MANDATORY MEASURES
OUTDOOR LIGHTING CONTROLS

(Reference: Sub-Chapter 4, Section 130.2)

Additions and Alterations

Over 50% replaced	**Mandatory Controls** §130.0, 130.2, 130.4 **+** **Prescriptive Requirements** LPD allowances of §140.7
10 – 50% replaced *Or* 5 luminaires *whichever is greater*	**Mandatory Controls** §130.0, 130.2, 130.4
0 – 10% replaced	No measures required

Any alteration that increases the connected lighting load must meet all mandatory and prescriptive measures that are required.

Local government agencies may adopt and enforce energy standards for newly constructed buildings, additions, alterations, and repairs that exceed those of Title 24, Part 6, provided that the Energy Commission has reviewed and approved the local standards.

BACKLIGHT, UPLIGHT, AND GLARE (BUG) RATINGS

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

Backlight

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

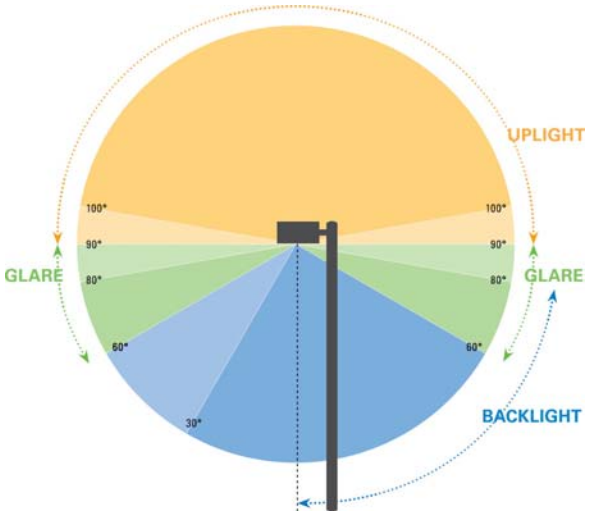
Uplight

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

Glare

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

BUG ANGLES



LUMINAIRES THAT MUST COMPLY WITH BUG REQUIREMENTS

Outdoor luminaires using lamps or light sources rated **greater than 150 watts** must comply with uplight and glare limitations if they are in the following areas:

1. Parking lots and service stations
2. Building entrances
3. All canopies
4. Outdoor dining areas
5. All outdoor sales areas

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LUMINAIRES THAT DO NOT NEED TO COMPLY WITH BUG

These limits do not apply to:

- Signs
- Building facades, public monuments, statues, and vertical surfaces of bridges
- Lighting required for health or safety
- Temporary lighting
- Replacement of pole-mounted luminaires in areas where *all* of the following apply:
  1. Connected lighting power is not increased
  2. No new wiring is being installed
  3. No additional poles are being added
  4. Spacing between poles is greater than six times the mounting height of the existing luminaires

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BUG RATINGS AND REQUIREMENTS

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

A list of BUG ratings and tables can be found on the IES website: http://www.iesna.org/PDF/Erratas/TM-15-07BUGRatingsAddendum.pdf.

TABLE 130.2-A: UPLIGHT RATINGS (MAXIMUM ZONAL LUMENS)

Secondary Solid Angle	Maximum Zonal Lumens per Outdoor Lighting Zone			
	OLZ 1	OLZ 2	OLZ 3	OLZ 4
Uplight High (UH) 100–180 degrees	10	50	500	1,000
Uplight Low (UL) 90–<100 degrees	10	50	500	1,000

Section 130.2 (b)

HOW EXTERIOR SPACES COMPLY WITH TITLE 24

There are two major steps for exterior spaces to comply with Title 24:

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

2. **Meet all prescriptive or performance requirements**
   The prescriptive requirements set a maximum lighting power allowance for exterior spaces. A space complies with these requirements if the *actual* lighting power installed in the space is less than the *allowed* lighting power for that space.

MANDATORY REQUIREMENTS: ALL SPACES

Photo: Philips

1. Any outdoor luminaire that is **capable** of operating an incandescent lamp that uses more than 100 watts must be controlled by a motion sensor.
2. All outdoor lighting must be controlled by a **photocontrol or astronomical time switch** that turns off all lighting when daylight is available.
3. Outdoor lighting must be **controlled independently** from other electrical loads.

MANDATORY REQUIREMENTS: LUMINAIRES MOUNTED AT OR BELOW 24 FEET

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

1. A motion sensor or other control system that automatically reduces lighting power when no occupants are detected—at least 40%, but not more than 90%
2. Controls must automatically turn on lights when an area becomes occupied
3. No more than 1,500 watts of lighting power may be controlled together

The following luminaires are exempt:

1. Pole-mounted luminaires with a maximum rated power of 75 watts
2. Non-pole-mounted luminaires with a maximum rated power of 30 watts
3. Linear lighting with a maximum power of 4 watts per linear foot

MANDATORY REQUIREMENTS: LUMINAIRES MOUNTED AT OR BELOW 24 FEET

These requirements do not apply to the following spaces:

1. Building facades, ornamental hardscape, and outdoor dining areas
2. Sales frontage, lots, and canopies
3. Any area listed in Section 140.7(a)

MANDATORY REQUIREMENTS: LUMINAIRES MOUNTED AT OR BELOW 24 FEET

There are different requirements for specific spaces:

1. Sales frontage, lots, and canopies must have a part-night control or motion sensors with auto-on capability
2. Building facades, ornamental hardscapes, and outdoor dining must have a part-night control, motion sensor, or centralized time-based lighting control

*A **part-night control** is a time or occupancy based lighting control that is programmed to reduce or turn off the lighting power to an outdoor luminaire for a portion of the night.*

Photo: WattStopper

CASE STUDY: WALL PACKS AT UC DAVIS

- UC Davis replaced 101 HPS and MH wall packs with adaptive LED
- Used WattStopper motion sensors and networked controls from Echelon Lumewave
- Retrofit cut energy consumption by 89%
- $76,000 in energy costs will be saved over the life of the new wall packs

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

	NEW CONSTRUCTION	ALTERATIONS	
	All Regulated Projects	Connected Lighting Load is Increased Any Size Project	Connected Lighting Load is not Increased Greater of 5 Luminaires or 10% affected
Outdoor Sales Frontage	• Photocontrol or outdoor astronomical time-switch • Part-night control or motion sensor	• Photocontrol or outdoor astronomical time-switch • Part-night control or motion sensor	• Photocontrol or outdoor astronomical time-switch • Motion sensor or lighting must be independently controlled from all other lighting by a time-switch
Outdoor Sales Lots			• Photocontrol or outdoor astronomical time-switch • Part-night control or motion sensor
Parking Lots			

Building Facades*	• Photocontrol or outdoor astronomical time-switch
	• One of following:
	  • Part-night control
	  • Motion sensor
	  • Centralized, time-based control system
		• Photocontrol or outdoor astronomical time-switch
		• One of following:
		  • Part-night control
		  • Motion sensor
		  • Centralized, time-based control system
			• Photocontrol or outdoor astronomical time-switch
			• Motion sensor or lighting must be independently controlled from all other lighting by a time-switch

Ornamental Hardscape			
Outdoor Dining			
All Other General Hardscape	• Photocontrol or outdoor astronomical time-switch • Part-night control or motion sensor	• Photocontrol or outdoor astronomical time-switch • Part-night control or motion sensor	

* Wallpacks mounted to building facades must use motion sensors.

2016 Outdoor Lighting Retrofits: If housing stays intact and lighting technology is changed = repair. Replacing fixture head = alteration.			
Alteration: ≥10% moved, changed, replaced fixtures: OR 5 or more fixtures per site (which ever is greater)			
Requirements	NEW Reducing installed wattage by 40% method	Altering 10-50% fixtures on site	Adding to connected load OR Altering >50% fixtures on site
Meet lighting power allowances: §140.7	No	No	Yes
Incandescent >100 w controlled by motion sensor: §130.2(a)	Yes	Yes *For altered fixtures only*	Yes
Luminaries >150 w to provide cut-off (BUG): §130.2(b)	Yes	Yes *For altered fixtures only*	Yes
Photocontrol/astronomical time clock: §130.2(c)1	Yes	Yes *For altered fixtures only*	Yes
Control separately from other electrical loads: §130.2(c)2	Yes	Yes *For altered fixtures only*	Yes
Motion Sensor if within 24 ft of ground: §130.2(c)3	Yes	Yes *For altered fixtures only*	Yes
Part night OR motion sensor for Sales Frontage: §130.2(c)4	Yes	Yes *For altered fixtures only*	Yes
Part night OR motion sensor OR time-based for façade, ornamental, dining: §130.2(c)5	Yes	Yes *For altered fixtures only*	Yes

Acceptance test technician required when any number of controls for **≥20** fixtures being added for project