



Figure 1. Types of Lighting Included In This Fact Sheet

## What's Included in This Fact Sheet

The 2022 California Building Energy Efficiency Standards (Energy Code or Title 24, Part 6) include requirements for New Construction, Additions, and Alterations to lighting systems serving nonresidential buildings and spaces, hotel and motel buildings and spaces excluding guest rooms, and multifamily common use areas, excluding dwelling units. This fact sheet includes the wattage allowances and control requirements for:

- ✦ Indoor lighting in conditioned and unconditioned spaces
- ✦ Outdoor lighting
- ✦ Illuminated signs

What's Not Included in this Fact Sheet:

- ✦ Indoor lighting in multifamily dwelling units or hotel and motel guest rooms
- ✦ Outdoor lighting controlled from within multifamily dwelling units or hotel and motel guest rooms
- ✦ Controlled environment horticulture lighting

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### WHAT'S NEW

Lighting for multifamily "Common Use Areas" is supported within the new subchapters developed for multifamily buildings (§§160, 170, 180). Common use area lighting requirements and calculation methods are very similar to those for nonresidential buildings (§§130, 140, 141), but there are some differences in wattage allowances and control credits.

See our [2022 Residential Indoor and Outdoor Lighting Fact Sheet](#) for lighting in multifamily dwelling units and hotel and motel guest rooms.

For a listing of occupancies and buildings covered in this fact sheet, see Table 1 below.

## Occupancies and Buildings Covered in this Fact Sheet

Building Type	Group	Occupancy Group and Building Type California Building Code §§303-306, 308-313	Building and Space Types Subject to Nonresidential and Multifamily Common Use Area Lighting Requirements
<b>Hotel and Motel Buildings</b>	<b>R-1</b>	<b>Residential Group R-1:</b> Buildings with sleeping units for primarily transient occupants	<p><b>Residential Group R-1:</b> Hotel and motel</p> <p>Nonresidential spaces associated with hotel and motel buildings with 6 or more guest rooms, vacation timeshare properties, boarding houses with over 6 guests, and alcohol or drug abuse treatment facilities with over 6 guests</p> <p>Examples: Hotel function areas, main entry lobbies, laundry rooms, meeting rooms</p> <p><i>Guest rooms are excluded.</i></p>
<b>Multifamily Buildings</b>	<b>R-2</b>	<b>Residential Group R-2:</b> Buildings with 3 or more dwelling units for permanent residents	<p><b>Multifamily:</b> a building, other than hotel or motel, of Occupancy Group R-2, R-3, or R-4</p> <p>Examples: Apartment building common use areas, including Area Category Primary Function Areas from <a href="#">Table 170.2-M</a></p> <p><i>Dwelling units, hotels, motels, and timeshares are excluded.</i></p>
	<b>R-3</b>	<b>Residential Group R-3:</b> Some multifamily congregate residences with primarily permanent residents	<p><b>Multifamily:</b> a building, other than hotel or motel, of Occupancy Group R-2, R-3, or R-4</p> <p>Examples: Dormitory common use areas, including Area Category Primary Function Areas from <a href="#">Table 170.2-M</a></p> <p><i>Dwelling units, boarding houses, or alcohol or drug abuse recovery homes with over 6 guests are excluded.</i></p>
	<b>R-4</b>	<b>Residential Group R-4:</b> Supervised residential environments for more than 6 ambulatory clients and up to 16 total residents, excluding staff	<p><b>Multifamily:</b> a building, other than hotel or motel, of Occupancy Group R-2, R-3, or R-4</p> <p>Examples: Common use areas of assisted living facilities, halfway houses, and drug treatment facilities, including Area Category Primary Function Areas from <a href="#">Table 170.2-M</a></p> <p><i>Dwelling units are excluded.</i></p>
<b>Miscellaneous Buildings and Structures on Multifamily Sites</b>	<b>U</b>	<b>Miscellaneous:</b> Accessory buildings and structures, and miscellaneous structures not classified in any specific occupancy	<p><b>Occupancy Group U:</b> Miscellaneous</p> <p>Examples: Common use accessory buildings, sheds, carports, and parking garages</p>

*(Continued)*



(Continued)

## Occupancies and Buildings Covered in this Fact Sheet

Building Type	Group	Occupancy Group and Building Type California Building Code §§303-306, 308-313	Building and Space Types Subject to Nonresidential and Multifamily Common Use Area Lighting Requirements
<b>Nonresidential Buildings</b>	<b>A</b>	<b>Assembly:</b> Buildings or spaces where groups of people gather for civic, social or religious functions, recreation, food or drink consumption, entertainment, awaiting transportation, or television and movie production, among other uses	<b>Occupancy Group A:</b> Assembly Examples: Auditoriums, convention centers (assembly buildings), libraries, tenant lease spaces <sup>1</sup> , theaters
	<b>B</b>	<b>Business:</b> Buildings or spaces for office, professional or service-type transactions, including storage of records and accounts	<b>Occupancy Group B:</b> Business Examples: Financial institutions, offices, restaurants, tenant lease spaces <sup>1</sup> , medical office buildings, or clinics
	<b>E</b>	<b>Education:</b> Buildings or spaces used for more than six persons at any one time for educational purposes through the 12th grade	<b>Occupancy Group E:</b> Education Examples: Schools for any number of students at any grade level, classrooms, training, vocational areas
	<b>F</b>	<b>Factory:</b> Buildings or spaces used for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair, or processing operations that are not classified as a Group H hazardous or Group S storage occupancy	<b>Occupancy Group F:</b> Factory Examples: Warehouses, tenant lease spaces <sup>1</sup>
	<b>H</b>	<b>High Hazard:</b> Buildings or spaces that involve the manufacturing, processing, generation, or storage of materials that constitute a substantial physical or health hazard	<b>Occupancy Group H:</b> High hazard Examples: Factories or storage facilities for hazardous materials
	<b>I-2</b>	<b>Institutional Group I-2:</b> Hospitals and 24-hour medical care facilities	<b>Occupancy Group I-2:</b> Hospitals and 24-hour medical care facilities Examples: Exam and treatment rooms, medical supply rooms, nurse’s stations, patient rooms, physical therapy rooms
	<b>M</b>	<b>Mercantile:</b> Buildings or spaces used to display and sell merchandise to the public, plus supporting areas for stocks of goods, wares, or merchandise	<b>Occupancy Group M:</b> Mercantile Examples: Grocery stores, retail stores, tenant lease spaces <sup>1</sup>
	<b>S</b>	<b>Storage:</b> Buildings or spaces used to store materials that are not classified as hazardous	<b>Occupancy Group S:</b> Storage Examples: Self storage facilities, public parking garages, open or enclosed
	<b>U</b>	<b>Miscellaneous:</b> Accessory buildings and structures, and miscellaneous structures not classified in any specific occupancy	<b>Occupancy Group U:</b> Miscellaneous Examples: Nonresidential accessory buildings, private parking garages

<sup>1</sup> Tenant lease space is a room or area in a building intended for lease for which a specific tenant is not identified at the time of building permit application.

**Table 1.** Occupancies and Buildings Covered in this Fact Sheet



## How Does this Fact Sheet Apply to Your Project?

Use this fact sheet to determine the wattage allowed for the lighting design and the lighting control requirements of the 2022 Energy Code. There are two basic steps to comply with the Energy Code:

1. Meet all applicable Mandatory Measures by installing required systems, equipment, and devices and ensuring that they perform all functions required by the Energy Code.
2. Select your method of compliance by choosing either the Performance Approach or the Prescriptive Approach.



### Mandatory Measures

All nonresidential and multifamily buildings must be designed and built to comply with the Mandatory Measures of the Energy Code using devices that adhere to the Appliance Efficiency Regulations. Mandatory Measures are the basic set of requirements that apply to all buildings. For example, most lighting control requirements are Mandatory Measures.



### Prescriptive Approach

The Prescriptive Approach allows builders to comply by using methods known to be efficient. This approach does not require software – rather, it is completed in a checklist format using the Certificates of Compliance. There are different Prescriptive requirements for Newly Constructed buildings, Additions, and Alterations. See the [Virtual Compliance Assistant](#) from Energy Code Ace to complete nonresidential and multifamily Certificates of Compliance and Certificates of Installation online.



### Performance Approach

The Performance Approach allows builders freedom of design so long as the building achieves the same overall efficiency as an equivalent building using the Prescriptive option. This approach requires using software approved by the California Energy Commission (CEC) and is best suited for use by experienced professionals familiar with the Energy Code. This method allows for energy trade-offs between building systems within the conditioned envelope. For example, under the Performance Approach, use of highly efficient lighting in the conditioned areas of the building can allow for a larger portion of the energy budget to be allocated to heating and cooling loads. The Performance Approach cannot be used for indoor lighting in unconditioned enclosed spaces, outdoor lighting, or sign lighting.

## Importance of Compliance

Energy-efficient nonresidential and multifamily buildings lead to both environmental benefits and cost savings. The lighting requirements of the Energy Code aim to reduce energy use and demand while maintaining high quality lighting.

## Finding Compliant Products

Certain lighting products must be certified to the CEC as meeting California’s Appliance Efficiency Regulations (Title 20). Others are regulated only under the Energy Code. See Table 2 below for a list of lighting product regulations.

Lighting Product Regulations	
Appliance Efficiency Regulations - Title 20	
<a href="#">§§1605.1(j), 1605.2(j), 1605.3(j)</a>	Fluorescent lamp ballasts
<a href="#">§1605.1(d)2</a>	Ceiling fan light kits
<a href="#">§§1605.1(k), 1605.3(k)</a>	Lamps
<a href="#">§1605.1(l)</a>	Emergency lighting
<a href="#">§§1605.1(n), 1605.2(n), 1605.3(n)</a>	Torchieres and metal halide luminaires
<a href="#">§§1605.1(u), 1605.3(u)</a>	External Power supplies
Energy Code - §110.9	
<a href="#">§110.9(a)</a>	Lighting control devices
<a href="#">§110.9(b)1</a>	Time-switch lighting controls: automatic time-switch controls, astronomical time-switch controls, multilevel time-switch controls, outdoor time-switch controls
<a href="#">§110.9(b)2</a>	Daylighting controls: automatic daylight controls, photo controls
<a href="#">§110.9(b)3</a>	Dimmers
<a href="#">§110.9(b)4</a>	Occupant sensing controls: occupancy sensors, motion sensors, vacancy sensors, partial-ON sensors, partial-OFF sensors
<a href="#">§110.9(b)6</a>	Sensors used to detect occupants
<a href="#">§110.9(b)7</a>	Indicator Lights
<a href="#">§110.9(c)</a>	Track lighting integral current limiter
<a href="#">§110.9(d)</a>	Track Lighting Supplementary Overcurrent Protection Panel

**Table 2.** Lighting Product Regulations



# Indoor Lighting

Indoor lighting is regulated by the Energy Code via installed lighting power by space or building type and controls. The lighting power allowances affect projects using any of the three compliance methods: Area Category, Complete Building, or Tailored.

## Key Terms for Indoor Lighting

### Spaces

Lighting regulations are determined by whether the space is conditioned or enclosed.

- ✦ **Conditioned Space** is an enclosed space within a building that is directly conditioned or indirectly conditioned.
- ✦ **Enclosed Space** is space that is substantially surrounded by solid surfaces, including walls, ceilings or roofs, doors, fenestration areas, and floors or ground.

### Tunable Lighting

Tunable lighting is defined as light sources with the ability to alter their luminous flux or spectral power distribution or both. Tunable lighting includes the following types:

- ✦ **Color** tunable light sources are capable of emitting highly saturated light of varying hues, as well as white light, for example by varying the relative intensity of individual emitters within the light source.
- ✦ **Dim-to-warm** (also known as warm dim) light sources can simultaneously decrease their correlated color temperature as their light output decreases, typically resembling the change in color temperature of an incandescent lamp as it dims.
- ✦ **Tunable white** light sources are able to adjust their correlated color temperature while maintaining the relative light output. They can also adjust their light output while maintaining the correlated color temperature.

### Layers of Light

- ✦ **Decorative** lighting or luminaires are installed only for aesthetic purposes and do not serve as display lighting or general lighting. Decorative luminaires are chandeliers, sconces, lanterns, neon or cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels that do not provide general lighting or task lighting.
- ✦ **General** lighting is electric lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting. General lighting is also known as ambient lighting.
- ✦ **Ornamental** lighting includes luminaires installed outdoors which are rated for 50 watts or less, and that are post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting. Ornamental lighting is not general lighting or task lighting.
- ✦ **Task** Lighting is directed to a specific surface or area, providing illumination for visual tasks. Task lighting is not general lighting.



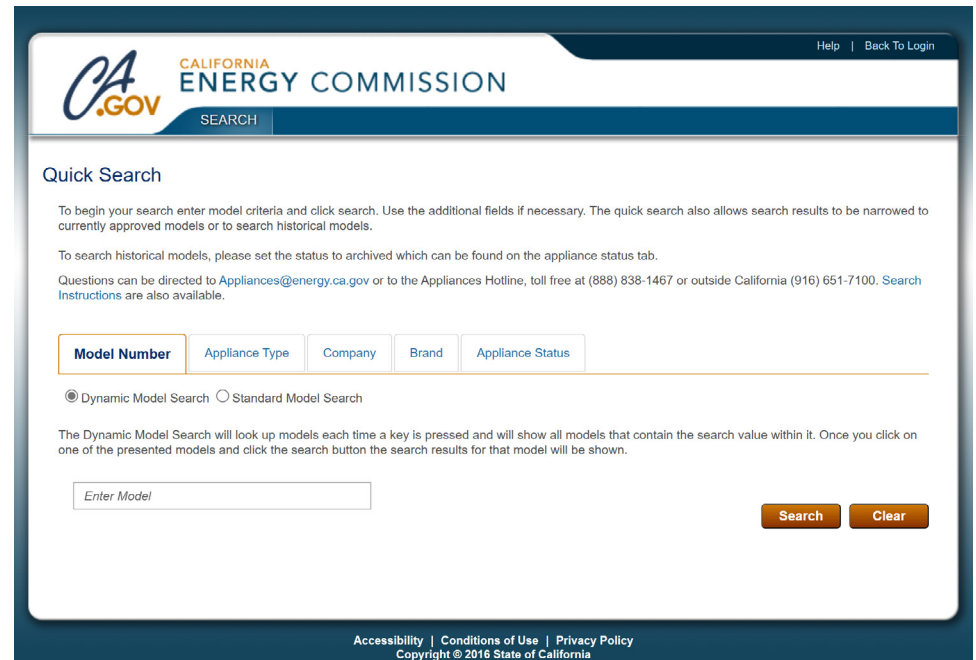
## WHAT'S NEW

Wattage allowances have been revised for all Prescriptive compliance options (Complete Building, Area Category, Tailored Approach). The demand-responsive lighting control trigger has been changed to the amount of general lighting wattage subject to the multilevel control requirements. All Mandatory lighting control requirements and exceptions have been revised, with major changes to daylighting and shut-off control requirements.

## MODERNIZED APPLIANCE EFFICIENCY DATABASE (MAEDbS)

The CEC's [Modernized Appliance Efficiency Database \(MAEDbS\)](#) lists a variety of products certified as meeting the Appliance Efficiency Regulations (Title 20), including lighting control devices, lamps, ballasts, and ceiling fan light kits.

This online database of products certified to the CEC has a Quick Search function allowing users to search by product type, brand, or model name.



**Figure 2.** Screenshot of Modernized Appliance Efficiency Database (MAEDbS)



## Is Your Indoor Lighting Project New Construction, Addition, Alteration, or Repair?

New Construction, Addition, and Alteration projects are subject to the Energy Code. Repairs are not subject to the Energy Code if the repair does not increase energy use. See Table 3 on this page for a list of typical indoor lighting project scopes, how they are classified, and whether they must comply with the Energy Code.

Is Your Indoor Lighting Project New Construction, Addition, Alteration, or Repair?		
Project Scope That Includes New or Modified Indoor Lighting Systems	Project Type	Is the Energy Code Triggered?
New building	<b>New Construction</b>	<b>YES</b>
First build-out of a tenant improvement (TI) space	<b>New Construction</b>	<b>YES</b>
Multifamily common use area with lighting installed for the first time	<b>New Construction</b>	<b>YES</b>
Addition to a building	<b>Addition - Must meet requirements for New Construction</b>	<b>YES</b>
Changing indoor lighting systems by:	<b>Alteration - Must meet requirements for New Construction</b>	<b>YES</b>
✦ Increasing the connected lighting load in a space		
✦ Replacing or rewiring $\geq 10\%$ of luminaires in a space		
✦ Replacing or rewiring $> 50$ luminaires a year in a $\leq 5,000$ ft <sup>2</sup> building or in each $\leq 5,000$ ft <sup>2</sup> tenant space in a multi-tenant building		
✦ Adding lighting controls and nothing else		
✦ Removing luminaires in a space	<b>Repair</b>	No
✦ Replacing lamp, lens, or driver and not increasing energy use	<b>Repair</b>	No

**Addition:** Any change to a building that increases conditioned floor area and conditioned volume. See also “newly conditioned space.” An Addition is also any change that increases the floor area and volume of an unconditioned building of an occupancy group or type regulated by the Energy Code. An Addition is also any change that increases the illuminated area of an outdoor lighting application regulated by the Energy Code.

**Alteration:** Any change to a building’s water-heating system, space-conditioning system, lighting system, electrical power distribution system, or envelope that is not an Addition. An Alteration is also any change that is regulated by the Energy Code to an outdoor lighting system that is not an Addition. An Alteration is also any change that is regulated by the Energy Code to signs located either indoors or outdoors. An Alteration is also any change that is regulated by the Energy Code to a covered process that is not an Addition.

**Newly Constructed Building:** A building that has never been used or occupied for any purpose.

**Repair:** The reconstruction or renewal for the purpose of maintenance of any component, system, or equipment of an existing building. Repairs that increase the preexisting energy consumption of the repaired component, system, or equipment are considered Alterations not Repairs. Replacing any component, system, or equipment for which there are requirements in the Energy Code is also considered an Alteration and not a Repair.

**Table 3.** Is Your Indoor Lighting Project New Construction, Addition, Alteration, or a Repair?



## 2022 Nonresidential Indoor Lighting Wheel

The 2022 Nonresidential Indoor Lighting Wheel is designed as a quick reference to check whether indoor lighting installations in various areas of a building meet 2022 Energy Code requirements —without the need to dive into the Energy Code language itself. The Lighting Wheel covers area wattage allowances and control requirements for each area space type for New Construction, Additions, and Alterations.

Use the link below to access:

- ✦ Online versions of the 2022 and 2019 Lighting Wheels (see Figure 3 on this page)
- ✦ Lighting Wheel Fact Sheet
- ✦ Demonstration video
- ✦ Instructions on how to order printed Lighting Wheels

[energycodeace.com/2022NonresIndoorLightingWheel](http://energycodeace.com/2022NonresIndoorLightingWheel)

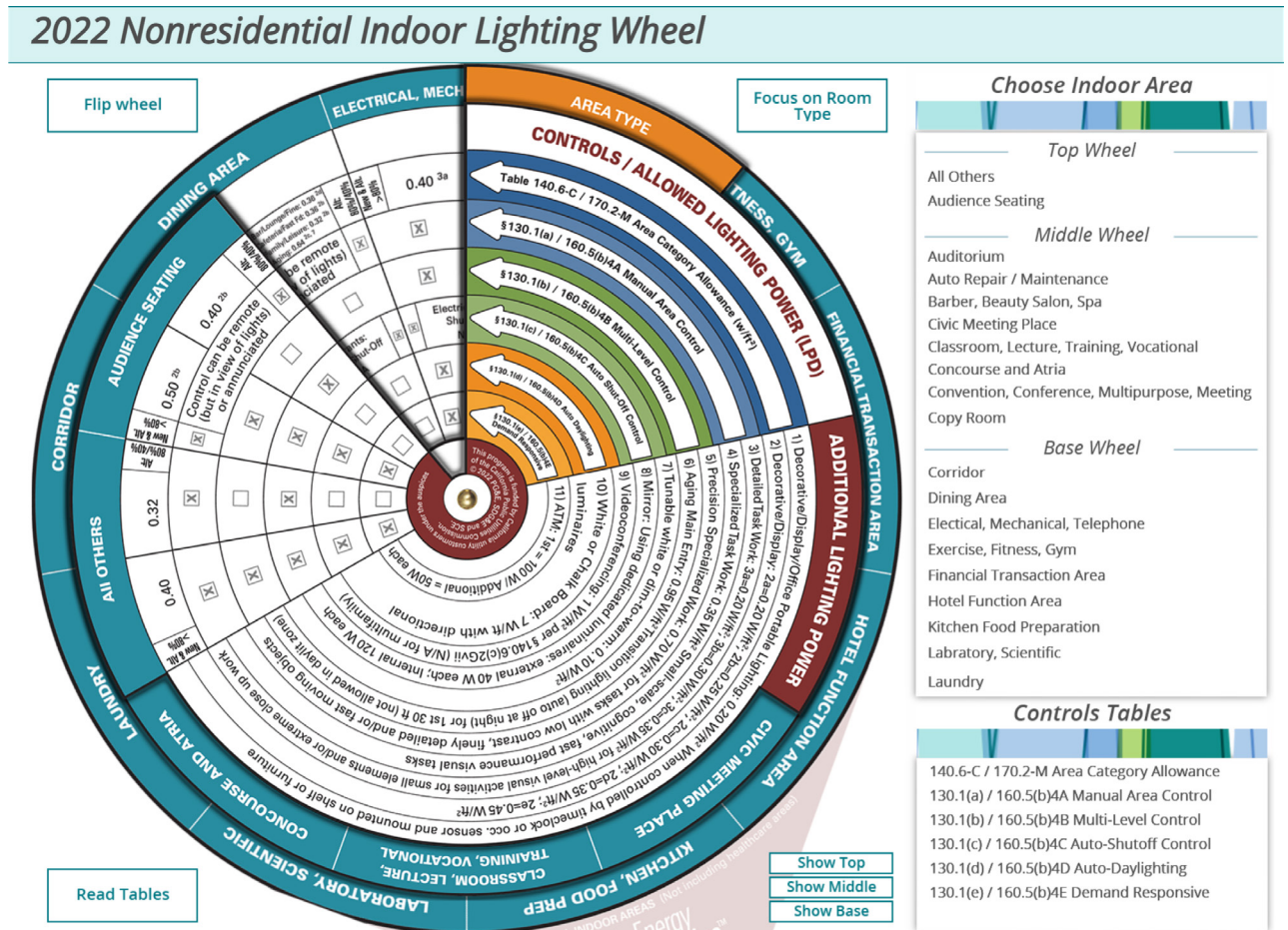


Figure 3. 2022 Nonresidential Indoor Lighting Wheel: Illustration of the Online Version



## New Construction and Additions: Indoor Lighting Requirements

### Indoor Lighting Design: Allowed and Actual Wattage

1. **Separate conditioned and unconditioned spaces:** Conditioned and unconditioned spaces are calculated separately from each other and must show compliance with the wattage allowances independently from each other.
2. **Choose Prescriptive wattage method per nonresidential §140.6(b) or multifamily common use §170.2(e):**
  - a. **Complete Building Method Table 140.6-B:** When  $\geq 90\%$  of a building is one primary type of use, the entire building floor area can be multiplied by one allowed lighting power density (LPD) value in watts per square foot to calculate allowed wattage. This method is not allowed for multifamily buildings except for parking garages.
  - b. **Area Category Method Table 140.6-C or Table 170.2-M:** Multifamily Table 170.2-M limits the Area Category primary function areas (i.e., space types) to those typically in multifamily common use areas, while nonresidential Table 140.6-C includes additional nonresidential space types. Each space (i.e., lobby, office, laundry room) has an allowed LPD which is multiplied by the space floor area to calculate wattage. Some Area Category space types allow additional lighting power for specific uses such as decorative or display lighting. These are "use it or lose it" allowances. Space wattage allowances are added together to determine project overall allowed wattage.
  - c. **Tailored Method Tables 140.6-D, E, F, G or Tables 170.2-N, O, P, Q:** In the Tailored method, allowed LPD is determined room-by-room and task-by-task. Any room using the Tailored Method cannot also use the Area Category Method.
3. **Determine the Total Allowed Wattage** for the project scope based on the methods listed above.

4. **Calculate Actual Lighting Power §140.6(a) or 170.2(e):** The designed or actual lighting power is the sum of the wattages of all planned permanent and portable lighting fixtures in the building, based on the same floor area as was used to calculate the allowed lighting power and the luminaire classification and wattages of nonresidential §130.0(c) or multifamily common use §160.5(b)1. If an interlocked lighting system design is being used, the wattage of the higher wattage system is used to document compliance per §140.6(a)1 or §170.2(e)2A. Qualified small aperture tunable lighting is adjusted by multiplying maximum rated wattage by 0.80 per nonresidential §140.6(a)4B or by 0.75 per multifamily common use §170.2(e)2D.
5. **Total Actual Watts Minus Control Credits §140.6(a)2 or 170.2(e)2 and Exempt Lighting §140.6(a)3 or 170.2(e)2C:** If optional lighting controls are installed, the actual lighting power may be adjusted through lighting control credits (power adjustment factors from nonresidential Table 140.6-A or multifamily common use Table 170.2-L) or use of interlocked lighting system (using the lower of the programed scene if allowed for the space type). Do not include the wattage associated with exempt lighting. Note that exempt lighting may still be subject to the lighting control requirements of the Energy Code.
6. **Determine Adjusted Actual Watts** using the method in steps 4 and 5.
7. **For Wattage Compliance, Compare to Confirm Total Allowed Watts  $\geq$  Adjusted Actual Watts** for all conditioned spaces separately from all unconditioned spaces.

*Next, move on to determining compliance with control requirements.*

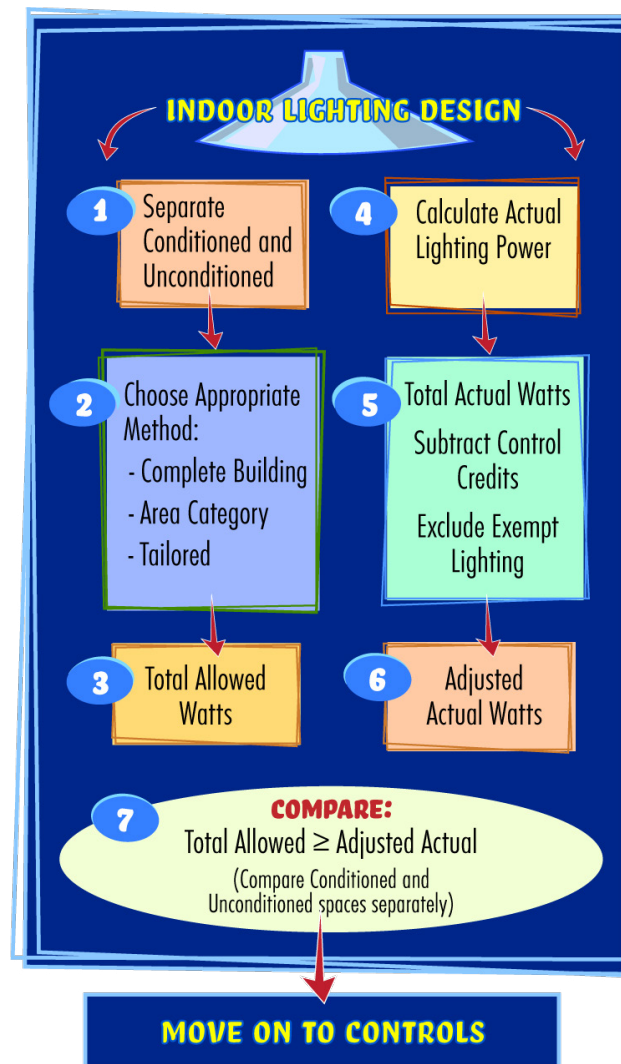


Figure 4. Indoor Lighting Design Flowchart





## Indoor Lighting Design: Controls

### Indoor Lighting Control Types

**Annunciated** is a type of visual signaling device that indicates the on, off or other status of a load.

**Automatic Daylight Control** adjusts the luminous flux of the electric lighting system in either a series of steps or by continuous dimming in response to available daylight. This kind of control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the electric lighting levels in response.

**Automatic Time-switch Control** automatically controls lighting based on the time of day.

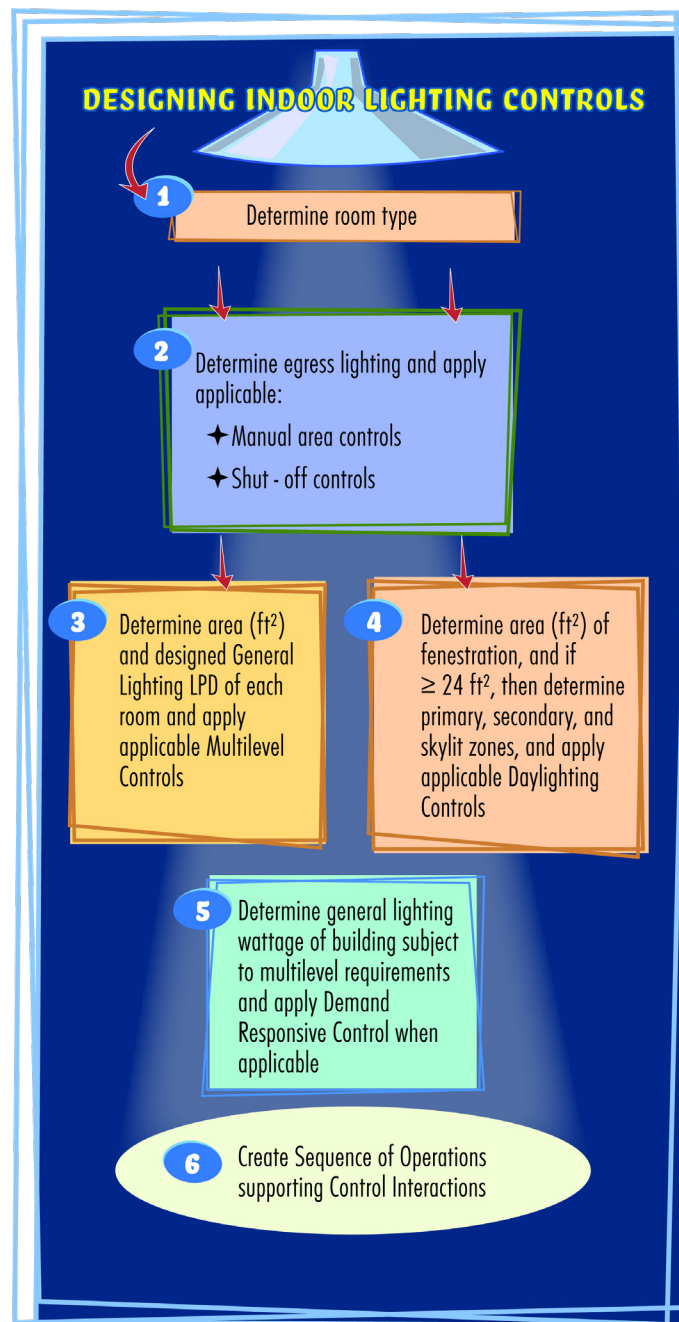
**Dimmer** is a device used to control the intensity of light emitted by a luminaire by controlling the voltage or current available to it.

**Demand Responsive Control** is an automatic control that is capable of receiving and automatically responding to a demand response signal.

**Multilevel Lighting Control** reduces power going to a lighting system in multiple steps.

**Occupant Sensing Controls** automatically control levels of illumination, allow for manual operation and consist of the following types:

- ✦ Occupant Sensing Controls are used indoors to automatically reduce lighting power or turn lights OFF after an area is vacated of occupants. They can automatically turn the lighting ON when an area is occupied.
- ✦ Partial-ON Occupant or Motion Sensing Controls automatically turn lights OFF after an area is vacated of occupants, and they can automatically or manually turn ON part of the lighting when an area is occupied.
- ✦ Partial-OFF Occupant or Motion Sensing Controls automatically dim the lighting or turn OFF part of the lighting after an area is vacated of occupants. They can automatically turn ON the lighting or restore it to full when an area is occupied.
- ✦ Vacancy Sensing Controls automatically turn lights OFF after an area is vacated of occupants, but they require lights to be turned ON manually.



**Figure 5.** Indoor Lighting Controls Design Flowchart



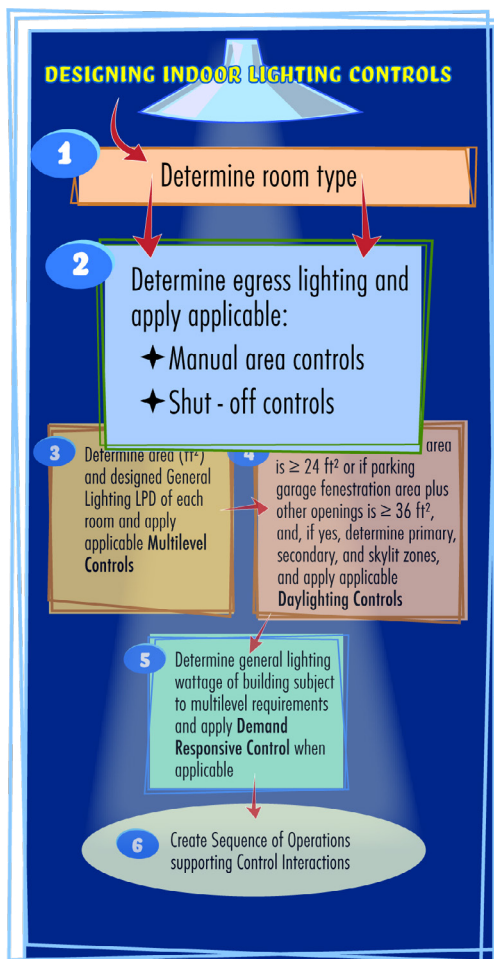


Figure 6. Indoor Lighting Controls Design Flowchart: Steps 1 and 2

### Indoor Lighting Design: Controls

1. **Determine Room Type:** Determining room type helps identify which compliance options are available for each control type.
2. **Determine Egress Lighting:** Up to 0.1 W/ft<sup>2</sup> of designated egress lighting does not require manual area controls or shut-off controls.
  - ◇ **Manual Area Controls §130.1(a) or §160.5(b)4C:** Readily accessible lighting controls must be located in each area enclosed by ceiling-height partitions. These controls must allow the lighting in that area to be manually turned on and off. General lighting must be controlled separately from any other lighting layers in the area.

### Manual Area Lighting Control Exceptions

Exceptions to Being Readily Accessible	Exceptions to Being Located in Each Area
The following may have controls only accessible to authorized personnel:  Restrooms ≥ 2 stalls, parking areas, stairwells, corridors, and areas of the building intended for access or use by the public	The following may annunciate or locate controls in areas outside the area where lighting can be seen:  <b>Nonresidential, hotel and motel, and multifamily common use:</b> Areas where placement of a manual area control poses a health and safety hazard  <b>Nonresidential, hotel, and motel:</b> Malls and atria, main entry lobbies, auditorium areas, dining areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, arenas, psychiatric and secure areas in healthcare facilities  <b>Healthcare facilities:</b> In restrooms and bathing rooms intended for a single occupant, the lighting control may be located outside the enclosed area but directly adjacent to the door.

Table 4. Manual Area Lighting Control Exceptions

- ◇ **Shut-off §130.1(c) or §160.5(b)4C:** Controls able to automatically reduce lighting power when the space is typically unoccupied and meeting install and acceptance testing requirements of §130.1(c) or §160.5(b)4C. This does not include emergency lighting used when normal power is absent. These controls do not apply to electrical equipment rooms or areas occupied 24 hours per day and 365 days per year.

### Mandatory Building and Space Level Lighting Shut-off Controls

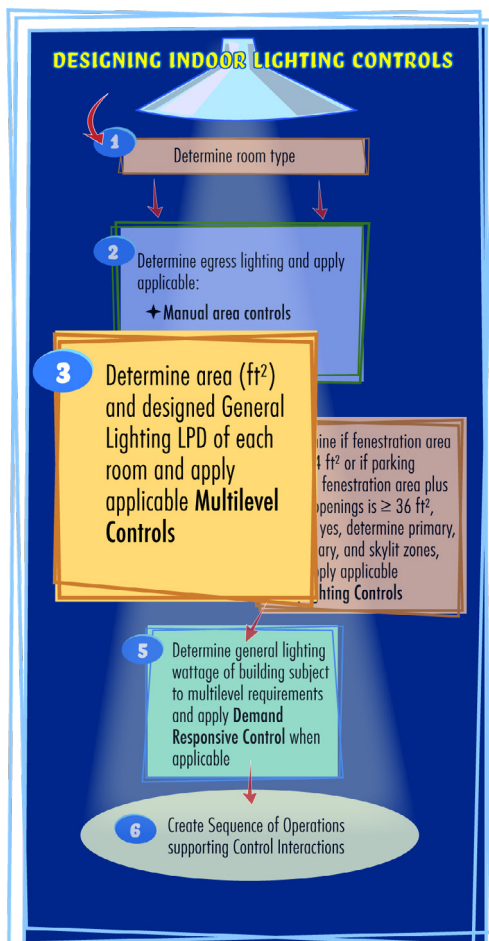
Building Level Shut-off	Space Level Shut-off		
<b>All lighting in the building</b> (not including up to 0.1 W/ft <sup>2</sup> of egress lighting) must be automatically shut off when a building or space is not occupied. This can be done at the building level with an automatic time-switch, or in each space with occupancy sensing controls. Be aware of the separate control requirements of §130.1(c)1B and C or §160.5(b)4Cib and c, and the override and holiday requirements for automatic time-switch in §130.1(c)3 and 4 or §160.5(b)4Ciii and iv.	<b>Office ≤ 250 ft<sup>2</sup>, multipurpose &lt; 1,000 ft<sup>2</sup>, classrooms, conference and restrooms of any size</b> require occupant sensing controls programmed as vacancy, partial-on or occupancy sensors depending on if multilevel control requirements apply to the space per §130.1(c)5 or §160.5(b)4Cv.	<b>Offices &gt; 250 ft<sup>2</sup>, corridors and stairwells</b>  <b>Aisle ways and open areas of warehouses, library book stack aisles ≥ 10 ft one way or ≥ 20 ft if two-way:</b>  Full or partial-off sensors that meet the criteria of §130.1(c)6 or §160.5(b)4Cvi are required.	<b>Lighting in hotel and motel or multifamily common use area stairwells, corridors serving dwelling units or hotel and motel guest rooms, and all parking garages</b> must use partial-off controls to reduce lighting levels per §130.1(c)7 or §160.5(b)4Cvii when the spaces are not occupied.  These spaces are not required to meet the automatic building shut-off requirements (100% off when not occupied).

Table 5. Mandatory Building and Space Level Lighting Shut-off Controls



**3. Determine Area (ft<sup>2</sup>) and designed General Lighting LPD of each room:** This will determine if multilevel controls are required for the space and, if so, the luminaire control steps required.

- ◇ Multilevel §130.1(b) or §160.5(b)4B: When the space is ≥ 100 ft<sup>2</sup> and has a general lighting connected load > 0.5 W/ft<sup>2</sup>, then multilevel controls are required. There is an exception for rooms with ceiling height partitions that only have one luminaire with two lamps or less or only one inseparable SSL luminaire. Multilevel controls can be a dimmer, daylighting or demand responsive control which then must use the minimum control steps and uniform level of illuminance of Table 130.1-A or 160.5-B. Multilevel controls are not required for restrooms or healthcare facilities. Classrooms with general lighting connected load ≤ 0.6 W/ ft<sup>2</sup> are not subject to Table 130.1-A, but they require at least one control step between 30 and 70% of full rated power for any luminaire type.



**Figure 7.** Indoor Lighting Controls Design Flowchart: Step 3

Multilevel Lighting Controls and Uniformity Requirements from Energy Code Tables 130.1-A and 160.5-B		
Luminaire Type	Minimum Required Control Steps (percent of full rated power <sup>1</sup> )	Uniform level of illuminance must be achieved by:
LED luminaires and LED light source systems Line-voltage sockets except GU-24 Low-voltage incandescent systems	Continuous dimming 10 – 100%	Continuous dimming 10 – 100%
Fluorescent luminaires	Continuous dimming 20 – 100%	Continuous dimming 20 – 100%
GU-24 sockets rated for fluorescent ≤ 20 W; Pin-based compact fluorescent ≤ 20 W <sup>2</sup> Linear fluorescent and U-bent fluorescent ≤ 13 W	Minimum one step between 30 – 70%	Continuous dimming; or Stepped dimming; or Switching alternate lamps in a luminaire.
Track Lighting	Minimum one step between 30 – 70%	Continuous dimming; or Stepped dimming; or Separately switching circuits in multi-circuit track with a minimum of 2 circuits.
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range: 20 – 40% 50 – 70% 75 – 85% 100%	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
Other light sources, including HID and Induction	Minimum one step between 50 – 70%	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.

<sup>1</sup> Full rated input power of driver, ballast and lamp, corresponding to maximum ballast factor

<sup>2</sup> Includes only pin-based lamps: twin tube, multiple twin tube, and spiral lamps

**Table 6.** Multilevel Lighting Controls and Uniformity Requirements from Energy Code Tables 130.1-A and 160.5-B



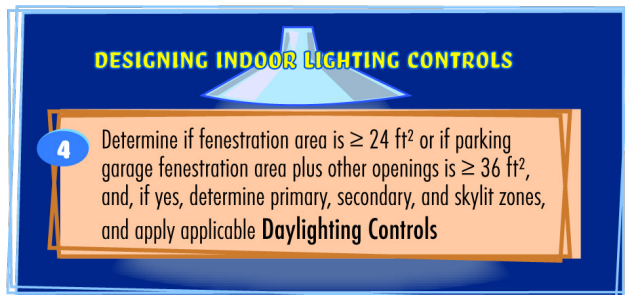


Figure 8. Indoor Lighting Controls Design Flowchart: Step 4

**4. Determine if Fenestration Area is  $\geq 24$  ft<sup>2</sup> or if Parking Garage Fenestration Area plus other Openings is  $\geq 36$  ft<sup>2</sup>.**

If yes, then determine Primary Sidelit, Secondary Sidelit, and Skylit Daylit Zones (see Table 7). Fenestration area includes windows, skylights, and glass doors in exterior walls or roofs. Daylit zones are required to be included in the plans, preferably using lighting reflected ceiling plans. This will help determine if automatic daylighting controls are required and, if so, the daylighting design parameters. If the skylights or vertical glazing below an overhang meet the shading exceptions of [§130.1\(d\)](#) or [§160.5\(b\)4D](#), daylighting is not required. Retail merchandise sales and wholesale showroom sidelit daylit zones are not subject to these daylighting control requirements, but their skylit zones do require daylighting controls.

- ◊ Daylighting in spaces other than parking garages [§130.1\(d\)](#) or [§160.5\(b\)4D](#): When a space has  $\geq 120$  W of general lighting in all the primary sidelit and skylit daylit zones combined, then primary daylighting controls are required. When a space has  $\geq 120$  W of general lighting in all the secondary sidelit daylit zones combined, then secondary daylighting controls are also required. Daylighting controls must be installed with acceptance testing and shown to meet the requirements of [§130.1\(d\)2-5](#) or [§160.5\(b\)4Dii-v](#).
- ◊ Daylighting in parking garage spaces [§130.1\(d\)](#) or [§160.5\(b\)4D](#): When a space has  $\geq 60$  W of general lighting in all the primary and secondary sidelit daylit zones combined, then daylighting controls are required. This does not include the daylight adaptation zone and luminaires supporting dedicated ramps for multifamily parking garages. Daylighting controls must be installed with acceptance testing and shown to meet the requirements of [§130.1\(d\)2-5](#) or [§160.5\(b\)4Dii-v](#).

Determining Daylit Zones	
<p><b>Primary and Secondary Sidelit</b></p>	<ul style="list-style-type: none"> <li>✦ The sidelit daylit zone includes the area directly adjacent to a vertical window.</li> <li>✦ Determine the window head height by measuring from the floor to the top of the window frame.</li> <li>✦ The primary sidelit daylit zone is then determined by extending one window head height in from the window.</li> <li>✦ The secondary sidelit zone is determined by extending two window head heights in from the window.</li> <li>✦ Then add 0.5 times the window head height to each side of the window, widthwise, to determine the width of the sidelit daylit zone.</li> <li>✦ Subtract any area on a plan that is beyond a permanent obstruction that is 6 ft or taller as measured from the floor.</li> </ul>
<p><b>Rooftop Monitor</b></p>	<ul style="list-style-type: none"> <li>✦ The depth of the sidelit daylit area for a roof monitor is measured as one window head height from the inward-facing plane of the fenestration and in the direction parallel to the fenestration.</li> <li>✦ Then add 0.5 times the window head height to each side of the window, widthwise, to determine the width of the sidelit daylit zone.</li> </ul>
<p><b>Skylit/Atrium</b></p>	<p><b>Skylit</b></p> <ul style="list-style-type: none"> <li>✦ Define the approximate shape of the opening of the skylight.</li> <li>✦ Determine the ceiling height (CH).</li> <li>✦ Multiply the CH by 0.7.</li> <li>✦ Add this value in all directions around the skylight (starting at the edge of the rough opening).</li> <li>✦ Subtract any area in which a permanent obstruction would block daylight (taller than half the distance from the floor to the bottom of the skylight).</li> </ul> <p><b>Atrium</b></p> <ul style="list-style-type: none"> <li>✦ The skylit daylit zone definition applies to the floor area directly under the atrium AND</li> <li>✦ The area of the top floor that is directly under the skylight                             <ul style="list-style-type: none"> <li>◊ Plus 0.7 times the average ceiling height of the top floor, in each direction from the edge of the rough opening of the skylight</li> <li>◊ Minus any area on a plan beyond a permanent obstruction that is taller than one-half the distance from the top floor to the bottom of the skylight</li> </ul> </li> </ul>

Table 7. Determining Daylit Zones



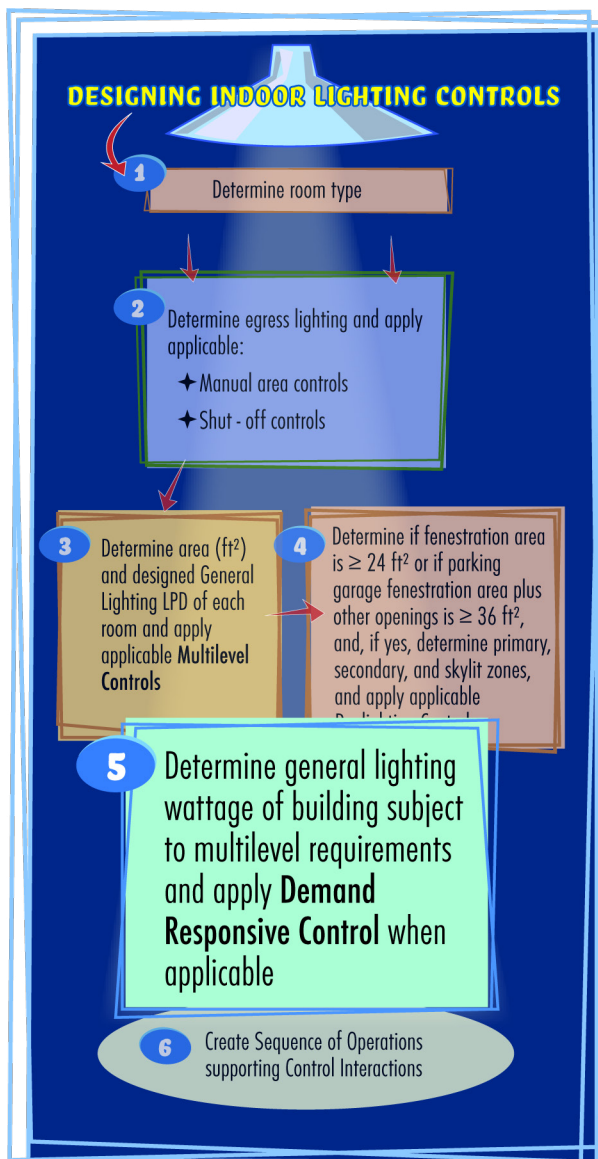


Figure 9. Indoor Lighting Controls Design Flowchart: Step 5

5. **Determine general lighting wattage of building subject to multilevel requirements:** If a project has  $\geq 4,000$  watts of general lighting subject to multilevel control requirements, then demand responsive controls meeting the install and acceptance testing requirements of [§110.12](#) are required. Demand responsive controls are not required for spaces where a health or life safety statute, ordinance, or regulation does not permit the lighting to be reduced.

- ◇ **Demand Responsive Lighting Controls §130.1(e) or §160.5(b)4E:** Receive and automatically respond to demand responsive signals by reducing building total lighting power by  $\geq 15\%$  as designed. Lighting controls are not allowed to turn lighting 100% off in any space in response to a demand responsive signal.
- ◇ **Demand Responsive Controlled Receptacles §130.5(d):** When controlled receptacles are required for office areas, lobbies, conference rooms, kitchen areas in office spaces, copy rooms, or hotel and motel guest rooms, and demand responsive lighting controls are required, then the demand responsive requirements of [§110.12\(e\)](#) will also be required. This does not apply to additions.

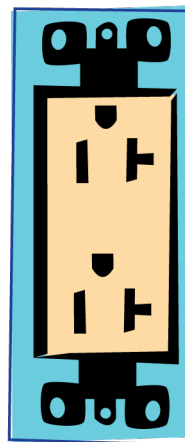


Figure 10. Demand Responsive Controlled Receptacle



The California Energy Commission (CEC) Blueprint newsletter Issue 141 (January – March 2023) provides more information on requirements and options for [Demand Responsive Controls](#).

Figure 11. Image of CEC Blueprint Newsletter

6. **Create Sequence of Operations supporting Control Interactions §130.1(f) or §160.5(b)4F:** When there are multiple controls within a space, the Energy Code provides some requirements for how they are to interact with each other. It is recommended that a sequence of operations be developed, along with the owner’s design requirements, to develop a control sequence that can be installed by the contractor, tested by the certified acceptance test technician (ATT), and support building occupants needs. Additionally, [§110.9\(b\)](#) dictates functionality of specific control types



Figure 12. Indoor Lighting Controls Design Flowchart: Step 6



Table 8 below explains the basic functions of different lighting controls. Table 8 also covers how different types of lighting controls must interact with each other when they control lighting in the same space. Use this table to help develop a lighting control sequence-of-operations plan to help guide design and construction.

<b>Mandatory Lighting Control Requirements and Interactions</b>	
Control Type	Control Requirements of <b>§110.9(b)</b> and Control Interactions of <b>§130.1(f)</b> or <b>§160.5(b)4F</b> <i>Indicator lights integral to lighting controls must consume ≤ one watt of power per indicator light.</i>
<b>Manual Area</b>	<p><b>Control Interactions of <u>§130.1(f)</u> or <u>§160.5(b)4F</u></b></p> <ul style="list-style-type: none"> <li>✦ For general lighting, the <b>manual area control</b> must allow the level or amount of light provided while the lighting is on to be set or adjusted by any other Mandatory lighting control.</li> <li>✦ The <b>manual area control</b> must allow the <b>shut-off control</b> to turn the lighting down or off.</li> <li>✦ The <b>shut-off control</b> must allow the <b>manual area control</b> to turn the lighting on. If the on request occurs while an <b>automatic time-switch control</b> would turn the lighting off, then the on request must be treated as an override request.</li> </ul>
<b>Multilevel</b>	<p><b>Control Requirements of <u>§110.9(b)</u></b></p> <p><b>Dimmers</b> must:</p> <ul style="list-style-type: none"> <li>✦ Be able to reduce lighting power consumption by a minimum of 65% when at the lowest setting</li> <li>✦ Provide reduced flicker operation, meaning that directly controlled light sources must be provided electrical power such that the light output has an amplitude modulation of less than 30% for frequencies less than 200 Hz without causing premature lamp failure</li> <li>✦ Provide an off setting that produces a zero lumen output</li> <li>✦ For wall box dimmers and associated switches designed for use in three way circuits, be capable of turning lights off, and on to the level set by the dimmer if the lights are off</li> </ul> <p><b>Control Interactions of <u>§130.1(f)</u> or <u>§160.5(b)4F</u></b></p> <ul style="list-style-type: none"> <li>✦ The <b>multilevel lighting control</b> must allow the <b>automatic daylighting control</b> to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.</li> <li>✦ The <b>multilevel lighting control</b> must allow the <b>demand responsive control</b> to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.</li> <li>✦ For lighting controlled by <b>multilevel lighting controls and by occupant sensing controls</b> that provide an automatic-on function, the controls must provide a partial-on function that is capable of automatically activating between 50 and 70% of controlled lighting power.</li> <li>✦ The <b>automatic daylighting control</b> must allow the <b>multilevel lighting control</b> to adjust the level of lighting.</li> </ul>

*(Continued)*



(Continued)

## Mandatory Lighting Control Requirements and Interactions

Control Type	Control Requirements of §110.9(b) and Control Interactions of §130.1(f) or §160.5(b)4F <i>Indicator lights integral to lighting controls must consume ≤ one watt of power per indicator light.</i>
<b>Shut-off</b> <i>(continued on next page)</i>	<p><b>Control Requirements of §110.9(b)</b></p> <p><b>Time Switch:</b> All controls that provide time-switch functionality, including all automatic and astronomical time-switch controls, must have program backup capabilities that prevent the loss of the device’s schedule for at least 7 days, and the device’s date and time for at least 72 hours if power is interrupted.</p> <p>When installed in nonresidential buildings, time-switch controls must:</p> <ul style="list-style-type: none"> <li>✦ For each connected load, be capable of providing manual override to each connected load and of resuming normally scheduled operation after a manual override is initiated within 2 hours</li> <li>✦ Provide an automatic holiday shut-off feature that turns off all connected loads for at least 24 hours and then resumes normally scheduled operation</li> </ul> <p><u>Astronomical Time Switch must:</u></p> <ul style="list-style-type: none"> <li>✦ Have sunrise and sunset prediction accuracy within plus-or-minus 15 minutes and timekeeping accuracy within 5 minutes per year</li> <li>✦ Be capable of displaying date, current time, sunrise time, sunset time, and switching times for each step during programming</li> <li>✦ Be capable of automatically adjusting for daylight savings time</li> <li>✦ Have the ability to independently offset the on and off for each channel by at least 90 minutes before and after sunrise or sunset</li> </ul> <p><u>Multilevel Time Switch:</u></p> <ul style="list-style-type: none"> <li>✦ Must include at least two separately programmable steps per zone</li> </ul> <p><u>Outdoor Time Switch:</u></p> <ul style="list-style-type: none"> <li>✦ Must have setback functions that allow the lighting on each controlled channel to be switched or dimmed to lower levels. The setback functions must be capable of being programmed by the user for at least one specific time of day.</li> </ul> <p><b>Occupant Sensing (all types including partial-on and partial-off) must:</b></p> <ul style="list-style-type: none"> <li>✦ Be capable of automatically turning the controlled lights in the area either off or down no more than 20 minutes after the area has been vacated</li> <li>✦ For manual-on controls, have a grace period of no less than 15 seconds and no more than 30 seconds to turn on lighting automatically after the sensor has timed out</li> <li>✦ Provide a visible status signal that indicates that the device is operating properly, or that it has failed or malfunctioned. The visible status signal may have an override that turns off the signal</li> </ul> <p>EXCEPTION: Occupant sensing control systems may consist of a combination of single or multilevel occupant, motion, or vacancy sensor controls, provided that components installed to comply with manual-on requirements cannot be converted by occupants from manual-on to automatic-on functionality.</p> <p><u>Sensors used to detect occupants:</u> Sensors that are used by occupant sensing controls to detect occupants must meet all of the following requirements:</p> <ul style="list-style-type: none"> <li>✦ Sensors must not incorporate switches or mechanical devices that allow the sensor to be disabled without changing the settings of the control.</li> <li>✦ Sensors that use ultrasonic radiation to detect occupants must comply with 21 C.F.R. part 1002.12; not emit audible sound; and not emit ultrasound in excess of the decibel levels shown in <a href="#">Table 110.9-A</a> measured no more than five feet from the source, on axis.</li> <li>✦ Sensors that use microwave radiation to detect occupants must comply with 47 C.F.R. parts 2 and 15; and not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device.</li> </ul>

(Continued)



(Continued)

Mandatory Lighting Control Requirements and Interactions	
Control Type	Control Requirements of §110.9(b) and Control Interactions of §130.1(f) or §160.5(b)4F <i>Indicator lights integral to lighting controls must consume ≤ one watt of power per indicator light.</i>
(continued) Shut-off	<p><b>Control Interactions of §130.1(f) or §160.5(b)4F</b></p> <ul style="list-style-type: none"> <li>✦ The <b>shut-off control</b> must allow the <b>manual area control</b> to turn the lighting on. If the on request occurs while an <b>automatic time-switch control</b> would turn the lighting off, then the on request must be treated as an override request.</li> <li>✦ For lighting controlled by <b>multilevel lighting controls</b> and by <b>occupant sensing controls</b> that provide an automatic-on function, the controls must provide a partial-on function that is capable of automatically activating between 50 and 70% of controlled lighting power.</li> <li>✦ For space conditioning system zones serving spaces that are required to have <b>occupancy sensing controls</b> as specified in §130.1(c) or §160.5(b)4C, and where <a href="#">Table 120.1-A</a> or <a href="#">160.2-B</a> allows the ventilation air to be reduced to zero when the space is in occupied-standby mode (supported with footnote F), the space conditioning system must be controlled by occupancy sensing controls.</li> </ul>
Daylighting	<p><b>Control Requirements of §110.9(b)</b></p> <p><b>Daylighting controls</b> must:</p> <ul style="list-style-type: none"> <li>✦ Automatically return to their most recent time delay settings within 60 minutes of the last received input when left in calibration mode</li> <li>✦ Have a set point control that easily distinguishes settings to within 10% of full scale adjustment</li> <li>✦ Provide a linear response within 5% accuracy over the range of illuminance measured by the light sensor</li> <li>✦ Be able to be calibrated such that the person initiating the calibration is remote from the sensor during calibration to avoid influencing calibration accuracy, for example by having a light sensor that is physically separated from where the calibration adjustments are made</li> </ul> <p><b>Control Interactions of §130.1(f) or §160.5(b)4F</b></p> <ul style="list-style-type: none"> <li>✦ The <b>automatic daylighting control</b> must allow the <b>multilevel lighting control</b> to adjust the level of lighting.</li> <li>✦ The <b>multilevel lighting control</b> must allow the <b>automatic daylighting control</b> to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.</li> </ul>
Demand Responsive	<p><b>Control Interactions of §130.1(f) or §160.5(b)4F</b></p> <ul style="list-style-type: none"> <li>✦ The <b>multilevel lighting control</b> must allow the <b>demand responsive control</b> to adjust the lighting during a demand response event and to return it to the level set by the <b>multilevel control</b> after the event.</li> </ul>

**Table 8.** Mandatory Lighting Control Requirements and Interactions





## Alterations: Indoor Lighting Requirements

### Key Terms for Indoor Lighting Alterations

**Luminaire Alteration §141.0(b)2i or §180.2(b)4Biv** is adding luminaires, removing and reinstalling luminaires, or combined replacement of lamps and ballasts or drivers. Luminaire Alterations do not include repairs, such as replacing lamps only, ballasts or drivers only, diffusers, shades or luminaire covers. Limited to projects removing and reinstalling  $\geq 10\%$  of the existing luminaires, replacing and/or removing  $\geq 10\%$  of luminaires in an enclosed space, and redesigning the lighting system. Excludes enclosed spaces with only one luminaire. The Area Category Method (§140.6 or §170.2(e)1) is used to determine the maximum wattage allowance per space type. If the project can show that the altered lighting power is  $\leq 80\%$  of the indoor lighting power allowance from §140.6 or §170.2(e)1, then not all Mandatory indoor lighting controls are required. Existing control functionality cannot be removed but can be replaced.

**One-for-One Alteration §141.0(b)2liii or §180.2(b)4Bivc** is either replacement of whole luminaires one for one, in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire, or when components of a luminaire are modified without replacing the entire luminaire. Limited to buildings and tenant spaces (in multi-tenant buildings)  $\leq 5,000$  ft<sup>2</sup> that can show  $\geq 40\%$  permanent reduction compared to the pre-altered wattage. Energy Code is not triggered when  $\leq 50$  luminaires per floor or tenant space are altered per year. Not all Mandatory indoor lighting controls are required with this method. Existing control functionality cannot be removed but can be replaced.

**Alterations that increase the indoor lighting load** of the space will be required to show compliance with the lighting requirements associated with New Construction.

#### WHAT'S NEW

Shut-off controls for offices  $> 250$  ft<sup>2</sup> are not required when using the one-for-one component method or using  $\leq 80\%$  of allowed LPD.

### Is Your Project an Alteration that Triggers the Energy Code?

In Alteration projects involving indoor lighting, some work triggers Energy Code requirements. See Table 9 below for a list of common project scope and whether they trigger the Energy Code. For a summary of the Mandatory requirements for indoor lighting Alterations, see Table 10.

Is Your Indoor Lighting Project an Alteration that Triggers the Energy Code?		
Project Scope	Project Type	Is the Energy Code Triggered?
Increasing the connected lighting load in a space	<b>Alteration</b> - <i>Must meet requirements for New Construction</i>	<b>YES</b>
Replacing or rewiring $\geq 10\%$ of luminaires in a space	<b>Alteration</b>	<b>YES</b>
Replacing or rewiring $> 50$ luminaires a year in a $\leq 5,000$ ft <sup>2</sup> building or $\leq 5,000$ ft <sup>2</sup> tenant space in a multi-tenant building	<b>Alteration</b>	<b>YES</b>
Moving $\geq 10\%$ of luminaires in a space, even if putting them back	<b>Alteration</b>	<b>YES</b>
Redesigning the reflected ceiling plan in a space	<b>Alteration</b>	<b>YES</b>
Adding luminaires while replacing or rewiring others in which the connected lighting load in the space is not increased	<b>Alteration</b>	<b>YES</b>
Rewiring lighting circuits, relocating, modifying or replacing lighting wiring	<b>Alteration</b>	<b>YES</b>
Replacing lamp <b>and</b> driver for $\geq 10\%$ of luminaires in a space	<b>Alteration</b>	<b>YES</b>
Adding or altering lighting controls Note that removing existing control functions is not allowed.	<b>Repair</b>	No
Moving walls but not making changes to the luminaires in a space	<b>Repair</b> – <i>Area Controls may apply</i>	No
Moving luminaires to facilitate asbestos abatement	<b>Repair</b>	No
Removing luminaires in a space	<b>Repair</b>	No
Replacing lamp, lens or driver and not increasing energy use	<b>Repair</b>	No

**Table 9.** Is Your Indoor Lighting Project an Alteration that Triggers the Energy Code?



## Mandatory Indoor Lighting Controls for Alterations

Table 10 below details the Mandatory lighting controls required for three different Prescriptive compliance paths for indoor lighting Alterations: the one-for-one component method with existing wattage reduced 40% or more, luminaire Alterations that use less than or equal to 80% of the allowed lighting power density (LPD), and luminaire Alterations that use more than 80% of the allowed LPD (see “Key Terms for Indoor Lighting Alterations” above). Table 10 shows that there are fewer Mandatory lighting controls required for both the one-for-one component method and luminaire Alterations using less than or equal to 80% of the allowed LPD, as compared with luminaire Alterations using more than 80% of the allowed LPD.

2022 Mandatory Indoor Lighting Controls for Alterations				
Requirements Based on Lighting Alteration Compliance Method Used				
Acceptance testing requirements of §130.4 or Multifamily Common Use §160.5(e) are not required for Alterations where lighting controls are added or altered to control ≤ 20 luminaires for the entire permitted project (including all indoor, outdoor and sign lighting associated with the permitted work).		One-for-One Component Method	Luminaire Alteration Method	Luminaire Alteration Method
		Total Wattage Reduced ≥ 40% Limited to ≤ 5,000 ft <sup>2</sup>	Excluding Spaces with ≤ 1 Luminaire Using ≤ 80% of Allowed LPD	Excluding Spaces with ≤ 1 Luminaire Using > 80% of Allowed LPD
<b>Manual Area Controls (On or Off):</b> §130.1(a) or Multifamily Common Use §160.5(b)4A	<b>Trigger:</b> For each enclosed space with ceiling-height partitions <b>Excluding</b> ≤ 0.1 w/ft <sup>2</sup> designed egress lighting consistent with <a href="#">California Building Code §1008</a>	<b>YES</b> <i>Separate switching for “general” and “other” not required for shared circuits</i>	<b>YES</b> <i>Separate switching for “general” and “other” not required for shared circuits</i>	<b>YES</b> <i>Separate switching for “general” and “other” not required for shared circuits</i>
<b>Multilevel Control:</b> §130.1(b) or Multifamily Common Use §160.5(b)4B	<b>Trigger:</b> For general lighting in enclosed spaces ≥ 100 ft <sup>2</sup> and with connected lighting load > 0.5 w/ft <sup>2</sup> per <a href="#">Table 130.1-A</a> or Multifamily Common Use <a href="#">Table 160.5-B</a> ; Exception: Enclosed spaces that only have one luminaire with two lamps or less or only one inseparable SSL luminaire <b>Excluding</b> restrooms and healthcare facilities	No	No	<b>YES</b> <i>Only for modified luminaires</i>
<b>Auto Shut-Off Control:</b> §130.1(c)1-8 or Multifamily Common Use §160.5(b)4C Excluding Healthcare Facilities <i>(continued)</i>	<b>Whole Building Shut-Off (timeclock, time switch or all luminaires controlled locally with sensors):</b> §130.1(c)1-4 or Multifamily Common Use §160.5(b)4C-i-iv <b>Excluding:</b> Areas in continuous use (24 hours per day and 365 days per year); ≤ 0.1 w/ft <sup>2</sup> egress lighting consistent with <a href="#">California Building Code §1008</a> ; Electrical rooms subject to Article 110.26(D) of California Electrical Code; Emergency lighting on emergency power or battery which is only on when normal power absent.	<b>YES</b> <i>Separate switching for “general” and “other” not required for shared circuits</i>	<b>YES</b> <i>Separate controls for “general” versus “other” not required for shared circuits</i>	<b>YES</b> <i>Separate switching for “general” and “other” not required for shared circuits</i>

*(Continued)*



(Continued)

## 2022 Mandatory Indoor Lighting Controls for Alterations

*Requirements Based on Lighting Alteration Compliance Method Used*

Acceptance testing requirements of §130.4 or Multifamily Common Use §160.5(e) are not required for Alterations where lighting controls are added or altered to control ≤ 20 luminaires for the entire permitted project (including all indoor, outdoor and sign lighting associated with the permitted work).	One-for-One Component Method Total Wattage Reduced ≥ 40% Limited to ≤ 5,000 ft <sup>2</sup>	Luminaire Alteration Method Excluding Spaces with ≤ 1 Luminaire Using ≤ 80% of Allowed LPD	Luminaire Alteration Method Excluding Spaces with ≤ 1 Luminaire Using > 80% of Allowed LPD		
<p>(continued)</p> <p><b>Auto Shut-Off Control:</b> §130.1(c)1-8 or Multifamily Common Use §160.5(b)4C Excluding Healthcare Facilities</p>	<p><b>Partial-ON or Vacancy Sensors (when multilevel required) or Occupancy Sensor (when multilevel not required):</b> <a href="#">§130.1(c)5</a> or Multifamily Common Use <a href="#">§160.5(b)4Cv</a> <i>Trigger: In offices ≤ 250 ft<sup>2</sup>, multipurpose rooms &lt; 1,000 ft<sup>2</sup>, classrooms, conference rooms, restrooms of any size</i></p>	<p><b>Full or Partial-OFF Sensors:</b> <a href="#">§130.1(c)6</a> or Multifamily Common Use <a href="#">§160.5(b)4Cvi</a> <a href="#">§130.1(c)6A</a>: Warehouse aisles and stacks; <a href="#">§130.1(c)6B</a>: Library book stacks; <a href="#">§130.1(c)6C</a> or <a href="#">§160.5(b)4Cvi</a>: Stairs and corridors; <a href="#">§130.1(c)6D</a> or <a href="#">§160.5(b)4Cvi</a>: Offices &gt; 250 ft<sup>2</sup> <b>Partial-OFF Sensors:</b> <a href="#">§130.1(c)7</a> or Multifamily Common Use Parking <a href="#">§160.5(b)4Cvii</a> <a href="#">§130.1(c)7A</a>: Stairs and common area corridors to hotel and motel guest rooms; <a href="#">§130.1(c)7B</a> or <a href="#">§160.5(b)4Cvii</a>: Parking garages</p>	<p><b>Hotel and Motel Guest Room Auto Shut-off:</b> <a href="#">§130.1(c)8</a></p>	<p><b>Primary and Secondary Automatic Daylighting Control:</b> <a href="#">§130.1(d)</a> or Multifamily Common Use <a href="#">§160.5(b)4D</a></p>	<p><b>Demand Responsive Controls:</b> <a href="#">§110.12(c)</a></p>
	YES	YES	YES		
	YES <a href="#">§130.1(c)6D</a> for offices > 250 ft <sup>2</sup> not required	YES <a href="#">§130.1(c)6D</a> for offices > 250 ft <sup>2</sup> not required	YES		
	YES	YES	YES		
	No	No	YES		
	No	No	YES		

**Table 10.** 2022 Mandatory Indoor Lighting Controls for Alterations



# Outdoor Lighting

## New Construction and Additions: Outdoor Lighting Requirements

### Outdoor Lighting Design: Power and Wattage

#### Outdoor Lighting Control Types

**Astronomical Time-switch Control** is a device that controls lighting based on the time of day and astronomical events such as sunset and sunrise, accounting for geographic location and calendar date.

**Automatic Daylight Control** adjusts the luminous flux of the electric lighting system in either a series of steps or by continuous dimming in response to available daylight. This kind of control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the electric lighting levels in response.

**Automatic Scheduling Control** is a time-based lighting control that is capable of being programmed to reduce or turn off lighting power for a portion of the night and to turn off lighting power for the day.

**Automatic Time-switch Control** is a device that controls lighting based on the time of day.

**Dimmer** is a device used to control the intensity of light emitted by a luminaire by controlling the voltage or current available to it.

**Multilevel Lighting Control** reduces power going to a lighting system in multiple steps.

**Occupant Sensing Controls** automatically control levels of illumination, allow for manual operation, and include the following type:

- ✦ Motion Sensing Control is used outdoors, automatically reduces lighting power or turns lights OFF after an area is vacated of occupants, and automatically turns the lights ON when the area is occupied.

#### Determining Outdoor Lighting Zones

Per Table 10-114-A found in §10-114 of Title 24, Part 1 Administrative Regulations, outdoor lighting zones are based on the 2010 U.S. Census.

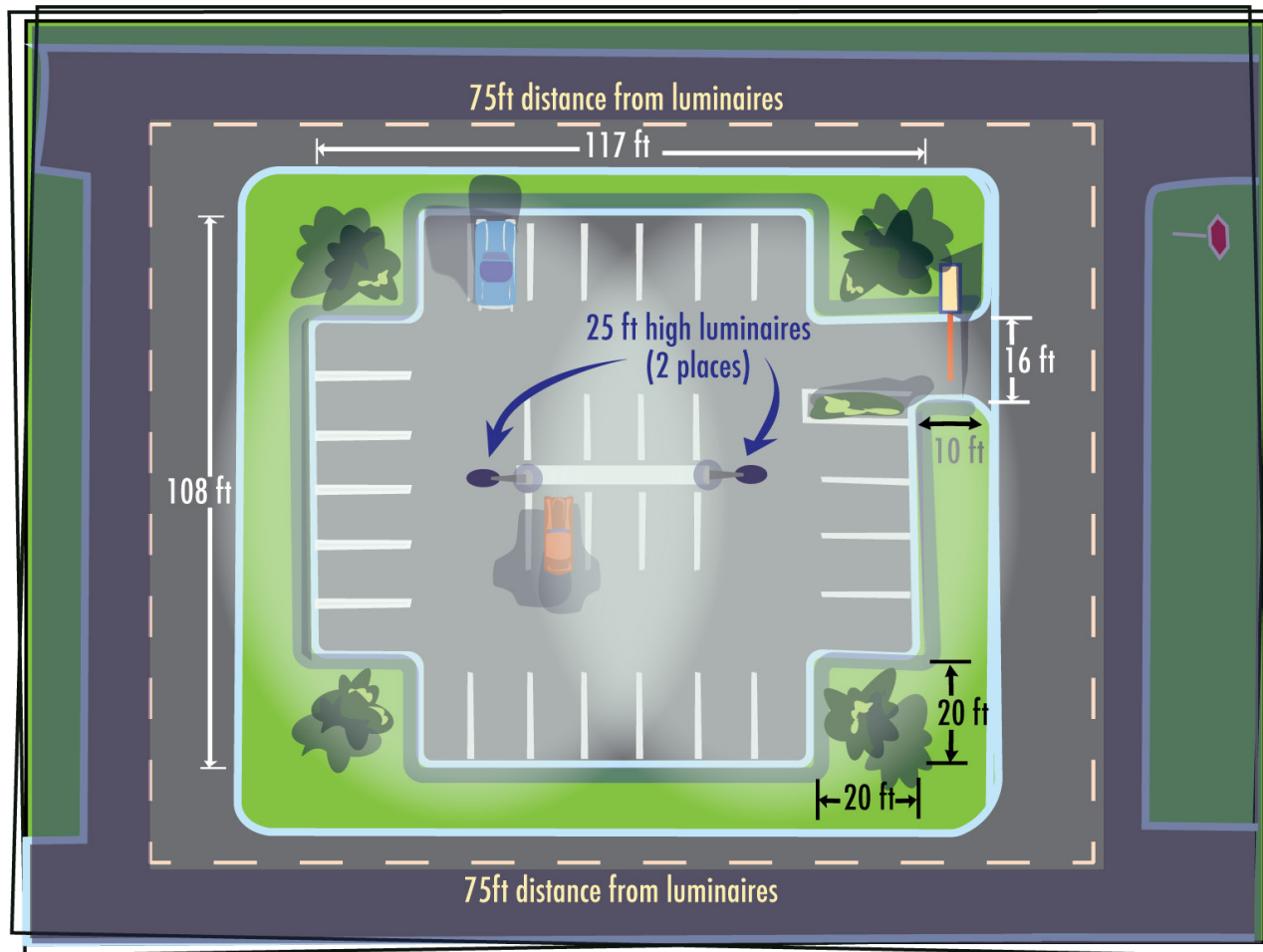
**Step 1:** Use this web page to determine lighting zone: [geocoding.geo.census.gov/geocoder/geographies/address?form](https://geocoding.geo.census.gov/geocoder/geographies/address?form)

**Step 2:** Select the "Vintage" as "Census2010\_Current"

- ✦ Go to the "Census Blocks" and look for UR:
  - ◇ UR: (R is Rural Areas): This is LZ1
  - ◇ UR: U
    1. Look for "Urban Clusters" near top of data: This is LZ2
    2. Look for "Urbanized Areas" near top of data: This is LZ3

**Figure 13.** Screenshot of U.S. Census Bureau "Find Address Geographies" Web Page with "Vintage" Set to "Census2010\_Current"





**Figure 14.** Outdoor Lighting Design: Determine Illuminated Hardscape Area and Perimeter from Plans

## Outdoor Lighting Design: Determining Power and Wattage

**1. Calculate Hardscape Allowance:** To determine hardscape wattage allowances, first identify the **outdoor lighting zone** and find the zone's **area, linear, and initial wattage allowances** (see [Table 11](#)). There are different hardscape allowances for nonresidential and multifamily buildings. The area, linear and initial wattage allowances may only be applied to illuminated hardscape areas. In plan view, the illuminated hardscape area for a single luminaire is defined as a square with the length of each side equal to 10 times the luminaire mounting height, with the luminaire in the middle of the square.

To calculate general hardscape area, add together illuminated areas for all outdoor luminaires that are within the property line, excluding overlapping illuminated areas, buildings, large landscape areas and other obstructions. Planters and small landscape areas are included within the general hardscape area if the width or length of the inclusion is less than 10 ft and the inclusion is bordered on at least three sides by the hardscape.

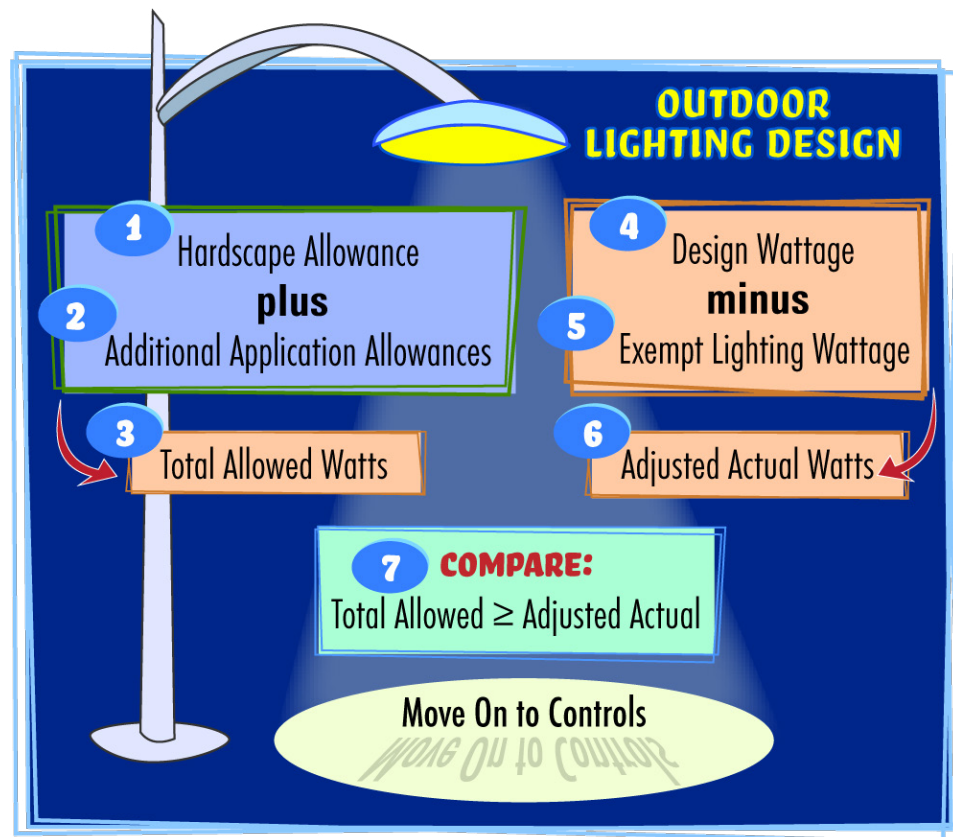
Multiply the area wattage allowance by the whole illuminated area minus excluded areas. Next, for nonresidential projects only, add the linear wattage allowance multiplied by the perimeter length of the illuminated hardscape area. Finally, add in the initial wattage allowance the first time an outdoor lighting calculation is performed for the site.

### WHAT'S NEW

Outdoor lighting wattage allowances have been reduced from the 2019 Energy Code, and those for multifamily buildings are calculated differently from nonresidential, hotel, and motel buildings. Security lighting now has an additional lighting power application allowance.



**2. Calculate Additional Application Allowances:** Nonresidential [Table 140.7-B](#) and multifamily [Table 170.2-S](#) list many additional lighting applications that may apply to the site. These applications have different wattage allowances for each outdoor lighting zone, and they are “use it or lose it” allowances, so the added wattage is the smaller of the calculated allowance or the actual installed lighting power. The resulting lighting allowance can be layered in addition to the hardscape allowance.



**Figure 15.** Outdoor Lighting Design

**3. Determine the Total Allowed Wattage:** Add the calculated hardscape allowance to the additional application allowances.

**4. Design Wattage:** The design or actual lighting power is the sum of the wattages of all planned permanent lighting fixtures.

**5. Exempt Lighting Wattage:** Do not include the wattage associated with exempt lighting for outdoor lighting compliance, although those luminaires will still be subject to the lighting control requirements of the Energy Code. Light fixtures are exempt when more than 50% of their light falls within one of certain applications including, but not limited to, the following:

- ◇ Temporary outdoor lighting
- ◇ Landscape lighting
- ◇ Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way
- ◇ Lighting for sports and athletic fields, and children’s playgrounds
- ◇ Lighting regulated by the Federal Aviation Administration or Coast Guard
- ◇ 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
- ◇ Lighting of public monuments including flag poles
- ◇ Lighting of illuminated signs meeting Energy Code requirements
- ◇ Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps
- ◇ In theme parks: outdoor lighting only for themes and special effects
- ◇ Lighting systems for outdoor theatrical and other outdoor live performances that are additions to area lighting systems and are that are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators
- ◇ 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

**6. Determine Adjusted Actual Watts** by subtracting the exempt lighting wattage from the design wattage.

**7. For Outdoor Lighting Wattage Compliance, Compare to Confirm:**  
Total Allowed Watts  $\geq$  Adjusted Actual Watts.

*Next, move on to determining compliance with control requirements.*



Table 11 below describes the characteristics of outdoor lighting zones. The table provides nonresidential and multifamily outdoor lighting wattage allowances for general hardscape for each outdoor lighting zone. Use this data to calculate the allowed watts available for general hardscape lighting under the Energy Code.

<b>Outdoor Lighting Zones and General Hardscape Wattage Allowances for Energy Code Compliance</b>				
<b>Zone</b>	<b>Outdoor Lighting Zone Characteristics</b>	<b>Ambient Illumination</b>	<b>Nonresidential Outdoor General Hardscape Allowances</b>	<b>Multifamily Outdoor General Hardscape Allowances</b>
<b>LZ0</b>	<b>Undeveloped areas</b> of government designated parks, recreation areas, and wildlife preserves	Very Low	<p><b>Nonresidential Wattage Allowances:</b> None</p> <p><b>Additional Wattage Allowance:</b> None</p> <p>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 must meet the maximum zonal lumen limits as specified in <a href="#">§130.2(b)</a> or <a href="#">§160.5(c)1</a>.</p>	<p><b>Multifamily Wattage Allowances:</b> None</p> <p><b>Additional Wattage Allowance:</b> None</p> <p>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 must meet the maximum zonal lumen limits as specified in <a href="#">§130.2(b)</a> or <a href="#">§160.5(c)1</a>.</p>
<b>LZ1<sup>1</sup></b>	<b>Rural areas:</b> Single-family residential areas, parks, agricultural zone districts, developed portion of government designated parks, recreation areas and wildlife preserves.	Low	<p><b>Nonresidential Area Wattage Allowance:</b> 0.016 W/ft<sup>2</sup></p> <p><b>Nonresidential Linear Wattage Allowance:</b> 0.13 W/lf</p> <p><b>Nonresidential Initial Wattage Allowance:</b> 150 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 140.7-B</a></p>	<p><b>Multifamily Area Wattage Allowance:</b> 0.026 W/ft<sup>2</sup></p> <p><b>Multifamily Linear Wattage Allowance:</b> None</p> <p><b>Multifamily Initial Wattage Allowance:</b> 300 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 170.2-S</a></p>
<b>LZ2<sup>1</sup></b>	<b>Urban clusters:</b> Multifamily housing, mixed use residential neighborhoods, religious facilities, schools and light commercial business districts or industrial zoning districts	Moderate	<p><b>Nonresidential Area Wattage Allowance:</b> 0.019 W/ft<sup>2</sup></p> <p><b>Nonresidential Linear Wattage Allowance:</b> 0.15 W/lf</p> <p><b>Nonresidential Initial Wattage Allowance:</b> 200 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 140.7-B</a></p>	<p><b>Multifamily Area Wattage Allowance:</b> 0.030 W/ft<sup>2</sup></p> <p><b>Multifamily Linear Wattage Allowance:</b> None</p> <p><b>Multifamily Initial Wattage Allowance:</b> 350 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 170.2-S</a></p>
<b>LZ3<sup>1</sup></b>	<b>Urban areas:</b> High intensity commercial corridors, entertainment centers and heavy industrial or manufacturing zone districts	Moderately High	<p><b>Nonresidential Area Wattage Allowance:</b> 0.021 W/ft<sup>2</sup></p> <p><b>Nonresidential Linear Wattage Allowance:</b> 0.20 W/lf</p> <p><b>Nonresidential Initial Wattage Allowance:</b> 250 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 140.7-B</a></p>	<p><b>Multifamily Area Wattage Allowance:</b> 0.038 W/ft<sup>2</sup></p> <p><b>Multifamily Linear Wattage Allowance:</b> None</p> <p><b>Multifamily Initial Wattage Allowance:</b> 400 W</p> <p><b>Additional Wattage Allowance:</b> See <a href="#">Table 170.2-S</a></p>
<b>LZ4<sup>1</sup></b>	Not currently allowed for any areas of California	High	N/A	N/A

<sup>1</sup> *Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna – shall be allowed a 2.0 lighting power allowance multiplier.*

**Table 11.** Outdoor Lighting Zones and General Hardscape Wattage Allowances for Energy Code Compliance



## Outdoor Lighting Design: Control Requirements

Table 12 below explains the basic functions of different lighting control types. Use this table to help select Energy Code compliant lighting controls.

### Mandatory Outdoor Lighting Control Requirements

#### Control Requirements of §110.9(b)

*Indicator lights integral to lighting controls must consume  $\leq$  one watt of power per indicator light.*

#### Dimmers must:

- ✦ Be able to reduce lighting power consumption by a minimum of 65% when at the lowest setting
- ✦ Provide reduced flicker operation, meaning that directly controlled light sources must be provided electrical power such that the light output has an amplitude modulation of less than 30% for frequencies less than 200 Hz without causing premature lamp failure
- ✦ Provide an off setting that produces a zero lumen output
- ✦ For wall box dimmers and associated switches designed for use in three way circuits, be capable of turning lights off, and on to the level set by the dimmer if the lights are off

**Time Switch:** All controls that provide time-switch functionality, including all automatic and astronomical time-switch controls, must have program backup capabilities that prevent the loss of the device's schedule for at least 7 days, and the device's date and time for at least 72 hours if power is interrupted.

#### Astronomical Time Switch must:

- ✦ Have sunrise and sunset prediction accuracy within plus-or-minus 15 minutes and timekeeping accuracy within 5 minutes per year
- ✦ Be capable of displaying date, current time, sunrise time, sunset time, and switching times for each step during programming
- ✦ Be capable of automatically adjusting for daylight savings time
- ✦ Have the ability to independently offset the on and off for each channel by at least 90 minutes before and after sunrise or sunset

#### Multilevel Time Switch:

- ✦ Must include at least two separately programmable steps per zone

#### Outdoor Time Switch:

- ✦ Must have setback functions that allow the lighting on each controlled channel to be switched or dimmed to lower levels. The setback functions must be capable of being programmed by the user for at least one specific time of day.

#### **Occupant Sensing (all types including partial-on and partial-off) must:**

- ✦ Be capable of automatically turning the controlled lights in the area either off or down no more than 20 minutes after the area has been vacated
- ✦ For manual-on controls, have a grace period of no less than 15 seconds and no more than 30 seconds to turn on lighting automatically after the sensor has timed out
- ✦ Provide a visible status signal that indicates that the device is operating properly, or that it has failed or malfunctioned. The visible status signal may have an override that turns off the signal.

EXCEPTION: Occupant-sensing control systems may consist of a combination of single or multilevel occupant, motion, or vacancy sensor controls, provided that components installed to comply with manual-on requirements cannot be converted by occupants from manual-on to automatic-on functionality.

Sensors used to detect occupants: Sensors that are used by occupant sensing controls to detect occupants must meet all of the following requirements:

- ✦ Sensors must not incorporate switches or mechanical devices that allow the sensor to be disabled without changing the settings of the control.
- ✦ Sensors that use ultrasonic radiation to detect occupants must comply with 21 C.F.R. part 1002.12; not emit audible sound; and not emit ultrasound in excess of the decibel levels shown in [Table 110.9-A](#) measured no more than five feet from the source, on axis.
- ✦ Sensors that use microwave radiation to detect occupants must comply with 47 C.F.R. parts 2 and 15; and not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device.

**Table 12.** Mandatory Basic Functions for Outdoor Lighting Controls



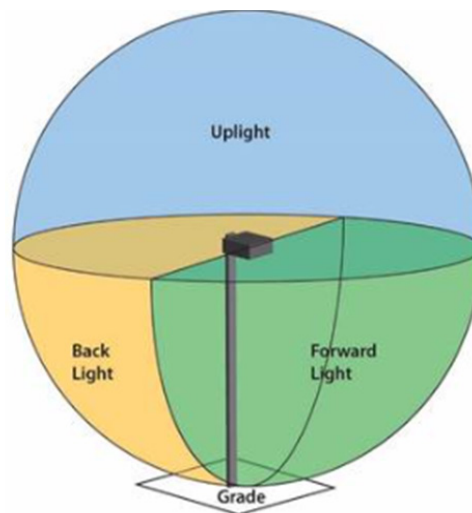


## Outdoor Lighting Design: Controls

**1. Shielding** (Backlight, Uplight, Glare – BUG) §130.2(b) or §160.5(c)1: BUG ratings are required for all outdoor luminaires with  $\geq 6,200$  initial lumens. Requirements are found in Title 24, Part 11 (CALGreen) §5.106.8 including Table 5.106.8 (see Table 13 below). Backlight and glare (i.e., forward light) ratings are based on outdoor lighting zone and on the luminaire distance from the property line measured in the number of luminaire mounting heights. Uplight ratings are based on lighting zone and the type of lighting.

### Exceptions:

- ◇ Signs
- ◇ Lighting for building facades, public monuments, public art, statues, and vertical surfaces of bridges
- ◇ Lighting not permitted by a health or life safety statute, ordinance, or regulation to be a cutoff luminaire
- ◇ Temporary outdoor lighting
- ◇ Luminaires that illuminate the public right of way including publicly-maintained or utility-maintained roadways, sidewalks, and bikeways
- ◇ Outdoor lighting attached to a multifamily building, hotel, or motel and separately controlled from the inside of a dwelling unit or guest room



**Figure 16.** Primary Solid Angles of the Luminaire Classification System for Outdoor Luminaires

Image Source: Illuminating Engineering Society (image from ANSI/IES TM-15-20)

## Maximum Allowable Backlight, Uplight and Glare (BUG) Ratings

Reprinted from Table 5.106.8 from Title 24, Part 11

Maximum Allowable Rating		LZ0	LZ1	LZ2	LZ3	LZ4
<b>Backlight Rating (B)</b>	Luminaire > 2 mounting heights (MH) from property line	N/A	No Limit	No Limit	No Limit	No Limit
	Luminaire back hemisphere is 1-2 MH from property line	N/A	B2	B3	B4	B4
	Luminaire back hemisphere is 0.5-1 MH from property line	N/A	B1	B2	B3	B3
	Luminaire back hemisphere is < 0.5 MH from property line	N/A	B0	B0	B1	B2
<b>Uplight Rating (U)</b>	For area lighting (outdoor parking, sales or storage lots)	N/A	U0	U0	U0	U0
	For all other lighting including decorative luminaires	N/A	U1	U2	U3	U4
<b>Glare Rating (G)</b>	Luminaire > 2 mounting heights (MH) from property line	N/A	G1	G2	G3	G4
	Luminaire front hemisphere is 1-2 MH from property line	N/A	G0	G1	G1	G2
	Luminaire front hemisphere is 0.5-1 MH from property line	N/A	G0	G0	G1	G1
	Luminaire front hemisphere is < 0.5 MH from property line	N/A	G0	G0	G0	G1

**Table 13.** Maximum Allowable BUG Ratings (Reprinted from Table 5.106.8 from Title 24, Part 11)

- 1** Determine if **Shielding** (i.e., **BUG**) requirements apply. If yes, meet BUG ratings based on lighting zone and other criteria from Table 13.
- 2** Determine if **Daylight Availability** controls apply. If yes, decide which control scheme to use.
- 3** Determine if **Automatic Scheduling** controls apply. If yes, decide how to support these requirements.
- 4** Determine if **Motion Sensing** controls apply. If yes, decide how to program the sensors.
- 5** **Create Sequence of Operations**

**Figure 17.** Designing Outdoor Lighting Controls: Step 1



## Outdoor Lighting Design: Controls (continued)

**2. Daylight Availability §130.2(c)1 or §160.5(c)2A:** All outdoor lighting must be capable of automatically shutting off lights when daylight is available using photo control, an astronomical time switch, or any other control that can automatically turn off lighting when daylight is available.

**Exceptions:**

- ◇ Health or life safety statute, ordinance or regulation
- ◇ Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year

**3. Automatic Scheduling §130.2(c)2 or §160.5(c)2B:** Provide automatic scheduling controls that can reduce lighting power by at least 50% but no more than 90% and be capable of separately turning OFF lighting during scheduled unoccupied times. Have at minimum of two nighttime periods with independent lighting levels, dim or OFF, which may include a 2-hour override function to turn lights ON. Acceptance testing by a certified ATT is required to verify the occupied and unoccupied periods programmed, or else use default schedules. These scheduling controls may be installed in combination with other outdoor lighting controls such as motion sensors, but not instead of other controls.

**Exceptions:** Health or life safety statute, ordinance, or regulation; lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

**4. Motion Sensing §130.2(c)3 or §160.5(c)2C:** Motion sensors are generally required for outdoor luminaires installed within 24 feet of the ground, but there are some differences between nonresidential and multifamily requirements (see Table 14 below).

Motion sensing controls must be able to reduce the lighting power of each applicable luminaire by at least 50% but no more than 90%, and be capable of separately turning OFF lighting during scheduled unoccupied times. They also must be able to reduce power within 15 minutes of area being vacant and to come back on again when occupied. A maximum of 1,500 luminaire watts can be controlled by a single sensor.

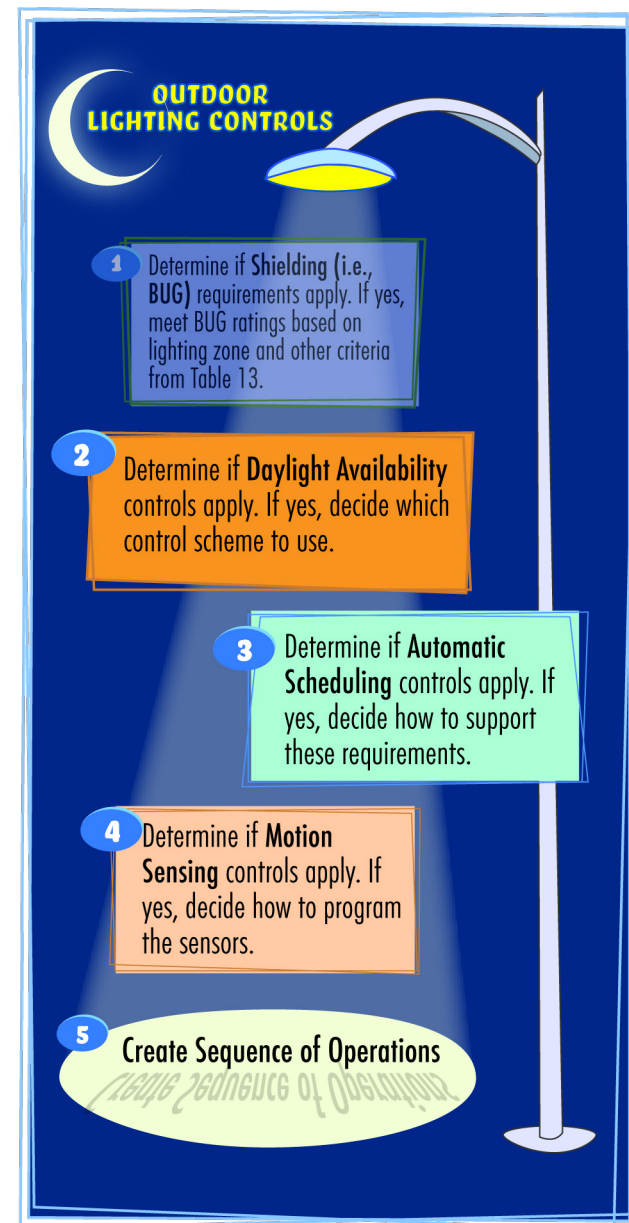
**Exceptions:**

- ◇ Luminaires ≤ 40 watts
- ◇ Health or life safety statute, ordinance or regulation
- ◇ Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year
- ◇ Exempt lighting of §140.7(a) or §170.2(e)6A (wattage excluded from Prescriptive wattage requirements)
- ◇ Building façade, ornamental hardscape, outdoor dining or outdoor sales frontage lighting (not including luminaires with bilaterally symmetric distribution which are subject to these requirements for nonresidential)

Nonresidential	Multifamily Common Use
Motion sensors are required for bilaterally symmetric wall-mounted luminaires (wall packs) that provide lighting for building façade, ornamental hardscape or outdoor dining. Motion sensors are also required for all other luminaires types that are NOT being used for building façade, ornamental hardscape, outdoor dining or outdoor sales frontage.	Motion sensors are required for any outdoor luminaires NOT being used for building façade, ornamental hardscape, or outdoor dining. Multifamily motion sensors are also required for general hardscape parking lot lighting located within one mounting height of a parking space.

**Table 14.** Motion Sensing Requirements

**5. Create Sequence of Operations:** It is recommended that the design team develop a sequence of operations document. This, along with the owner's design requirements, represents a control sequence that can be installed by the contractor, tested by the certified acceptance test technician (ATT), and support building occupancy needs.



**Figure 18.** Designing Outdoor Lighting Controls: Steps 2 through 5



## Alterations: Outdoor Lighting Requirements

Table 15 below describes the allowed wattage and control requirements for different types of outdoor lighting Alterations. The requirements vary depending on luminaire modifications versus replacements, the percentage or number of luminaires replaced, and whether or not the Alteration increases the connected lighting load. Use this table to help understand Energy Code requirements for outdoor lighting Alterations.

Outdoor Lighting Alteration Requirements <u>§141.0(b)2L</u> or <u>§180.2(b)4Bv</u>					
Alteration Requirement	Modify or Retrofit Luminaires <sup>1</sup>	Replaced Luminaires < 10% or ≤ 4	Replaced Luminaires 10 to 49% and ≥ 5	Replaced Luminaires ≥ 50% and ≥ 5	Modifying, Retrofitting or Replacing Luminaires That Add to Existing Connected Load
<b>Prescriptive Wattage Allowance</b> <u>§140.7</u> or <u>§170.2(e)6A</u>	No	No	No	<b>YES</b> , unless replacement uses ≤ 40% of existing wattage	<b>YES</b> Treat as New Construction
<b>Acceptance Testing</b> <u>§130.4</u> or <u>§160.5(e)1F</u>	No	<b>YES</b> , if lighting controls are altered or added to control > 20 luminaires for the entire project (indoor, outdoor, and sign combined)	<b>YES</b> , if lighting controls are altered or added to control > 20 luminaires for the entire project (indoor, outdoor, and sign combined)	<b>YES</b> , if lighting controls are altered or added to control > 20 luminaires for the entire project (indoor, outdoor, and sign combined)	<b>YES</b> , if lighting controls are altered or added to control > 20 luminaires for the entire project (indoor, outdoor, and sign combined)
<b>Shielding (i.e., BUG)</b> <u>§130.2(b)</u> or <u>§160.5(c)1</u>	No	<b>YES</b> , if luminaire ≥ 6,200 lumens <sup>2</sup>	<b>YES</b> , if luminaire ≥ 6,200 lumens <sup>2</sup>	<b>YES</b> , if luminaire ≥ 6,200 lumens <sup>2</sup>	<b>YES</b> , if luminaire ≥ 6,200 lumens <sup>2</sup>
<b>Daylight Availability</b> <u>§130.2(c)1</u> or <u>§160.5(c)2A</u>	No	No	<b>YES</b>	<b>YES</b>	<b>YES</b>

<sup>1</sup> Projects that modify or retrofit existing luminaires (for example changing the luminaire light source) are not subject to the Energy Code unless the modification increases the connected lighting load.

<sup>2</sup> **Exception for Alterations:** Replacement of existing pole luminaires meeting **all** of the following:

- ✦ The existing luminaire does NOT meet the luminaire BUG requirements in §130.2(b)
- ✦ Spacing between existing poles is greater than six times the mounting height of the existing luminaires.
- ✦ NO additional poles are being added to the site.
- ✦ New wiring to the luminaires is NOT being installed.
- ✦ The connected lighting power wattage is NOT increased.

*(Continued)*



(Continued)

**Outdoor Lighting Alteration Requirements §141.0(b)2L or §180.2(b)4Bv**

Alteration Requirement	Modify or Retrofit Luminaires <sup>1</sup>	Replaced Luminaires < 10% or ≤ 4	Replaced Luminaires 10 to 49% and ≥ 5	Replaced Luminaires ≥ 50% and ≥ 5	Modifying, Retrofitting or Replacing Luminaires That Add to Existing Connected Load
<b>Automatic Scheduling</b> <u>§130.2(c)2 or §160.5(c)2B</u>	No	No	<ul style="list-style-type: none"> <li>✦ <b>No</b>, for parking or sales lot luminaires ≤ 24 ft above ground</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft above ground, or any other luminaire type at any height, and does not include a motion sensor</li> </ul>	<ul style="list-style-type: none"> <li>✦ <b>No</b>, for parking or sales lot luminaires ≤ 24 ft above ground</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft above ground, or any other luminaire type at any height, and does not include a motion sensor</li> </ul>	<ul style="list-style-type: none"> <li>✦ <b>No</b>, for parking or sales lot luminaires ≤ 24 ft above ground</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft above ground, or any other luminaire type at any height, and does not include a motion sensor</li> </ul>
<b>Motion Sensing</b> <u>§130.2(c)3 or §160.5(c)2C</u>	No	No	<ul style="list-style-type: none"> <li>✦ <b>YES</b>, for parking or sales lot luminaires ≤ 24 ft above ground and &gt; 40 watts</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft, or any other luminaire type at any height, and does not include automatic scheduling (luminaire lighting power to be reduced with motion sensor ≥ 40%)</li> </ul>	<ul style="list-style-type: none"> <li>✦ <b>YES</b>, for parking or sales lot luminaires ≤ 24 ft above ground and &gt; 40 watts</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft, or any other luminaire type at any height, and does not include automatic scheduling (luminaire lighting power to be reduced with motion sensor ≥ 40%)</li> </ul>	<ul style="list-style-type: none"> <li>✦ <b>YES</b>, for parking or sales lot luminaires ≤ 24 ft above ground and &gt; 40 watts</li> <li>✦ <b>YES</b>, for <b>either</b> automatic scheduling or motion sensing for: Parking or sales lot luminaires &gt; 24 ft, or any other luminaire type at any height, and does not include automatic scheduling (luminaire lighting power to be reduced with motion sensor ≥ 40%)</li> </ul>

<sup>1</sup> Projects that modify or retrofit existing luminaires (for example changing the luminaire light source) are not subject to the Energy Code unless the modification increases the connected lighting load.

**Table 15.** Outdoor Lighting Alteration Requirements



# Illuminated Sign Lighting

## Key Terms for Illuminated Sign Lighting Controls

**Astronomical Time-switch Control** is a device that controls lighting based on the time of day and astronomical events such as sunset and sunrise, accounting for geographic location and calendar date.

**Automatic Daylight Control** adjusts the luminous flux of the electric lighting system in either a series of steps or by continuous dimming in response to available daylight. This kind of control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the electric lighting levels in response.

**Automatic Scheduling Control** is a time-based lighting control that is capable of being programmed to reduce or turn off lighting power for a portion of the night and to turn off lighting power for the day.

**Automatic Time-switch Control** is a device that controls lighting based on the time of day.

**Demand Responsive Control** is an automatic control that is capable of receiving and automatically responding to a demand response signal.

**Dimmer** is a device used to control the intensity of light emitted by a luminaire by controlling the voltage or current available to it.

**Illuminated Face** is a side of a sign that has the message on it. For an exit sign it is the side that has the word "EXIT" on it.

**Photo Control** automatically turns lights ON and OFF, or automatically adjusts lighting levels, in response to the amount of daylight that is available. A photo control may also be one component of a field assembled lighting system, the component having the capability to provide a signal proportional to the amount of daylight to a lighting control system to dim or brighten the electric lights in response.

**Sign, Externally Illuminated** is any sign or a billboard that is lit by a light source that is external to the sign directed towards and shining on the face of the sign.

**Sign, Internally Illuminated** is a sign that is illuminated by a light source that is contained inside the sign where the message area is luminous, including cabinet signs and channel letter signs.

## New and Altered Illuminated Signs: Wattage and Control Requirements

[Table 16](#) includes wattage allowances and control requirements for new and altered indoor and outdoor illuminated signs. This table shows that illuminated signs can comply with wattage allowances by either calculating the maximum allowed lighting power for an internally or externally illuminated sign, or else by installing one of a number of alternate lighting sources. Unfiltered neon and unfiltered light emitting diode (LED) signs must use the alternate lighting source method. [Table 16](#) shows that there are different requirements for relocated signs versus different percentages of replacements or rewired ballasts, or for simply changing some parts of signs. Use this table to find requirements for and exceptions to Energy Code compliance for illuminated signs.



### WHAT'S NEW

Exception added for demand responsive electronic message center (EMC) controls in which, if the building associated with the EMC sign location is not required to meet the demand responsive lighting control requirements, then the EMC is not required to either.



## Wattage Allowances and Control Requirements for New and Altered Illuminated Signs

### Triggered: YES

- ✦ New signs
- ✦ Relocated signs
- ✦ When replacing or rewiring  $\geq 50\%$  ballasts
- ✦ When increasing the connected lighting load

### Triggered: NO

- ✦ When replacing or rewiring  $< 50\%$  ballasts
- ✦ When replacing parts of an existing sign that do not require rewiring, including replacing lamps, sign face or ballasts, but NOT including any part replacements when relocating the sign

**Prescriptive Wattage Allowance New Signs: §140.8 or §170.2(e)7, Altered Signs: §141.0(b)2H, M or §180.2(b)4Biii, vi**

**Maximum Allowed Lighting Power (This method is not allowed for unfiltered LEDs or unfiltered neon signs. It is allowed for all other sign types.)**

- ✦ Internally illuminated:  $\leq 12$  W per ft<sup>2</sup> of illuminated sign area (one side of double-sided signs)
- ✦ Externally illuminated:  $\leq 2.3$  W per ft<sup>2</sup> of illuminated sign area

### Alternate Lighting Source (Allowed for all sign types)

If any of the following alternate light sources are used, nothing further is required to show compliance with wattage:

- ✦ **High pressure sodium lamps**
- ✦ **Metal halide lamps** that are pulse start or ceramic served by a ballast  $\geq 88\%$  efficiency, or pulse start that are  $\leq 320$  W (not including 250 W or 175 W lamps) and served by a ballast with  $\geq 80\%$  efficiency. *Ballast efficiency is the reference lamp power divided by the ballast input power when tested according to ANSI C82.6-2015.*
- ✦ **Neon or cold cathode lamps** with transformer or power supply efficiency  $\geq 75\%$  when the transformer or power supply rated output current is  $< 50$  mA, or  $\geq 68\%$  when the transformer or power supply rated output current is  $\geq 50$  mA. *The ratio of the output wattage to the input wattage is at 100% tubing load.*
- ✦ **Fluorescent lighting systems** using either  $\geq 80$  color rendering index (CRI) or electronic ballasts with a fundamental output frequency not less than 20 kHz
- ✦ **Light emitting diodes (LEDs)** with a power supply efficiency of  $\geq 80\%$   
**Exception:** Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power  $\leq 250$  W, must comply with the applicable requirements of the Appliance Efficiency Regulations (Title 20)
- ✦ **Compact fluorescent lamps** that do not contain a medium screw base socket (E24/E26)

### Exceptions

- ✦ Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign
- ✦ Exit and traffic signs must meet the requirements of the Appliance Efficiency Regulations (Title 20)

## Mandatory Controls §130.3(a) or §160.5(c)

<b>Automatic Shut-Off</b>	<b>Indoor sign lighting</b> , other than illuminated exit signs, must be controlled with an automatic time-switch control or an astronomical time-switch control.
<b>Daylight Availability</b>	All <b>outdoor sign lighting</b> must be controlled with either a photo sensor AND an automatic time switch, or an astronomical time-switch control. <b>Exception:</b> Outdoor signs in tunnels and large covered areas that are intended to be illuminated 24 hours per day and 365 days per year.
<b>Dimmer</b>	When <b>outdoor signs</b> are illuminated at night, and for more than one hour during daylight hours, they are considered ON both day and night and must have dimmers capable of automatically dimming light output by 65% during nighttime hours. <b>Exception:</b> Signs in tunnels and large covered areas that are intended to be illuminated 24 hours per day and 365 days per year.
<b>Demand Responsive</b>	<b>Electronic message center (EMC)</b> per §110.12(e): When $> 15$ kW of new connected lighting power must have controls capable of reducing lighting power by 30% in response to a demand response signal. <b>Exception:</b> Lighting for EMCs that is not permitted to be reduced due to health and safety regulations; buildings not required to have demand responsive lighting controls.

**Table 16.** Wattage Allowances and Control Requirements for New and Altered Illuminated Signs



# Energy Code Compliance Forms for Nonresidential and Multifamily Lighting Projects

Guidance on where to find specific compliance forms can be found on Energy Code Ace at [energycodeace.com/NonresidentialForms/2022](http://energycodeace.com/NonresidentialForms/2022).

- ✦ The NRCC and LMCC Certificates of Compliance define the minimum lighting specifications to be supported in the design documents and in construction of the permitted project.
  - ◊ If using the Performance Approach allowed for conditioned areas of the building, CEC-approved software must be used to generate compliance forms: [www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency-1](http://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency-1)
  - ◊ Prescriptive forms: Nonresidential and high-rise multifamily can be found at [energycodeace.com/NonresidentialForms/2022](http://energycodeace.com/NonresidentialForms/2022); Low-rise multifamily can be found at [energycodeace.com/LowriseMultifamilyForms/2022](http://energycodeace.com/LowriseMultifamilyForms/2022)
- ✦ The NRCI and LMCI Certificates of Installation must be provided by the installing contractor for each building feature subject to the Energy Code. These forms must be made available onsite for the Building Inspector and provided to the Building Owner. These forms must be completed via the Virtual Compliance Assistant at [energycodeace.com/content/project-tool](http://energycodeace.com/content/project-tool).
- ✦ The NRCA Certificate of Acceptance is to be provided by the certified acceptance test technician (ATT) who is responsible for performing the acceptance test or tests, documenting the tests on the NRCA form and signing the form. The ATT is also responsible for submitting the form to the Acceptance Test Technician Certificate Provider (ATTCP), providing the NRCA to the building owner and making it available onsite for building inspection. Field technicians may also perform acceptance tests, document them on the NRCA and sign the form, as well as providing the NRCA to the building owner and making it available onsite for inspection.

## For More Information

### CALIFORNIA ENERGY COMMISSION

#### [www.energy.ca.gov](http://www.energy.ca.gov)

Learn more about the California Energy Commission (CEC) and its programs on its website.

#### [2022 Building Energy Efficiency Standards](#)

Explore the main CEC web portal for the 2022 Energy Code, including information, documents and historical information.

#### [2022 Building Energy Efficiency Standards Summary](#)

Download this visual summary of the Energy Code's purpose, current changes and impact.

#### [Energy Code Hotline](#)

Call: 1-800-772-3300 (Free)

Email: [Title24@energy.ca.gov](mailto:Title24@energy.ca.gov)

#### [Online Resource Center](#)

Use these online resources developed for building and enforcement communities to learn more about the Energy Code.

#### [2022 Nonresidential and Multifamily Compliance Manual](#)

#### [2022 Energy Code Compliance Software](#)

Use CEC-approved software when following the Performance Approach of compliance for the 2022 Energy Code.



#### [2022 Nonresidential and Multifamily Alternative Calculation Method Reference Manual](#)

#### [Modernized Appliance Efficiency Database System \(MAEDbS\)](#)

Search this database to find products that comply with the Energy Code.

See our YouTube video series on how to use the VCA for both the Prescriptive NRCC and the [NRCI](#) forms.

## Energy Code Compliance Forms

Nonresidential, Hotel, Motel and Multifamily	Certificates of Compliance	Certificates of Installation	Certificates of Acceptance	Certificates of Verification
 <b>Performance Method</b> Allowed for indoor lighting in conditioned spaces only, Not allowed for indoor lighting in unconditioned spaces, outdoor lighting, or sign lighting	NRCC-PRF-01-E or LMCC-PRF-01-E (multifamily buildings ≤ 3 habitable stories)	See below	See below	N/A
 <b>Prescriptive Method</b> Indoor Lighting for New Construction, Additions, and Alterations	NRCC-LTI-E or LMCC-LTI-E	NRCI-LTI-E or LMCI-LTI-E	NRCA-LTI-E	N/A
Outdoor Lighting	NRCC-LTO-E or LMCC-LTO-E	NRCI-LTO-E or LMCI-LTO-E	NRCA-LTO-E	N/A
Sign Lighting	NRCC-LTS-E or LMCC-LTS-E	NRCI-LTS-E or LMCI-LTS-E	N/A	N/A

**Table 17.** Energy Code Compliance Forms for Nonresidential and Multifamily Common Use Area Lighting Projects



## For More Information (continued)

### ADDITIONAL RESOURCES

#### Reach Codes

Collaborating with cities, counties and stakeholders to drive reach code development and adoption for long-term climate and energy efficiency benefits. View a list of adopted ordinances at [www.LocalEnergyCodes.com](http://www.LocalEnergyCodes.com)



#### [www.energycodeace.com](http://www.energycodeace.com)

Stop by this online “one-stop-shop” for no-cost tools, training and resources designed to help you comply with California’s Title 24, Part 6 and Title 20.



Tools

#### Energy Code Ace Tools

Explore this suite of interactive tools to understand the compliance process, required forms, installation techniques and energy efficiency regulations in California.

#### Reference Ace

Navigate the Title 24, Part 6 Energy Code using an index, keyword search and hyperlinked text.

#### Q&Ace

Search our online knowledge base or submit your question to Energy Code Ace experts.

#### Product Finder

Find Title 24, Part 6, compliant products.

#### Virtual Compliance Assistant

Get interactive help to fill in NRCC or LMCC Forms.



Training

#### Energy Code Ace Training

On-demand, live in-person and online training alternatives are tailored to a variety of industry professionals and address key measures.

Of Special Interest:

- ♦ [2022 Title 24, Part 6 Essentials – Nonresidential Standards: What’s New](#)



Resources

#### Energy Code Ace Resources

Downloadable materials provide practical and concise guidance on how and when to comply with California’s building and appliance energy efficiency standards.

Of Special Interest:

#### Fact Sheets for Buildings

- ♦ [Nonresidential Buildings: What’s Changed in 2022](#)
- ♦ [Nonresidential and Multifamily Buildings Acceptance Testing Fact Sheet](#)
- ♦ [Nonresidential Design Review and Commissioning Fact Sheet](#)

#### Fact Sheets for Appliances

- ♦ [MAEDbS 101](#)
- ♦ [2022 Nonresidential Indoor Lighting Wheel](#)
- ♦ [Title 20 Lighting FAQs Fact Sheet](#)

