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6. Outdoor Lighting

This chapter covers the Title 24 California Code of Regulations, Part 6 (Energy Code) requirements for nonresidential outdoor lighting systems design, installation, luminaires, and lighting controls.

This chapter is addressed primarily to lighting designers, electrical engineers, electrical contractors, energy consultants, manufacturers, local enforcement agency staff, others working on behalf of local government building departments, and still others who provide outreach and education of the Energy Code.

Chapter 5 addresses nonresidential indoor lighting requirements and covers lighting in parking garages.

Chapter 7 addresses sign lighting requirements.

Overview

What's New for the 2022 California Energy Code

The significant changes for outdoor lighting systems in the 2022 update to the Energy Code include:

- Lighting Zones 1-4 have new definitions according to U.S. Census designations for rural, urban cluster, and urban areas.
- Updates to lighting power allowances for general hardscape lighting in Table 140.7-A including reduction in lighting power allowances and using a single allowance for all hardscape surfaces instead of separate allowances for concrete and asphalt surfaces. Allowances follow IES RP-8 recommended practices.
- Updates to specific applications in Table 140.7-B, including addition of security camera application.
- All instances of the term "cutoff" have been updated to the term "shielding"; these terms refer to the same luminaire distribution features.
- See Section 11.6 for changes to the Multifamily Outdoor Lighting Compliance Manual.
- Reorganization of and improvement in phrasing of the outdoor lighting control requirements in §130.2(c) to enhance readability.

Scope, Approach, and Applications

This chapter applies to all nonresidential outdoor lighting, whether attached to buildings, poles, structures or self-supporting, including, but not limited to, lighting for hardscape areas such as parking lots, lighting for building entrances, lighting for all outdoor sales areas, and lighting for building façades.

The nonresidential outdoor lighting part of the Energy Code includes minimum control requirements, maximum allowable lighting power, and shielding (uplight and glare) zonal lumen limits for outdoor luminaires.

All section (§) and table references in this chapter refer to sections and tables contained in the Energy Code.

Refer to Residential Compliance Manual Chapter 6 for information on lighting requirements for single-family residential buildings.

Refer to Nonresidential Compliance Manual Chapter 14 for information on lighting requirements for multifamily buildings.

6.2.1 Outdoor Lighting Power Compliance Approach

Outdoor lighting power densities are structured using a layered lighting approach. With the layered approach, the first layer of allowed lighting power is general hardscape for the entire site. After the allowed lighting power has been determined for this first layer, additional layers of lighting power are allowed for specific applications when they occur on the site. For example, the total allowed power for a sales lot with frontage is determined by layering the general hardscape, outdoor sales lot, and outdoor sales lot frontage allowances, with specific restrictions associated with the location of the power used for frontage and sales lot lighting.

Figure 6-1: Concept of a Layered Lighting Approach for Outdoor Lighting — Lighting Power Allowance (LPA)

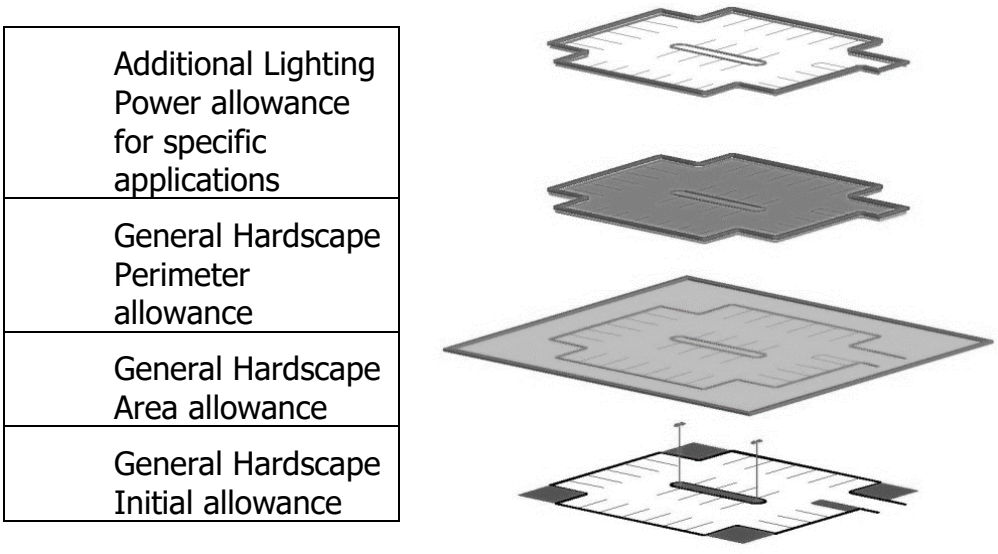


Image Source: California Energy Commission

The outdoor lighting applications that are addressed by the Energy Code are shown in the first two columns of Table 6-1. The first column is general site illumination applications, which allow trade-offs within the outdoor portion only. The second column is specific outdoor lighting applications, which do not allow trade-offs and are considered "use it or lose it." The lighting applications in the third column are exempt from lighting power requirements. However, these lighting applications must meet applicable lighting control requirements.

6.2.2 Lighting Power Trade-Offs

The Energy Code does not allow trade-offs between outdoor lighting power allowances and indoor lighting, sign lighting, heating, ventilation, and air-conditioning (HVAC) system, building envelope, or water heating (§140.7[a]).

There is only one type of trade-off permitted for outdoor lighting power. Allowed lighting power determined according to §140.7(d)1 for general hardscape lighting may be traded to specific applications in §140.7(d)2, provided the luminaires used to determine the illuminated area are installed as designed. This means that if luminaires used to determine the total illuminated area are removed from the design, resulting in a smaller illuminated area, then the general hardscape lighting power allowance must also be reduced accordingly.

Allowed lighting power for specific applications may not be traded between specific applications or to hardscape lighting in §140.7(d)1. This means that for each specific application, the allowed lighting power is the smaller of the allowed power determined for that specific application according to §140.7(d)2, or the actual installed lighting power that is used in that specific application. These additional power allowances are "use it or lose it" allowances.

Table 6-1: Scope of the Outdoor Lighting Requirements

Lighting Applications Covered General Hardscape (trade-offs permitted)	Lighting Applications Covered Specific Applications (trade-offs not permitted)	Lighting Applications Not Regulated (only as detailed in §140.7)
The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated.	Canopies: Sales and Non-sales Tunnels Drive-Up Windows Emergency Vehicle Facilities Building Entrances or Exits Building Facades Guard Stations Hardscape Ornamental Lighting Outdoor Dining Primary Entrances for Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities Outdoor Sales Frontage and Lots Special Security Lighting for Retail Parking and Pedestrian Hardscape Student Pick-up/Drop-off zone Vehicle Service Station: Canopies, Hardscape, and Uncovered Fuel Dispenser ATM Lighting Security Cameras	Temporary outdoor lighting Required and regulated by FAA Required and regulated by the Coast Guard. For public streets, roadways, highways, and traffic signage lighting, and occurring in the public right-of-way For sports and athletic fields, and children's playground For industrial sites For public monuments Signs regulated by §130.3 and §140.8 For stairs and wheelchair elevator lifts For ramps that are not parking garage ramps Landscape lighting For themes and special effects in theme parks For outdoor theatrical and other outdoor live performances For qualified historic buildings

Source: California Energy Commission

Other outdoor lighting applications that are not included in Energy Code Tables 140.7-A or 140.7-B are assumed to be not regulated by the Energy Code. This includes decorative gas lighting and emergency lighting powered by an emergency source as defined by the California Electrical Code. The text in the above list of

lighting applications that are not regulated has been shortened for brevity. Please see Section 6.2.3 for details about unregulated lighting applications.

6.2.3 Outdoor Lighting Applications Not Regulated by §140.7

When a luminaire is installed only to illuminate one or more of the following applications, the lighting power for that luminaire shall be exempt from the lighting power requirements in §140.7(a). Refer to the right column of Table 6-1 for a quick reference to the lighting applications that are exempted. Also, the Energy Code clarifies that at least 50 percent of the light from the luminaire must fall within an application to qualify as being installed for that application.

Outdoor Lighting Zones

The basic premise of the Energy Code is to base allowable outdoor lighting power on the brightness of the surrounding conditions. The Energy Code contains lighting power allowances for new lighting installations and specific alterations that depend on the lighting zone (LZ) in which the project is located.

Five categories of outdoor lighting zones are defined: LZ0, LZ1, LZ2, LZ3, and LZ4. Lighting zones with lower numbers are darker from LZ0, which is in national parks and other areas intended to be very dark at night, to LZ4 for high-intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels. The eyes adapt to darker surrounding conditions, and less light is required to properly see. When the surrounding conditions get brighter, more light is needed to see. Providing greater power than is needed potentially leads to debilitating glare and an increasing spiral of brightness as overbright projects populate surrounding conditions causing future projects to unnecessarily require greater power resulting in wasted energy. The least power is allowed in LZ1, and increasingly more power is allowed in LZ2, LZ3, and LZ4. LZ0 is intended for undeveloped spaces in parks and wildlife preserves and is very low ambient illumination.

The following summarizes the default locations for outdoor lighting zones as specified in §10-114:

- Lighting Zone 0 includes undeveloped areas of government-designated parks, recreation areas, and wildlife preserves.
- Lighting Zone 1 includes developed portions of government designated parks, recreation areas, and wildlife preserves. LZ 1 also includes rural areas as defined by the 2010 United States (U.S.) Census.
- Lighting Zone 2 includes urban clusters as defined by the 2010 U.S. Census.
- Lighting Zone 3 includes urban areas as defined by the 2010 U.S. Census.
- Lighting Zone 4 includes special use districts that may be created by a local government through application to the California Energy Commission (CEC).

Lighting Zones 1-4 are designated according to 2010 U.S. Census definitions for rural areas, urban clusters, and urban areas. See below for details on rural areas, urban clusters, and urban areas and how they are related to lighting zones.

6.3.1 Parks, Recreation Areas, and Wildlife Preserves

The default lighting zone for undeveloped portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 0.

The default lighting zone for developed portions of government designated parks, recreation areas, and wildlife preserves is Lighting Zone 1.

The local jurisdiction having authority over the property will know if the property is a government-designated park, recreation area, or wildlife preserve. However, a Lighting Zone 2 designation can be adopted if the property is surrounded by a default Lighting Zone 2 area (as defined by the U.S. Census Bureau). Similarly, when a park, recreation area, wildlife preserve, or portions thereof are surrounded by urban areas (as defined by the U.S. Census Bureau), such areas may be designated as Lighting Zone 3 by adoption of the local jurisdiction. All adjustments in lighting zone designation must be reviewed by the CEC for approval.

6.3.2 Rural Areas

The default for rural areas as defined by the U.S. Census Bureau is Lighting Zone 1. However, local jurisdictions may designate certain areas as Lighting Zone 2 if it is determined that ambient lighting levels are higher than typical for a rural area. Examples of areas that might be designated Lighting Zone 2 are retail stores located in residential neighborhoods or rural town centers that operate during hours of darkness.

6.3.3 Urban Clusters

The default lighting zone for urban clusters as defined by the U.S. Census Bureau is Lighting Zone 2. However, local jurisdictions may designate certain areas as either Lighting Zone 3 or Lighting Zone 4 if it is determined that ambient lighting levels are higher than typical for a rural area. Examples of areas that might be designated Lighting Zone 3 are special commercial districts or areas with special security considerations.

Local jurisdictions also may designate default Lighting Zone 2 areas as Lighting Zone 1, which would establish lower lighting power for outdoor areas with lower surrounding brightness. An example of an area that might be changed to Lighting Zone 1 would include an undeveloped, environmentally sensitive, or predominately residential area within a default Lighting Zone 2 area.

6.3.4 Urban Areas

Lighting Zone 3 is the default for urban areas, as defined by the U.S. Census Bureau. Local jurisdictions may designate areas as Lighting Zone 4 for high-intensity

nighttime use, such as entertainment, commercial districts, or areas with special security considerations requiring very high light levels.

Local jurisdictions also may designate default Lighting Zone 3 areas as Lighting Zone 2 or Lighting Zone 1 if deemed appropriate.

Table 6-2: Lighting Zone Characteristics and Rules for Amendments by Local Jurisdictions

Zone	Ambient Illumination	Statewide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
A) LZ0	B) Very Low	C) Undeveloped areas of government designated parks, recreation areas, and wildlife preserves.	D) Undeveloped areas of government designated parks, recreation areas, and wildlife preserves can be designated as LZ1 or LZ2 if they are contained within such a zone.	E) Not applicable
F) LZ1	G) Low	H) Rural areas, as defined by the 2010 U.S. Census. These areas include single or dual family residential areas, parks, and agricultural zone districts, developed portion of government designated parks, recreation areas, and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	I) Developed portion of a government designated park, recreation area, or wildlife preserve, can be designated as LZ2 or LZ3 if they are contained within such a zone. Retail stores, located in residential neighborhood, and rural town centers, as defined by the 2010 U.S. Census, can be designated as LZ2 if the business operates during hours of darkness.	J) Not applicable.
K) LZ2	L) Moderate	M) Urban clusters, as defined by the 2010 U.S. Census. The following building types may occur here: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.	O) Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a mixed-use residential area or city center.	P) Special districts may be designated as LZ1 by the local jurisdiction, without any size limits.

Zone	Ambient Illumination	Statewide Default Location	Moving Up to Higher Zones	Moving Down to Lower Zones
		N)		
Q) LZ3	R) Moderately High	S) Urban areas, as defined by the 2010 U.S. Census. T) The following building types may occur here: high intensity commercial corridors, entertainment centers, and heavy industrial or manufacturing zone districts.	U) Special districts within a default LZ3 may be designated as a LZ4 by local jurisdiction for high intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	V) Special districts may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
W) LZ4	X) High	Y) None	Z) Not applicable.	AA) Not applicable.

Source: Energy Code Table 10-114-A

6.3.5 Determining the Lighting Zone for an Outdoor Lighting Project

Permit applicants may determine the lighting zone for a particular property using the following steps.

For government-designated parks, recreation areas, and wildlife preserves:

- Check with the local jurisdiction having authority over permitting of the property. The local jurisdiction will know if the property is a government-designated park, recreation area, or wildlife preserve, and therefore in default Lighting Zone 0 or 1. The local jurisdiction also may know if the property is contained within the physical boundaries of a lighting zone for which a locally adopted change has been made.

For urban areas, urban clusters, and rural areas:

- The lighting zones for urban areas, urban clusters, and rural areas as well as the legal boundaries of wilderness and park areas are based on the 2010 U.S. Census Bureau boundaries. According to the U.S. Census Bureau, there are two types of urban designations, urbanized areas of 50,000 or more people and urban clusters of at least 2,500 and less than 50,000 people. "Rural" areas encompass all population, housing, and territory not included within an urban area or urban cluster.
- The U.S. Census Bureau website can be used to determine if the property is within Lighting Zone 1 (rural areas), Lighting Zone 2 (urban clusters), or Lighting Zone 3 (urban areas). Using an online map overlay tool provided by the U.S. Census Bureau on tool for geographic overlays at

https://tigerweb.geo.census.gov/tigerweb/, the property address can be entered to look up geography results indicating whether the address is within an urban area ("2010 Census Urbanized Area" layer), urban cluster ("2010 Census Urban Clusters" layer), or rural area (no layer) or move the map over the region of interest. Blue layers represent the boundaries of urban areas. Purple layers represent the boundaries of urbanized clusters. Figure 6-2 shows a screen image of the U.S. Census Bureau online map overlay tool.

Figure 6-2: Example of U.S. Census Bureau Web Tool With Map Overlay

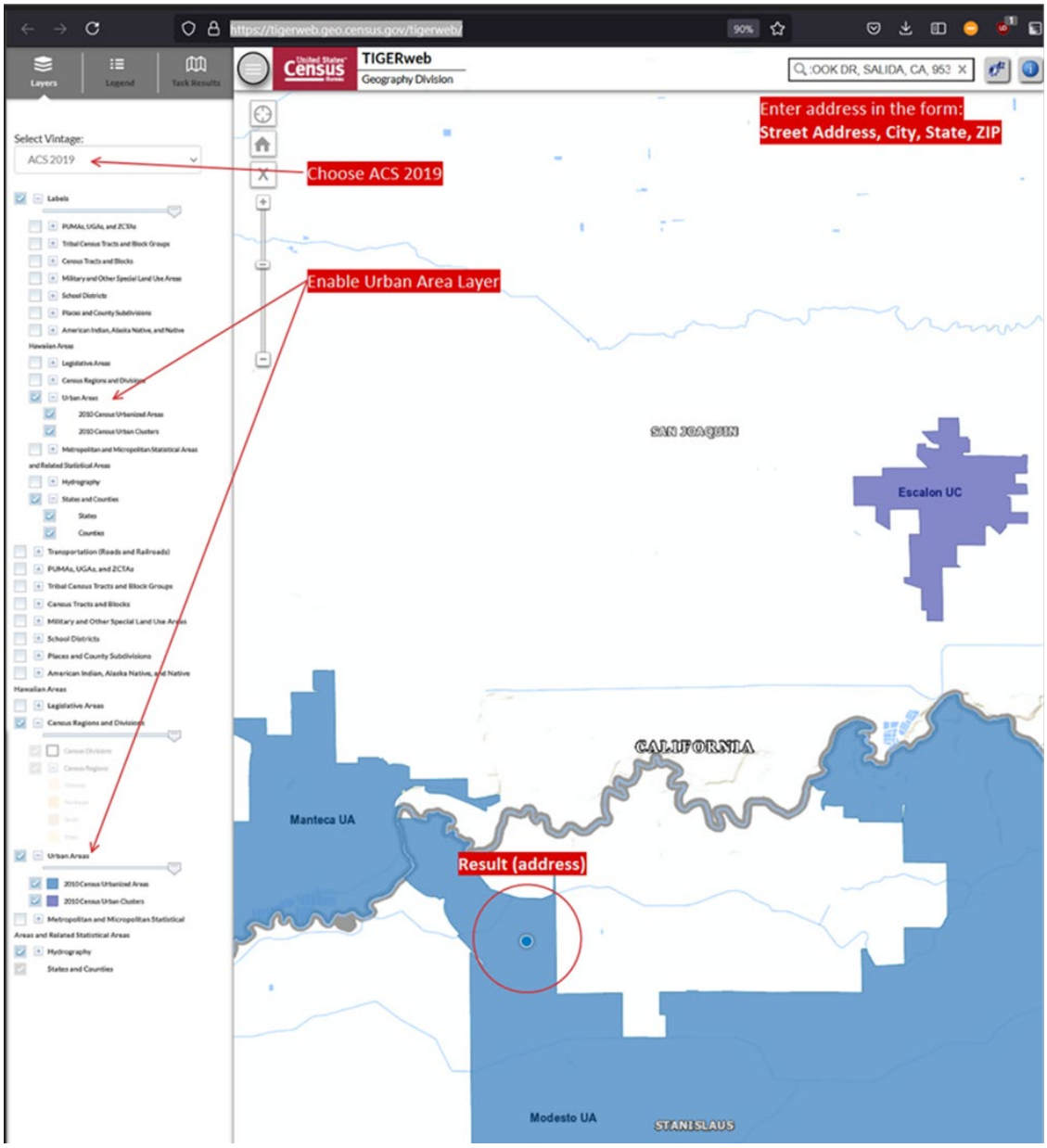


Image Source: U.S. Census Bureau website

6.3.6 Lighting Zone Adjustments by Local Jurisdictions

§10-114

Energy Standards Table 10-114-A

The CEC sets statewide default lighting zones. However, jurisdictions (usually a city or county) may change lighting zones to accommodate local conditions. Local governments may designate a portion of Lighting Zones 2 or 3 as Lighting Zone 3 or 4. The local jurisdiction also may designate a portion of Lighting Zone 3 to Lighting Zone 2 or even Lighting Zone 1. When a local jurisdiction adopts changes to the lighting zone boundaries, it must follow a public process that allows for formal public notification, review, and comment about the proposed change.

6.3.7 Lighting Zone Examples of Using Physical Boundaries

Using metes and bounds is a good method to use for defining the physical boundaries of an adopted lighting zone.

"Metes and bounds" is a system that uses physical features of the local geography, along with directions and distances, to define and describe the boundaries of a parcel of land. The boundaries are described in a running prose style, working around the parcel of the land in sequence, from a beginning point and returning to the same point. The term "mete" refers to a boundary defined by the measurement of each straight run, specified by a distance between the terminal points, and an orientation or direction. The term "bounds" refers to a more general boundary description, such as along a certain watercourse or public roadway.

The following examples use metes and bounds to define the physical boundaries of an adopted lighting zone:

- Properties with frontage on Kennedy Memorial Expressway, between First Avenue and Main Street to a depth of 50 ft. from each frontage property line.
- The area 500 ft. east of Interstate 5, from 500 ft. north of Loomis Ave to 250 ft. south of Winding Way.
- The area of the Sunrise Bike Trail starting at Colfax Avenue and going east to Maple Park, the width of a path which is from the edge of the South Fork of the American River on one side, to 100 ft. beyond the paved bike trail, or to private property lines, whichever is shorter, on the other side.
- The area that is bounded by the Truckee River on the West, Grizzly Lane on the south, Caddis Road on the east, and the boundary of Placer County on the north.

Note: The physical boundaries of a changed lighting zone are not required to coincide with the physical boundaries of a census tract.

Example 6-1: Changing the Default Lighting Zone

Question

I want to have the default outdoor lighting zone for a particular piece of property changed. How do I accomplish that?

Answer

Check with the local jurisdiction having authority over the property and ask them how to petition to have the default outdoor lighting zone officially adjusted.

Mandatory Requirements

The mandatory requirements must be met for all outdoor lighting projects when they are applicable. Mandatory requirements for outdoor lighting are specified in §110.9, §130.0, §130.2, and §130.4. Mandatory requirements include lighting controls devices and system requirements, outdoor lighting controls installation requirements, luminaire shielding, and outdoor lighting control acceptance testing.

6.4.1 Luminaire Shielding and CALGreen BUG Requirements

§130.2(b)

The 2022 Energy Code includes outdoor luminaire shielding requirements based on the luminaire's initial lumen rating. All outdoor luminaires that emit 6,200 initial lumens or greater must comply with backlight, uplight, and glare (BUG) requirements contained in §5.106.8 of the CALGreen Code (Title 24, Part 11).

The BUG ratings assume that the light emitted from the luminaire is providing useful illuminance on the task surfaces rather than scattering the light in areas where the light is not needed or intended, such as toward the sky. These BUG ratings also increase visibility because high amounts of light shining directly into observer's eyes are reduced, thus decreasing glare. Additionally, light pollution into neighbors' properties is reduced. The BUG requirements vary by outdoor lighting zones which are described in section 6.3.

Luminaire manufacturers are aware of the technical details of the BUG ratings and typically provide the BUG ratings for their luminaires in product specifications or cutsheets. In the rare occasions where the luminaire manufacturer does not provide a BUG rating, it can be calculated with outdoor lighting software if the luminaire photometric data is available.

There are exceptions to the luminaire shielding and the BUG rating requirements in CALGreen and the Energy Code.

The following are the exceptions in CALGreen Section 5.106.8: (The information is extracted from the 2022 CALGreen Code):

1. Luminaires that qualify as exceptions in Sections 130.2(b) and 140.7 of the California Energy Code
2. Emergency lighting

3. Building façade meeting the requirements in Table 140.7-B of the California Energy Code, Part 6

- Custom features as allowed by the local enforcing agency, as permitted by Section 101.8 (of the CALGreen Code) Alternate materials, designs and methods of construction
- Luminaires with less than 6,200 initial luminaire lumens.

The following are exceptions in §130.2 of the Energy Code for outdoor lighting applications that are exempted from the luminaire shielding requirements. In some of these applications lighting directed sideways and upwards may be desirable.

- Signs.
- Lighting for building façades, public monuments, public art, statues, and vertical surfaces of bridges.
- Lighting required by a health or life safety statute, ordinance, or regulation that may fail to meet the uplight and glare limits due to application limitations.
- Temporary outdoor lighting that does not persist beyond 60 consecutive days or more than 120 days per year.
- Replacement of existing pole mounted luminaires in hardscape areas that are spaced more than six times the mounting height of the existing luminaires and the replacement luminaire wattage is less than or equal to the wattage of the original luminaires. In addition:

  Where the existing luminaire does not meet the BUG requirements in Section 130.2(b).

  Where no additional poles are being added to the site.

  Where new wiring to the luminaires is not being installed.
- Luminaires that light the public right of way including publicly maintained or utility-maintained roads, sidewalks, or bikeways.

In addition, local ordinance may have a more stringent outdoor lighting BUG requirements than that of the CALGreen Code — the local ordinance would govern the outdoor lighting BUG requirements in that scenario.

Example 6-2:

Question

Which outdoor lighting are exempted from the CALGreen requirements in Section 5.106.8?

Answer

Certain categories of outdoor lighting luminaires are exempted from the light pollution reduction requirements of CALGreen Code Section 5.106.8, and they are as follows.

First, outdoor lighting luminaires with less than 6,200 initial luminaire lumens are exempted.

Second, listed below are additional outdoor lighting luminaires which are also exempted. (Listed below are for a quick reference. For more details, see the box further below.)

- Outdoor lighting with custom features as allowed by Section 101.8 of the California CALGreen Code.
- Outdoor luminaires exempted in §130.2(b) and §140.7 of the California Energy Code.
- Building façade lighting indicated in Table 140.7-B of the California Energy Code.
- Emergency lighting.

Example 6-3:

Question

How do you determine the glare rating for a luminaire located in Lighting Zone 3?

Reference

(Relevant information extracted from the 2022 CALGreen Code and they are included here for reference.)

CALGreen 5.106.8.2 Facing – Glare.

For luminaires covered by Section 5.106.8.1 of the CALGreen Code, if a property line also exists within or extends into the front hemisphere within two mounting heights (2 MH) of the luminaire, then the luminaire shall comply with the more stringent glare rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point on the nearest property line within the front hemisphere.

CALGreen Table 5.106.8

TABLE 5.106.8 [N]
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS[1,2]

	ALLOWABLE RATING	LIGHTING ZONE LZ0	LIGHTING ZONE LZ1	LIGHTING ZONE LZ2	LIGHTING ZONE LZ3	LIGHTING ZONE LZ4
>	**Maximum Allowable Backlight Rating (B)**					
	Luminaire greater than 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 less than 0.5 MH from property line	N/A	B0	B0	B1	B2
	Maximum Allowable Uplight Rating (U)					
	For area lighting[3]	N/A	U0	U0	U0	U0
	For all other outdoor lighting, including decorative luminaires	N/A	U1	U2	U3	U4
>	**Maximum Allowable Glare Rating (G)**					
	Luminaire greater than 2 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 less than 0.5 MH from property line	N/A	G0	G0	G0	G1

1. IESNA Lighting Zones 0 are not applicable; refer to Lighting Zones as defined in the *California Energy Code* and Chapter 10 of the *California Administrative Code*.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
> 3. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet *U*-value limits for "all other outdoor lighting."
>

5.106.8.1 Facing – Backlight.

Images Source: California Energy Commission. (The information is extracted from the 2022 CALGreen Code and included here for reference.)

Answer

Start by looking up **Table 5.106.8** of CALGreen Code.

Refer to Column 5 for Lighting Zone 3. The top rows show the backlight rating, the two rows in the middle show the glare rating, and the bottom rows show the uplight rating.

Next, determine the glare rating from the bottom rows and locate the values from Column 5.

See below for a summary of information related to the luminaires in this example for Lighting Zone 3.

Luminaire greater than 2 mounting heights (MH) from property line	Glare rating of G3 or less
Luminaire back/front hemisphere is 1 — 2 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is 0.5 — 1 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is less than 0.5 MH from property line	Glare rating of G0 or less

Images Source: California Energy Commission. (The information is extracted from the 2022 CALGreen Code and included here for reference to the above example.)

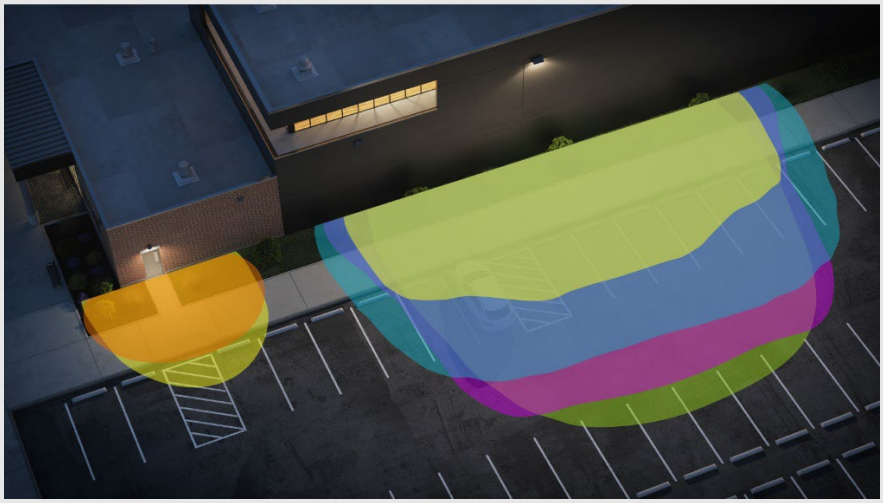
The maximum allowable glare rating for Lighting Zone 3 ranges from G3, G1, and G0 and the glare rating would depend on the location of the luminaire from a property line.

The glare rating is the maximum allowable rating and therefore any rating that is less than the maximum rating is also allowed. For luminaires located greater than two mounting heights from a property line, a luminaire with a glare rating of G3, G2, G1, or G1 meets the requirement.

Example 6-4:

Question

How do you determine glare requirements for the luminaires shown in the pictures below and are located in Lighting Zone 3?



Images Source: courtesy of Lithonia Lighting, a part of Acuity Brands Lighting & Controls.

Answer

First, determine if the luminaire is located within two mounting heights (2 MH) of distance from property line, and refer to Table 5.106.8 of the CALGreen code for the allowable glare rating.

If the distance is greater than 2 MH, the glare rating of the luminaire must be G3 or less (i.e., G2, G1 or G0).

If the distance is within one to two mounting heights (MH) of distance from the property line, the glare rating of the luminaire must be G1 or less (i.e., G0).

Similarly, if the distance is within a half to one mounting height of distance from the property line, the glare rating of the luminaire must be G1 or less (i.e., G0).

If the distance is less than a half mounting height of distance from the property line, the glare rating of the luminaire must be G0.

The above could also be summarized in a tabular format as follows.

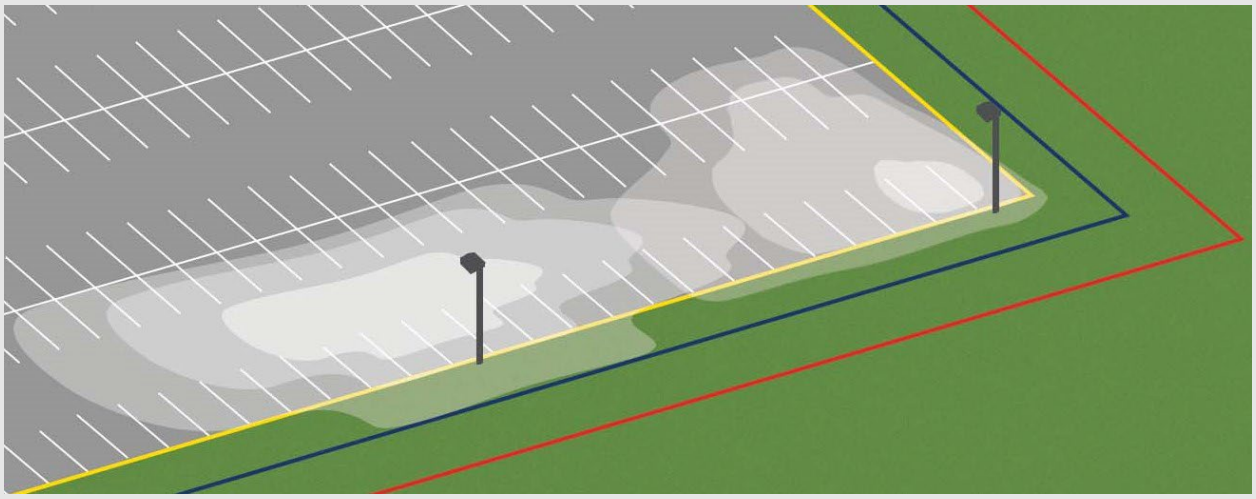
Luminaire greater than 2 mounting heights (MH) from property line	Glare rating of G3 or less
Luminaire back/front hemisphere is 1 — 2 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is 0.5 — 1 MH from property line	Glare rating of G1 or less
Luminaire back/front hemisphere is less than 0.5 MH from property line	Glare rating of G0 or less

Images Source: California Energy Commission. (The information is extracted from the 2022 CALGreen Code Table 150.6.8 and included here for reference to the above example.)

Example 6-5:

Question

How do you determine backlight requirements for the luminaire shown in the picture below and the luminaires are located in Lighting Zone 3?



Images Source: courtesy of Lithonia Lighting, a part of Acuity Brands Lighting & Controls.

Reference

(This information below is extracted from the 2022 CALGreen Code and included here for reference.)

CALGreen 5.106.8.1 Facing — Backlight

Luminaires within two mounting heights (2 MH) of a property line shall be oriented so that the nearest property line is behind the fixture, and shall comply with the backlight rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point of that property line.

Exception: Corners. If two property lines (or two segments of the same property line) have equidistant points to the luminaire, then the luminaire may be oriented so that the intersection of the two lines (the corner) is directly behind the luminaire. The luminaire shall still use the distance to the nearest point(s) on the property lines to determine the required backlight rating.

CALGreen Table 5.106.8

TABLE 5.106.8 [N]
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS[1,2]

ALLOWABLE RATING	LIGHTING ZONE LZ0	LIGHTING ZONE LZ1	LIGHTING ZONE LZ2	LIGHTING ZONE LZ3	LIGHTING ZONE LZ4
Maximum Allowable Backlight Rating (B)					
Luminaire greater than 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 less than 0.5 MH from property line	N/A	B0	B0	B1	B2
Maximum Allowable Uplight Rating (U)					
For area lighting[3]	N/A	U0	U0	U0	U0
For all other outdoor lighting, including decorative luminaires	N/A	U1	U2	U3	U4
Maximum Allowable Glare Rating (G)					
Luminaire greater than 2 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 less than 0.5 MH from property line	N/A	G0	G0	G0	G1

1. IESNA Lighting Zones 0 are not applicable; refer to Lighting Zones as defined in the *California Energy Code* and Chapter 10 of the *California Administrative Code*.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
3. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet *U*-value limits for "all other outdoor lighting."

5.106.8.1 Facing – Backlight.

(The above information is extracted from the 2022 CALGreen Code and included here for reference.)

Answer

First, if the luminaire is located at more than two mounting height (2 MH) of distance from the property line, there is no mandatory backlight rating (no limit on backlight) for the luminaire.

For a luminaire located within two mounting height (2 MH) of distance from the property line and that is not exempt, the luminaire must comply with the backlight rating listed in Table 5.106.8.

For a luminaire located in Lighting Zone 3 (LZ3) and within one to two mounting heights (MH) of distance from the property line, the backlight rating of the luminaire must be B4 or less (i.e., B3, B2, B1 or B0).

For the same luminaire in LZ3 and within a half to one mounting height of distance from the property line, the backlight rating of the luminaire must be B3 or less (i.e., B2, B1 or B0).

For the same luminaire in LZ3 and located less than a half mounting height of distance from the property line, the backlight rating of the luminaire must be B1 or less (i.e., B0).

The above information could also be summarized in a tabular format below.

Luminaire greater than 2 mounting heights (MH) from property line	No limit
Luminaire back hemisphere is 1 - 2 MH from property line	B4 or less
Luminaire back hemisphere is 0.5 - 1 MH from property line	B3 or less
Luminaire back hemisphere is less than 0.5 MH from property line	B1 or less

(This information is extracted from the 2022 CALGreen Code.)

Example 6-6: Defining the Property Line for the Purpose of BUG Rating Compliance

Question

Where is the property line if the area under construction is located next to a public road?

Answer

For a property line that abuts a public roadway or transit corridor, the property line may be the centerline of the public roadway or transit corridor.

For a property lines that abuts a public walkway, bikeway, plaza, or parking lot, the property line may be 5 feet beyond the actual property line.

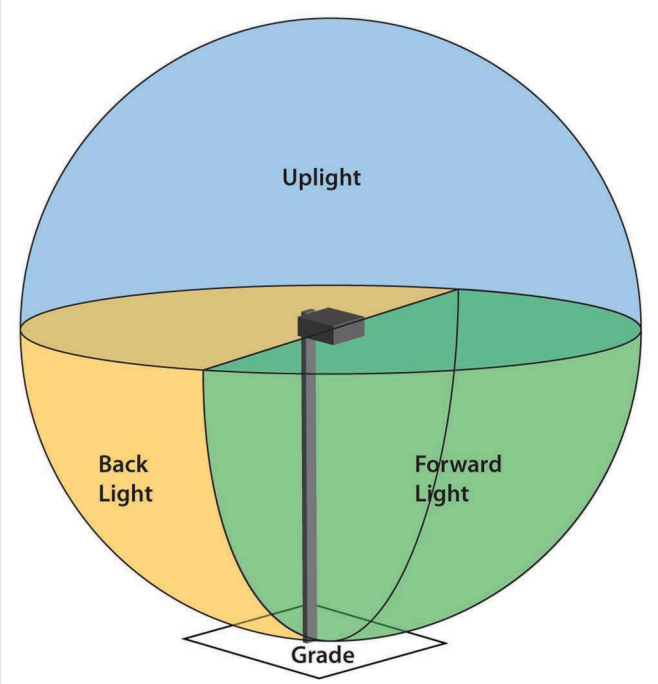
Example 6-7: Luminaire Classification for Outdoor Luminaires

Question

What is the IES BUG system for outdoor luminaires?

Answer

Illuminating Engineering Society (IES) published the technical memorandum 'Luminaire Classification for Outdoor Luminaires' (document TM-15-20). This document defines three-dimensional regions of analysis for exterior luminaires and further establishes zonal lumen limits for these regions as part of a larger method of categorizing outdoor lighting equipment into backlight, uplight, and glare components. Collectively, the three components are referred to as the BUG system.



The Three Primary Solid Angles of the Luminaire Classification System for Outdoor Luminaires

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

The zonal lumen limits per secondary solid angles for uplight and glare are based upon the methodology found in TM-15. The lighting zone in which the project is located determines the maximum zonal lumens for backlight, uplight, and glare.

To comply with this mandatory measure, the luminaire must not exceed the maximum zonal lumen limits for each secondary solid angle region per lighting zone. The zonal lumen values in a photometric test report must include any tilt or other nonlevel mounting condition of the installed luminaire. The BUG rating requirements can be found in CALGreen Code §5.106.8.

The BUG rating for luminaires may be determined with outdoor lighting software or by contacting the manufacturer. There is also software available to produce a BUG rating for a tilted luminaire condition (which is not a typical circumstance for most applications). Since the California BUG limits and calculation procedures match the IES, no deviation from the IES BUG rating is necessary.

Example 6-8: Wallpacks and Zonal Lumen Limits

Question

A new parking lot adjacent to a building is being designed to be illuminated by wall packs rated at 7,000 initial luminaire lumens. The wall packs are mounted on the side of the building, and their main purpose is parking lot illumination. But they are also illuminating the façade of the building. Do these wall packs have to meet the backlight, uplight, and glare (BUG) rating limits?

Answer

Yes, these 7,000 lumen wall packs will have to meet the BUG rating requirements because the main purpose is parking lot illumination. Luminaire mounting methods or locations do not necessarily determine the purpose of the illumination. Define the function of the luminaire by determining what the majority of the light is striking. For a typical wall pack, 80% or more of the light is likely striking the parking lot or sidewalk in front of the building, and only 20% or less on the façade, so BUG rating limits apply.

Each luminaire must be appropriately assigned to the function area that it is illuminating, whether it is mounted to a pole, building, or other structure. Only luminaires that are rated less than 6,200 initial luminaire lumens or outdoor lighting applications that are exempt, are not required to meet the backlight, uplight, and glare (BUG) requirements in the Energy Code.

Example 6-9: Tilted Luminaires Meeting the BUG Requirements

Question

If a low BUG rating luminaire is mounted at a tilt, does it still meet the BUG requirements?

Answer

It depends. Luminaires that meet the zonal lumen limits when mounted at 90° to nadir may or may not comply with the BUG rating limits when they are mounted at a tilt.

For a tilted luminaire to meet this requirement, a photometric test report must be provided showing that the luminaire meets the zonal lumen limits at the proposed tilt. There are lighting design software available to calculate a BUG rating for a tilted luminaire, or this can be provided by the manufacturer.

6.4.2 Requirements for Outdoor Lighting Controls

§130.2(c)

The primary requirements for outdoor lighting controls are as follows:

1. Daylight Availability: All outdoor lighting shall be automatically controlled so that lighting is off when daylight is available (§130.2[c]1).

2. Automatic Scheduling Controls: All outdoor lighting shall be automatically controlled by a time-based scheduling control (§130.[c]2).
3. Motion-Sensing Controls: Outdoor luminaires greater than 40 watts and mounted 24 ft or less above the ground shall be controlled by motion-sensing controls. This applies to luminaires providing general hardscape lighting, outdoor sales lot lighting, vehicle service station hardscape lighting, or vehicle service station canopy lighting (§130.2[c]3).

Outdoor lighting control requirements do not apply to any of the following lighting applications:

1. Lighting where a health or life safety statute, ordinance, or regulation prohibits outdoor lighting to be turned OFF or reduced.
2. Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

Example 6-10: Circuiting of Non-Outdoor Lighting Load

Question

Can irrigation controllers be on the same power circuit as lighting?

Answer

The outdoor lighting load may be on the same circuit with other electrical loads if the outdoor lighting load is independently controlled from all other electrical loads.

A. Daylight Availability

§130.2(c) 1

All installed outdoor lighting must be controlled by a photocontrol, astronomical time-switch control, or other controls that automatically turns off the outdoor lighting when daylight is available.

- A photocontrol measures the amount of ambient light outdoors. When the light level outside is high enough to indicate that it is daytime, the control turns lighting off.
- Astronomical time-switch controls require an initial setup of the time clock device, which may include the entry of the current date and time (and time zone), site location (by longitude and latitude), and whether daylight saving time is applicable. The clock calculates sunrise and sunset times (which vary by location and day of the year) and turns lighting off at sunrise and on at sunset.

Astronomical time switches are time-based controls that can be used to meet the daylight availability and automatic scheduling control requirements.

B. Automatic Scheduling Controls

§130.2(c)2

All installed outdoor lighting shall be controlled by an automatic scheduling control capable of reducing lighting power by 50 to 90 percent and separately capable of turning lighting off when not needed according to a schedule.

Further, automatic scheduling controls are required to have the capability of programming at least two nighttime periods (a scheduled occupied period and a scheduled unoccupied period) with different light levels, if desirable by the building design and operation.

Automatic scheduling controls provide flexibility to accommodate changes in building operation. If different operating schedules or different lighting levels are desired, the settings of the automatic scheduling controls can be adjusted.

There are applications in which there are benefits to employ both motion-sensing controls and automatic scheduling controls. Some lighting applications will require both control types.

Example 6-11: Using Automatic Scheduling Controls Plus Some Other Controls

Question

Can motion-sensing controls be used together with automatic scheduling controls?

Answer

Some applications require the installation of motion-sensing controls. For these applications, automatic scheduling controls are required in addition to motion-sensing controls. During the scheduled occupied period, motion-sensing controls can detect occupancy of an outdoor space and turn on or reduce lighting based on the occupancy of the space. During the scheduled unoccupied period, the automatic scheduling control can turn off all lighting.

Example 6-12: Using Automatic Scheduling Controls for Buildings That Operate 24x7

Question

Is the automatic scheduling control requirement applicable to a building occupied 24 hours per day, seven days per week?

Answer

Yes, automatic scheduling controls are required for buildings that are occupied 24 hours per day, seven days per week.

Business activities can change over time as business models and hours of operation evolve. The required nighttime periods of a scheduled occupied period and a scheduled unoccupied period are decided by the building owner or the building operator, as appropriate, to suit the business needs.

Acceptance Tests Required for Automatic Scheduling Controls

Outdoor automatic scheduling controls are required to have acceptance testing conducted to confirm the appropriate schedules are programmed and the controls operate per the programmed schedule. The acceptance test procedures are detailed in Reference Nonresidential Appendix NA7.8.5. Refer to Section 6.7.5 of this manual for details about outdoor lighting controls acceptance test.

C. Motion-Sensing Controls

§130.2(c)3

Outdoor luminaires greater than 40 watts, where the bottom of the luminaire is mounted 24 ft. or less above the ground, shall be operated with motion-sensing controls if they are used in the following applications:

1. General hardscape lighting including parking lot lighting
2. Vehicle service station hardscape lighting and canopy lighting
3. Wall pack lighting installed for building façade, ornamental hardscape, or outdoor dining lighting

The motion sensing controls shall:

1. Be capable of reducing the lighting power of each luminaire by at least 50 percent and no more than 90 percent, and separately be capable of turning the luminaire off during unoccupied periods.
2. Be capable of reducing the lighting to the dim or off state within 15 minutes of vacancy detection and turning the lighting back on upon occupancy.
3. Control no more than 1,500 watts of lighting power by a single sensor or as a single zone.

Exceptions to All Motion-Sensing Control Requirements

The motion control requirements do not apply to applications listed as exceptions to §140.7(a). These applications exempted from the motion controls requirements of §130.2(c)3 when more than 50 percent of the light fails in the application. The applications include temporary outdoor lighting, lighting for public roadways, and lighting for public monuments. The complete listing can be found in Section 140.7(a). Exempt lighting applications are also provided on the rightmost column of Table 6-1.

In addition, luminaires serving the following applications are not required to have motion-sensing controls:

1. Lighting for outdoor sales frontage, building façades, ornamental hardscape, and outdoor dining (wall pack luminaires in these applications must meet motion sensor requirements).
2. Luminaires with a rated wattage of 40 watts or less.
3. Wall pack luminaires and luminaires mounted greater than 24 feet above grade.

4. Lighting subject to health or life safety statute, ordinance, or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent.

Acceptance Tests Required for Motion Sensing Controls

Motion-sensing controls are required to have an acceptance testing conducted to confirm that the sensor can sense activity within the detection zone and turn lighting on when occupancy is detected and reduce or turn lighting off within 15 minutes of vacancy detected. The acceptance test procedures are detailed in Reference Nonresidential Appendix NA7.8.1. Refer to Section 6.7.5 of this manual for details about outdoor lighting controls acceptance test.

6.4.3 Lighting Control Functionality

§110.9(b)

All installed lighting control device and systems must meet the functionality requirements in §110.9(b). In addition, all components of a lighting control system installed together shall meet all applicable requirements for the application for which they are installed as required in §130.0 through §130.5, §140.6 through §140.8, §141.0, and §150.0(k).

Designers and installers should review features of their specified lighting control products for meeting the requirements of §110.9(b) as part of the code compliance process.

D. Time-Switch Lighting Controls

Time-switch lighting control products shall provide the functionality listed in §110.9(b)1 of the Energy Code.

E. Daylighting Controls

Daylighting control products shall provide the functionality listed in §110.9(b)2 of the Energy Code.

F. Dimmers

Dimmer products shall provide the functionality listed in §110.9(b)3 of the Energy Code.

G. Occupant-Sensing Controls

Occupant-sensing control products for outdoor lighting applications (including motion sensors) shall provide the functionality listed in §110.9(b)4 and §110.9(b)6 of the Energy Code.

One important feature of occupant sensing controls is that it must automatically reduce lighting or turn the lighting off within 20 minutes after the area has been vacated.

Example 6-13: Designer Responsibility for Lighting Control Devices and Systems

Question

What is the responsibility of the designer regarding using lighting control products that meet the functionality requirements in §110.9(b)?

Answer

It is the responsibility of the designer to specify only lighting control products that meet the functionality requirements in §110.9(b).

Example 6-14: Installer Responsibility for Lighting Control Devices and Systems

Question

What is the responsibility of the installer regarding using lighting control products that meet the functionality requirements in §110.9(b)?

Answer

It is the responsibility of the installer to install only lighting control products that meet the functionality requirements in §110.9(b). It is also the responsibility of the installer to sign the installation certificate.

Prescriptive Measures

6.5.1 Outdoor Lighting Power Compliance

An outdoor lighting installation complies with the Energy Code if the actual outdoor lighting power is no greater than the allowed outdoor lighting power. This section describes the procedures and methods for complying with §140.7.

The allowed outdoor lighting power is the sum of the general hardscape allowance, and additional lighting power allowances.

- The general hardscape allowance is for luminaires that provide general hardscape lighting to hardscape areas such as parking lots, walkways, roadways, and other improved areas that are illuminated. The general hardscape allowance is calculated using the general hardscape area and perimeter length.
- Additional lighting power allowances are used for specific outdoor lighting applications such as outdoor dining areas, building entrances and exits, and outdoor sales frontage. These allowances are calculated per application (W per occurrence), per unit length (W/ft.), or per area (W/ft^2).

The allowed lighting power must be calculated for the general hardscape lighting of the site and for specific applications if desired. (See §140.7[d])

The allowed outdoor lighting power is calculated by lighting zone as defined in §10-114. Local governments may amend lighting zones in compliance with §10-114. See Section 6.4.1 for more information about amending outdoor ordinances by local jurisdictions.

The actual power of outdoor lighting is the total wattage of all nonexempt lighting systems that will be installed (including ballast, driver, or transformer loss) (See §140.7[c]). The wattage of outdoor luminaires must be determined in accordance with §130.0(c) or Reference Nonresidential Appendix NA8. See Section 5.3 for more information about determining luminaire wattage.

H. Allowed Lighting Power

The Energy Code establish maximum allowed outdoor lighting power that can be installed. The allowed outdoor lighting power must be determined according to the outdoor lighting zone in which the site is located. See Section 6.3 for more information about outdoor lighting zones.

An outdoor lighting installation complies with the lighting power requirements if the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under §140.7(d) and complies with certain stipulations associated with specific special application allowances. The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with §140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with §140.7(d)2.

I. Illuminated Area

With indoor lighting applications, the entire floor area is illuminated for the determining the allowed lighting power. However, for outdoor lighting applications, the number of luminaires, mounting heights and layout affect the presumed illuminated area and, therefore, the allowed lighting power.

The area of the lighting application may not include any areas on the site that are not illuminated. The area beyond the last luminaire is considered illuminated only if it is located within 5 mounting heights of the nearest luminaire.

In plan view of the site, the "illuminated area" is defined as any hardscape area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. Another way to envision this is to consider an illuminated area from a single luminaire as the area that is 5 times the mounting height in four directions.

Illuminated areas shall not include any area that is obstructed by any other structure, including a sign, within a building, or areas beyond property lines.

The primary purpose for validating the illuminated area is to exclude any areas that are not illuminated. Areas that are illuminated by more than one luminaire shall not be double-counted. An area is either illuminated or it is not illuminated.

When luminaires are located farther apart (more than 10 times their mounting height apart), then the illuminated area stops at 5 times the mounting height of each luminaire.

Planters and small landscape areas are included within the general hardscape area if the short dimension of the inclusion is less than 10 ft. wide, and the inclusion is bordered on at least three sides.

Landscape areas that are greater than 10 ft. wide in the short dimension are excluded from the general hardscape area calculation, but the perimeter of these exclusions may be included.

6.5.2 General Hardscape Lighting Power Allowance

The general hardscape allowance is calculated based on the general hardscape area, perimeter length and lighting zone that the property is located in.

J. Calculation of Allowed Lighting Power — General Hardscape Lighting Power Allowance

Hardscape is defined in §100.1 as an improvement to a site that is paved and has other structural features, including, but not limited to, curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

Determine the general hardscape lighting power allowances as follows:

1. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines, or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the area wattage allowance (AWA) from Table 6-4 (Table 140.7-A) for the appropriate lighting zone.
2. Determine the perimeter length of the general hardscape area. The total hardscape perimeter is the length of the actual perimeter of the illuminated

hardscape on the property. It shall not include portions of hardscape that are not illuminated according to §140.7(d)1A. Multiply the hardscape perimeter by the linear wattage allowance (LWA) for hardscape from Table 6-4 (Table 140.7-A) for the appropriate lighting zone. Generally, if there is an enclosed exclusion in the area AWA calculation, the perimeter may be included in the LWA calculation.

3. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:
    a. Landscaped areas completely enclosed within the hardscape area, and with a width or length a minimum of 10 feet wide, shall have the perimeter of the landscaped areas or permanent planter added to the hardscape perimeter length.
    b. Landscaped areas completely enclosed within the hardscape area, and with a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
    c. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
4. Determine the initial wattage allowance (IWA). The IWA can be used one time per site. The purpose is to provide additional watts for small sites, or for odd hardscape geometries. Add the IWA for general hardscape lighting from Table 6-4 (Table 140.7-A) for the appropriate lighting zone.
5. The general hardscape lighting allowance shall be the sum of the allowed watts determined from (1), (2) and (3) above.

Refer to Figure 6-1 for a concept layout of the general hardscape lighting allowance for area, and perimeter, as well as initial wattage allowance.

Table 6-3 (Table 140.7-A): General Hardscape Lighting Power Allowance

Type of Power Allowance	Lighting Zone 03	Lighting Zone 13	Lighting Zone 23	Lighting Zone 33	Lighting Zone 43
Area Wattage Allowance (AWA)	No allowance[1]	0.016 W/ft^2	0.019 W/ ft^2.	0.021 W/ft^2	0.024 W/ ft^2
Linear Wattage Allowance (LWA)	No allowance[1]	0.13 W/lf	0.15 W/lf	0.20 W/lf	0.29 W/lf
Initial Wattage Allowance (IWA)	No allowance[1]	150 W	200 W	250 W	320 W

Footnotes to Table:

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

[2] RESERVED.

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

Table 140.7-A from the Energy Standards

The allowed lighting power for general hardscape lighting is calculated using the following components:

1. Area wattage allowance (AWA), which is expressed in watts per sq. ft.
2. Linear wattage allowance (LWA), which is expressed in watts per linear foot.
3. Initial wattage allowance (IWA), which is a flat allowance for each property and is expressed in watts.

To determine the total allowed power for general hardscape lighting, use the equation:

General Hardscape Lighting Power Allowance = (Hardscape Area x AWA) + (Perimeter Length of Hardscape Area x LWA) + IWA

Example 6-15: Outdoor Lighting for Healthcare Facilities

Question

Is the parking lot outside of a healthcare facility ("I" occupancy) regulated by the Energy Code?

Answer

Healthcare facilities overseen by the California Office of Statewide Health Planning and Development (OSHPD) must comply with California Energy Code including the outdoor lighting requirements for all outdoor areas of healthcare facilities. For outdoor lighting, a licensed healthcare facility must meet the outdoor lighting power requirements as specified in §140.7 as well as the outdoor lighting control requirements in §130.2.

Example 6-16: Hardscape Materials for Parking Lots

Question

Our overflow parking lot is covered with gravel. Is this parking lot considered "hardscape," and must it comply with the Energy Code?

Answer

Yes, parking lots covered with gravel, or any other material used to enhance the surface to accommodate parking or travel, such as pavers, asphalt, cement, deck board, or other pervious or impervious materials are considered hardscape and must comply with the requirements for hardscape areas. Note that the updates to 140.7-A now cover all hardscape materials to the same power allowances.

Example 6-17: Power Allowance for a Parking Lot

Question

In a parking lot in front of a retail store, we are not using the full general lighting power allowed according to Table 140.7-A. Can we use the remaining allowance to illuminate the building entrance and the walkways near the store to a higher level?

Answer

Yes. Because the general hardscape power allowance is tradable, you may use the unused portion of the power allowance from the parking lot to increase the illumination levels for other lighting applications, including building entrance and walkway areas.

Example 6-18: Calculating the Illuminated Area of a Parking Lot

Question

A parking lot is illuminated by five cut-off wall packs mounted to an adjacent building. The parking lot extends 100 ft. from the building. The luminaires are mounted at a height of 15 ft. above the ground and spaced 50 ft. apart. How large is the illuminated area?

Answer

The illuminated area extends a distance equal to five times the mounting height in three directions. (The fourth direction is not counted because it is obstructed by the building.) The illuminated area, therefore, extends from the building 75 ft. The total illuminated area is 75 ft. x 350 ft. or 26,250 ft.^{2}

Example 6-19: Calculating the Illuminated Area

Question 1

If a -ole mounted luminaire has a height of 15 ft., what are the dimensions of the illuminated area used for power calculations?

Answer 1

The illuminated area is defined as any area within a square pattern around each luminaire or pole that is 10 times the luminaire mounting height, with the luminaire in the middle of the pattern. It does not include any area that is within a building, under a canopy, beyond property lines, or obstructed by a sign or structure. Therefore, for a 15 ft. pole-mounted luminaire, the area will be described by a square that is 150 ft. (15 ft. x 10) on each side, or 22,500 ft^2 (150 ft. x 150 ft.), minus areas that are beyond the property line or other obstructions.

Question 2

If two poles are separated by a distance greater than 10 times the mounting height, will all of the square footage between them be included in the general hardscape area?

Answer 2

In most applications, such as parking lots, these square patterns will typically overlap, so the entire area of the parking lot between poles will typically be included in the general hardscape area when determining the lighting power budget. However, if the poles are so far apart that they exceed 10 times the mounting height of the luminaires on the poles, and the coverage squares do not overlap, then the nonilluminated areas between poles cannot be included in the general hardscape area.

Example 6-20: Calculating the Power Allowance for a Parking Lot

Question

The parking lot illustrated below has two luminaires that are mounted at a height of 25 ft. What is the illuminated hardscape area and what is the general hardscape lighting power allowance? The lot is in Lighting Zone 3.

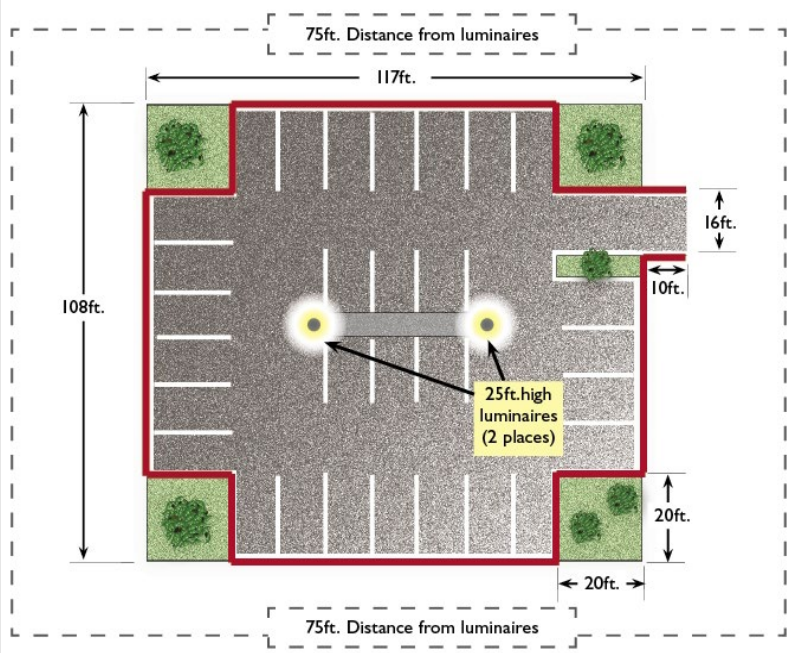


Image Source: California Energy Commission

Answer

The poles are 40 ft. apart, and using the 10 times mounting height rule, the illuminated area can be as large as 250 ft. by 290 ft. The boundary of this illuminated area extends beyond the edges of the parking lot as well as the entrance driveway, so the entire paved area is considered illuminated. The landscaped island in middle and peninsula below the entrance driveway are less than 10 ft. wide, so they are included as part of the illuminated area, but not part of the hardscape perimeter. The landscaped cutouts (20 x 20 ft.) in the corners of the parking lot are bound by pavement on only two sides so they are not included. The total paved area is 11,196 sq. ft. [(12,636 sq. ft. + 160 sq. ft. (driveway) – 1,600 sq. ft (cutouts)]. The perimeter of the hardscape is 470 ft. [(2 x 77 ft.) + (2 x 68 ft.) + (8 x 20 ft.) + (2 X10 ft.)].

Three allowances make up the general hardscape allowance: Area, Linear, and Initial. All allowances are based on Lighting Zone 3 and found in Table 6-3 (Table 140.7-A of the Energy Code).

The area wattage allowance is equal to 235.1 W.

The linear wattage allowance is equal to 94 W.

The initial wattage allowance (IWA) is 250 W for the entire site.

The sum of these three allowances gives a total wattage allowance for the site of 579.1 W.

The calculations are tabulated below.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Initial	250 W	-	250 W
Area	0.021 W/sq. ft.	11,196 sq. ft.	235.1 W
Perimeter	0.2 W/LF	470 ft.	94 W
-	-	**Total Power Allowance:**	**579.1 W**

Example 6-21: General Hardscape Surface Question

Question

Before the 2022 Energy Code, Title 24-2019 allowed a higher lighting power allowance for concrete hardscape surface. If I have a concrete plaza, what is the allowed lighting power allowance I should use for Title 24-2022? The plaza is 115 ft. long and 105 ft. wide in a Lighting Zone 3 location.

Answer

The distinction between different surface material types was removed in Title 24-2022. The lighting power allowance will be based on the Lighting Zone of the project location.

For a plaza located in Lighting Zone 3 the hardscape area must first be calculated. The general hardscape area is 115 ft. x 105 ft. or 12,075 sq. ft. The linear perimeter of this hardscape is the sum of the sides 115 ft. + 105 ft. + 115 ft. + 105 ft. or 440 ft.

Three allowances make up the total power allowance: Area, Linear, and Initial.

However, the initial wattage allowance applies one time to the entire site. It will be considered for usage for this plaza assuming that there is no associated parking lot or other general hardscape area. All allowances are based on the general hardscape Lighting Zone 3 application and can be found in Table 6-3 (Table 140.7-A of the Energy Code).

The initial wattage allowance is equal to 250 W.

The area wattage allowance is equal to 253.6 W.

The linear wattage allowance is equal to 88.0 W.

The sum of these allowances gives a total wattage allowance for the plaza of 591.6 W.

The calculation can also be tabulated as below.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Initial	250 W	-	250 W
Area	0.021 W/sq. ft	12,075 sq. ft.	253.6 W

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Perimeter	0.2 W/LF	615 ft.	88 W
-	-	**Total Power Allowance:**	**591.6 W**

Example 6-22: Calculating the Power Allowance for a Roadway

Question

A 300-ft.-long, 15-ft.-wide roadway leads through a wooded area to a hotel entrance in Lighting Zone 2, and the owner wants to light the roadway with luminaires mounted at a height of 20 ft. What is the allowed lighting power for this roadway with asphalt surface?

Answer

The hardscape area for the roadway must first be calculated. If the entire roadway will be lit, then the 20 ft. poles will not be spaced more than 200 ft. apart and not more than 100 ft. from the ends of the roadway. (Lighted area is 10 times the pole height.) The hardscape area therefore is 15 ft. x 300 ft. or 4,500 sq. ft. The linear perimeter of this hardscape is the sum of the sides (not including the side that connects to the larger site) 300 ft. + 15 ft. + 300 ft. or 615 ft.

Three allowances make up the total power allowance: area, linear, and initial. However, the initial wattage allowance applies one time to the entire site. It is not considered for usage for this roadway piece which would only be one small part of the site. All allowances are based on Lighting Zone 2 and can be found in Table 6-4 (Table 140.7-A of the Energy Code).

The area wattage allowance is equal to 85.5 W.

The linear wattage allowance is equal to 92.3 W.

The sum of these allowances gives a total wattage allowance for the roadway of 177.8 W.

The calculation is tabulated below.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Initial, Hardscape	200 W	-	not used
Area, Hardscape	0.019 W/sq. ft	4,500 sq. ft.	85.5 W
Perimeter, Hardscape	0.15 W/LF	615 ft.	92.3 W
-	-	**Total Power Allowance:**	**177.8 W**

Example 6-23: Flagpole Lighting

Question

Is the lighting power for a flagpole exempt from the 2022 Energy Code?

Answer

Yes. Lighting for a flagpole is considered lighting for a public monument. As described in the exceptions to §140.7(a), lighting power for public monuments is exempt from §140.7 of the 2022 Energy Code. Note that while the power is exempt, this lighting is still subject to the applicable control requirements of §130.2(a), §130.2(c)1, and §130.2(c)2 of the 2022 Energy Code.

Example 6-24: Lighting for Private Streets

Question

Does street lighting inside a gated community with private streets have to meet any lighting requirements?

Answer

Yes. Lighting of private streets must meet the nonresidential outdoor lighting requirements. There are no exceptions to §140.7(a) for private streets. The lights must meet all applicable sections of the nonresidential lighting requirements. (The third exception to §140.7(a) is specific to public streets.)

Example 6-25: Lighting Control Requirements for Outdoor Lighting Exempt From §140.7(a)

Question

For outdoor lighting, if lighting is excluded from the outdoor power limitations per the exceptions to §140.7(a), is that lighting also excluded from the outdoor lighting control requirements of §130.2? ‘

Answer

No. The only outdoor lighting control exception that aligns with the outdoor power exceptions is Exception 2 to §130.2(c)3. This means that if the lighting in question is exempt from the power limitations, it is also exempt from the motion sensing control requirements of §130.2(c)3. All other sections still apply.

K. Calculation of Allowed Lighting Power — Narrow Band Spectrum Light Source Applications

The 2022 Energy Code includes a lighting power provision for narrow band spectrum light source application to minimize the impact of electric light on local, active professional astronomy or nocturnal habitat of specific local fauna. The

provision is in the format of lighting power multiplier as specified on the footnote of Table 140.7-A (footnote 3) which reads, "Footnote 3: Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm – as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna, shall be allowed a 2.0 lighting power allowance multiplier."

Example 6-26: Calculating Allowed Lighting Power for Narrow Band Spectrum Lighting

Question

The lighting system for a lot in Lighting Zone 2 is being designed next to an active, professional astronomical observatory. The parking lot is 800 sq. ft. with a perimeter of 280 linear feet. All lighting within 10 miles of the observatory is required by a local ordinance to use a narrow band spectrum light source with a wavelength above 580 nm to be compatible within the telescopes' ability to filter out stray light while capturing most of the wavelengths of light from the night sky. Spectral power distributions of two amber light sources are shown in the two images in Figure 6-21a.

Figure 6-21a Spectral Distribution of Light Source Product A and B

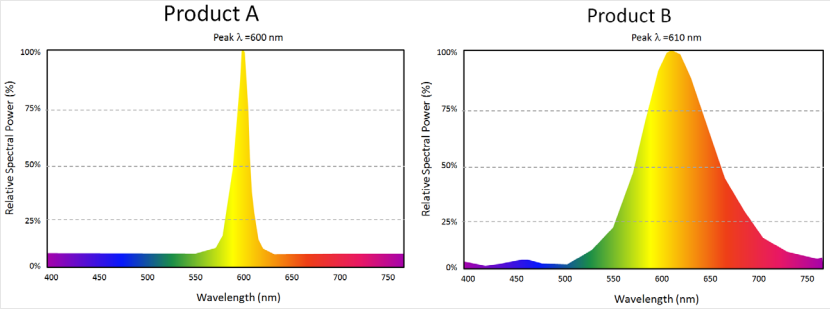


Image Source: Clanton Associates

Question 1: Which of these products meet criteria for "narrow band spectrum" light sources?

Question 2: What is the allowed lighting power for this parking lot with and without the use of a narrow band spectrum light source?

Answer

Answer 1: Narrow band spectrum light sources are those which have a spectral power distribution closely distributed around the wavelength of peak spectral power. There are no spectral power limitations on the wavelengths that are within 20 nm of the peak wavelength. As the spectrum diverges from the peak wavelength, the allowed relative spectral power declines rapidly.

Between 20 to 75nm from peak wavelength, the spectral power shall be no greater than 50% of the peak spectral power.

Beyond 75 nm the spectral power shall be no greater than 10% of the peak spectral power. This distribution is reflected in the narrow ban spectrum criteria line centered around the peak wavelength in Figure 6-21b. As shown in the figure, Product A is a narrow band spectrum light source as it fits within the spectral power criteria, whereas Product B does not comply as the spectral power exceeds the narrow band criteria.

Figure 6-21b Spectral Distribution with Narrow Band Criteria Superimposed

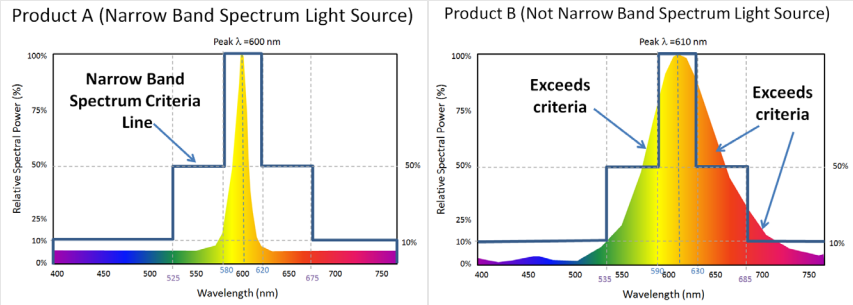


Image Source: Clanton Associates

Answer 2: To claim the two times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project must comply with all three of the following criteria:

1. The light source must have a narrow band spectrum (true for product A).

2. The dominant peak wavelength must be greater than 580 nm (true for product A with a peak wavelength of 600 nm).

3. The narrow band spectrum and dominant peak wavelength of the light source must be greater than 580 nm as mandated by local, state, federal agencies, to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna. (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

The allowed wattage without the narrow spectrum multiplier is calculated as follows:

Allowed Wattage = (Area Wattage Allowance) x (Area, sq. ft.) + (Linear Wattage Allowance) x (Perimeter Length, linear ft.) + (Initial Wattage Allowance)

The asphalt parking lot is 800 sq. ft. with a perimeter of 280 linear feet and is in Lighting Zone 2. From Table 140.7-A in the asphalt column of Lighting Zone 2, the power allowance factors are:

Area Wattage Allowance = 0.019 W/sq. ft., Linear Wattage Allowance = 0.15 W/lf, and Initial Wattage Allowance = 200 Watts.

Allowed Wattage = (0.019 W/sq. ft) x (800 sq. ft.) + (0.15 W/lf) x (280 lf) + (200 W) = 257.2 Watts

If the design makes use of narrow band light sources and meets all three criteria of footnote 3 to Table 140.7-A, the allowed wattage is multiplied by 2.

Narrow Band Allowed Wattage = Allowed Wattage x 2 = 257.2 W x 2 = 514.4 Watts.

Example 6-27: Low Blue Content Light Source Design

Question

A lighting system is being designed for a similar parking lot as in Example 6-23 except that it is next to a wildlife refuge and all outdoor lighting near the refuge is required by a local ordinance to use low blue content light sources to minimize the lighting impact on nocturnal animals.

If the designer specifies a narrow band spectrum light source (such as Product A in Example 6-23), can the designer make use of the narrow band spectrum lighting power allowance multiplier in determining the lighting power allowance?

Answer:

To claim the two-times multiplier for narrow band spectrum light sources, as described in footnote 3 to Table 140.7-A, the project must comply with all three of the following criteria:

1. The light source must have a narrow band spectrum.

2. The dominant peak wavelength must be greater than 580 nm.

3. The narrow band spectrum and dominant peak wavelength of the light source be greater than 580 nm, as mandated by local, state, federal agencies to minimize the impact on local, active professional astronomy or on the nocturnal habitat of specific local fauna (The credit is not available unless the ordinance specifically calls out a requirement for a narrow band spectrum.)

For this example, the narrow band spectrum credit is not available since the local ordinance called for low blue light content without specifying this had to be accomplished with narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm. As a result, the two-times multiplier for narrow band spectrum light sources cannot be used in calculating the lighting power allowance for this project.

6.5.3 Additional Light Power Allowances and Requirements by Application

The lighting power allowances for specific applications provide additional lighting power that can be layered in addition to the general hardscape lighting power allowances as applicable.

Most of a site will be classified as general hardscape and will be calculated using Table 6-4 (Table 140.7-A of the Energy Code) as the only source of allowance.

Some portions of the site may fit use categories that permit the inclusion of an additional lighting allowance for that portion of the site. These specific applications are detailed in Table 6-5 (Table 140.7-B of the Energy Code). Additional allowances for specific applications can be per application, per hardscape area, per specific application unit length, or per specific application area.

Hardscape ornamental lighting is calculated independent of the rest of the specific applications. See Section 6.5.3E for more information about the hardscape ornamental lighting allowance.

Table 6-4 (From Table 140.2-B): Additional Lighting Power Allowance for Specific Applications

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Building Entrances or Exits. Allowance per door. Luminaires must be within 20 feet of the door.	Not applicable	9 watts	15 watts	19 watts	21 watts
Primary Entrances to Senior Care Facilities, Police Stations, Healthcare Facilities, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances are entrances that provide access for the general public. This allowance is in addition to the building entrance or exit allowance above. Luminaires must be within 100 feet of the primary entrance.	Not applicable	20 watts	40 watts	57 watts	60 watts
Drive Up Windows. Allowance per customer service location. Luminaires must be within 2 mounting heights of the sill of the window.	Not applicable	16 watts	30 watts	50 watts	75 watts
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires must be within	Not applicable	55 watts	77 watts	81 watts	135 watts

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**
2 mounting heights of the dispenser.					
ATM Lighting. Allowance per ATM. Luminaires must be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM, 35 watts for each additional ATM.	100 watts for first ATM, 35 watts for each additional ATM	100 watts for first ATM, 35 watts for each additional ATM	100 watts for first ATM, 35 watts for each additional ATM
Lighting Application WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft.). May be used for one or two frontage side(s) per site.	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**
Outdoor Sales Frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires must be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	11 W/linear ft.	19 W/linear ft.	25 W/linear ft.
Lighting Application WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/sq. ft.). May be used for any illuminated hardscape area on the site	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires must be rated for 50 watts or less and be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	Not applicable	No Allowance	0.007 W/ ft^2.	0.013 W/ ft^2	0.019 W/ ft^2
Lighting Application WATTAGE ALLOWANCE PER SPECIFIC AREA (W/sq. ft.). May be used as appropriate provided that only one is used for a given area (i.e., provided that two allowances are not applied to the same area).	**Lighting Zone 0**	**Lighting Zone 1**	**Lighting Zone 2**	**Lighting Zone 3**	**Lighting Zone 4**
Building Facades. Only areas of building façade that are illuminated qualify for this allowance. Luminaires must be aimed at the façade and capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not applicable	No Allowance	0.100 W/ ft^2	0.170 W/ ft^2	0.225 W/ ft^2
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas are considered hardscape areas even if	Not applicable	0.060 W/ ft^2	0.210 W/ ft^2	0.280 W/ ft^2	0.485 W/ ft^2

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
these areas are completely surrounded by sales lots on all sides. Luminaires must be within 5 mounting heights of the sales lot area.					
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires must be illuminating the hardscape area and must not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.	Not applicable	0.006 W/ ft^2	0.068 W/ ft^2	0.138 W/ ft^2	0.200 W/ ft^2
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	0.220 W/ ft^2	0.430 W/ ft^2	0.580 W/ ft^2	1.010 W/ ft^2
Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires must be located under the canopy.	Not applicable	No Allowance	0.470 W/ ft^2	0.622 W/ ft^2	0.740 W/ ft^2
Non-sales Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel.	Not applicable	0.057 W/ ft^2	0.137 W/ ft^2	0.270 W/ ft^2	0.370 W/ ft^2

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Luminaires must be located under the canopy or tunnel.					
Guard Stations. Allowed up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentations, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting height of a vehicle lane or the guardhouse.	Not applicable	0.081 W/ ft^2	0.176 W/ ft^2	0.325 W/ ft^2	0.425 W/ ft^2
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off, with or without canopy, for preschool through 12^{th} grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting	Not applicable	No Allowance	0.056 W/ ft^2	0.200 W/ ft^2	No Allowance

Lighting Application WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
heights of the student pick-up/drop-off zone.					
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	Not applicable	0.004 W/ ft^2	0.030 W/ ft^2	0.050 W/ ft^2	0.075 W/ ft^2
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not applicable	0.004 W/ ft^2	0.005 W/ ft^2	0.010 W/ ft^2	No Allowance
Security Cameras. This additional allowance is for illuminated general hardscape area. This allowance shall apply when a security camera is installed within 2 mounting heights of the general hardscape area and mounted more than 10 feet away from a building.	Not applicable	No allowance	0.018 W ft^2	0.018 W/ ft^2	0.018 W/ ft^2

Source: California Energy Commission

Assigned lighting applications must be consistent with the actual use of the area. Outdoor lighting definitions in §100.1 must be used to determine appropriate lighting applications.

Specific applications that are based on the number of specific application instances on the site are calculated by multiplying each instance by the allowed wattage per instance.

Specific applications that are based on the length of an instance on the site are calculated by multiplying the total length of the instance by the allowance per linear foot for the application.

L. General Hardscape Power Trade-Offs

Allowed lighting power determined according to §140.7(d)1 for general hardscape lighting may be traded to specific applications in §140.7(d)2 if the hardscape area from which the lighting power is traded continues to be illuminated in accordance with §140.7(d)1A.

M. Specific Allowances Power Trade-Offs Not Allowed

Allowed lighting power for specific applications shall not be traded between specific applications, or to general hardscape lighting in §140.7(d)1. For each specific application, the allowed lighting power is the smaller of the allowed power determined for that specific application according to Table 140.7-B, or the actual installed lighting power that is used in that specific application.

N. Wattage Allowance per Application

The applications in this category are provided with additional lighting power, in watts (W) per instance, as defined in Table 6-5 (Table 140.7-B of the Energy Code). Use all that apply as appropriate. Wattage allowances per application are available for the following areas:

- Building entrances or exits.
- Primary entrances of senior care facilities, police stations, healthcare facilities, fire stations, and emergency vehicle facilities.
- Drive-up windows. See Section 6.5.4F for additional information about drive-up windows
- Vehicle service station uncovered fuel dispenser. See Section 6.5.4C for additional information about vehicle service stations.
- ATM lighting

O. Wattage Allowance for Outdoor Sales Frontage Application

The wattage allowance per linear foot is available only for outdoor sales frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for

this allowance shall be located between the principal viewing location and the frontage outdoor. The outdoor sales frontage allowance is calculated by multiplying the total length of qualifying sales frontage by the outdoor sales frontage lighting allowance in Table 6-5 (Table 140.7-B of the Energy Code). See Section 6.5.4B for additional information about sales frontage.

P. Wattage Allowance per Hardscape Ornamental Lighting Application

The ornamental lighting allowance on the site is calculated by multiplying the total illuminated hardscape for the site by the hardscape ornamental lighting allowance in Table 6-5 (Table 140.7-B of the Energy Code), in watts per square foot (W/ft^2). Luminaires qualifying for this allowance shall be rated for 50 W or less as determined in accordance with §130.0(c) and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers. This additional wattage allowance may be used for any illuminated hardscape area on the site. See Section 6.5.4E for additional information about ornamental lighting.

Q. Wattage Allowance per Specific Area

Applications in this category are provided with additional lighting power per specific area, in watts per square foot (W/ sq. ft.), as defined in Table 6-5 (Table 140.7-B of the Energy Code). Wattage allowances per specific area are available for the following applications:

1. Building Facades

Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects. See Section 6.5.4A for additional information about building facades.

2. Outdoor Sales Lots

Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas shall be considered hardscape areas, not outdoor sales lots, even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area. See Section 6.5.4B for more information.

3. Vehicle Service Station Hardscape

Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure. See Section 6.5.4C for additional information about vehicle service station hardscape.

4. Vehicle Service Station Canopies

Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy. See Section 6.5.4C for additional information about vehicle service station canopies.

5. Sales Canopies

Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy. See Section 6.5.4D for additional information about lighting under canopies.

6. Non-Sales Canopies and Tunnels

Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel. See Section 6.5.4D for additional information about lighting under canopies.

7. Guard Stations

Allowance up to 1,000 sq. ft. per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse. See Section 6.5.4G for additional information about guarded facilities.

8. Student Pick-Up/Drop-Off Zone

Allowance for the area of the student pickup/drop-off zone, with or without canopy, for preschool through twelfth grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 ft., multiplied by the smaller of the actual length or 250 ft. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.

9. Outdoor Dining

Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.

10. Special Security Lighting for Retail Parking and Pedestrian Hardscape

This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.

11. Security Cameras

This additional allowance is for the illuminated general hardscape area. This

allowance shall apply when a security camera is installed within 2 mounting heights of the general hardscape area and mounted more than 10 feet away from a building. See Section 6.5.4H for additional information about security cameras.

Figure 6-2: Example of a Security Camera That Does Not Qualify for Additional Lighting Power Allowance for Security Cameras

Image: California Energy Commission

6.5.4 Further Discussion About Additional Lighting Power Allowance for Specific Applications

R. Building Façades

Building façade is defined in §100.1 as the exterior surfaces of a building, not including horizontal roofing, signs, and surfaces not visible from any public viewing location. Only areas of building façade that are illuminated should qualify for this allowance. Luminaires qualifying for this allowance should be aimed at the façade and should be capable of illuminating it without obstruction or interference by permanent building features or other objects.

Building façades and architectural features may be illuminated by flood lights, sconces, or other lighting attached to the building. Building façade lighting is not permitted in Lighting Zone 0 and Lighting Zone 1. Façade orientations that are not illuminated and façade areas that are not illuminated because the lighting is obstructed shall not be included. General site illumination, sign lighting, and/or lighting for other specific applications can be attached to the side of a building and not be considered façade lighting. Wall packs mounted on sides of the

buildings are not considered façade lighting when most of the light exiting these luminaires lands on areas other than the building façade.

Example 6-28: Calculating the Allowance for a Projected Area

Question

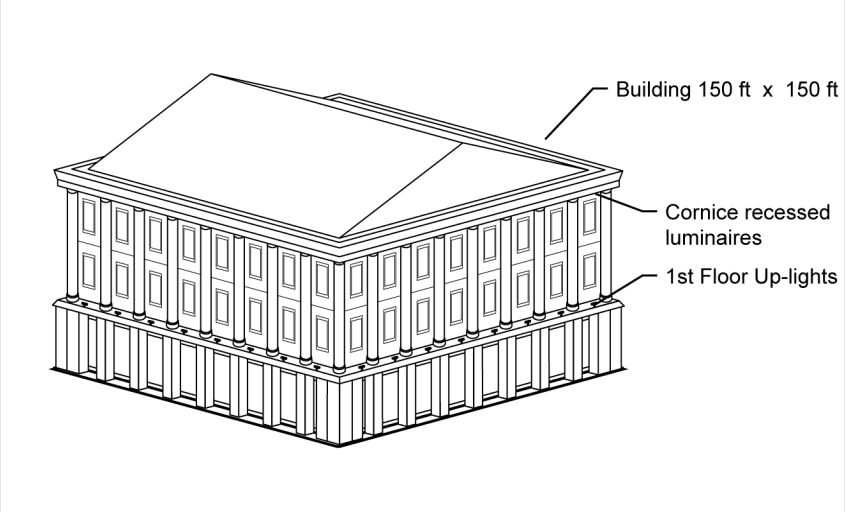


Image: California Energy Commission

A city wants to illuminate its city hall (in Lighting Zone 3) on two sides (two façades). The structure is a three-story building with a colonnade on the second and third floors and a cornice above. The columns are considered important architectural features and the principal goal of the lighting project is to highlight these features. The columns are 30 ft. tall x 3 ft. in diameter and are spaced at 8 ft. For the purposes of determining the lighting power allowance for the building, what is the surface area to be illuminated? What is the lighting power allowance? The columns will be illuminated by downlights at the cornice and uplights above the first floor.

Answer

The area of the façade for the purposes of calculating the lighting allowance is the projected area of the illuminated façade. Architectural features such as columns, recesses, facets, etc. are ignored. The illuminated area for each façade is therefore 30 ft. x 150 ft. or 4,500 sq. ft. The façade allowance for Lighting Zone 3 is 0.17 W/sq. ft., so the total power allowed is 765 W per façade, or 1,530 W total.

Type of Allowance	*Allowance*	*Area/Perimeter Value*	*Power Allowance*
Facade	0.17 W/ sq. ft.	4,500 sq. ft.	765 W per facade

Type of Allowance	*Allowance*	*Area/Perimeter Value*	*Power Allowance*
-	-	**Total Power Allowance:**	**1,530 W**

Example 6-29: Permanent vs. Temporary Façade Lighting

Question

I am designing a hotel building. Permanently mounted marquee lights will be installed along the corners of the building. The lighting will be turned on at night, but only for the holiday season, roughly between mid-November and mid-January. The lighting consists of a series of 7 W LED luminaires spaced at 12 inches on-center (OC) along all the corners of the building and along the top of the building. Essentially, the lights provide an outline of the building. Are these considered façade lighting? Because they will only be used for two months of the year, are they considered temporary lighting and therefore exempt from lighting power allowance requirements?

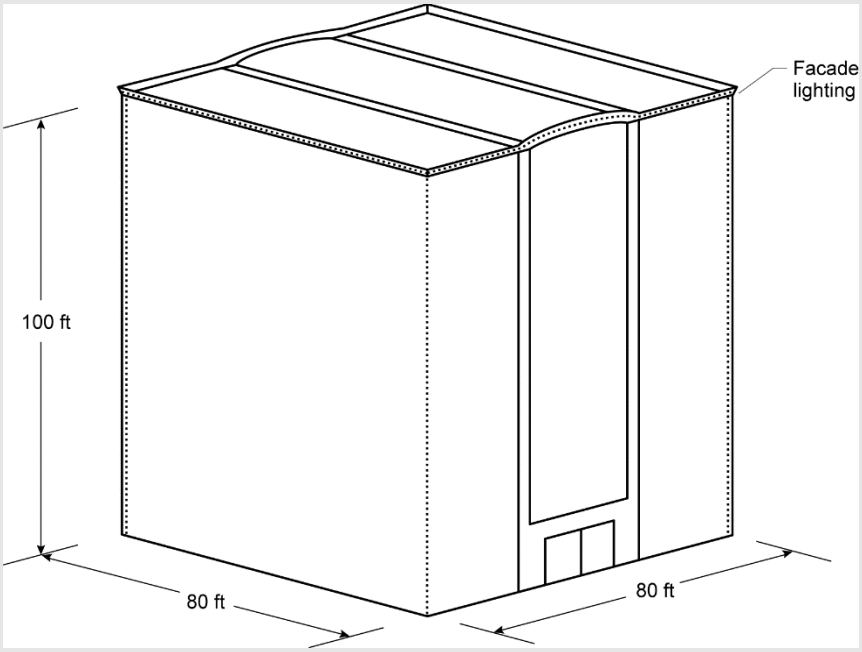


Image: California Energy Commission

Answer

The lighting is permanent lighting and must comply with the Energy Code. Temporary lighting is defined in §100.1 as a lighting installation with plug-in connections that does not persist beyond 60 consecutive days or more than 120 days per year. Anything that is permanently mounted to the building is considered permanent lighting, and the hours of intended use do not affect its status as permanent lighting. Because this lighting is primarily used to accent the architectural outline of the building, it may be considered façade lighting. And because all corners of the building are illuminated, all four facades may be illuminated. The area on each façade is 80 ft. x 100 ft. or 8,000 sq. ft. The total illuminated area is four times 8,000 sq. ft. or 32,000 sq. ft. The Lighting Zone 3 allowance for façade lighting is 0.17 W/sq. ft., and the specific application power allowance for façade lighting is 5,440 W.

There are 100 ft. x 4 plus 80 ft. x 4 luminaires (a total of 720 luminaires) on the building. Each luminaire is 7 W. The installed power is 720 luminaires times 7 W/luminaire or 5,040 W. The installed power is less than the specific application power allowance, so the façade lighting complies. If this building were in Lighting Zone 2, the specific application power allowance would be 0.1 W/sq. ft. or a total of 3,200 W. The lighting design would not comply in Lighting Zone 2.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Facade	0.17 W/ sq. ft.	32,000 sq. ft.	5,440 W
-	-	**Total Power Allowance:**	**5,440 W**

Example 6-30: Power Allowance for Façades

Question

Portions of the front façade of a proposed wholesale store in Lighting Zone 3 are going to be illuminated. The front wall dimensions are 120 ft. by 20 ft. There is 250 sq. ft. of fenestration in the front wall that is illuminated by the façade lighting. Signs cover another 500 sq. ft. of the front wall, and another 400 sq. ft. is not illuminated at all. What is the allowed front façade lighting power?

Answer

The gross wall area is 2,400 sq. ft. (120 x 20). However, we must subtract all those areas that are not illuminated. Note that because the 250 sq. ft. of fenestration is intended to be illuminated by the façade lighting, this area may be included in the total area eligible for power calculations.

The areas not eligible for power calculations include:

500 sq. ft. of signs + 400 sq. ft. of unlighted façade = 900 sq. ft.

The net wall area used for façade lighting: 2,400 sq. ft. - 900 sq. ft. = 1,500 sq. ft.

From Table 6-5 (Table 1407-B of the Energy Code), the allowed façade lighting power density in Lighting Zone 3 is 0.17 W/ sq. ft.

The allowed façade lighting power based on the net wall area is 1,500 sq. ft. x 0.17 W/ sq. ft. = 255 W.

The allowed power is therefore the smaller of actual wattage used for façade lighting or 255 W.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Facade	0.17 W/ sq. ft.	1,500 sq. ft.	255 W
-	-	**Total Power Allowance:**	**255 W**

Example 6-31: Sign Lighting

Question

Is sign lighting part of my façade lighting?

Answer

The sign area must be subtracted from the façade area so that the area is not double-counted. The sign lighting must meet the requirements of the Energy Code for sign lighting. See Chapter 7 for more information about sign lighting.

Example 6-32: Hardscape vs. Façade Lighting

Question

If I mount a luminaire on the side of my building to illuminate an area, is it considered façade lighting or hardscape lighting?

Answer

It depends on the primary intent of the luminaire. For example, if the luminaire is primarily illuminating the walls (such as a sconce), then it should be considered part of the building façade lighting. If, on the other hand, the luminaire is primarily illuminating the parking lot beyond (most wall packs), then it should be part of the hardscape lighting. It should be noted that lighting power tradeoffs are not allowed between building façade and hardscape areas.

S. Sales Frontage

This additional allowance is intended to accommodate the retailers' need to highlight merchandise to motorists who drive by their lot. Outdoor sales frontage includes car lots but can also include any sales activity.

Outdoor sales frontage must be immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor. The outdoor sales frontage allowance is calculated by multiplying the total length of qualifying sales frontage by the outdoor sales frontage lighting allowance in Table 147-B of the Energy Code.

When a sales lot qualifies for the sales frontage allowance, the total sales lot wattage allowance is determined by adding the following three layers:

- General hardscape lighting power allowance
- Outdoor sales frontage
- Outdoor sales lot

T. Vehicle Service Stations

According to the definition in §100.1, a vehicle service station is a gasoline, natural gas, diesel, or other fuel-dispensing station. In addition to allowances for building entrances and exits, hardscape ornamental lighting, building façade, and outdoor dining allowances, as appropriate, the total wattage allowance specifically applying to vehicle service station hardscape is determined by adding the following layers, as appropriate:

- General hardscape lighting power allowance
- Vehicle service station uncovered fuel dispenser (allowance per fueling dispenser, with 2 mounting heights of dispenser)
- Vehicle service station hardscape (less area of buildings, under canopies, off property, or obstructed by signs or other structures)
- Vehicle service station canopies (within the drip line of the canopy)

The lighting power allowances are listed in Table 140.7-B of the Energy Code.

Example 6-33: Canopy Area and Hardscape Area

Question

Where does canopy area end and hardscape area start?

Answer

The horizontal projected area of the canopy on the ground establishes the area for under-canopy lighting power calculations. This area also referred to as the "drip line" of the canopy.

U. Under Canopies

According to the definition in §100.1, a "canopy" is a permanent structure, other than a parking garage, consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.

The definition of a canopy states that a canopy is not a parking garage. A parking garage is classified as an unconditioned interior space, whereas a canopy is classified as an outdoor space.

The lighting power allowance for a canopy depends on its purpose. Service station canopies are treated separately. (See the previous section.) The two types of canopies addressed in this section are those that are used for sales and those that are not. Non-sales canopies include covered walkways and covered entrances to hotels, office buildings, convention centers and other buildings. Sales canopies specifically cover and protect an outdoor sales area, including garden centers, covered automobile sales lots, and outdoor markets with permanent roofs. The lighting power allowances are listed in Table 140.7-B of the Energy Code.

The area of a canopy is defined as the "horizontal projected area," in plan view, directly underneath the canopy. This area is also referred to as the "drip line" of the canopy. Canopy lighting, either sales or non-sales, shall comply separately; for example, trade-offs are not permitted between other specific lighting applications or with general site illumination.

General site lighting or other specific applications lighting and/or sign lighting that is attached to the sides or top of a canopy cannot be considered canopy lighting. For example, internally illuminated translucent panels on the perimeter of a canopy are considered sign lighting, while the lighting underneath the canopy and directed toward the ground is canopy lighting.

Example 6-34: Power Allowance Under Canopies

Question

The first floor of an office tower in Lighting Zone 3 is setback 20 ft. on the street side. The width of the recessed façade is 150 ft. The primary purpose of the setback (and canopy) is to provide a suitable entrance to the office tower; however, space under the canopy is leased as newsstand, a flower cart, and a shoeshine stand. These commercial activities occupy about half of the space beneath the canopy. What is the allowed lighting power?

Answer

The total canopy area is 20 ft. x 150 ft. or 3,000 sq. ft. The general hardscape allowance for the site will need to be separately determined. The canopy allowance is an additional layer allowed only for the canopy area. The 1,500 sq. ft. used for the flower cart, newsstand, and shoeshine stand is considered a sales canopy, and the allowance is 0.622 W/ sq. ft. or a total of 933 W. The other 1,500 sq. ft. is a non-sales canopy, and the allowance is 0.270 W/sq. ft. or a total of 405 W. Trade-offs are not permitted between the sales portion and the non-sales portions.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Non-Sales Canopy	0.270W/ sq. ft.	1,500 sq. ft.	405 W
Sales Canopy	0.622 w/ sq. ft.	1,500 sq. ft.	933 W
-	-	**Total Power Allowance:**	**1,338 W**

V. Ornamental Lighting

"Ornamental lighting" is defined in §100.1 as post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting. However, marquee lighting does not qualify for the ornamental lighting allowance. The allowances for ornamental lighting are listed in Table 140.7-B of the Energy Code.

The ornamental lighting allowance on the site is calculated by multiplying the total illuminated hardscape for the site by the hardscape ornamental lighting allowance in Table 140.7-B. This allowance is calculated separately and is not accumulated into the other allowances. This additional wattage allowance may be used for any illuminated hardscape area on the site.

Luminaires used for ornamental lighting as defined in Table 140.7-B shall have a rated wattage, as listed on a permanent, preprinted, factory-installed label, of 50 W or less.

Example 6-35: Bollard Luminaires

Question

Are bollard luminaires considered ornamental lighting?

Answer

No, Ornamental lighting is defined in Table 140.7-B of the Energy Code as post-top luminaires, lanterns, pendant luminaires, chandeliers.

W. Drive-Up Windows

Drive-up windows are common for fast food restaurants, banks, and parking lot entrances. To qualify, a drive-up window must have someone working behind the "window." Automatic ticket dispensers at parking lots do not count.

The lighting power allowances are listed in Table 140.7-B of the Energy Code as a wattage allowance per application.

The wattage allowance in Lighting Zone 3 is 125 W for each drive-up window.

Luminaires qualifying for this allowance must be within 2 mounting heights of the sill of the window.

Example 6-36: Power Allowance for Drive-Up Window

Question

A drive-up window in Lighting Zone 2 has width of 7 ft. What is the allowed lighting power for this drive-up window?

Answer

The width of a drive-up window in not used for determining the allowed wattage. In Lighting Zone 2, 30 W is allowed for each drive-up window.

X. Guard Stations

Guard stations include the entrance driveway, gatehouse, and guardhouse that provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification documentation, vehicle license plates, and vehicle contents.

There is an allowance of up to 1,000 sq. ft. per vehicle lane. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.

The power allowances for guarded facilities are listed in Table 140.7-B of the Energy Code.

Example 6-37: Specific Application Power Allowance for Guard Stations

Question

A guard station to the research campus of a defense contractor consists of a guard station building of 300 sq. ft. Vehicles enter to the right of the station and exit to the left. What is the outdoor lighting power allowance? The guard station is located in Lighting Zone 2.

Answer

Since there are two vehicle lanes, the specific application allowance for a guard station located in Lighting Zone 2 is 2 lanes x 300 sq. ft. x 0.176 W/sq. ft. or 105.6 W.

Y. Security Cameras

Security cameras for general hardscape areas apply to nonbuilding-mounted security cameras that require higher levels of general illumination to identify objects or determine what activities are occurring in a space.

This allowance applies for any general hardscape areas where a security camera is installed within two camera mounting heights of the general hardscape area. The camera must be mounted at least 10 feet away from an adjacent building to qualify for this allowance. This allowance can be applied to the entire general hardscape area associated with the camera's field of view.

The power allowances for security cameras are listed in Table 140.7-B of the Energy Code.

Example 6-38: Power Allowance for Security Cameras

Question

My building has two parking lots located on either side of the building. The parking lot on the east is 180 ft. long and 130 ft. wide and has two security cameras mounted on the building. The parking lot to the west is 180 ft. long and 250 ft. wide and has security cameras mounted on the light poles. This building is in Lighting Zone 2. What is the outdoor lighting power allowance I can use?

Answer

Since the parking lots are located on separate sides of the building, the power allowances must be calculated separately for each parking lot. The security camera allowance applies only to the parking lot on the west side of the building, since these cameras are mounted on poles more than 10 feet away from the building (see Example 6-36).

First the general hardscape allowance for both parking lots in Lighting Zone 2 must be calculated.

The east parking lot general hardscape area is 180 ft. x 130 ft., or 23,400 sq. ft. The area wattage allowed is 23,400 sq. ft. x 0.019 W/sq. ft. or 444.6 W.

The perimeter of this hardscape is the sum of the sides 180 ft. + 130 ft. + 180 ft. + 130 ft. or 620 ft. The linear wattage allowed is 620 ft. x 0.15 W/sq. ft. or 93 W.

The initial wattage allowance will be split between the east and the west parking lots. Half the initial wattage allowance is equal to 100 W.

The general hardscape allowance for the east parking lot is 637.6 W (444.6 W+ 93 W + 100 W).

Similarly, the west parking lot general hardscape area is 180 ft. x 205 ft., or 36,900 sq. ft. The area wattage allowed is 36,900 sq. ft. x 0.019 W/sq. ft. or 701.1 W.

The perimeter of this hardscape is the sum of the sides 180 ft. + 205 ft. + 180 ft. + 205 ft. or 770 ft. The linear wattage allowed is 770 ft. x 0.15 W/sq. ft. or 115.5 W.

The initial wattage allowance will be split between the east and the west parking lots. Half the initial wattage allowance is equal to 100 W.

The general hardscape allowance for the west parking lot is 916.6 W (701.1 W + 115.5 W + 100 W).

The security camera allowance can then be applied to the west parking lot general hardscape allowance. The west parking lot general hardscape area is 180 ft. x 250 ft. or 36,900 sq. ft. The west parking lot security camera allowance is 36,900 sq. ft. x 0.018 W/sq. ft. or 664.2 W.

The total wattage allowance for the west parking lot is 916.6 W + 664.2 W or 1580.8 W.

The calculation for the west parking lot can be tabulated as below.

Type of Allowance	Allowance	Area/Perimeter Value	Power Allowance
Initial, Gen. Hardscape	100 W	-	100 W
Area, Gen. Hardscape	0.019 W/sq. ft	36,900 sq. ft.	701.1 W
Perimeter, Gen. Hardscape	0.15 W/LF	770 ft.	115.5 W
Security Camera	0.018 w/ sq. ft.	36,900 sq. ft.	664.2 W
	-	**Total Power Allowance:**	**1,580.8 W**

Example 6-39: Application of Security Cameras

Question

My building has a security camera mounted to a building above a side entry door facing the loading dock. Can I apply the security camera allowance to the loading dock general hardscape area?

Answer

No, the security camera allowance does not apply to the outdoor lighting system of the building as these are building-mounted security cameras. The security camera allowance applies only to security cameras that are installed within 2 mounting heights of the general hardscape area and mounted more than 10 feet away from buildings.

Alterations and Additions for Outdoor Lighting

§141.0(b)2L

The Energy Code applies to alterations and additions to outdoor lighting systems, and the application of the Energy Code to alterations depends on the scope of the proposed improvements.

"Outdoor lighting alterations" generally refer to replacing entire luminaires or adding luminaires to an existing outdoor lighting system. Modifications or retrofitting existing luminaires (for example changing the luminaire light source) is not considered outdoor lighting alterations unless the modification increases the connected lighting load.

Example 6-40: Requirements for Replacing Ballasts

Question

I am going to change the ballasts in my façade lighting system. Will I be required to meet the outdoor lighting alteration requirements?

Answer

No, the replacement of only lamps or ballasts in outdoor lighting systems is not considered an alteration and does not trigger compliance with outdoor lighting requirements. Replacing entire luminaires will trigger mandatory lighting control requirements for the altered (replaced) luminaires only. Replacing 50 percent or more of the existing luminaires or increasing the connected lighting load for any outdoor lighting application will trigger the prescriptive lighting power allowance requirements of the Energy Code.

6.6.1 Outdoor Lighting Alterations – Increasing Connected Lighting Loads

For alterations that increase the connected lighting load in a lighting application listed in Table 140.7-A or 140.7-B, the added or altered luminaires must meet all the applicable requirements of §130.2(c) and §140.7.

Example 6-41: Requirements for Adding New Luminaires in a Parking Lot

Question

We are adding new luminaires to the existing lighting systems in a parking lot. Which code requirements are triggered by this alteration?

Answer

Because additional load is being added to the parking lot general hardscape lighting, the entire general hardscape area must comply with the lighting power allowance requirements. However, only the newly installed lighting system must comply with the applicable mandatory requirements, including control requirements and luminaire shielding requirements.

6.6.2 Outdoor Lighting Alterations – 10 Percent or More of Existing Luminaires Are Replaced

For alterations in parking lots or outdoor sales lots that do not increase connected lighting load, where 10 percent or more of the existing luminaires are replaced, and where the luminaire is mounted 24 feet or less above the ground, the replaced luminaires must meet the applicable controls requirements of §130.2(c)1 and §130.2(c)3.

For parking lots and outdoor sales lots where the bottom of the luminaire is mounted greater than 24 feet above the ground and for all other lighting applications, the replaced luminaires must meet the applicable controls requirements of §130.2(c)1 and either comply with §130.2(c)2 or be controlled by lighting control systems (including motion sensors) that reduce lighting power by at least 40 percent when the area is vacated.

If fewer than five existing luminaires are replaced, the replacement luminaires are exempt from the control requirements for alterations to existing outdoor lighting systems.

Example 6-42: BUG Requirements for Lighting Alterations

Question

We are replacing 20 percent of the existing HID luminaires in a parking lot. Does the luminaire shielding requirement apply to the new and existing luminaires?

Answer

Replacement luminaires must meet the luminaire shielding (BUG) requirements if the luminaire initial lumen output is 6,200 lumens or greater; however, existing luminaires that are not replaced are not required to be upgraded to meet the luminaire BUG requirement.

Section 141.0(b)2L specifies that all altered luminaires must meet applicable mandatory requirements, including the BUG requirements for replacements luminaires. Therefore, replacement luminaires that are greater than 6,200 initial luminaire lumens must meet the luminaire BUG requirements, even if fewer than five luminaires or 10 percent of the luminaires on site are replaced.

6.6.3 Outdoor Lighting Alterations – Half (50 Percent) or More of Existing Luminaires Are Replaced

For alterations that do not increase connected lighting load, where 50 percent or more of the existing luminaires are replaced in a lighting application listed in Table 140.7-A or 140.7-B, the replaced luminaires must meet the control requirements discussed in the previous section and meet the lighting power allowance requirements of §140.7.

If the replacement luminaires are at least 40 percent more efficient in lighting power than the existing luminaires, the alteration is exempt from the lighting power allowance requirements of §140.7.

If fewer than five existing luminaires are replaced, the replacement luminaires are exempt from the control requirements and lighting power allowance requirements.

Example 6-43: Requirements for Replacing More Than 50 Percent of Luminaires

Question

In a service station, we are replacing five under-canopy luminaires, which is more than 50 percent of the existing under canopy luminaires. Does this trigger the alteration requirements for outdoor lighting? Do we need to bring non-canopy lighting such as hardscape lighting up to code as well?

Answer

Yes, §141.0(b)2Liii specifies that when five or more luminaires are replaced, or 50 percent or more of luminaires are replaced in a given lighting application included in Energy Code Tables 140.7-A and 140.7-B, the alteration requirements apply. So, in this example, all under-canopy luminaires must meet the lighting power allowance requirements of §140.7 and the applicable control requirements of §130.2. Existing outdoor lighting systems for hardscape and other outdoor lighting applications do not need to meet alteration requirements even if they are included in the permit along with the canopy lighting.

Example 6-44: Exemption From Lighting Power Allowance Requirements

Question

Fifty HID exterior pole luminaires in a parking lot are being replaced with 50 new LED luminaires. However, to improve poor coverage in one end of the lot, an additional three pole luminaires are added, bringing the total new luminaire count to 53. Despite the addition of 3 luminaires, the total connected load for the 53 luminaires were reduced by 42 percent compared to the original 50 luminaires. Does this project have to meet the outdoor lighting power allowance requirements in §140.7?

Answer

No, the project does not have to meet the lighting power allowance requirements in §140.7. Even though the number of luminaires has increased, the total wattage of the project is less than before, so the connected lighting load has decreased. Since the connected load was reduced by 40 percent or more compared to the original luminaires, the exception to §141.0(b)2Liii applies, and the new fixtures are not required to comply with the lighting power allowance requirements in §140.7.

6.6.4 Outdoor Lighting Alterations – Less Than 10 Percent of Existing Luminaires Are Replaced

For alterations that do not increase connected lighting load and replace fewer than five luminaires or fewer than 10 percent of the existing luminaires, the replacement luminaires must comply with the luminaire shielding (BUG) requirements of §130.2(b) and applicable installation and acceptance requirements of §130.4.

Example 6-45: Outdoor Lighting Alteration Triggers

Question

I am retrofitting all my existing HID parking lot lights with an LED retrofit kit. What requirements do I need to follow for the LED retrofits?

Answer

Outdoor lighting alteration requirements apply when increasing the connected lighting load or when replacing existing luminaires. Modifications and retrofitting of existing luminaires are not an outdoor lighting alteration if the modification or retrofit does not increase the connected lighting load.

If the LED retrofit increases the connected lighting load, retrofit luminaires must meet all the applicable requirements of §130.2(c) and §140.7.

6.6.5 Outdoor Lighting Additions — Mandatory Control Requirements and Lighting Power Requirements

§141.0(a)1., §130.0, §130.2

Outdoor lighting additions include adding illuminated area to an existing outdoor lighting site. The additional illuminated area must comply with all mandatory lighting control requirements and lighting power allowance requirements in §§110.9, 130.0, 130.2, 130.4, and 140.7.

A. Mandatory Requirements

Additions to existing outdoor lighting must meet all mandatory measures for the newly installed lighting system. The mandatory requirements include:

- Lighting control device and system functionality requirements in §110.9 (Refer to section 6.4.3 for more information).
- Luminaire shielding requirements, also known as backlight, uplight, and glare (BUG) requirements in §130.2(b) (Refer to Section 6.4.1 for more information).
- Outdoor lighting control requirements in §130.2(c) (Refer to Section 6.4.2 for more information).
- Outdoor lighting control acceptance testing in §130.4 (Refer to Sections 6.4.2 and 6.7.5 for more information).

B. Lighting Power Allowance Requirements

Outdoor lighting additions must also comply with lighting power allowance requirements in §140.7. (Refer to Section 6.5 for more information.)

6.6.6 Outdoor Lighting Additions and Alterations — More Examples

Example 6-46: Power Allowance for Additional Outdoor Dining (Inside Illuminated Area)

Question

A strip mall in Lighting Zone 3 with a common parking lot has its lighting system already designed and installed. A restaurant moves into one of the buildings and designates 400 sq. ft. as outdoor dining. The outdoor dining area is within the illuminated area (5 mounting heights) of the preexisting lighting. How is the allowable lighting calculated?

Answer

The allowable lighting power can be calculated in two ways:

Compliance Method 1

Calculate only the additional allowance layer for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B of the Energy Code. In this case, the allowance is 0.050 W/sq. ft. Multiplying this allowance by 400 sq. ft. yields 20 W.

Type of Allowance	*Allowance*	*Area/Perimeter Value*	*Power Allowance*
Outdoor Dining	0.050 W/ sq. ft.	400 sq. ft.	20 W
Left intentionally blank-	**Left intentionally blank**	**TOTAL POWER ALLOWANCE**	**20 W**

Compliance Method 2

One could have the permit cover all the site lighting including the outdoor dining area. (This second compliance path would provide a greater power allowance but would require more work in the application process.) This yields a higher allowance only if the current lighting system serving hardscape areas for the rest of the site has less wattage than the calculated total site hardscape wattage allowance. Additional allowances would be possible if one upgraded to the current hardscape system for other parts of the site and reduced its wattage.

Example 6-47: Power Allowance for Additional Outdoor Dining (Outside Illuminated Area)

Question

A strip mall in Lighting Zone 3 with a common asphalt parking lot has the parking lot lighting system designed and installed. A restaurant moves into one of the buildings and designates 400 ft.^{2} as outdoor dining. The outdoor dining area is outside the illuminated area of the preexisting parking lot lighting. How is the allowable lighting calculated?

Answer

In addition to adding outdoor dining area, which is a specific application that is allowed more lighting, the illuminated general hardscape lighting area is also increasing in size by 400 sq. ft. Adding illuminated hardscape area results in increased general hardscape area wattage allowances (AWA) and increased linear wattage allowances (LWA), but it does NOT add an additional initial wattage allowance (IWA) because only one initial wattage

allowance is allowed per site. The allowable lighting power can be calculated in two ways:

Compliance Method 1

Calculate the general hardscape area wattage allowances (AWA) and the increase to the general hardscape linear wattage allowances (LWA) and the additional allowance layer for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B of the Energy Code. As discussed, previously, it is not permissible to also claim the general hardscape initial wattage allowance (IWA) as this is calculated only once per site. The linear wattage allowance applies only to the new perimeter length, which is not adjacent to the previously illuminated area that is part of the site.

As shown in the figure below, the perimeter length is 41 ft. (25 ft. + 16 ft.). In LZ3, the AWA is 0.021 W/sq. ft. and the LWA is 0.20 W/ft. The additional allowance for the outdoor dining area for specific applications (Outdoor Dining) as contained in Table 140.7-B is 0.05 W/sq. ft. Thus, for a perimeter length of 41 ft. and an area of 400 sq. ft., the total lighting wattage allowance is:

Hardscape LWA of 0.20 W/ sq. ft. x 41 ft. = 8.2 W

Hardscape AWA of 0.021 W/sq. ft. x 400 sq. ft. = 8.4 W

Specific Allowance Outdoor Dining 0.05 W/sq. ft. x 400 sq. ft. = 20 W

Total allowance = 36.6 W

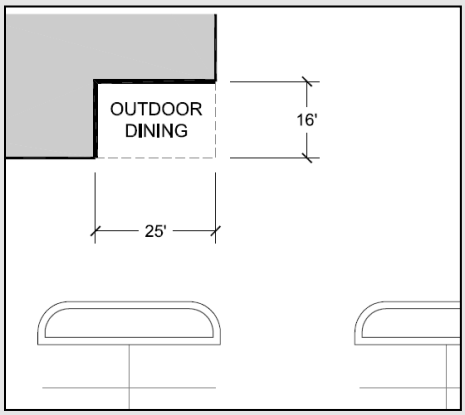


Image: California Energy Commission

Compliance Method 2

One could have the permit cover all the site lighting including the outdoor dining area. (This second compliance path would provide a greater power allowance but would require more work in the application process.) This yields a higher allowance only if the current lighting system serving hardscape areas for the rest of the site has less wattage than the calculated total site hardscape wattage allowance.

Outdoor Lighting Compliance Documents and Acceptance Tests

This section contains information about the certificate of compliance, certificate of installation, and certificate of acceptance needed for compliance with the nonresidential outdoor lighting requirements of the Energy Code.

6.7.1 Overview

At the time a building permit application is submitted to the local enforcement agency, the applicant also submits plans and energy compliance documentation, including the certificate of compliance. The enforcement agency plan checkers examine these documents for compliance with the Energy Code

The person responsible for the construction of the lighting system should submit the certificate of installation and certificate of acceptance to the local building department or the local enforcement agency after the installation and before receiving the building occupancy permit.

6.7.2 Compliance Documentation and Numbering Scheme

The Energy Code use the following numbering scheme for the nonresidential lighting compliance documents:

NRCC	Nonresidential Certificate of Compliance
NRCI	Nonresidential Certificate of Installation
NRCA	Nonresidential Certificate of Acceptance
LTI	Lighting, Indoor
LTO	Lighting, Outdoor
LTS	Lighting, Sign
01	The first set of compliance documents in this sequence
E	Primarily used by enforcement authority
A	Primarily used by acceptance tester

The paper prescriptive compliance documents have a limited number of rows per section for entering data. Some designs may need fewer rows, and some designs may need additional rows. If additional rows are required for a particular design, then multiple copies of that page may be used.

6.7.3 Certificate of Compliance Documents

The certificate of compliance is used to demonstrate that the overall design of the regulated building or system complies with the Energy Code requirements.

The plans examiner will be responsible for verifying that these documents are submitted with the building plans and are complete when required. See Section 2.2.2 for more information about the certificate of compliance.

The nonresidential outdoor lighting certificate of compliance includes the following:

- NRCC-LTO-E: Certificate of Compliance, Outdoor Lighting

6.7.4 Certificate of Installation Documents

The certificate of installation is used primarily to declare that what was installed matches the plans and certificates of compliance. The certificate of installation is signed by a person with an approved license.

Even if the design has errors and has specified incorrect features and devices, the installer is responsible to meet all the applicable requirements that he or she installs.

A copy of the completed signed and dated installation certificate must be posted at the building site for review by the local enforcement agency in conjunction with requests for final inspection for the building. See Section 2.2.5 for more information about installation certificates.

Before a lighting control system, including an energy management control system (EMCS), can be recognized for compliance with the lighting control requirements in the Energy Code, the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components, or manufactured devices shall sign and submit an Installation Certificate (§130.4[b] 1 and 2).

For sign lighting controlled by a lighting control system or by an EMCS, the NRCI-LTO-02-E must be completed

The nonresidential outdoor lighting certificate of installation includes the following:

- NRCI-LTO-01-E: Certificate of Installation, Outdoor Lighting
- NRCI-LTO-02-E: Certificate of Installation, Energy Management Control

6.7.5 Certificate of Acceptance

Before an occupancy permit is granted for a newly constructed building or space, or a new lighting system serving a building, space, or site is operated for normal use, all outdoor lighting controls serving the site shall be certified as meeting the acceptance requirements for code compliance. A certificate of acceptance shall be submitted to the local enforcement agency under Administrative Regulations §10-103(a).

The acceptance requirements that apply to outdoor lighting controls include:

- Certifying plans, specifications, installation certificates, and operating and maintenance information to meet the requirements of the Energy Code.
- Certifying that outdoor lighting controls meet the applicable requirements of §110.9 and §130.2.

Lighting controls acceptance testing must be performed by a certified acceptance test technician, and a certificate of acceptance must be completed and submitted before the local enforcement agency can issue the certificate of occupancy. See the following Chapter 2 and Chapter 13 for additional information on compliance and enforcement, and acceptance requirements.

The nonresidential outdoor lighting certificate of acceptance includes the following:

- NRCA-LTO-02-A: Certificate of Acceptance, Outdoor Lighting Controls

6.7.6 Acceptance Testing

The primary purpose of outdoor lighting acceptance tests is to assure the lighting controls are configured properly and are functioning as expected in meeting the energy code requirements.

The procedures for performing the lighting controls acceptance tests are documented in Reference Nonresidential Appendix NA7. See the following sections for the outdoor lighting controls acceptance testing procedures:

- NA7.8.1 for Motion Sensing Controls
- NA7.8.2 for Photocontrols
- NA7.8.5 for Automatic Scheduling Controls

See Section 2.2.7 for more information about the certificate of compliance.