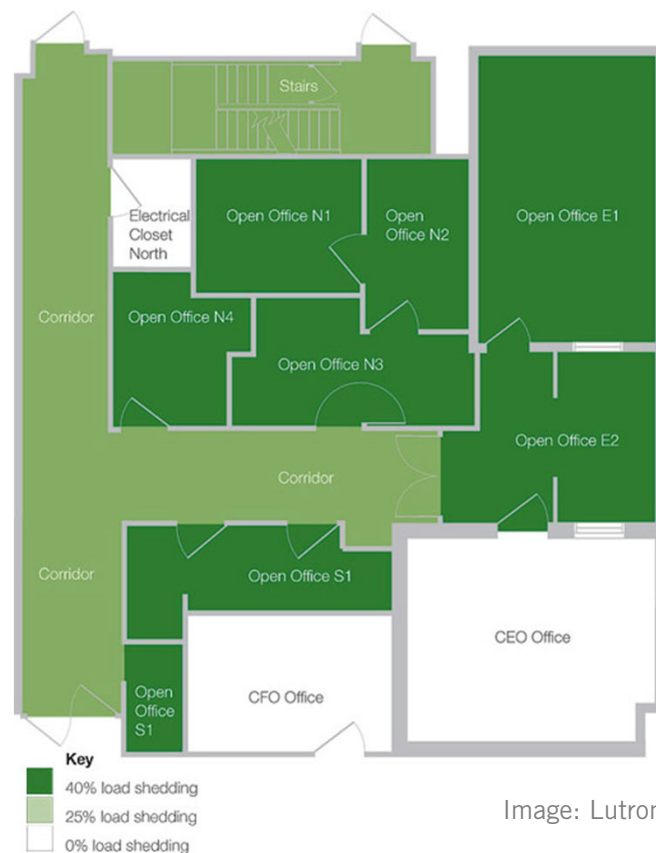


Image: Lutron



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.



Examples of Demand Response Controls: Leviton GreenMax Relay Panel, WattStopper Digital Lighting Management



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.



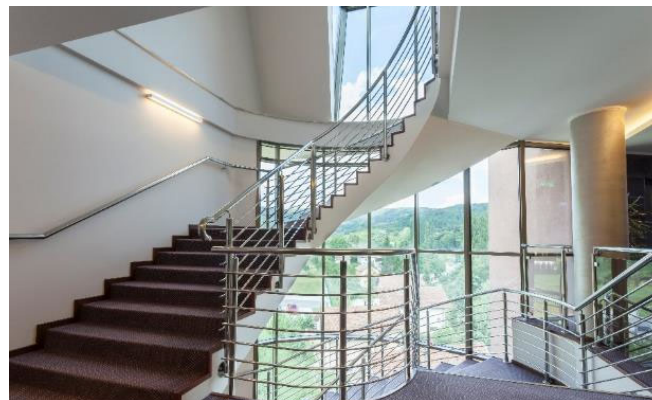
Section 130.1(f)



CONTROL INTERACTIONS

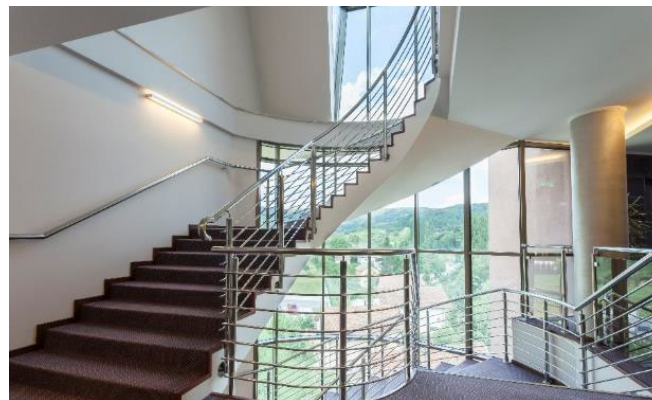
1. For general lighting, the manual area control must permit the amount of light provided while the lighting is on to be set or adjusted by the controls specified in Section 130.1(b), (c), (d) and (e).
2. The manual area control must permit the shut-off control to turn the lighting down or off.
3. The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

Section 130.1(f)



CONTROL INTERACTIONS

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.

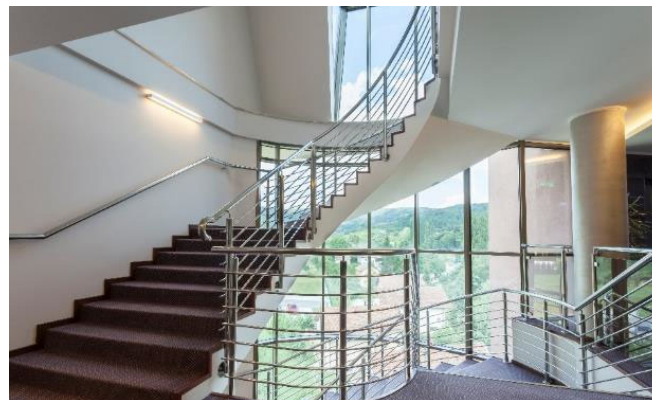


Section 130.1(f)



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.



Section 130.1(f)





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

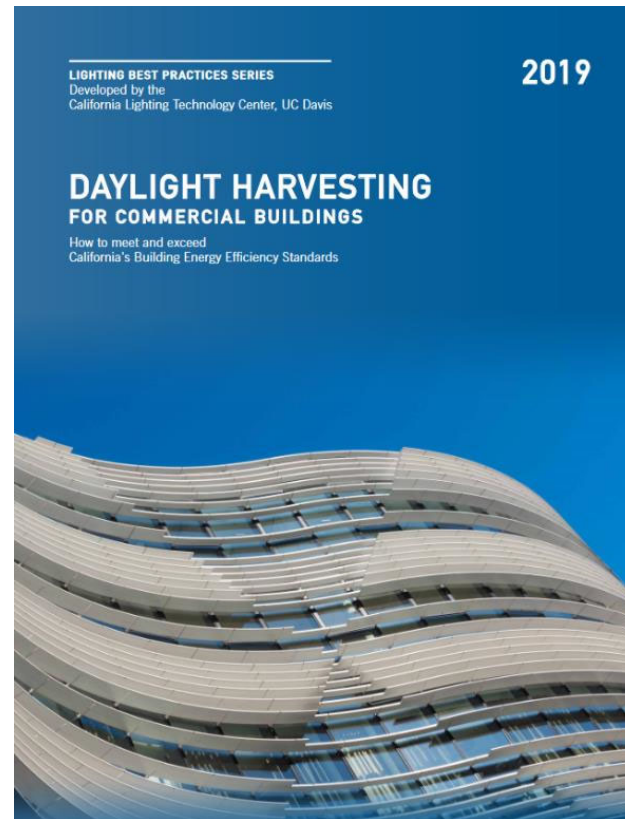
2019 version available online for download!

cltc.ucdavis.edu

Printed copies are available at:

amazon.com

2022 update is in progress!



INDOOR DAYLIGHTING CONTROLS

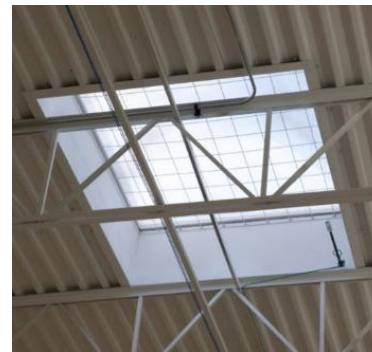
- General lighting in the areas under skylights and directly adjacent to windows must have daylighting controls. Each zone is controlled separately.
- Lighting in daylit zones should have multi-level steps, per Table 130.1-A
- Light levels provided at night should be available at all other times
- When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



Photo: Lutron



Photo: Sensor Switch/Acuity Brands



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

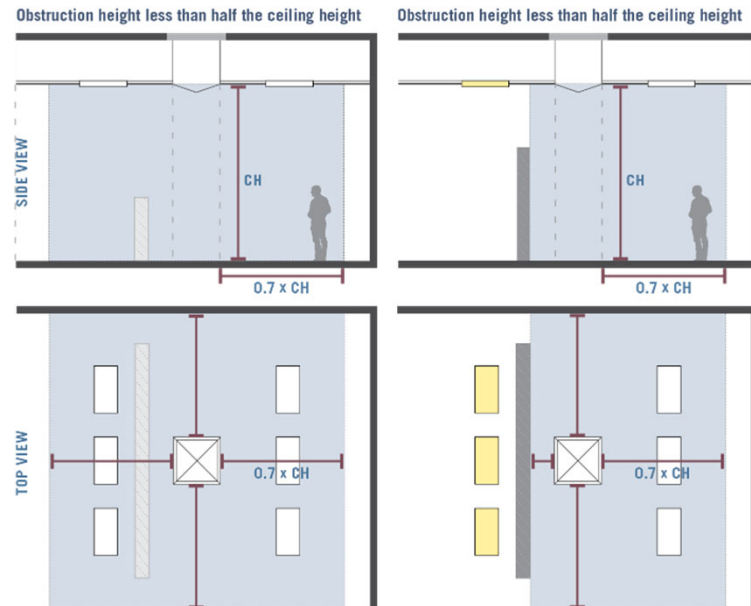
Daylit zones must be marked on building floor plans.



CALCULATING A SKYLIT ZONE

CALCULATION STEPS:

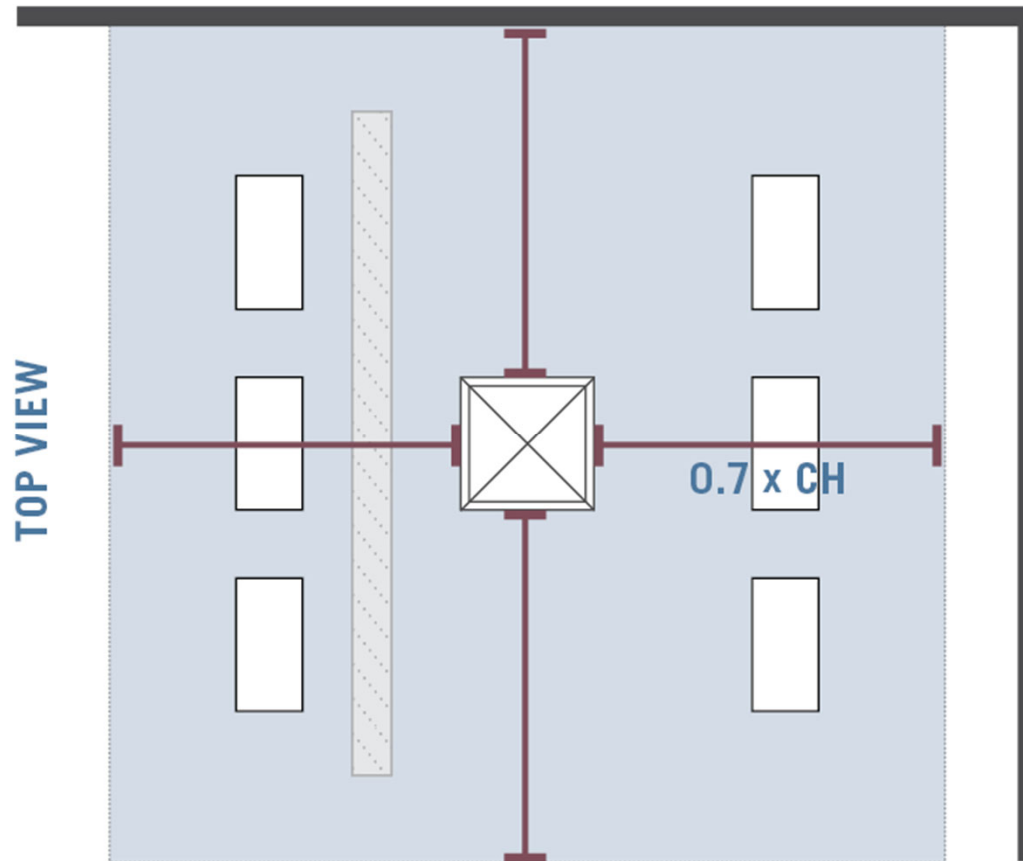
1. Define the approximate shape of the opening of the skylight
2. Determine the ceiling height (CH)
3. Multiply the CH by 0.7
4. Add this value in all directions around the skylight (starting at the edge of the rough opening)
5. Subtract any area that has a permanent obstruction taller than half the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



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



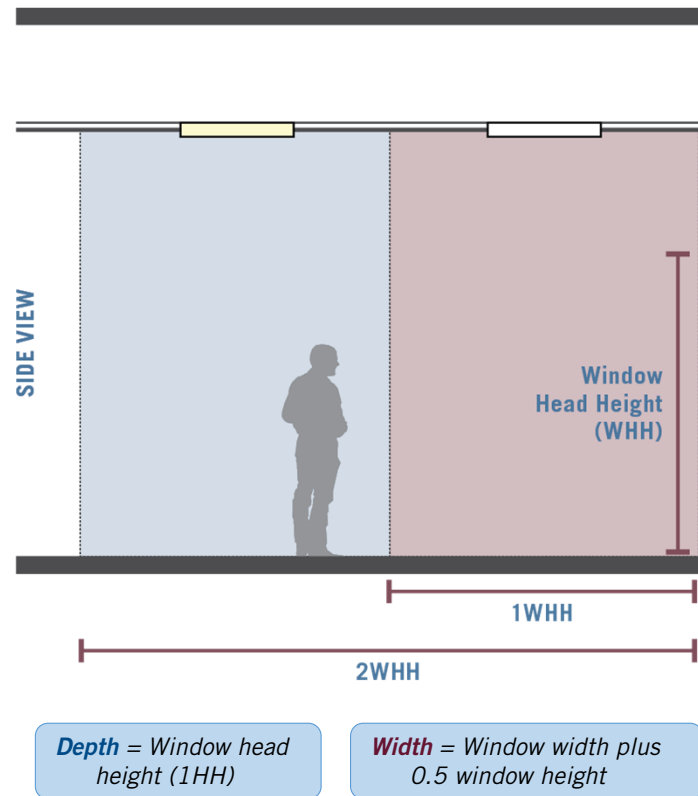
CALCULATING A SKYLIT ZONE



CALCULATING PRIMARY SIDELIT ZONES

Calculation Steps

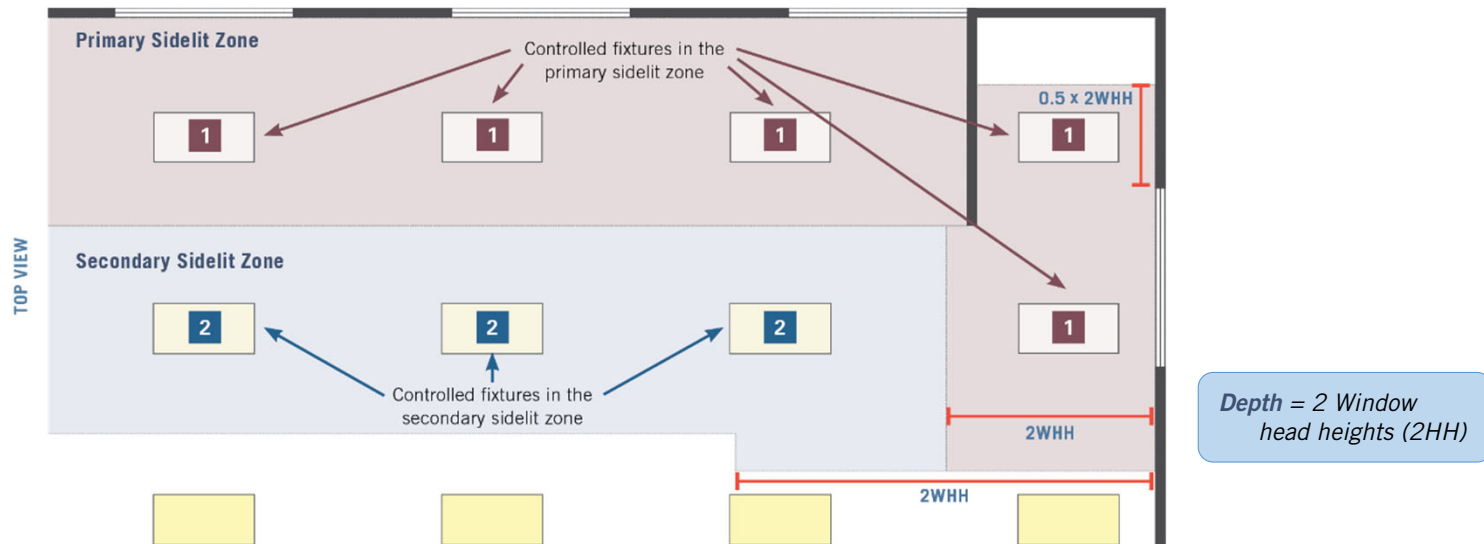
1. Determine the window head height for each window
2. The **depth** of the zone is one window head height (HH) into the area adjacent to the window
3. The **width** of the zone is the width of the window plus half the window head height on each side of the window
4. Subtract any area on a plan that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



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



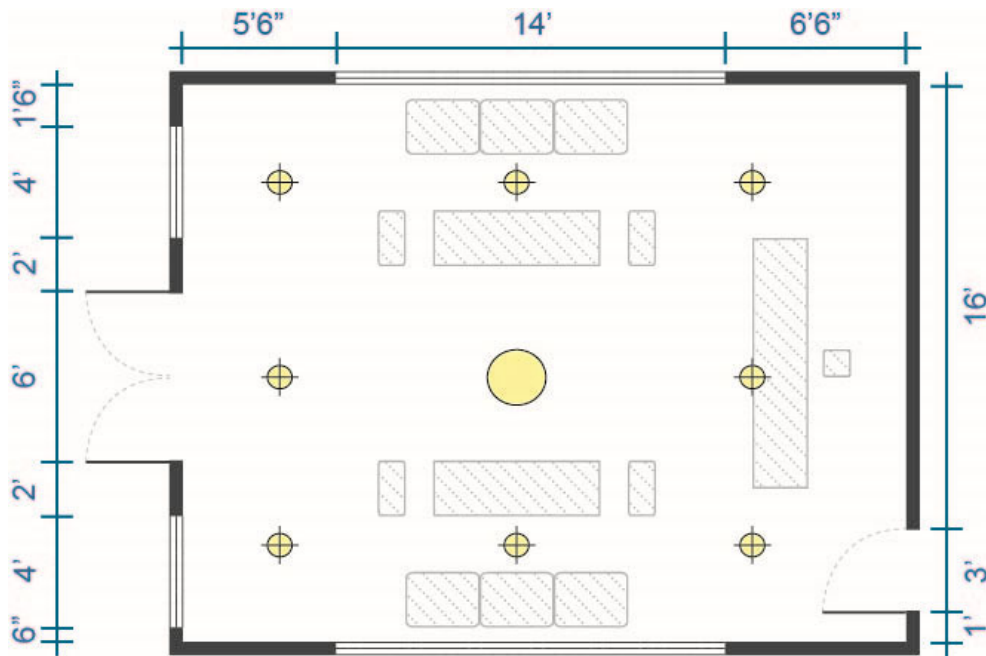
AUTOMATIC DAYLIGHTING CONTROLS

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

1. Primary sidelit zones
2. Secondary sidelit zones

Assume the following:

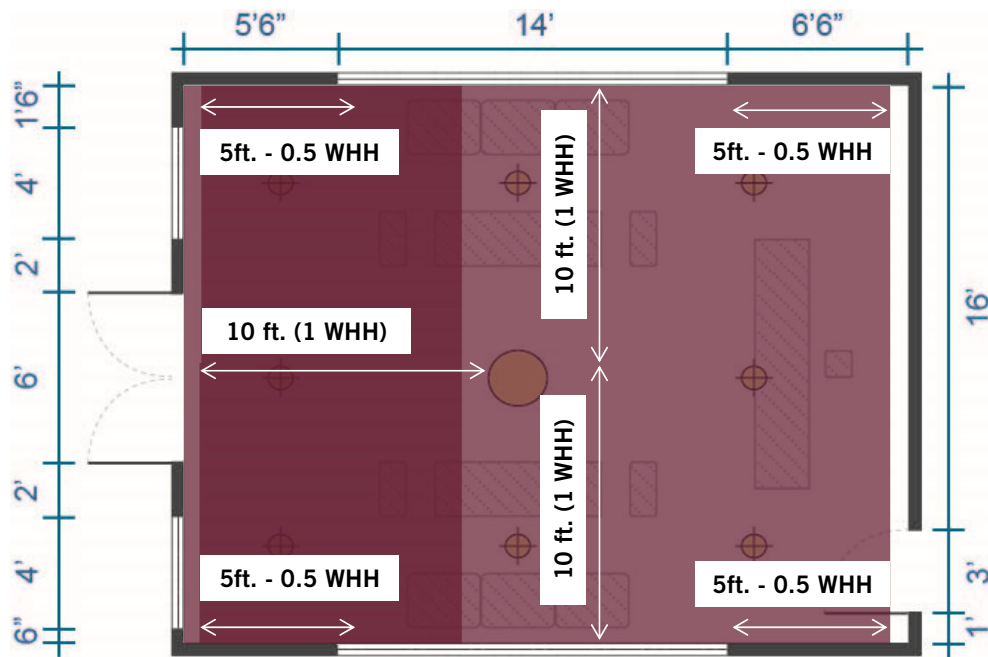
- Window head height: 10 feet
- Doors are glass (count as windows)



AUTOMATIC DAYLIGHTING CONTROLS

Notes:

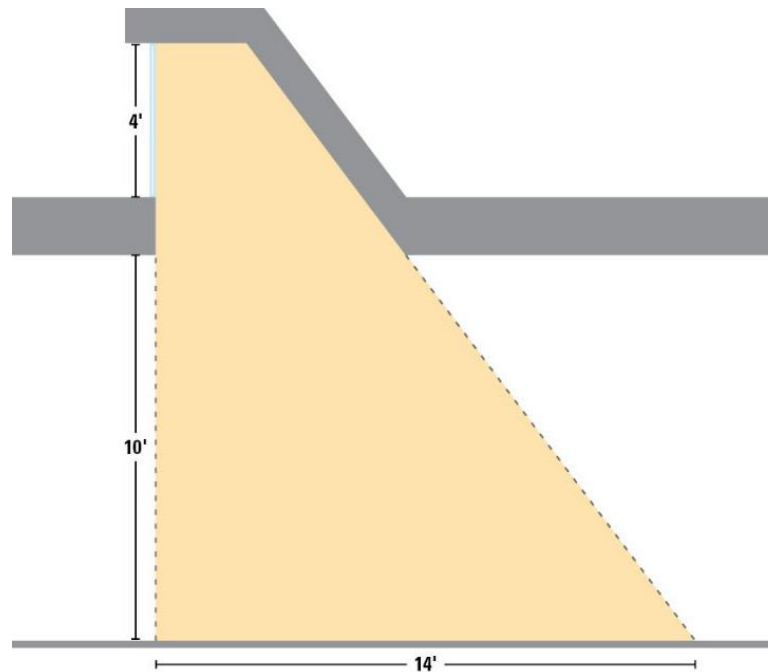
1. Window head height: 10 feet
2. Doors are glass (count as windows)



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.

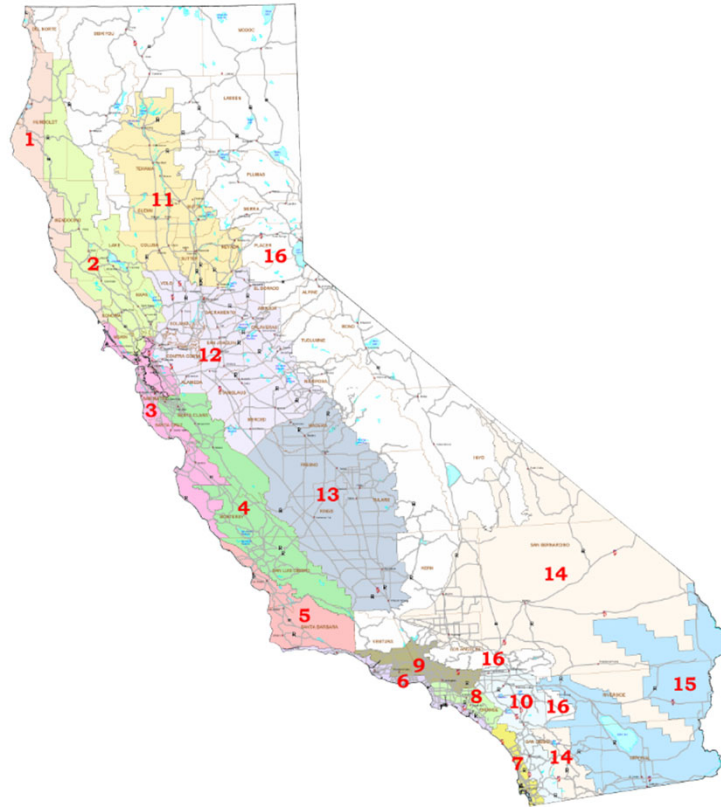


NEW CONSTRUCTION OF LARGE SPACES

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



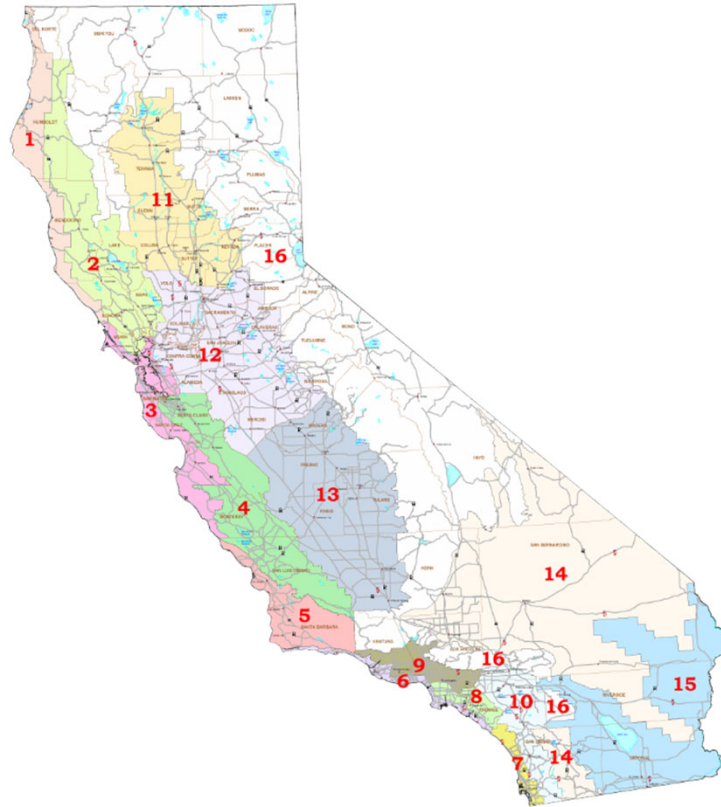
Section 140.3(c)



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

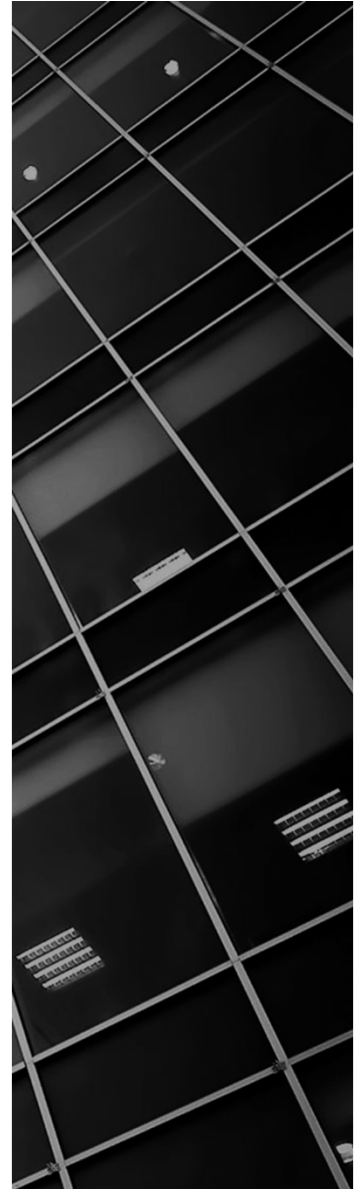
1. Actual and Allowed LPD
2. Complete Building Method
3. Area Category Method
4. Tailored Method
5. Reduced Wattage Method for Alterations

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)

Type of Control	Type of Area	Factor
<p>a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2.</p> <p>b. Only one PAF may be used for each qualifying luminaire unless stated below.</p> <p>c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.</p>		
Daylighting Continuous Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone or secondary sidelit daylit zone.	0.10
Occupant Sensing Controls in Offices Larger than 250 ft²	One sensor controlling an area that is:	No larger than 125 ft ²
		From 126 to 250 ft ²
Institutional Tuning	Luminaires in non-daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10
	Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
Demand Responsive Control	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.	0.05
Clerestory Fenestration	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
Horizontal Slats	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.	0.05
Light Shelves	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.	0.10

Based on Table 140.6-A in the Energy Code



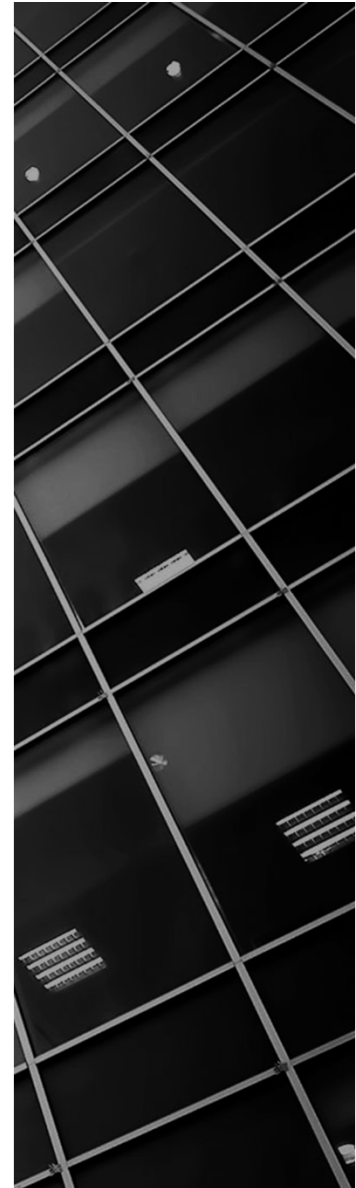
ACTUAL LIGHTING POWER: REDUCTION THROUGH CONTROLS

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.

$(\text{Controlled W}) \times (\text{PAF from 140.6-A}) =$
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:

$(100\text{W}) \times (0.2) = 20\text{W}$ 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

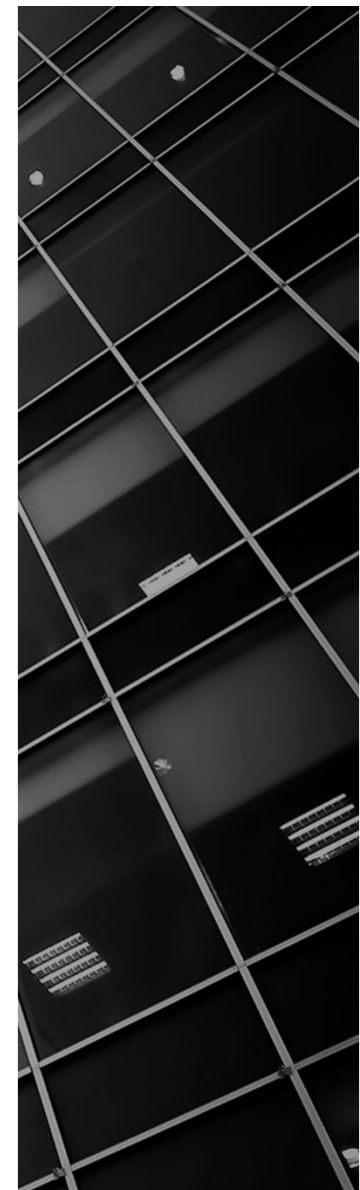
Section 140.6(a)3



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

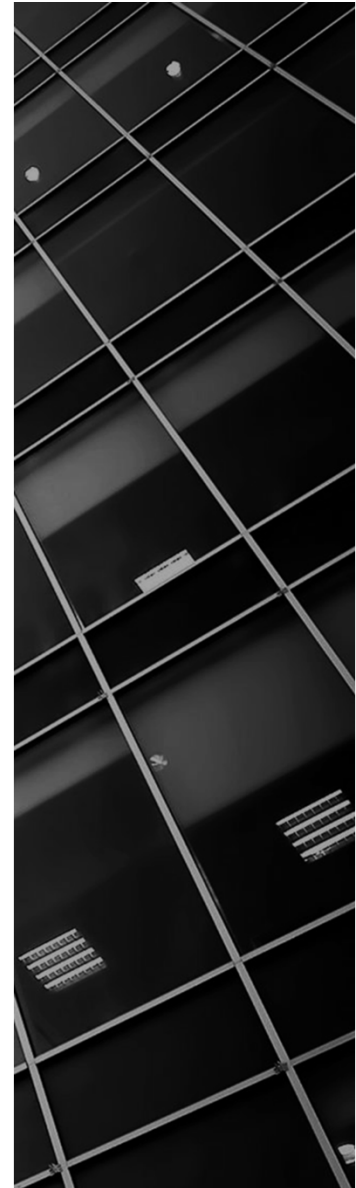


ALLOWED LIGHTING POWER

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



Photo: Finelite



Photo: Tech Lighting



LIGHTING POWER DENSITY VALUES

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

Primary Function Area		Allowed Lighting Power Density for General Lighting (W/ft²)	Additional Lighting Power¹	
			Qualified Lighting Systems	Additional Allowance (W/ft², unless noted otherwise)
Aging Eye/ Low-vision¹¹	Corridor Area	0.70	Decorative or Display	0.30
	Dining	0.80	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Lobby, Main Entry	0.85	Decorative or Display	0.30
			Transition Lighting OFF at night¹²	0.95
			Tunable white or dim-to-warm¹⁰	0.10
	Lounge or Waiting Area	0.80	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Multipurpose Room	0.85	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Religious Worship Area	1.00	Decorative or Display	0.30
			Tunable white or dim-to-warm¹⁰	0.10
	Restroom	1.00	Decorative or Display	0.20
	Stairwell	0.80	Decorative or Display	0.30



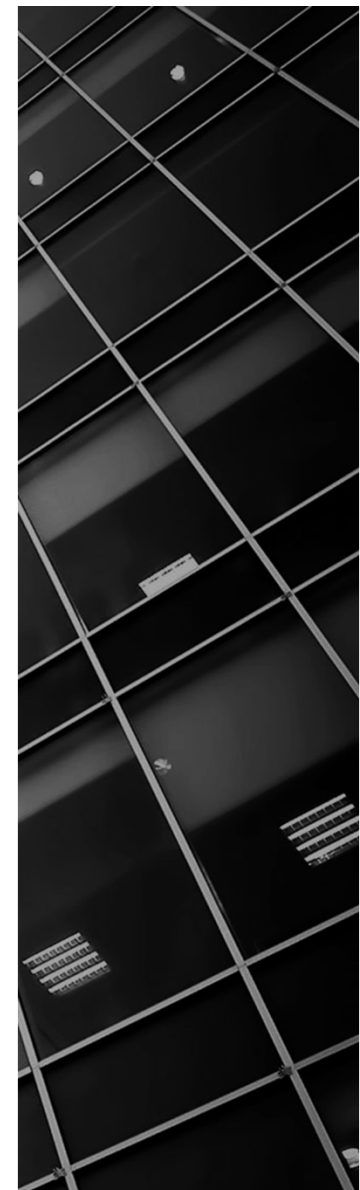


PREScriptive APPROACH IN PRACTICE

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:

www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

NRCC-LTI-E:
 Indoor Lighting

STATE OF CALIFORNIA
 CALIFORNIA ENERGY COMMISSION
 NRCC-LTI-E

CERTIFICATE OF COMPLIANCE

This document is used to demonstrate compliance with requirements in 110.9, 110.12(c), 130.0, 130.1, 140.6 and 141.0(b)(2) for indoor lighting scopes using the prescriptive path for nonresidential and hotel/motel occupancies. It is also used to document compliance with requirements in 160.5, 170.2(e) and 180.2(b)(4) for indoor lighting scopes using the prescriptive path for multifamily occupancies. Multifamily includes dormitory and senior living facilities.

Project Name: J.S.H. Associates Report Page: (Page 1 of 13)
 Project Address: Date Prepared: 2023-01-31T16:37:05-05:00

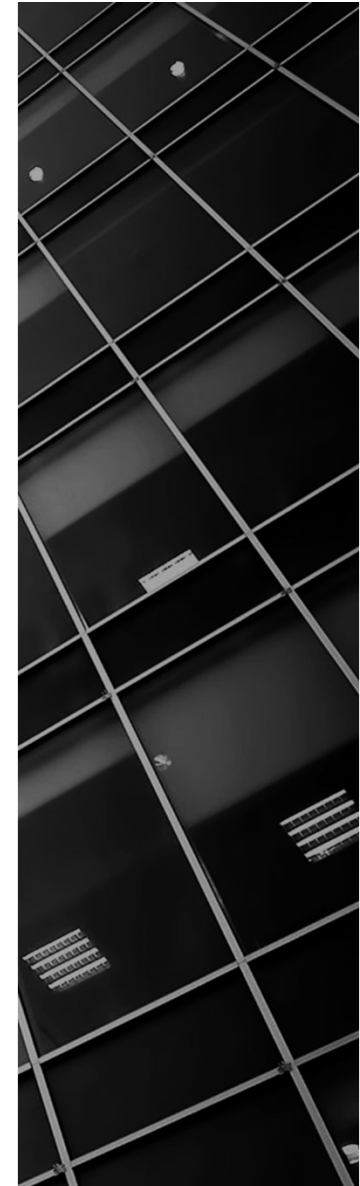
A. GENERAL INFORMATION				
01 Project Location (city)	Sacramento	04 Total Conditioned Floor Area (ft ²)	1,860	
02 Climate Zone	12	05 Total Unconditioned Floor Area (ft ²)	0	
03 Occupancy Types Within Project (select all that apply):		06 # of Stories (Habitable Above Grade)	1	
• Office				

B. PROJECT SCOPE				
This table includes any lighting systems that are within the scope of the permit application and are demonstrating compliance using the prescriptive path outlined in 140.6 / 170.2(e) or 141.0(b)(2) / 180.2(b)(4) for alterations.				
Scope of Work	Conditioned Spaces		Unconditioned Spaces	
01	02	03	04	05
My Project Consists of (check all that apply):	Calculation Method	Area (ft ²)	Calculation Method	Area (ft ²)
<input checked="" type="checkbox"/> New Lighting System	Area Category Method	1860	N/A	0
<input type="checkbox"/> New Lighting System - Parking Garage	N/A	0	N/A	0
Total Area of Work (ft²)	1860			

Registration Number: CA Building Energy Efficiency Standards - 2022 Nonresidential Compliance
 Generated Date/Time: Report Version: 2022.0.000
 Schema Version: rev 20230101

Documentation Software: Energy Code Act
 Compliance ID: 86618-0123-0003
 Report Generated: 2023-01-31 13:37:03

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.





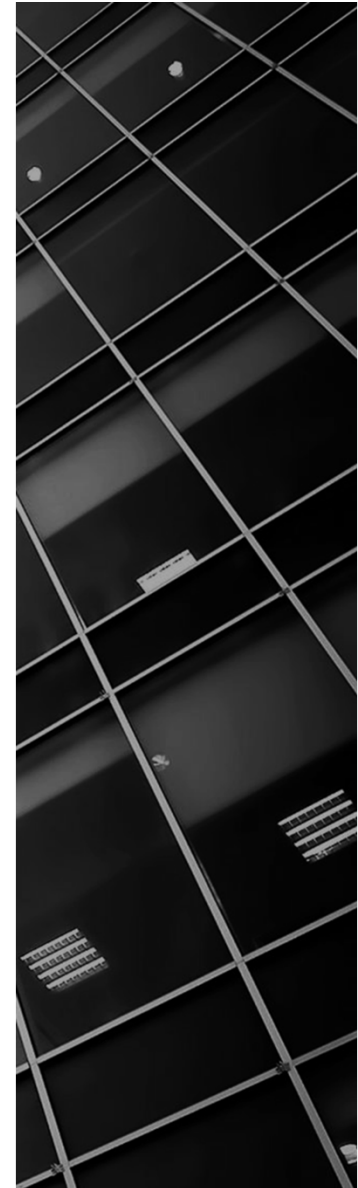
J.S.H. ASSOCIATES

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

Office Information

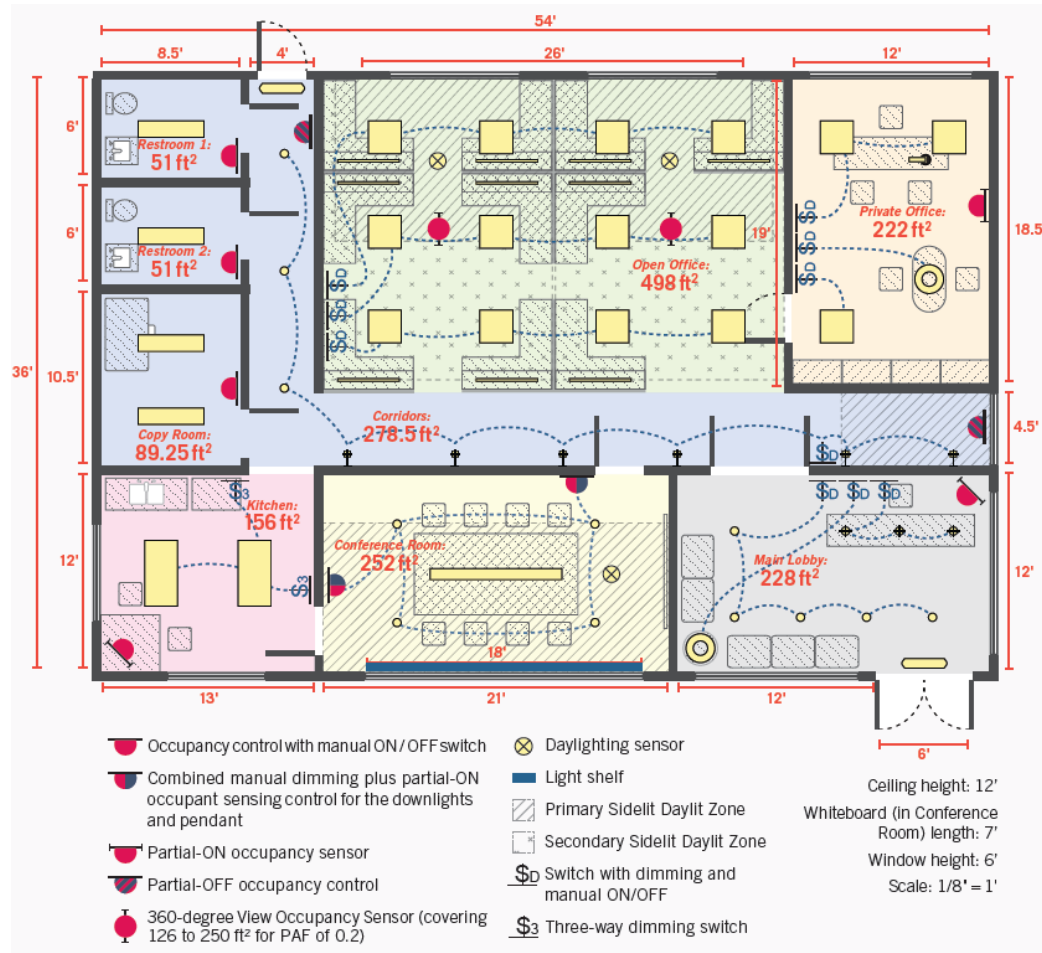
- Open Office: 498 ft²
- Private Office: 222 ft²
- Conference Room: 252 ft²
- Main Lobby: 228 ft²
- Kitchen: 156 ft²
- Corridors: 278.5 ft²
- Restroom 1: 51 ft²
- Restroom 2: 51 ft²
- Copy Room: 89.25 ft²

Total: 1,826 square feet






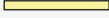










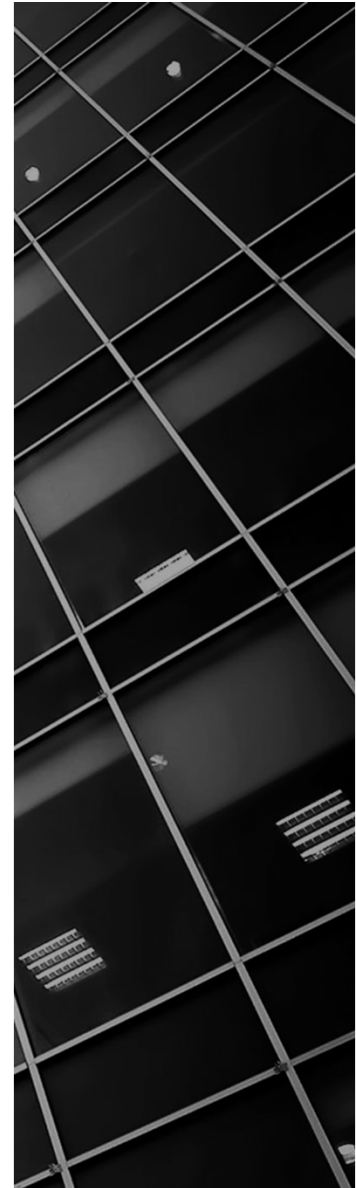
J.S.H. ASSOCIATES FLOOR PLAN





INDOOR LIGHTING SCHEDULE

LIGHTING SCHEDULE						
Name	Symbol	Luminaire	Quantity	System Wattage	Total Watts	Efficacy (lm/W)
1		2 x 2 LED RECESSED TROFFER Cree CR22	15	35	525	90-100
2		1 x 4 1-LAMP FLUORESCENT RECESSED TROFFER Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast	4	28	112	89
3		2 x 4 2-LAMP FLUORESCENT RECESSED TROFFER Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast	2	54	108	89
4		8' LED SUSPENDED LUMINAIRE Visa Limesse	1	85	85	84
5		6" LED RECESSED DOWNLIGHT Cree CR6	12	12	144	90
6		LED WALL SCENCE Tech Lighting Mura	6	8	48	50
7		LED PENDANT Philips Vetro	3	10	30	76
8		LED SUSPENDED LUMINAIRE Philips Ledino Cinta Suspension Light	2	22.5	45	100
11		LED EXIT SIGN Ciata Lighting Exit Sign and Emergency Lights	2	2	Exempt per §140.6(a)3	100
TOTAL INSTALLED LIGHTING WATTS:					1,097 W	
PORTABLE LIGHTING						
9		45" LED UNDERCABINET TASK LIGHTING Finelite Edge Undercabinet	10	12.2	122	62.2
10		LED TASK LIGHT Koncept Z Bar Mini Task Light	1	6.5	6.5	—
TOTAL PORTABLE LIGHTING WATTS					128.5 W	
DAYLIGHTING DEVICES						
N/A		LIGHT SHELF Architectural Grilles & Sunshades (AGS)	1	—	—	—
TOTAL WATTS:					1,225.5W	



AREA CATEGORY METHOD



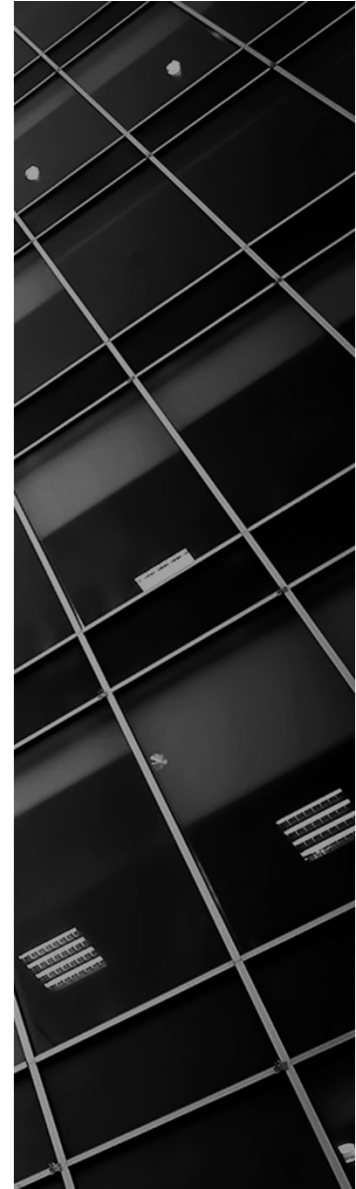


PROJECT SCOPE

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.

B. PROJECT SCOPE				
<i>This table includes any lighting systems that are within the scope of the permit application and are demonstrating compliance using the prescriptive path outlined in 140.6 / 170.2(e) or 141.0(b)2 / 180.2(b)4 for alterations.</i>				
Scope of Work	Conditioned Spaces		Unconditioned Spaces	
01	02	03	04	05
My Project Consists of (check all that apply):	Calculation Method	Area (ft ²)	Calculation Method	Area (ft ²)
<input checked="" type="checkbox"/> New Lighting System	Area Category Method	1826	N/A	0
<input type="checkbox"/> New Lighting System - Parking Garage	N/A	0	N/A	0
Total Area of Work (ft²)	1826			



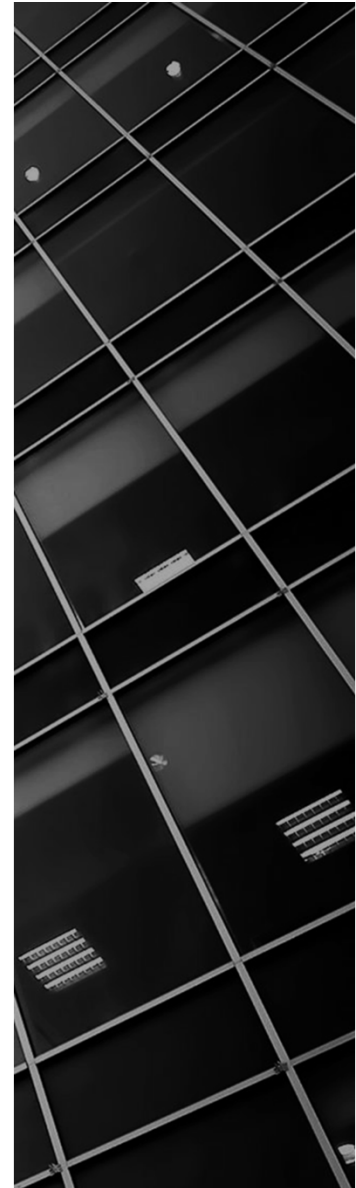


COMPLIANCE RESULTS

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.

	Allowed Lighting Power per §140.6(b)/§170.2(e) (Watts)					Adjusted Lighting Power per §140.6(a)/§170.2(e) (Watts)			Compliance Results
	01	02	03	04	05	06	07	08	09
	Complete Building §140.6(c)1 (See Table I)	Area Category §140.6(c)2/ §170.2(e)4 (See Table I)	Area Category Additional §140.6(c)2G/ §170.2(e)4Av (+) (See Table J)	Tailored §140.6(c)3/ §170.2(e)4B (+) (See Table K)	Total Allowed (Watts)	Total Designed (Watts) (See Table F)	Adjustments PAF Lighting Control Credits §140.6(a)2/ §170.2(e)1B (-) (See Table P)	Total Adjusted (Watts) *Includes Adjustments	05 Must be >= 08 §140.6/§170.2(e)
Conditioned:									
Unconditioned:									
Controls Compliance (See Table H for Details)								COMPLIES with Exceptional Conditions or COMPLIES or DOES NOT COMPLY	
Rated Power Reduction Compliance (See Table Q for Details)								COMPLIES or DOES NOT COMPLY or NOT APPLICABLE	





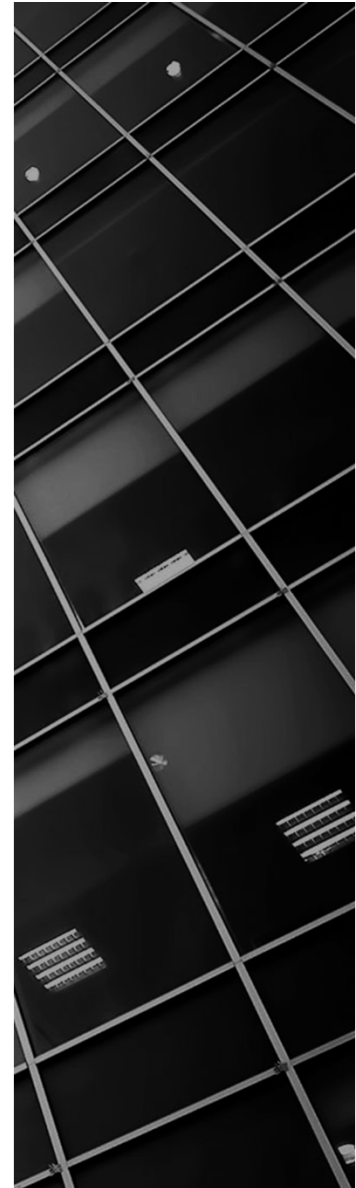
1. INSTALLED LIGHTING POWER

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

F. 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										
01	02	03	04	05	06	07	08	09	10	
Name or Item Tag	Complete Luminaire Description	Modular (Track) Fixture	Small Aperture & Color Change ¹	Watts per luminaire ²	How is Wattage determined	Total Number of Luminaires	Excluded per 140.6(a)3 / 170.2(e)2C	Design Watts	Field Inspector	
									Pass	Fail
2x2 LED RECESSED TROFFER	Cree CR22	No	NA	35	Mfr. Spec	15	No	525	<input type="checkbox"/>	<input type="checkbox"/>
1 x 4 1-LAMP FLUORESCENT RECESSED TROFFER	Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast	No	NA	28	Mfr. Spec	4	No	112	<input type="checkbox"/>	<input type="checkbox"/>
2 x 4 2-LAMP FLUORESCENT RECESSED TROFFER	Finelite HPR with Sylvania 32W T8 lamp; Sylvania Quicktronic Ballast	No	NA	54	Mfr. Spec	2	No	108	<input type="checkbox"/>	<input type="checkbox"/>
8' LED SUSPENDED LUMINAIRE	Visa Linese	No	NA	85	Mfr. Spec	1	No	85	<input type="checkbox"/>	<input type="checkbox"/>
6" LED RECESSED DOWNLIGHT	Cree CR6	No	NA	12	Mfr. Spec	12	No	144	<input type="checkbox"/>	<input type="checkbox"/>
LED WALL SCNCE	Tech Lighting Mura	No	NA	8	Mfr. Spec	6	No	48	<input type="checkbox"/>	<input type="checkbox"/>
LED PENDANT	Philips Vetro	No	NA	10	Mfr. Spec	3	No	30	<input type="checkbox"/>	<input type="checkbox"/>
LED SUSPENDED LUMINAIRE	Philips Ledino Cinta Suspension Light	No	NA	22.5	Mfr. Spec	2	No	45	<input type="checkbox"/>	<input type="checkbox"/>
LED EXIT SIGN	Ciata Lighting Exit Sign and Emergency Lights	No	NA	2	Mfr. Spec	2	Exempt	---	<input type="checkbox"/>	<input type="checkbox"/>
45" LED UNDERCABINET TASK LIGHTING	Finelite Edge Undercabinet	No	NA	12.2	Mfr. Spec	10	No	122	<input type="checkbox"/>	<input type="checkbox"/>
LED TASK LIGHT	Koncept Z Bar Mini Task Light	No	NA	6.5	Mfr. Spec	1	No	6.5	<input type="checkbox"/>	<input type="checkbox"/>
Total Designed Watts: CONDITIONED SPACES								1,225.5		





COMPLIANCE RESULTS

	Allowed Lighting Power per §140.6(b)/§170.2(e) (Watts)					Adjusted Lighting Power per §140.6(a)/§170.2(e) (Watts)			Compliance Results
	01	02	03	04	05	06	07	08	09
	Complete Building §140.6(c)1	Area Category §140.6(c)2/ §170.2(e)4	Area Category Additional §140.6(c)2G/ §170.2(e)4Av (+)	Tailored §140.6(c)3/ §170.2(e)4B (+)	= Total Allowed (Watts)	≥ Total Designed (Watts)	Adjustments PAF Lighting Control Credits §140.6(a)2/ §170.2(e)1B (-)	= Total Adjusted (Watts) *Includes Adjustments	05 Must be ≥ 08 §140.6/§170.2(e)
	(See Table I)	(See Table I)	(See Table J)	(See Table K)			(See Table F)	(See Table P)	
Conditioned:						1,225.5			
Unconditioned:									
Controls Compliance (See Table H for Details)									COMPLIES with Exceptional Conditions or COMPLIES or DOES NOT COMPLY
Rated Power Reduction Compliance (See Table Q for Details)									COMPLIES or DOES NOT COMPLY or NOT APPLICABLE





2. LIGHTING POWER ALLOWANCE

NRCC-LTI-E: Indoor Lighting

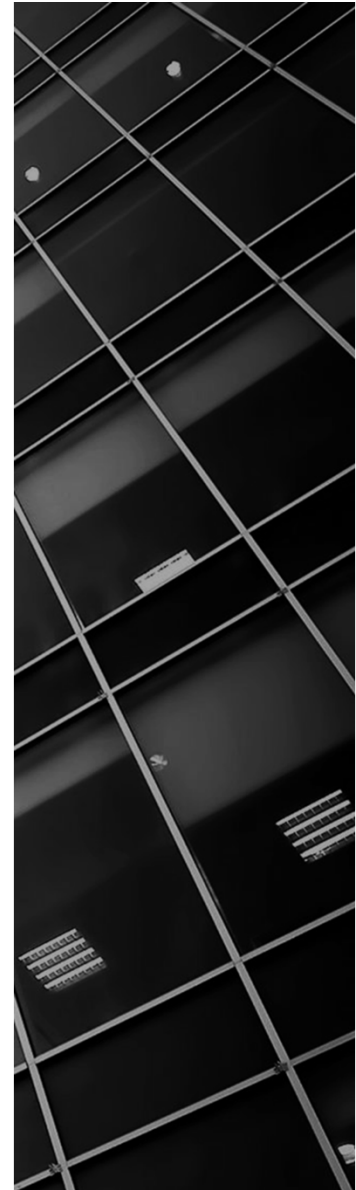
Section I. Lighting Power Allowance for Area Category Methods

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





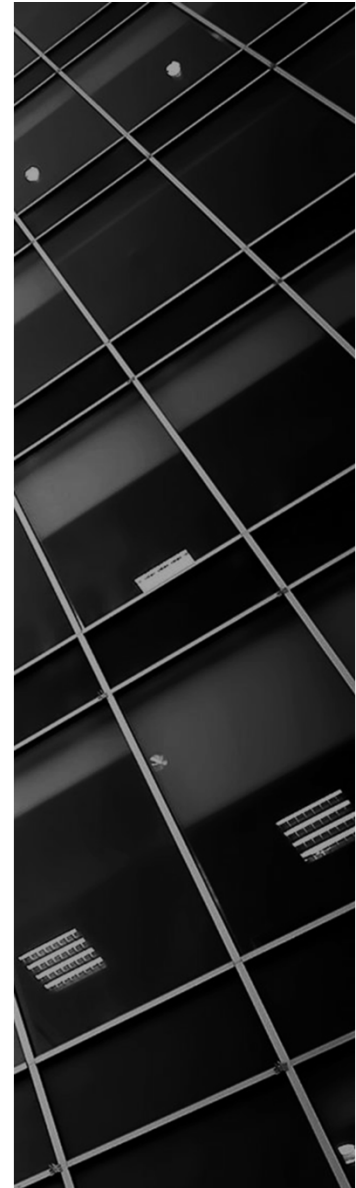
LIGHTING POWER ALLOWANCE: AREA CATEGORY METHOD

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.

Conditioned Spaces

01	02	03	04	05	06	
Area Description	Complete Building or Area Category Primary Function Area	Allowed Density (W/ft ²)	Area (ft ²)	Allowed Wattage (Watts)	Additional Allowance / Adjustment	
					Area Category	PAF
Open Plan Office	Office (>250 square feet)	0.6	498	298.8	Yes	Yes
Private Office	Office (<=250 square feet)	0.65	222	144.3	Yes	No
Conference Room	Convention, Conference, Multipurpose and Meeting Center	0.75	252	189	No	Yes
Main Lobby	Main Entry Lobby	0.7	228	159.6	Yes	No
Kitchen	Kitchen/ Food Preparation	0.95	156	148.19	No	No
Corridors	Corridor	0.4	278.5	111.4	No	No
Restroom #1	Restroom	0.65	51	33.15	No	No
Restroom #2	Restroom	0.65	51	33.15	No	No
Copy Room	Copy Room	0.5	89.25	44.63	No	No
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 I 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

Conditioned Spaces

01	02	03	04	05	06	07	08	09	10
Area Description	Primary Function Area	Applicable Qualifying Lighting System from Table 140.6-C	Allowed Density (W/ft² or W/lf or W/unit)	Ltg Area, Length or ATM/Mirror (ft², lf or #)	Extra Allowance (Watts)	Luminaire Name or Item Tag	Watts per Luminaire	Number of Luminaires	Total Design Watts
Open Plan Office	Office (250 square feet)	PortableOfficeLighting	0.2	498	99.6	45" LED UNDERCABINET TASK LIGHTING	12.2	10	122
Total Design Watts	Calculated Allowance (Watts):	Total Additional Allowance for this area:							
122	99.6	99.6							
Private Office	Office (250 square feet)	PortableOfficeLighting	0.2	222	44.4	LED TASK LIGHT	6.5	1	6.5
Total Design Watts	Calculated Allowance (Watts):	Total Additional Allowance for this area:							
6.5	44.4	6.5							
Main Lobby	Main Entry Lobby	DecorativeDisplay C	0.25	228	57	LED SUSPENDED LUMINAIRE	22.5	1	22.5
Total Design Watts	Calculated Allowance (Watts):	Total Additional Allowance for this area:							
22.5	57	22.5							
11									
Total Additional Allowance (Watts) CONDITIONED SPACES		128.6							





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.

$1,162.23\text{W} + 128.6\text{W} = \mathbf{1,290.83\text{W}}$ total allowed lighting power





COMPLIANCE RESULTS

	Allowed Lighting Power per §140.6(b)/§170.2(e) (Watts)						Adjusted Lighting Power per §140.6(a)/§170.2(e) (Watts)				Compliance Results	
	01	02	03	04	=	05	≥	06	07	=	08	09
	Complete Building §140.6(c)1	Area Category §140.6(c)2/ §170.2(e)4	Area Category Additional §140.6(c)2G/ §170.2(e)4Av (+)	Tailored §140.6(c)3/ §170.2(e)4B (+)				Total Designed (Watts)	Adjustments		Total Adjusted (Watts) *Includes Adjustments	05 Must be >= 08 §140.6/§170.2(e)
									PAF Lighting Control Credits §140.6(a)2/ §170.2(e)1B (-)			
									(See Table I)			
Conditioned:		1,162.23	128.6		1,290.83		1,225.5					
Unconditioned:												
Controls Compliance (See Table H for Details)											COMPLIES with Exceptional Conditions or COMPLIES or DOES NOT COMPLY	
Rated Power Reduction Compliance (See Table Q for Details)											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).

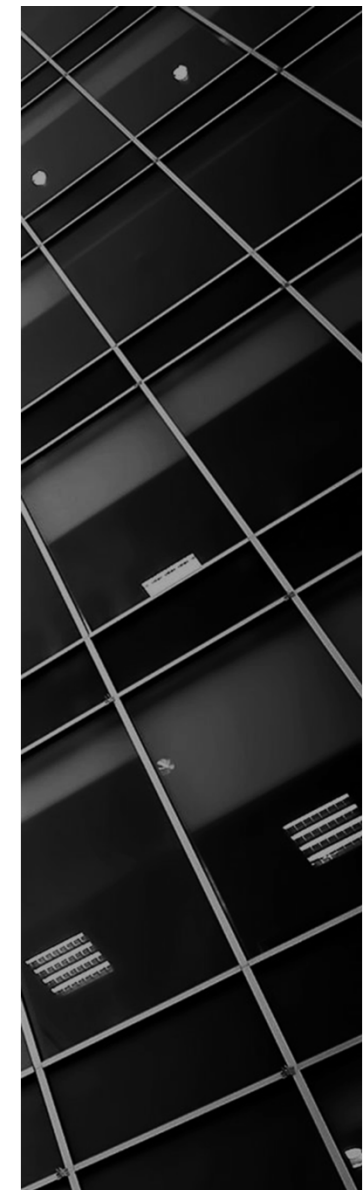
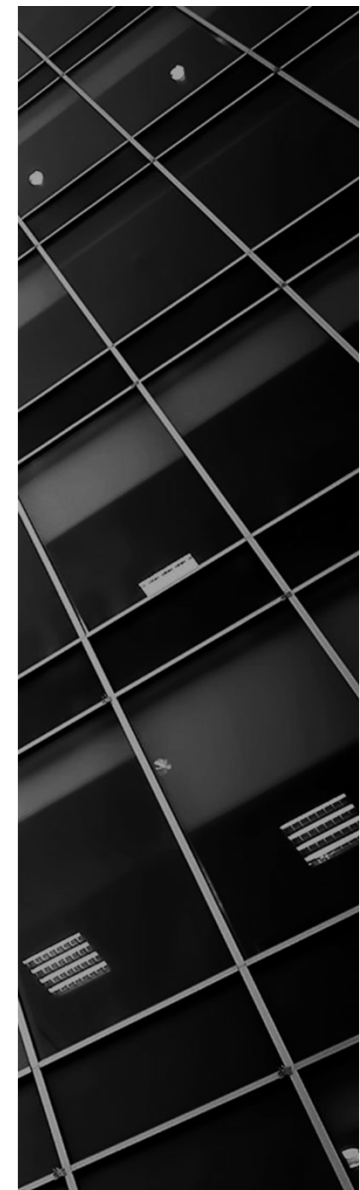


Table 140.6-A: Lighting Power Adjustment Factors (PAF)

Type of Control	Type of Area	Factor
<p>a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2.</p> <p>b. Only one PAF may be used for each qualifying luminaire unless stated below.</p> <p>c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.</p>		
Daylighting Continuous Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone or secondary sidelit daylit zone.	0.10
Occupant Sensing Controls in Offices Larger than 250 ft²	One sensor controlling an area that is:	No larger than 125 ft ²
		From 126 to 250 ft ²
Institutional Tuning	Luminaires in non-daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10
	Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
Demand Responsive Control	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.	0.05
Clerestory Fenestration	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
Horizontal Slats	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.	0.05
Light Shelves	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.	0.10

Based on Table 140.6-A in the Energy Code





P. ADDITIONAL LIGHTING ALLOWANCE: LIGHTING CONTROL CREDIT (POWER ADJUSTMENT FACTOR (PAF))

P. POWER ADJUSTMENT: 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)2 / 170.2(e)2B.														
Conditioned Spaces														
01	02									03	04	05	06	07
Area Description	PAF per 140.6(a)2 / 170.2(e)2B ¹ (*Can be used in conjunction with other PAF'S)									Luminaires Controlled for PAF Credit				Additional Control Credit Allowance (Watts)
	1	2A	2B	3A*	3B*	4*	5*	6*	7*	Luminaire Name or Item Tag	Luminaire Design Watts	Number of Luminaires	Lighting Controlled (Watts)	
				Pick up to onePick up to one		Pick up to one ² Pick up to one ²								
Open Plan Office	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2x2 LED RECESSED TROFFER	35	12	420	84
Conference Room	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8' LED SUSPENDED LUMINAIRE	85	1	85	8.5
Conference Room	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	6" LED RECESSED DOWNLIGHT	12	4	48	4.8
08										09				
<input checked="" type="checkbox"/>	All spaces applying PAF 5, 6 or 7 include a daylight design meeting requirements in 140.3(d). See Table S.									Total Power Adjustment (Watts) CONDITIONED SPACES:				97.3
¹ FOOTNOTES: PAFs outlined in Table 140.6-A /170.2-L include 1) Daylight continuous dimming plus OFF; 2A) Occupant sensors in offices with one sensor per <= 125 ft ² ; 2B) Occupant sensors in offices with one sensor per 126 - 250 ft ² ; 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

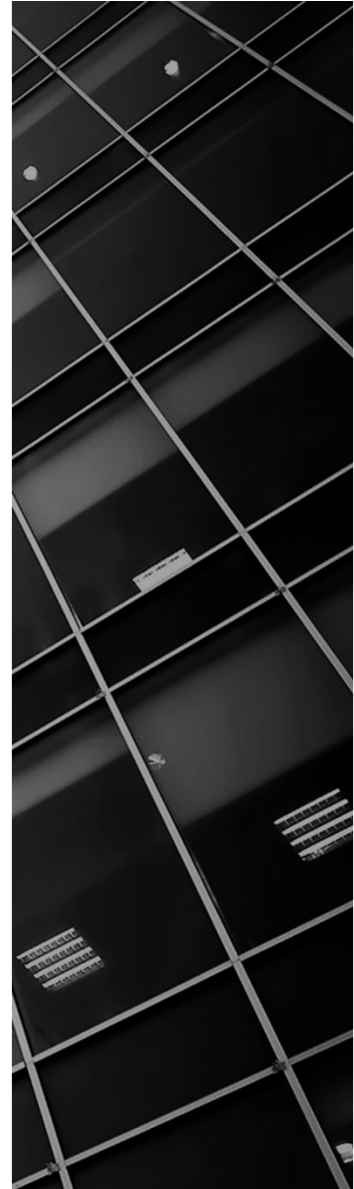
Required Forms:

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.

$1,225.5\text{W} - 97.3\text{W} = \mathbf{1,128.2\text{W}}$ 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)

C. COMPLIANCE RESULTS									
If any cell on this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D. for guidance.									
Lighting in conditioned and unconditioned spaces must not be combined for compliance per 140.6(b)1 / 170.2(e)	Allowed Lighting Power per 140.6(b) / 170.2(e) (Watts)					Adjusted Lighting Power per 140.6(a) / 170.2(e) (Watts)			Compliance Results
	01	02	03	04	05	06	07	08	09
	Complete Building 140.6(c)1	Area Category 140.6(c)2 / 170.2(e)4	Area Category Additional 140.6(c)2G / 170.2(e)4Av (+)	Tailored 140.6(c)3 / 170.2(e)4B (+)	Total Allowed (Watts)	Total Designed (Watts)	Adjustments PAF Lighting Control Credits 140.6(a)2 / 170.2(e)1B (-)	Total Adjusted (Watts) *Includes Adjustments	05 must be >= 08 140.6 / 170.2(e)
	(See Table I)	(See Table I)	(See Table J)	(See Table K)		(See Table F)	(See Table P)		
Conditioned		1,162.23	128.6		= 1,290.83	≥ 1,225.5	97.3	= 1128.2	COMPLIES
Unconditioned					=	≥		=	
Controls Compliance (See Table H for Details)									COMPLIES
Rated Power Reduction Compliance (See Table Q for Details)									

✓ Our lighting plan is compliant.



COMPLETE BUILDING METHOD

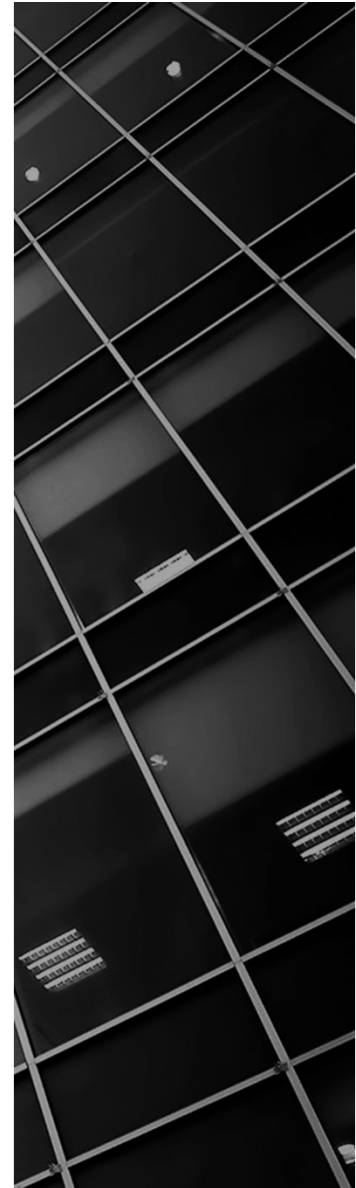


COMPLETE BUILDING METHOD

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.

$(\text{Table 140.6-B}) \times (\text{floor area of entire building}) = \text{Allowed Lighting Power}$





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)

Type of Building	Allowed Lighting Power
Assembly Building	0.65
Bank or Financial Institution Building	0.65
Grocery Store Building	0.90
Gymnasium Building	0.60
Healthcare Facility	0.90
Industrial or Manufacturing Facility Building	0.60
Library Building	0.70
Motion Picture Theater Building	0.60
Museum Building	0.65
Office Building	0.60
Parking Garage Building	0.13
Performing Arts Theater Building	0.75
Religious Facility Building	0.70
Restaurant Building	0.65
Retail Store Building	0.9
School Building	0.60
Sports Arena Building	0.75
All other buildings	0.4





COMPLIANCE RESULTS

Required Forms:
NRCC-LTI-E: Indoor Lighting
C. Compliance Results

C. COMPLIANCE RESULTS												
If any cell on this table says "DOES NOT COMPLY" or "COMPLIES with Exceptional Conditions" refer to Table D. for guidance.												
Lighting in conditioned and unconditioned spaces must not be combined for compliance per 140.6(b)1 / 170.2(e)	Allowed Lighting Power per 140.6(b) / 170.2(e) (Watts)					≥	Adjusted Lighting Power per 140.6(a) / 170.2(e) (Watts)			Compliance Results		
	01	02	03	04	=		05	06	07	=	08	09
	Complete Building 140.6(c)1	Area Category 140.6(c)2 / 170.2(e)4	Area Category Additional 140.6(c)2G / 170.2(e)4Av (+)	Tailored 140.6(c)3 / 170.2(e)4B (+)			Total Allowed (Watts)	Total Designed (Watts)	Adjustments		Total Adjusted (Watts) *Includes Adjustments	
									PAF Lighting Control Credits 140.6(a)2 / 170.2(e)1B (-)			
(See Table I)	(See Table I)	(See Table J)	(See Table K)	(See Table F)	(See Table P)							
Conditioned	1,095.45				=	1,095.45	≥	1,225.5	97.3	=	1128.2	DOES NOT COMPLY
Unconditioned					=		≥			=		
Controls Compliance (See Table H for Details)											COMPLIES	
Rated Power Reduction Compliance (See Table Q for Details)												

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.

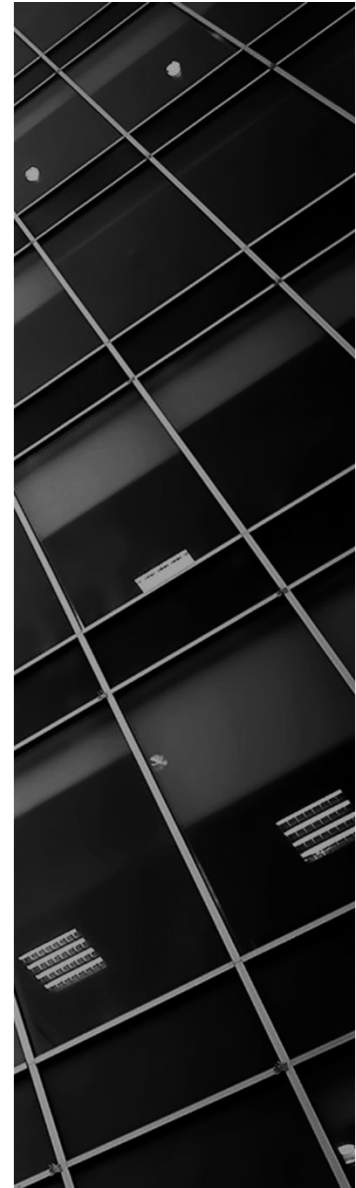


TAILORED METHOD ALLOWANCES

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.



ADDITIONS AND ALTERATIONS

Greater than or equal to 50% replaced	Mandatory Controls §130.0, 130.2, 130.4 + Prescriptive Requirements LPD allowances of §140.7 <i>(Or meet reduced power requirement!)</i>
Greater than or equal to 10% replaced	Mandatory Controls §130.0, 130.2, 130.4
Less than 10% replaced or less than 5 luminaires replaced	No measures required

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.

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

Uplight 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.

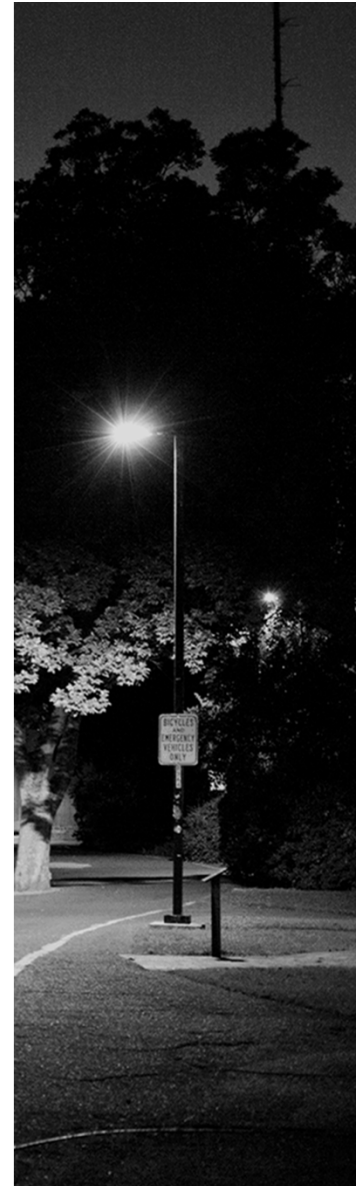
Uplight

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

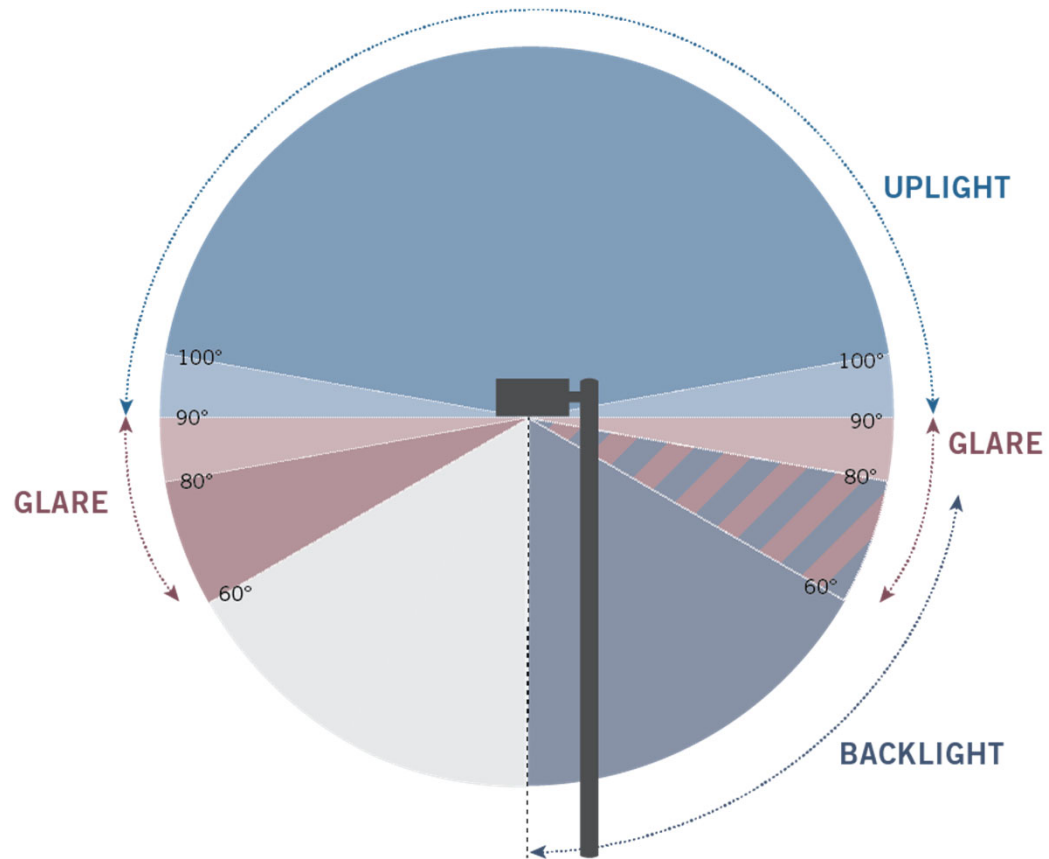
Glare

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)



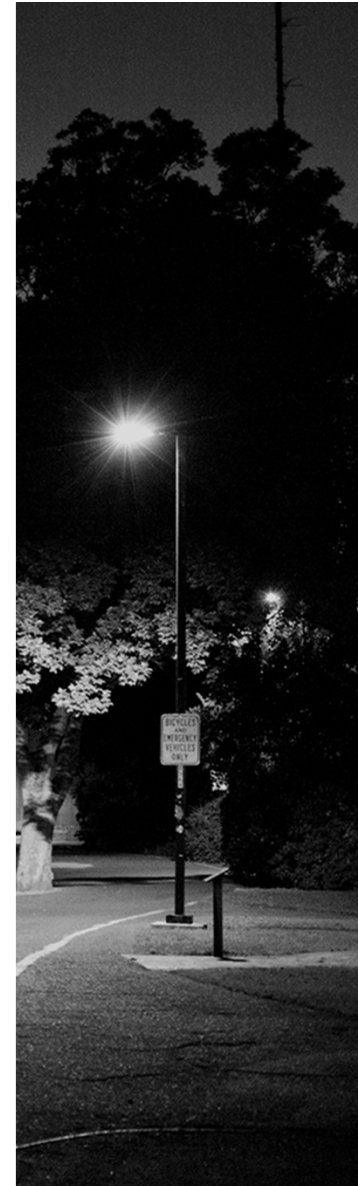
LUMINAIRES THAT MUST COMPLY WITH BUG REQUIREMENTS

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)



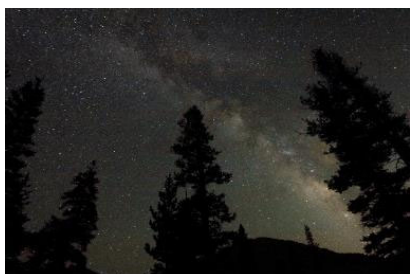
LIGHTING ZONES



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.

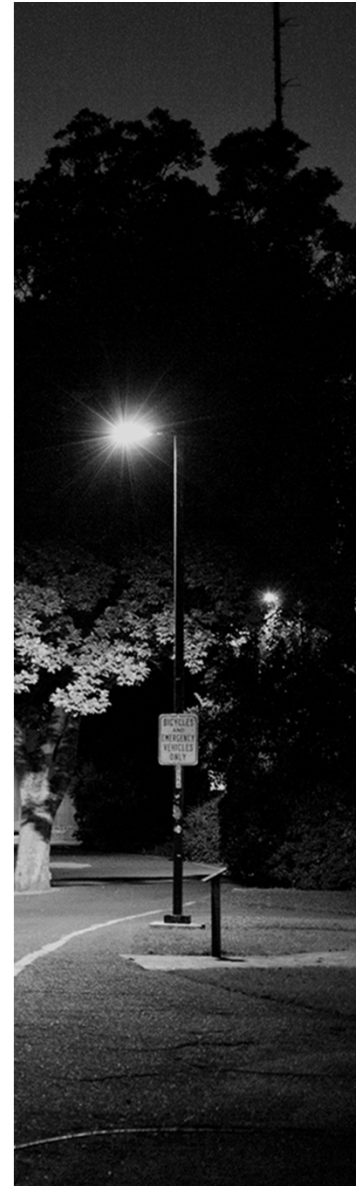


BUG RATINGS AND REQUIREMENTS

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.

A list of BUG ratings and tables can be found on the IES website:
www.ies.org/wp-content/uploads/2017/03/TM-15-11BUGRatingsAddendum.pdf.

Section 130.2(b)



BUG RATINGS AND REQUIREMENTS

Backlight Ratings (Maximum Zonal Lumens)

Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ0 (B0)	LZ1 (B1)	LZ2 (B2)	LZ3 (B3)	LZ4 (B4)
Backlight High (BH) 60 to 80 degrees	110	500	1,000	2,500	5,000
Backlight Medium (BM) 30 to < 60 degrees	220	1,000	2,500	5,000	8,500
Backlight Low (BL) 0 to < 30 degrees	110	500	1,000	2,500	5,000

Uplight Ratings (Maximum Zonal Lumens)

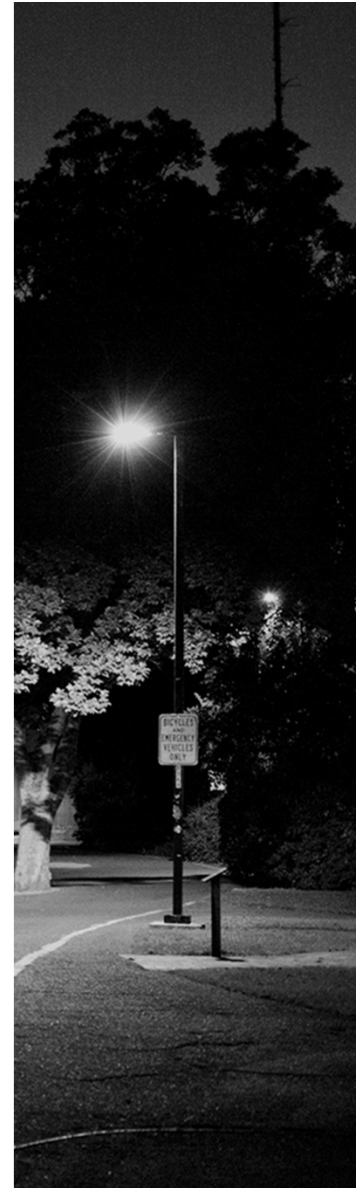
Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ0 (U0)	LZ1 (U1)	LZ2 (U2)	LZ3 (U3)	LZ4 (U4)
Uplight High (UH) 100 to 180 degrees	0	10	50	500	1,000
Uplight Low (UL) 90 to < 100 degrees	0	10	50	500	1,000



BUG RATINGS AND REQUIREMENTS

Glare Ratings (Maximum Zonal Lumens)

GLARE RATING FOR ASYMMETRICAL LUMINAIRE TYPES (TYPE I, TYPE II, TYPE III, TYPE IV)					
Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ0 (G0)	LZ1 (G1)	LZ2 (G2)	LZ3 (G3)	LZ4 (G4)
Forward Very High (FVH) 80 to 90 degrees	10	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	10	100	225	500	750
Forward High (FH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to < 80 degrees	110	500	1,000	2,500	5,000
GLARE RATING FOR QUADRILATERAL SYMMETRICAL LUMINAIRE TYPES (TYPE V, TYPE V SQUARE)					
Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ0 (G0)	LZ1 (G1)	LZ2 (G2)	LZ3 (G3)	LZ4 (G4)
Forward Very High (FVH) 80 to 90 degrees	10	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	10	100	225	500	750
Forward High (FH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000



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.

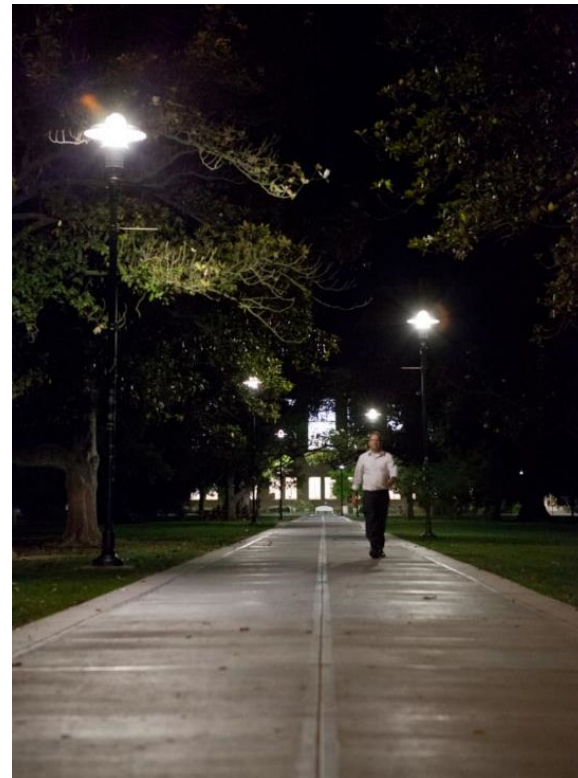
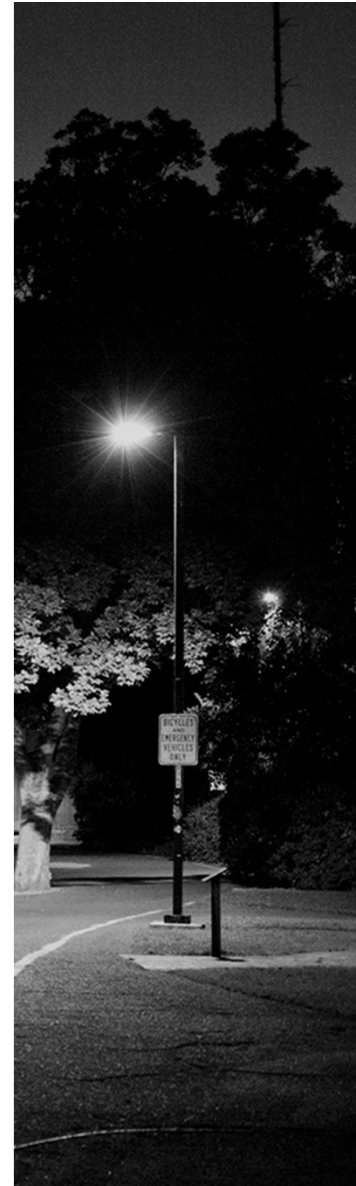


Photo: Smart Lighting Initiative, UC Davis



LUMINAIRES MOUNTED 24 FEET AND BELOW

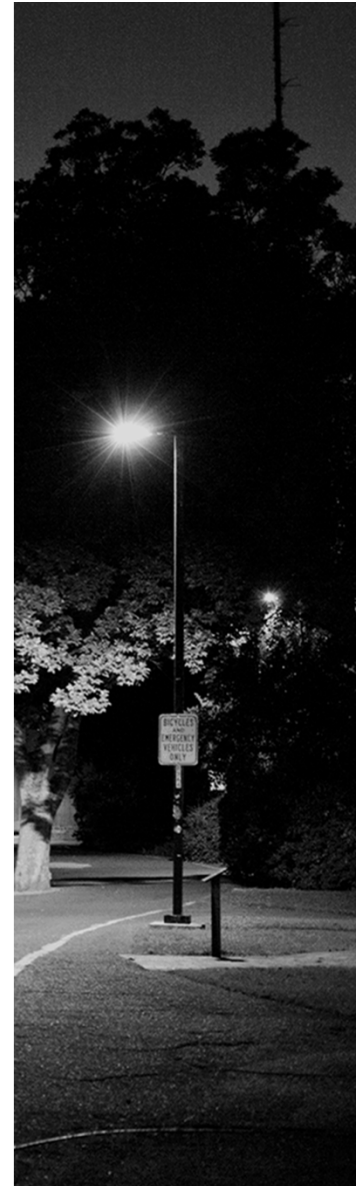
Where the bottom of a luminaire is mounted at 24 feet above grade or lower, the following automatic lighting controls are required:

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.
6. Lighting of public monuments.
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)



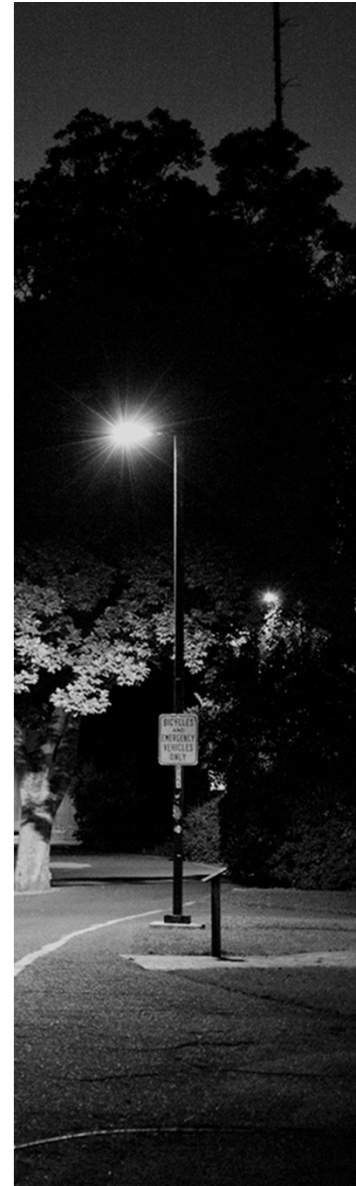
LUMINAIRES MOUNTED 24 FEET AND BELOW

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.



Section 130.2(c)



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).

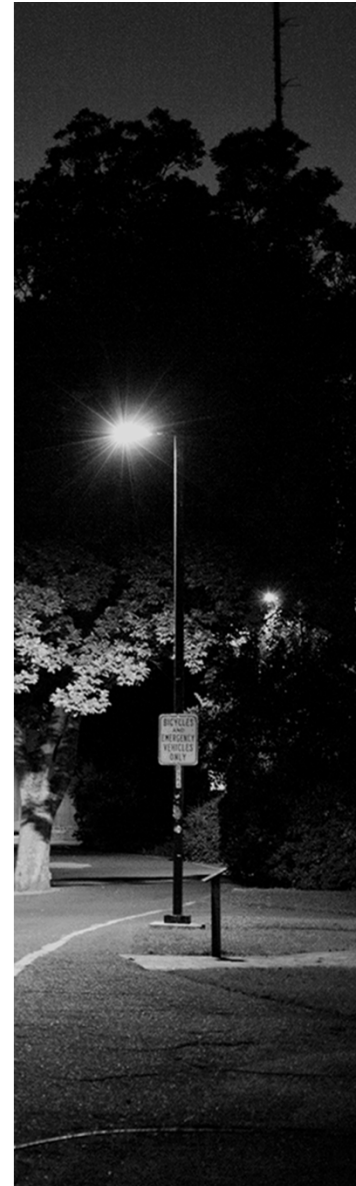


LIGHTING POWER ALLOWANCES

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

Type of Power Allowance	Lighting Zone 0 ³	Lighting Zone 1 ³	Lighting Zone 2 ³	Lighting Zone 3 ³	Lighting Zone 4 ³
Area Wattage Allowance (AWA)	No allowance ¹	0.016 W/ft ²	0.019 W/ft ²	0.021 W/ft ²	0.024 W/ft ²
Linear Wattage Allowance (LWA)		0.13 W/lf	0.15 W/lf	0.20 W/lf	0.29 W/lf
Initial Wattage Allowance (IWA)		150W	200W	250W	320W

¹ 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).

² Reserved.

³ 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

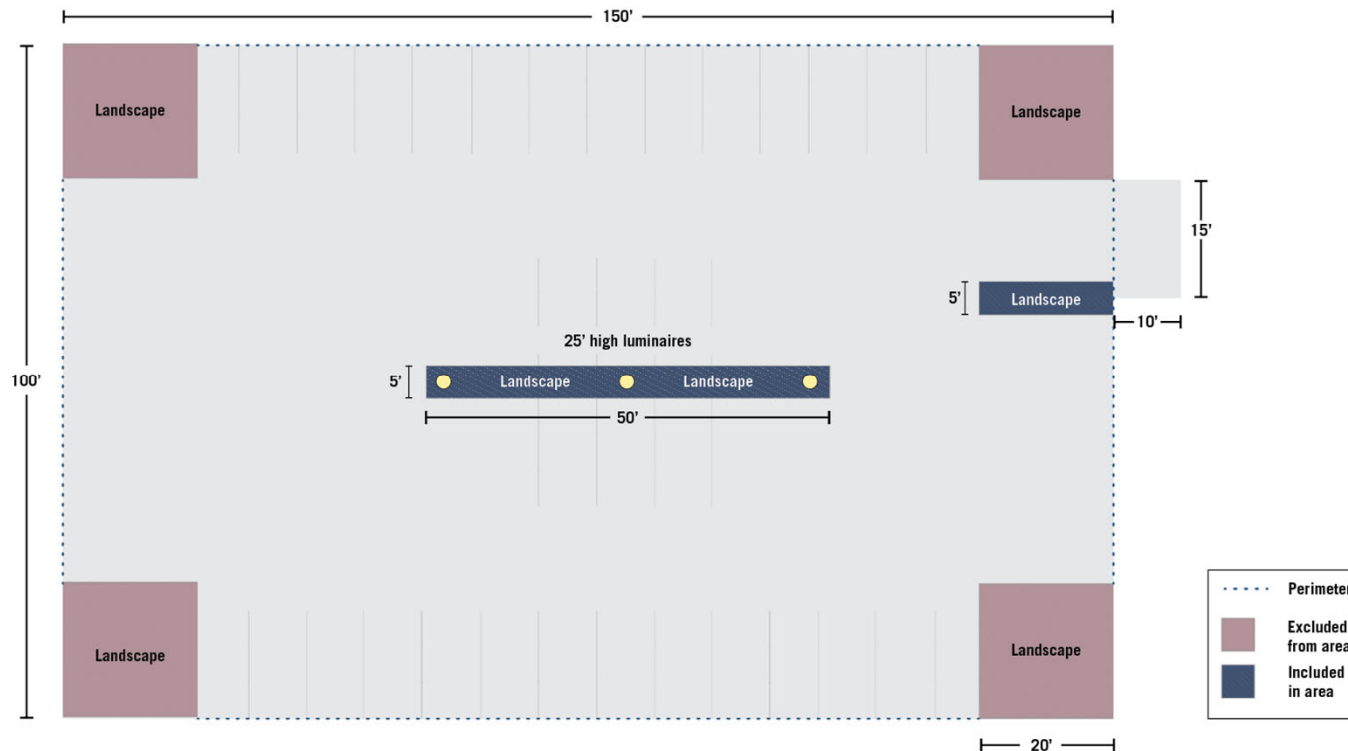
Planters and small landscape areas are included within the general hardscape area as long as the width or length of the inclusion is less than 10 feet, and the inclusion is bordered on at least three sides.

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

F. OUTDOOR LIGHTING FIXTURE SCHEDULE

For new or altered lighting systems demonstrating compliance with 140.7 / 170.2(e)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)2L only new luminaires being installed and replacement luminaires being installed as part of the project scope are included (ie, 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 H. and are not included here. All other multifamily outdoor lighting is included here.

Designed Wattage:

01	02		03	04	05	06	07	08	09	10	
Name or Item Tag	Complete Luminaire Description		Watts per luminaire ^{1, 2}	How is Wattage determined	Total Number Luminaires ²	Luminaire Status ³	Excluded per 140.7(a) / 170.2(e)6A	Design Watts	Cutoff Req. > 6,200 initial lumen output 130.2(b) / 160.5(c)1 ⁴	Field Inspector	
										Pass	Fail
200 W LED	29,000 lm output	<input type="checkbox"/> Linear	200	Mfr. Spec	3	New	<input type="checkbox"/>	600	Provided	<input type="checkbox"/>	<input type="checkbox"/>
Total Design Watts:								600			

* NOTES: Selections with a * require a note in the space below explaining how compliance is achieved.

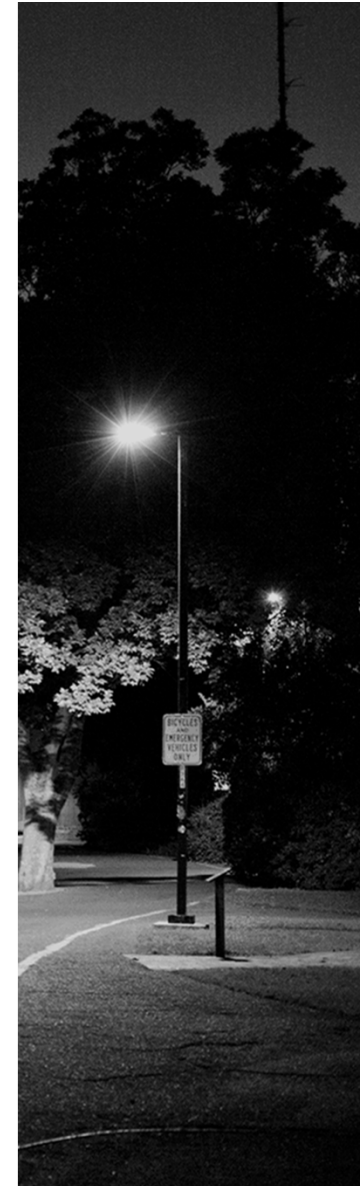
EX: Luminaire is lighting a statue; EXCEPTION 2 to 130.2(b)

¹ FOOTNOTES: Authority Having Jurisdiction may ask for Luminaire cut sheets to confirm wattage used for compliance per 130.0(c) / 160.5(b)

² For linear luminaires, wattage should be indicated as W/lf instead of Watts/luminaire. Total linear feet should be indicated in column 05 instead of number of luminaires.

³ 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.

⁴ 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 $\geq 6,200$ 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.

01	02	03	04	05	06	07	08	09	10	11	12	
Name or Item Tag	Complete Luminaire Description	Backlight Rating ²			Uplight Rating ²			Glare Rating (Lumens) ²			Field Inspector	
		Mounting Height ¹	Max Allowable Backlight Rating ³	Backlight Rating Per Design	Lighting type	Max Allowable Uplight Rating ³	Uplight Rating Per Design	Mounting Height ¹	Max Allowable Glare Rating ³	Glare Rating Per Design	Pass	Fail
200 W LED	29,000 lm output	Back hemisphere is 1 - 2 MH from prop line	B4	B3	Area Lighting	U0	U0	Front hemisphere is 1 - 2 MH from prop line	G1	G1	<input type="checkbox"/>	<input type="checkbox"/>

¹FOOTNOTES: Mounting Height is labeled MH in this table.

² Authority 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)

³ BUG 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 (ie 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

Mandatory Controls for Nonresidential Occupancies, Parking Garages & Common Areas in Multifamily Buildings

01	02	03	04	05
Area Description	Shut-Off 130.2(c)1 / 160.5(c)	Auto-Schedule 130.2(c)2 / 160.5(c)	Motion Sensor 130.2(c)3 / 160.5(c)	Field Inspector
				Pass Fail
Parking Lot: "200 W LED"	Astronomical Timer	Provided	NA: Facade, etc. ≥ 24 ft	<input type="checkbox"/> <input type="checkbox"/>

¹FOOTNOTE: Text has been abbreviated, please refer to Table 160.5-A to confirm compliance with the specific light source technologies listed.

² Authority having jurisdiction may ask for cutsheets or other documentation to confirm compliance of light source.

³ Recessed 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))							
<p><i>This table includes areas using allowance calculations per 140.7 / 170.2(e). General Hardscape Allowance is per Table 140.7-A/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 H. and are not included here. All other multifamily outdoor lighting is included here.</i></p>				01			
				"Use it or lose it" Allowance (select all that apply) (select all that apply)			
				<input checked="" type="checkbox"/> General Hardscape Allowance Table I (below)	<input type="checkbox"/> Per Application Table J	<input type="checkbox"/> Sales Frontage Table K	<input type="checkbox"/> Ornamental Table L
Calculated General Hardscape Lighting Power Allowance per Table 140.7-A for Nonresidential & Hotel/Motel							
02	03	04	05	06	07	08	09
Area Description	Area Wattage Allowance (AWA)			Linear Wattage Allowance (LWA)			Total General AWA + LWA (Watts)
	Illuminated Area (ft ²)	Allowed Density (W/ft ²)	Area Allowance (Watts)	Perimeter Length (lf)	Allowed Density (W/lf)	Linear Allowance (Watts)	
Parking Lot	13550	0.021	284.55	520	0.2	104	388.55
Initial Wattage Allowance for Entire Site (Watts):							250
Instances of Initial Wattage Allowance (LZ 0 only) ¹							
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.															
Calculations of Total Allowed Lighting Power (Watts) 140.7 / 170.2(e)6 or 141.0(b)2L / 180.2(b)4Bv											Compliance Results				
01		02		03		04		05		06		07		08	09
General Hardscape Allowance 140.7(d)1 / 170.2(e)6 (See Table I)	+	Per Application 140.7(d)2 / 170.2(e)6 (See Table J)	+	Sales Frontage 140.7(d)2 (See Table K)	+	Ornamental 140.7(d)2 / 170.2(e)6 (See Table L)	+	Per Specific Area 140.7(d)2 / 170.2(e)6 (See Table M)	OR	Existing Power Allowance 141.0(b)2L / 180.2(b)4Bv (See Table N)	=	Total Allowed (Watts)	≥	Total Actual (Watts)	07 must be >= 08
638.54	+	---	+	---	+	---	+	---	OR	---	=	638.54	≥	600	COMPLIES
Shielding Compliance (See Table G for Details)											COMPLIES				
Controls Compliance (See Table H for Details)											COMPLIES				





SIGNAGE

Mandatory Measures



SIGN LIGHTING REQUIREMENT OVERVIEW

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

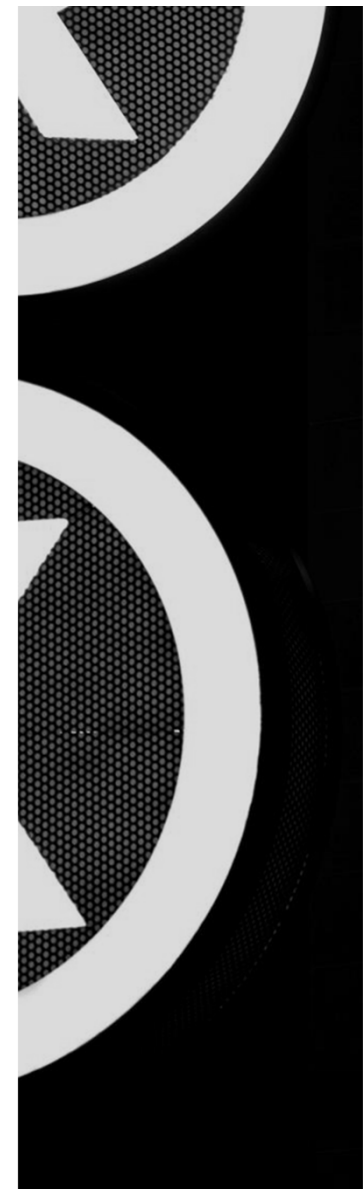
- **Control requirements** are established for all illuminated signs (§130.3)
- **Lighting power requirements** are established for internally illuminated and externally illuminated signs (§140.8).

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

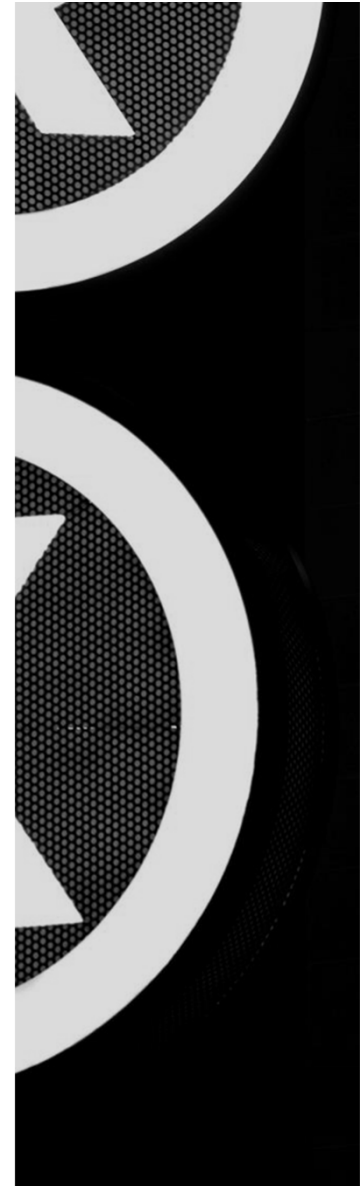
Outdoor sign lighting must be automatically controlled by one of the following two options:

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



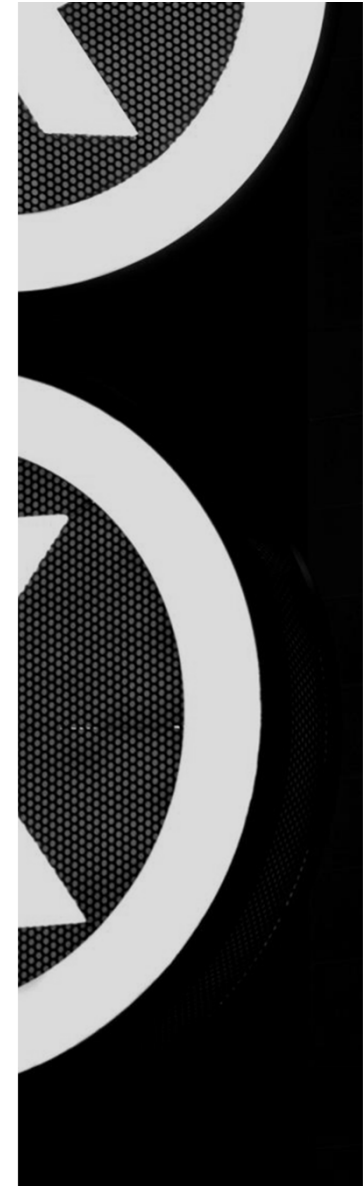
DEMAND RESPONSE FOR EMCs

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)



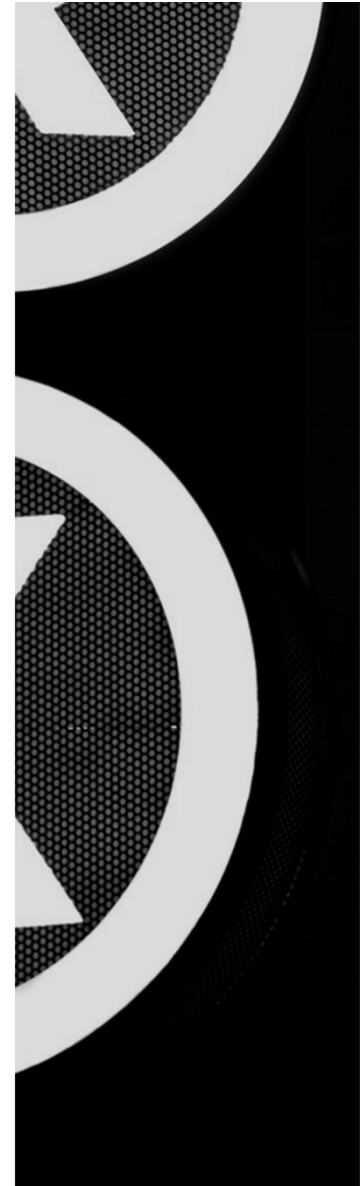
ENERGY COMPLIANCE

Signs must also:

1. Comply with an allowed lighting power maximum
or
2. Use one of several approved and compliant light sources

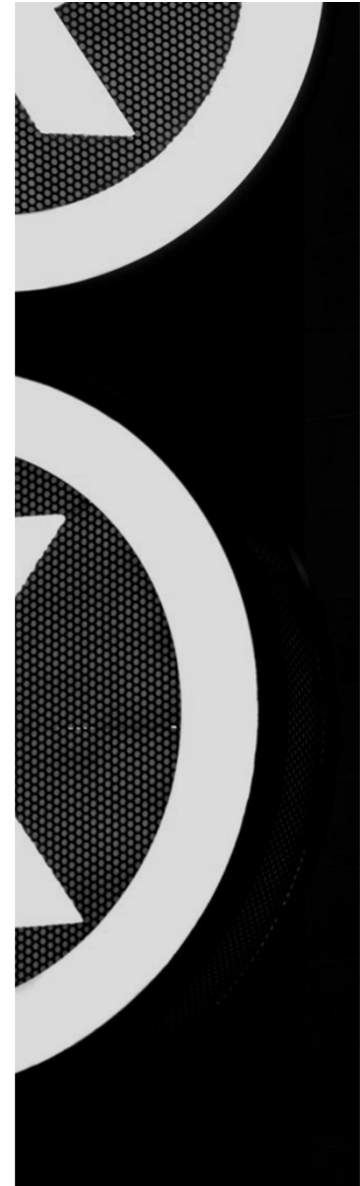


Section 130.3(a)



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.

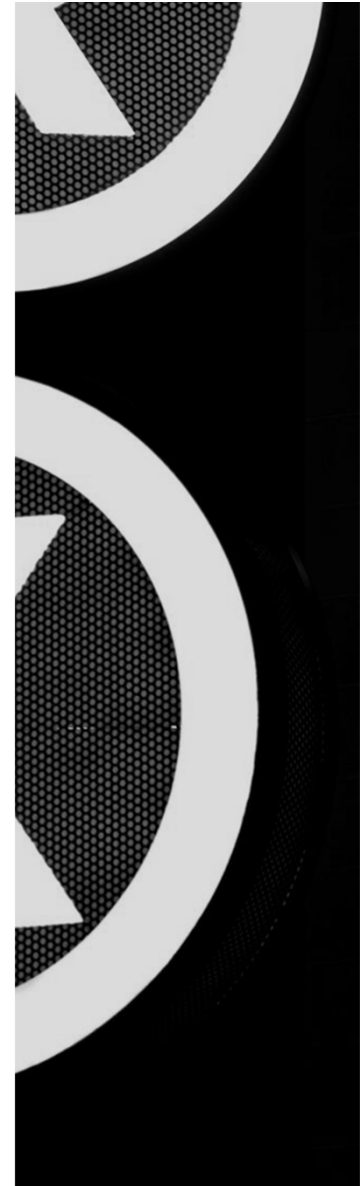


EXTERNALLY ILLUMINATED SIGNS

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.



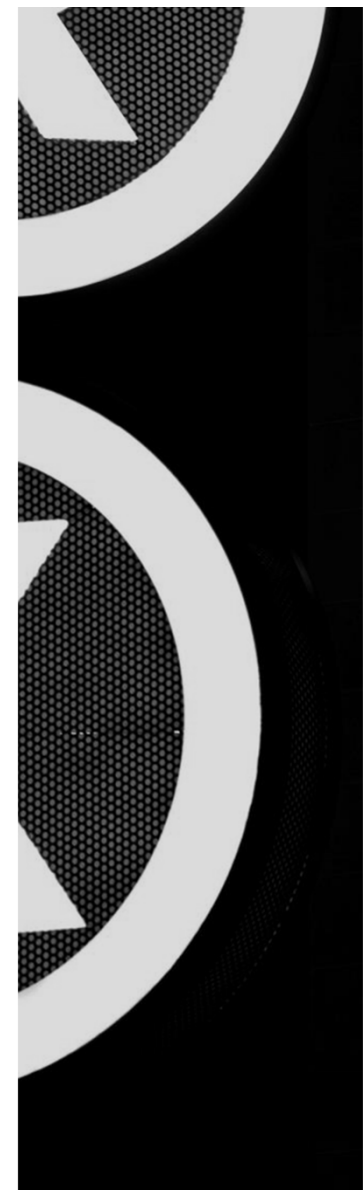
Section 140.8(a)



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



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.**

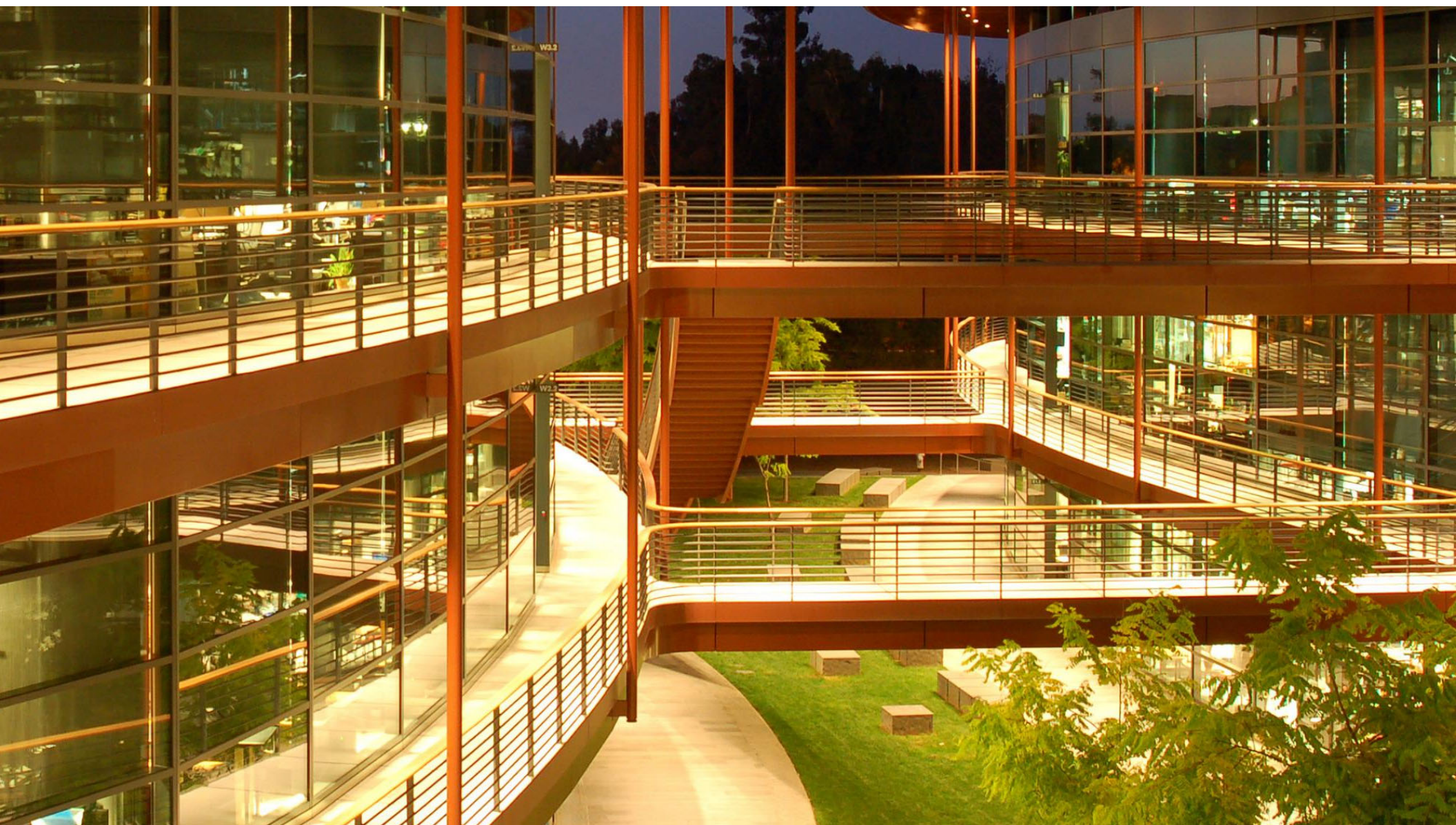
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Company:	Signature Date:
Address:	CEA/ HERS Certification Identification (if applicable):
City/State/Zip:	Phone:

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.

Responsible Designer Name:	Responsible Designer Signature:
Company:	Date Signed:
Address:	License:
City/State/Zip:	Phone:



IN CLOSING



RESOURCES

FOR MORE INFORMATION:

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

Nonresidential Compliance Manual
www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency

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




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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

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