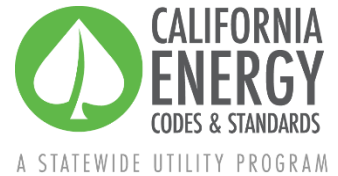


# Proposal Summary



## 2022 California Energy Code (Title 24, Part 6)

### Nonresidential Indoor Lighting – Update Lighting Power Densities (LPDs)

Updated: February 12, 2020

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#### Introduction

The document summarizes proposed revisions to the California Energy Code (Title 24, Part 6) that will be discussed during Round 2 of the utility-sponsored stakeholder meetings on March 5, 2020. The Statewide Utility Codes and Standards Enhancement (CASE) Team is seeking input and feedback. Please share comments by email to [info@title24stakeholders.com](mailto:info@title24stakeholders.com).

#### Measure Description

This measure updates indoor LPDs and wattage calculations. The updates to interior LPDs are driven by the following factors:

- Ongoing LED technology advancement and improved integration into luminaires, including efficacy degradation for high CRI sources, lower lamp lumen depreciation factors over the expected effective luminaire life and improved optical control and optical efficiency.
- Better integration of task/ambient lighting design approach. Confirm general lighting allowances are not also covered under use-it-or-lose-it adders.
- Careful review of the use-it-or-lose-it adders and how these are enforced in the forms and performance approach such as the Small Aperture Tunable-White and Dim-to-Warm Luminaires Lighting Power Adjustment.
- Update the LPD of spaces which are currently conservative. Examples include: classrooms, and the general lighting allowance for portions of the tailored lighting method.

Related to the development of the lighting wattage allowance LPDs, are the updates to the calculation of installed wattage in Section 130.0(c).

- Remove the 50 Watt minimum for downlights.

There are proposed changes to Section 130.1 to remove requirements and exemptions for legacy lighting products as these are now outdated.

#### Draft Code Language

The proposed changes to the Standards and Reference Appendices are provided below. Changes to the 2019 documents are marked with red underlining (new language) and ~~strikethroughs~~ (deletions). Expected sections or tables of the proposed code (but not specific changes at this time) are highlighted in **yellow**.



## Standards

### SECTION 130.0 – LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS —GENERAL

...

(c) **Luminaire classification and power.** Luminaires shall be classified and their wattage determined as follows:

...

2. For luminaires with line voltage lamp holders not containing permanently installed ballasts or transformers, the wattage of such luminaires shall be determined as follows:

~~A- The the maximum rated wattage of the luminaire as labeled in accordance with Section 130.0(c)1; and~~

~~B- For recessed luminaires with line-voltage medium screw base sockets, wattage shall not be less than 50 watts per socket, or the rated wattage of the installed JA8 compliant lamps.~~

### SECTION 130.1 – MANDATORY INDOOR LIGHTING CONTROLS

...

(c) Shut-OFF Controls. All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

...

7. Areas where partial OFF occupant sensing controls are required. Lighting installed in the following areas shall meet the following requirements instead of complying with Section 130.1(c)1.

A. Lighting in stairwells and common area corridors that provide access to guestrooms and dwelling units of high-rise residential buildings and hotel/motels shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

EXCEPTION to Section 130.1(c)7A: In corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the Area Category Method, occupant sensing controls shall reduce power by at least 40 percent.

B. In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power. No more than 500 watts of rated lighting power shall be controlled together as a single zone. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in TABLE 130.1-A. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 130.1(c)7B. Parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in Section 130.2.

~~EXCEPTION to Section 130.1(c)7B: Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt, used for general lighting in parking garages, parking areas and loading and unloading areas, shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power.~~

...

*TABLE 130.1-A MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS*

Luminaire Type	Minimum Required Control Steps (percent of full rated power <sup>1</sup> )	Uniform level of illuminance shall be achieved by:			
Line-voltage sockets except GU-24	Continuous dimming 10-100 percent				
<del>Low-voltage incandescent systems</del>					
LED luminaires and LED source systems					
GU-24 rated for LED					
<del>Pin-based compact fluorescent &gt; 20 watts<sup>2</sup></del>	Continuous dimming 20-100 percent				
<del>GU-24 sockets rated for fluorescent &gt; 20 watts</del>					
<del>GU-24 sockets rated for fluorescent ≤ 20 watts</del>	Minimum one step between 30-70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in a luminaire			
<del>Pin-based compact fluorescent ≤ 20 watts<sup>2</sup></del>					
<del>Linear fluorescent and U-bent fluorescent ≤ 13 watts</del>					
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range:				Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
	20-40 %	50-70 %	75-85 %	100 %	
Track Lighting	Minimum one step between 30 - 70 percent				Step dimming; or Continuous dimming; or Separately switching circuits in multi-circuit track with a minimum of two circuits.
<del>HID &gt; 20 watts</del>	Minimum one step between 50 - 70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner			
<del>Induction &gt; 25 watts</del>					
Other light sources					
<p>1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor</p> <p><del>2. Includes only pin based lamps: twin tube, multiple twin tube, and spiral lamps</del></p>					
<p>EXCEPTION 1 to Table 130.1-A Minimum Required Control Steps: Classrooms with a connected general lighting load of 0.7 watts per square feet or less shall have a minimum of one control step between 30-70 percent of full rated power, regardless of luminaire type.</p> <p>EXCEPTION 2 to Table 130.1-A Minimum Required Control Steps: Library stack aisles, aisle ways and open areas in warehouses, parking garages, parking areas, loading and unloading areas, stairwells, and corridors shall have a minimum of one control step between 20-60 percent of full rated power, regardless of luminaire type.</p>					

## SECTION 140.6 – PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

...

- (a) **Calculation of Adjusted Indoor Lighting Power.** The adjusted indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through 4 of this subsection.

...

3. Lighting wattage excluded. The watts of the following indoor lighting applications may be excluded from Adjusted Indoor Lighting Power. ~~(Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6.):~~

...

### 4. Luminaire Classification and Power Adjustment.

A. Luminaire Classification and Power shall be determined in accordance with Section 130.0(c).

B. **Small Aperture Tunable-White and Dim-to-Warm Luminaires Lighting Power Adjustment.** For qualifying small aperture tunable-white and dim-to-warm LED luminaires, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage by 0.75. Qualifying luminaires shall meet all of the following:

- i. **Small Aperture.** Qualifying luminaires longer than 18 inches shall be no wider than four inches. Qualifying luminaires with a length of 18 inches or less shall be no wider than eight inches.
- ii. **Color Changing.** Qualifying tunable-white luminaires shall be capable of a color change greater than or equal to 2000 Kelvin correlated color temperature (CCT). Qualifying dim-to-warm luminaires shall be capable of color change greater than or equal to 500 Kelvin CCT.
- iii. **Controls.** Qualifying luminaires shall be connected to controls that allows color changing of the luminaires.

C. **Tailored Method Display Lighting Mounting Height Lighting Power Adjustment.** For wall display luminaires or floor display luminaires meeting Tailored Method Section 140.6(c)3G and H and where the bottom of luminaires are 10 feet 7 inches and greater above the finished floor, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage and the appropriated mounting height adjustment factor from TABLE 140.6-E. Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire. General lighting shall not qualify for a mounting height multiplier.

...

**TABLE 140.6-B COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES**

<b>TYPE OF BUILDING</b>	<b>ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)</b>
Assembly Building	0.70
Financial Institution Building	0.65
Industrial/Manufacturing Facility Building	0.60
Grocery Store Building	0.95
Gymnasium Building	0.65
Library Building	0.70
Healthcare Facility	0.90
Office Building	0.65
Parking Garage Building	0.13
Religious Facility Building	0.70
Restaurant Building	0.70
Retail Store Building	0.90
School Building	0.65
Sports Arena Building	0.75
Motion Picture Theater Building	0.70
Performing Arts Theater Building	0.80
All others buildings	0.40

**TABLE 140.6-C AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT<sup>2</sup>)**

<b>Primary Function Area</b>	<b>Allowed Lighting Power Density for General Lighting (W/ft<sup>2</sup>)</b>	<b>Additional Lighting Power<sup>1</sup></b>	
		<b>Qualified Lighting Systems</b>	<b>Additional Allowance (W/ft<sup>2</sup>, unless noted otherwise)</b>
Auditorium Area	0.70	Ornamental	0.30
		Accent, display and feature <sup>3</sup>	0.20
Auto Repair / Maintenance Area	0.55	Detailed Task Work <sup>7</sup>	0.20
Audience Seating Area	0.60	Ornamental	0.30
Beauty Salon Area	0.80	Detailed Task Work <sup>7</sup>	0.20
		Ornamental	0.30

Civic Meeting Place Area		1.00	Ornamental	0.30
Classroom, Lecture, Training, Vocational Area		0.70	White or Chalk Board <sup>1</sup>	4.50 W/ft
Commercial/Industrial Storage	Warehouse	0.45	-	-
	Shipping & Handling	0.60	-	-
Convention, Conference, Multipurpose and Meeting Area		0.85	Ornamental	0.30
Copy Room		0.50	-	-
Corridor Area		0.60	-	-
Dining Area	Bar/Lounge and Fine Dining	0.55	Ornamental	0.30
	Cafeteria/Fast Food	0.40		
	Family and Leisure	0.50		
Electrical, Mechanical, Telephone Rooms		0.40	Detailed Task Work <sup>7</sup>	0.20
Exercise/Fitness Center and Gymnasium Area		0.50	-	-
Hotel Function Area		0.85	Ornamental	0.30
Museum Area	Exhibition/Display	0.60	Accent, display and feature <sup>3</sup>	0.50
	Restoration Room	0.75	Detailed Task Work <sup>7</sup>	0.20
Financial Transaction Area		0.80	Ornamental	0.30
General/Commercial & Industrial Work Area	Low Bay	0.60	Detailed Task Work <sup>7</sup>	0.20
	High Bay	0.65	Detailed Task Work <sup>7</sup>	0.20
	Precision	0.85	Precision Specialized Work <sup>9</sup>	0.70
Library	Reading Area	0.80	Ornamental	0.30
	Stacks Area	1.10	-	-
Main Entry Lobby		0.85	Ornamental	0.30
Locker Room		0.45	-	-
Lounge, Breakroom, or Waiting Area		0.65	Ornamental	0.30
Concourse and Atria Area		0.90	Ornamental	0.30
Office Area	> 250 square feet	0.65	Portable lighting for office areas <sup>6</sup>	0.20
	≤ 250 square feet	0.70		
	Open plan office	0.60		
Parking Garage Area	Parking Zone	0.10	First ATM	100 W
			Additional ATM	50 W each
	Dedicated Ramps	0.25	-	-
	Daylight Adaptation Zones <sup>2</sup>	0.50	-	-

Pharmacy Area		1.10	Specialized Task Work <sup>8</sup>	0.35
Retail Sales Area	Grocery Sales	1.05	Accent, display and feature <sup>3</sup>	0.20
			Decorative	0.15
	Retail Merchandise Sales	1.00	Accent, display and feature <sup>3</sup>	0.20
			Decorative	0.15
	Fitting Room	0.60	External Illuminated Mirror <sup>5</sup>	40 W/ea
Internal Illuminated Mirror <sup>5</sup>			120 W/ea	
Theater Area	Motion picture	0.60	Ornamental	0.30
	Performance	1.00		
Kitchen/Food Preparation Area		0.95	-	-
Scientific Laboratory Area		1.00	Specialized Task Work <sup>8</sup>	0.35
Healthcare Facility and Hospitals	Exam/Treatment Room	1.15	-	-
	Imaging Room	1.00	-	-
	Medical Supply Room	0.55	-	-
	Nursery	0.95	Tunable white or dim-to-warm <sup>10</sup>	0.10
	Nurse's Station	0.75	Tunable white or dim-to-warm <sup>10</sup>	0.10
	Operating Room	1.90	-	-
	Patient Room	0.55	Decorative	0.15
			Tunable white or dim-to-warm <sup>10</sup>	0.10
	Physical Therapy Room	0.85	Tunable white or dim-to-warm <sup>10</sup>	0.10
Recovery Room	0.90	Tunable white or dim-to-warm <sup>10</sup>	0.10	
Laundry Area		0.45	-	-
Religious Worship Area		0.95	Ornamental	0.30
Restrooms		0.65	Accent, display and feature <sup>3</sup>	0.20
			Decorative <sup>4</sup>	0.15
Transportation Function	Baggage Area	0.40	-	-
	Ticketing Area	0.45	Accent, display and feature <sup>3</sup>	0.20

Sports Arena – Playing Area	Class I Facility <sup>13</sup>	2.25	-	-
	Class II Facility <sup>13</sup>	1.45	-	-
	Class III Facility <sup>13</sup>	1.10	-	-
	Class IV Facility <sup>13</sup>	0.75	-	-
Stairwell		0.50	Accent, display and feature <sup>3</sup>	0.20
			Decorative <sup>4</sup>	0.15
Videoconferencing Studio		0.90	Videoconferencing	1.00
All other		0.40	-	-
Aging Eye/Low-vision <sup>11</sup>	Main Entry Lobby	0.85	Ornamental	0.30
			Transition Lighting OFF at night <sup>12</sup>	0.95
	Stairwell	0.80	-	-
	Corridor Area	0.80	Decorative <sup>4</sup>	0.15
	Lounge/Waiting Area	0.75	Ornamental	0.30
	Multipurpose Room	0.95	Ornamental	0.30
	Religious Worship Area	1.00	Ornamental	0.30
	Dining	0.80	Ornamental	0.30
	Restroom	0.80	Accent, display and feature <sup>3</sup>	0.20



Footnotes for this table are listed below.

1. White board or chalk board. – Directional lighting dedicated to a white board or chalk board.
2. Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage.
3. Accent, display and feature lighting – luminaires shall be adjustable or directional.
4. Decorative lighting – primary function shall be decorative and not to provide general lighting.
5. Illuminated mirrors. Lighting shall be dedicated to the mirror.
6. Portable lighting in office areas includes under shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.
7. Detailed task work – Lighting provides high level of visual acuity required for activities with close attention to small elements and/or extreme close up work.
8. Specialized task work – Lighting provides for small-scale, cognitive or fast performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical/laboratorial activities.
9. Precision specialized work – Lighting for work performed within a commercial or industrial environment that entails working with low contrast, finely detailed, or fast moving objects.
10. Tunable white luminaires capable of color change greater than or equal to 2000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allows color changing of the luminaires.
11. Aging Eye/Low-vision areas can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and are or will be licensed by local or state authorities for either senior long-term care, adult day care, senior support, and/or people with special visual needs.
12. Transition lighting OFF at night. Lighting power controlled by astronomical time clock or other control to shut off lighting at night. Additional LPD only applies to area within 30 feet of an exit. Not applicable to lighting in daylit zones.
13. Class I Facility is used for competition play for 5000 or more spectators. Class II Facility is used for competition play for up to 5000 spectators. Class III Facility is used for competition play for up to 2000 spectators. Class IV Facility is normally used for recreational play and there is limited or no provision for spectators.

**TABLE 140.6-D TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Lighting Power Density (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power Density (W/ft <sup>2</sup> )	Allowed Ornamental/Special Effect Lighting Power Density (W/ft <sup>2</sup> )
Auditorium Area	300	3.00	0.20	0.40
Convention, Conference, Multipurpose, and Meeting Center Areas	300	2.00	0.35	0.40
Dining Areas	200	1.25	0.50	0.40
Exhibit, Museum Areas	150	11.50	0.80	0.40
Hotel Area:				
Ballroom/Events	400	1.80	0.12	0.40
Lobby	200	3.50	0.20	0.40
Main entry lobby	200	3.50	0.20	0.40
Religious Worship Area	300	1.30	0.40	0.40
Retail Sales				
Grocery	600	6.80	0.70	0.40
Merchandise Sales, and Showroom Areas	500	11.80	0.80	0.40
Theater Area:				
Motion picture	200	2.00	0.20	0.40
Performance Arts	200	7.50	0.20	0.40

**TABLE 140.6-E TAILORED WALL AND FLOOR DISPLAY MOUNTING HEIGHT ADJUSTMENT FACTORS**

Height in feet above finished floor and bottom of luminaire(s)	Floor Display or Wall Display Mounting Height Adjustment Factor
< 10'-7"	1.00
10'-7" to 14'-0"	0.85
>14'-0" to 18'-0"	0.75
> 18'-0"	0.70

**TABLE 140.6-F ROOM CAVITY RATIO (RCR) EQUATIONS**

Determine the Room Cavity Ratio for TABLE 140.6-G using one of the following equations.
Room cavity ratio for rectangular rooms $RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms $RCR = \frac{2.5 \times H \times P}{A}$
Where: L =Length of room; W = Width of room; H =Vertical distance from the work plane to the centerline of the lighting fixture; P = Perimeter of room, and A = Area of room

**TABLE 140.6-G TAILORED METHOD GENERAL LIGHTING POWER ALLOWED – BY ILLUMANCE AND ROOM CAVITY RATIO**

General Illuminance Level (lux) <sup>a</sup>	General Lighting Power Density (W/ft <sup>2</sup> ) for the following RCR values <sup>b</sup> values <sup>b</sup>			
	RCR ≤ 2.0	RCR > 2.0 and ≤ 3.5	RCR > 3.5 and ≤ 7.0	RCR > 7.0
150	0.40	0.45	0.60	00.75
200	0.45	0.55	0.75	1.00
300	0.65	0.80	1.00	1.40
400	0.75	0.95	1.25	1.50
500	0.90	1.05	1.45	1.85
600	1.08	1.24	1.64	2.38

<sup>a</sup> Illuminance values from Column 2 of TABLE 140.6-D.  
<sup>b</sup> RCR values are calculated using applicable equations in TABLE 140.6-F.