



**2019**

**California Building Energy Efficiency Standards  
Title 24 Lighting Guide**

**WHAT'S NEW IN 2020**

On January 1, 2020, new 2019 California Title 24 (T24), Part 6 Building Energy Efficiency Standards went into effect with significant updates. These standards are updated every three years. Cooper Lighting Solutions offers the most comprehensive coverage of products and services to help you comply. We are industry's leaders for Title 24.

**NON-RESIDENTIAL APPLICATIONS**

**LIGHTING POWER ALLOWANCES**

On average, indoor lighting power allowances have been reduced by 37% for the Complete Building Method and 29% for the Area Category and Tailored Method. Outdoor lighting power allowances have been reduced by an average of 23%. These reductions are based on the assumption that all New Construction, Alterations and Additions will be installing LED lighting technologies by January 1, 2020. The California Energy Commission estimates this to be the single largest savings in the 2019 Energy Code for nonresidential occupancies.

**POWER ADJUSTMENT FACTORS**

New power adjustment factors (PAFs) have been added to encourage the use of clerestory fenestration, horizontal slats and light shelves. Existing PAFs from the 2016 Energy Code also remain as options, for a total of seven PAFs. ADDITIONS, ALTERATIONS AND REPAIRS: The Additions, Alterations and Repairs section has been simplified. Now, the trigger for all Alterations is 10% of the luminaires serving an enclosed space. Similar to 2016, there are three paths to compliance, but now, all share a universal set of exemptions and more clear-cut requirements.

**RESIDENTIAL APPLICATIONS**

**(INCLUDING HIGH/LOW RISE MULTI FAMILY BUILDINGS)**

**NEW LIGHT SOURCE CATEGORIES ADDED**

Step lights and path lights are now included in the same category as night lights. Light sources integral to drawers, cabinets and linen closets are now regulated by the Energy Code. If these light sources are greater than 5 watts or emit more than 150 lumens, they must comply with the high-efficacy requirements of Table 150.0-A and be controlled by a vacancy sensor; otherwise, the light sources are exempt. Additionally, light sources in drawers, cabinets and linen closets must be equipped with controls that automatically turn the light off when the drawer, cabinet or linen closet is closed.

**MARKING UPDATE**

Light sources meeting the new 2019 JA8 (Title 24) performance requirements must mark the light source itself with 'JA8-2019,' or 'JA8-2019-E' for products that also have passed the ENER STAR® Product Specification Version 2.1 Elevated Temperature Life Test and/or Rated Life Test. Products certified to JA8-2016 do not need to be retested or recertified to remain compliant with JA8-2019/JA8-2019-E. These products may be marked with JA8-2019/JA8-2019-E. Additionally, products marked with JA8-2016/JA8-2016-E may be installed in permitted construction.

**COLOR QUALITY**

JA8 now aligns with the Appliance Efficiency Regulations for color rendering index (CRI) requirements of state-regulated LED lamps. In addition, the 2019 JA8 now requires that all light sources be capable of providing a correlated color temperature (CCT) of 4,000 Kelvin or less.

**MULTIFAMILY RESIDENTIAL BUILDINGS**

In low-rise multifamily residential buildings where the total interior common area is more than 20% of the floor area, the permanently installed lighting for the interior common areas must adhere to the nonresidential requirements. In high-rise residential buildings, all common areas must meet the nonresidential lighting and controlled receptacle requirements. Lighting in the dwelling units must meet the residential lighting requirements

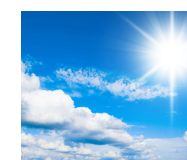
This guide is designed to serve as a resource for industry professionals involved in the design, construction or retrofit of California's buildings. The guide includes compliance requirements and recommendations for implementing Title 20 Appliance Efficiency Regulations and the 2019 Title 24 Building Standards Energy Code in New Construction, Addition or Alteration projects and provides links to Cooper Lighting Solutions products and services available to facilitate California's ambitious goals of energy conservation that are applied across North America. While energy efficiency is a priority in today's lighting design practice, so are occupant comfort, health and wellness. A successful lighting design balances these objectives where Cooper Lighting Solutions can assist to achieve those goals.

**CALIFORNIA ENERGY COMMISSION ESTIMATED REDUCTION BENEFITS FROM CODE COMPLIANCE:**



**Annual energy savings**

- 2019 Code offers 53% Savings over the 2016 Residential Guidelines.
- 85,000 GW/h electricity savings target by 2030, compared to 2015.



**Resulting air quality and emission reductions per year**

- 700 Metric Tons of Greenhouse Gas reductions in next three years.
- 115,000 Fossil fueled cars removed from California roads in next three years.

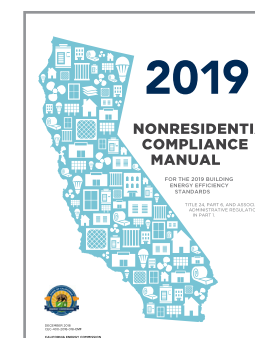
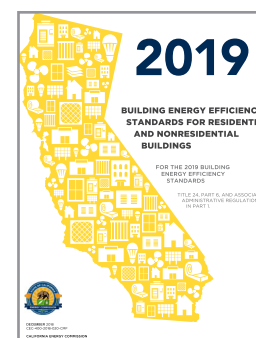
**Title 24 Guidelines for Controlled Lighting**

Factors to consider in lighting design include human needs, like visibility, safety and comfort; and environmental and economic issues, such as energy, equipment costs and sustainability. Additionally, how well the lighting complements the building design must be considered. A successful lighting design utilizes the right equipment to maximize visual comfort while reducing energy consumed, installation/operating costs and the building's carbon footprint.

Adding task and accent lighting to ambient lighting, also referred to as general lighting, allows the ambient lighting loads to be reduced without compromising safety or visual comfort. This layered approach to lighting improves visual comfort by reducing contrast and glare.

Lighting controls address an entire space or area. These controls are typically programmed to provide general purpose areas with energy-efficient control strategies. Personal lighting controls address a sub-area and are typically associated with work stations or task areas.

An effective lighting system combines the right light source, suitable luminaire and the appropriate controls for desired function and effect. A higher up-front investment in a more efficient, functional lighting system yields a better long term compared to lower cost alternatives, especially in retail, hospitality and healthcare applications where lighting quality influences critical success factors.



This guide was developed based upon published Building Energy Efficiency Standards for Residential and Nonresidential Buildings (CEC-400-2018-020-CMF), Residential Compliance Manual for the 2019 Building Energy Efficiency Standards (CEC-400-2018-017-CMF), and Nonresidential Compliance Manual for Building Energy Efficiency Standards (CEC-400-2018-018-CMF) (collectively, "the code"); it is not intended to replace the code nor be a source of expertise that interpret the code. This training material is based on CEC T24 code as it exists at the time of publication, and may be updated without notice. Cooper Lighting Solutions accepts no liability for the content of this publication, or the consequences of any action taken on the basis of the information provided herein. California Energy Commission Building Energy Efficiency Standards documents can be found at: [www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards](http://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards).

WHEN IS TITLE 24 COMPLIANCE REQUIRED?

CONSTRUCTION / PROJECT TYPE	REQUIRED	
New Construction	YES	Meeting Title 24 is required for all residential and nonresidential new construction projects.
Additions	YES	Meeting Title 24 is required for all residential and nonresidential additions.
Alterations (classified as "Retrofit" that change the space occupancy classification)	Conditional	Based upon the resulting lighting power density and if greater than 10% of luminaires altered. Refer to Table 141.0-E; Sections 141.0(b)2F - 141.0(b)2K
Modification-in-Place (classified as "Retrofit" when luminaires are modified with kits)	Conditional	Based upon the resulting lighting power density and if greater than 10% of luminaires altered. Refer to Table 141.0-E; Sections 141.0(b)2F - 141.0(b)2K
Repairs	Conditional	Based upon the resulting lighting power density and if greater than 10% of luminaires altered. Refer to Table 141.0-E; Sections 141.0(b)2F - 141.0(b)2K

Note: As a general rule, when a permit is needed Title 24 Compliance is required.

Overview for Non-Residential Compliance



Step 1

ANALYZE THE FOLLOWING MANDATORY MEASURES FOR EACH SPACE

1. MANUAL AREA CONTROL for each area enclosed by ceiling height partitions.
2. MULTILEVEL LIGHTING CONTROL for any area >100 sq.ft. with a connected lighting load >0.5 Watts/sq.ft.
3. SHUT-OFF CONTROLS automatically reduce lighting load in unoccupied spaces and to preset normal occupancy schedules.
4. AUTOMATIC DAYLIGHTING CONTROLS adjust lighting power, keeping light level stable as incoming daylight changes.
5. AUTOMATED DEMAND RESPONSE implements functions requested by a compliant signal.

Step 2

STAY WITHIN ALLOWABLE ENERGY BUDGET USING EITHER OF THESE OPTIONS:

1. PERFORMANCE APPROACH: Software-based method that uses energy modeling to plan for an energy-efficient total building. Not suitable for lighting only projects.
2. PRESCRIPTIVE APPROACH: Complete Building Method; Area Category Method; Tailored Method; all use allowed Lighting Power Density (LPD) plus special allowances. T24/2019 reduced complete building power allowance by 37% indoors and 23% outdoors, assuming LED use.
3. TAILORED METHOD: Uses target illuminance values and calculated based upon the room cavity ratio to determine LPD for general lighting and allows for additional allowances for ornamental, wall display, etc. INTERACTIONS liaise all control functions within building.

Overview for Residential Compliance

Selection Process

EFFICACY REQUIREMENTS

- Title 24 requires all new construction, additions or alterations to use high efficiency lighting.
- Linear fluorescent, pin-based compact fluorescent with electronic ballasts, pulse-start metal halide, HPS and induction light sources are automatically high efficiency.
  - LED light sources installed outdoors and inseperable SSL luminaires containing colored light sources for decorative illumination are automatically high efficiency.
  - All other light sources must be certified as high efficacy to the California Energy Commission Joint Appendix JA8 requirements.
  - Cetified products are at: <https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx>.



CONTROL REQUIREMENTS

Title 24 requires the use of controls to reduce power usage based upon room/area type and the usage.



STRUCTURES CLASSIFIED AS RESIDENTIAL



Single Family Home



Multi-Family Home



High-Rise Home



Dormitory Living Quarters



Senior Living Quarters



Hotel/Motel/Guest Rooms

TITLE 24 AND TITLE 20: THE BASICS

**T24** Can be used to comply with California Title 24 High Efficacy requirements

Applied at: Building/Space level

- Similar: ASHRAE and IECC
- Product or combination of products commissioned properly meet the Title 24 requirements
- Example: Office space using Portfolio LED luminaire with occupancy and daylight sensors

**T20** Certified to California Title 20 Appliance Database

Applied at: Product Level

- Similar: DLC qualified and ENERGY STAR® certified products
- Certified to the California Energy Commission Title 20 Appliance Database
- Equipment tested and certified to meet Appliance Efficiency Regulations (and listed on the T20 database)
- Example: Wall Box Dimmer, Ceiling Daylight Sensor, Occupancy Sensor, Automatic Time Switch, Emergency Exit, etc

Egress Requirements for Meeting Title 24 (Nonresidential only)

SPACE TYPE	REQUIRED	
Exit	Yes	Exit signs shall meet Appliance Efficiency Regulations and be certified to California Title 20 Appliance Database.
Building Level	No	Up to 0.2 Watts per sq. ft. of indoor lighting may be continuously illuminated to allow egress.
Space Level	Conditional	Egress lighting more than 0.2 watts per square foot within an area enclosed by a ceiling height space must have a manual ON/OFF control switch but not accessible to unauthorized personnel.
Multi-Level Dimming	Yes	Code requires luminaires to be dimming capable even though the functionality is not enabled.
Shut-OFF	Conditional	Up to 0.05 watts per square foot may be continuously illuminated in enforcement agency designated egress area. Stairwells, corridors in hotel/motel and high-rise require a minimum of 50%.
Daylighting	No	No Title 24 compliances required. Up to 0.2 watts per square foot may be continuously illuminated in designated egress areas.

Title 24 makes special accommodations for egress lighting and must be identified on the building design documents. Egress must be shut off after typically unoccupied times, except in offices (0.05 W/ft2 allowed 24/7).

Demand Response (Nonresidential building level mandatory requirement)

Demand Response required when 10,000 square feet or more are built or altered. Nonresidential interior code requirements call for each building, including parking garages, to be capable of responding to demand response signals when the building is greater than 10,000 square feet. The installation must be capable of shedding a minimum of 15% of the lighting loads with uniform dimming which utilizes the luminaire requirements of Table 130.1-A for multi-level dimming. Starting with the 2019 Energy Code, demand responsive lighting control requirements are located in a new section in the sub-chapter for the manufacturing, construction and installation of systems, equipment and building components. Lighting demand responsive controls requirements are now listed under Section 110.12



Daylighting Details (Nonresidential only)

Daylighting in Title 24 Nonresidential Indoor compliance include skylit sidelit and secondary sidelit areas. Daylighting control is a mandatory requirement in spaces where daylighting is present. Skylit zones: Illuminated by one or more skylights; Primary sidelit zones: Daylit areas directly adjacent to window(s); Secondary sidelit zones: Areas not directly adjacent to a window but close enough to still receive some daylight. Luminaires located at least 50% inside skylit or sidelit zone(s) must be controlled independently and separately from each other.

All daylighting zone(s) must reduce general lighting power at least 65% when daylight contribution in that zone is more than 150% of the general lighting system's design light level at full power (for areas other than parking garages). **Reference:** Section 130.1(d) page 145 and 140.6(d) page 240 of CEC-400-2018-020-CMF.

Nonresidential Interior	Parking Garage	Required Controls
<ul style="list-style-type: none"> <li>• Up to 0.1 watts per square foot may be continuously illuminated in enforcement agency designated egress area.</li> <li>• Sidelit or Skylight Openings &gt;24 sqft.</li> <li>• Lighting power is 120W or greater in the daylit zone</li> <li>• Reduce at least 65% power when daylight provides more than 150% design illuminance</li> </ul>	<ul style="list-style-type: none"> <li>• Sidelit Openings &gt;36 sqft.</li> <li>• Lighting power is 60W or greater in the daylit zone</li> <li>• Turn off power when daylight provides more than 150% design illuminance</li> </ul>	<ul style="list-style-type: none"> <li>• Luminaire Dimming Control</li> <li>• Daylighting Control</li> </ul>

## TWO STEPS REQUIRED TO COMPLY WITH TITLE 24

- Meet mandatory requirements by installing luminaires and controls, ensuring they perform all required functions.
- Select method of compliance by choosing either a Performance or Prescriptive Approach.



### PERFORMANCE APPROACH

The Performance Approach builds on the Prescriptive Approach by allowing energy allotments (defined in the Prescriptive requirements) to be traded between building systems, such as lighting, HVAC or the building envelope. This compliance approach requires using energy analysis software approved by the Energy Commission to model the overall energy performance of a building.

The Performance Approach allows the same overall efficiency as an equivalent building using the Prescriptive option and is mostly used for New Construction projects.

### APPROVED COMPUTER COMPLIANCE PROGRAMS

<https://www.energy.ca.gov/programs-and-topics/programs/building-energyefficiency-standards/2019-building-energy-efficiency-2>

Cooper Lighting offers a broad range of controlled lighting solutions to satisfy the latest in Title 24 code compliance that are certified and listed on the California Title 20 Appliance database JA8. The DesignLights Consortium (DLC) maintains a Qualified Products List products that passed a review of test results as verification of performance. DLC is comprised of regional, provincial/state, utility and energy efficiency programs throughout Canada and the United States. Products listed often qualify for incentives through participating programs. FTC Label summarizes lighting characteristics for Cooper Lighting consumer products tested according to industry standards.

Cooper Lighting's ENERGY STAR® products that meet California's efficiency requirements are labeled to inform they comply with the Energy Code. Title 20 certified Cooper Lighting products can be found at: <https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx>

The Complete Building Method may be used only in projects involving entire buildings with one primary use or in mixed-use buildings and tenant spaces where 90% of the spaces have one primary use. The Area Category Method is used for buildings with multiple space types; it can be used in combination with the Tailored Method. The Tailored Method is an option for areas that utilize lighting to highlight unique features, such as retail spaces, lobbies or waiting areas where awards or artwork are displayed.

### COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES

Reference: Table 140.6-B

Type of Use	Allowed Lighting Power
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 other buildings	0.40



## Area Category Method – Lighting Power Density Values

Reference: Table 140.6-C

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft <sup>2</sup> )	Additional Lighting Power	
		Qualified Lighting Systems	Additional Allowance (W/ft <sup>2</sup> , unless noted otherwise)
Auditorium Area	0.7	Ornamental	0.3
		Accent, display and feature <sup>3</sup>	0.2
Auto Repair or Maintenance Area	0.55	Detailed task work <sup>7</sup>	0.2
Audience Seating Area	0.6	Ornamental	0.3
Beauty Salon Area	0.8	Detailed task work	0.2
		Ornamental	0.3
Civic Meeting Place Area	1.0	Ornamental	0.3
Classroom, Lecture, Training, Vocational Area	0.7	White or chalkboard <sup>1</sup>	4.5 W/ft
Commercial or Industrial Storage	Warehouse	—	—
	Shipping and Handling	0.6	—
Convention, Conference, Multipurpose and Meeting Area	0.85	Ornamental	0.3
Copy Room	0.5	—	—
Corridor Area	0.6	—	—
Dining Area	Bar or Lounge and Fine Dining	Ornamental	0.3
	Cafeteria or Fast Food		
	Family and Leisure		
Electrical, Mechanical, Telephone Rooms	0.4	Detailed task work <sup>7</sup>	0.2
Exercise or Fitness Center and Gymnasium Areas	0.5	—	—
Hotel Function Area	0.85	Ornamental	0.3
All other buildings	0.4		
Museum Area	Exhibition or Display	Accent, display and feature <sup>3</sup>	0.5
	Restoration Room	Detailed task work <sup>7</sup>	0.2
Financial Transaction Area	0.8	Ornamental	0.3
General or Commercial and Industrial Work Areas	Low Bay	Detailed task work <sup>7</sup>	0.2
	High Bay	Detailed task work <sup>7</sup>	0.2
	Precision	Precision specialized work <sup>9</sup>	0.7
Library	Reading Area	Ornamental	0.3
	Stacks Area	—	—

## Area Category Method – Lighting Power Density Values

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft <sup>2</sup> )	Additional Lighting Power	
		Qualified Lighting Systems	Additional Allowance (W/ft <sup>2</sup> , unless noted otherwise)
Main Entry Lobby	0.85	Ornamental	0.3
Locker Room	0.45	—	—
Lounge, Breakroom or Waiting Area	0.65	Ornamental	0.3
Concourse and Atria Area	0.9	Ornamental	0.3
Office Area	> 250 ft <sup>2</sup>	Portable lighting for office areas <sup>6</sup>	0.2
	≤ 250 ft <sup>2</sup>		
	Open plan office		
Parking Garage Area	Parking Zone	First ATM	100W
	Dedicated Ramps	Additional ATM	50W each
	Daylight Adaptation Zones <sup>2</sup>	—	—
Pharmacy Area	1.1	Specialized task work <sup>8</sup>	0.35
Retail Sales Area	Grocery Sales	Accent, display and feature <sup>3</sup>	0.2
		Decorative <sup>4</sup>	0.15
	Retail Merchandise Sales	Accent, display and feature <sup>3</sup>	0.2
		Decorative <sup>4</sup>	0.15
	Fitting Room	External illuminated mirror <sup>5</sup>	40W each
	Internal illuminated mirror <sup>5</sup>	120W each	
Theater Area	Motion picture	Ornamental	0.3
	Performance		
Kitchen or Food Preparation Area	0.95	—	—
Scientific Laboratory Area	1.0	Specialized task work <sup>8</sup>	0.35
Healthcare Facility and Hospitals	Exam or Treatment Room	—	—
	Imaging Room	—	—
	Medical Supply Room	—	—
	Nursery	Tunable white or dim-to-warm <sup>10</sup>	0.1
	Nurse's Station	Tunable white or dim-to-warm <sup>10</sup>	0.1
	Operating Room	—	—
	Patient Room	Decorative <sup>4</sup>	0.15
		Tunable white or dim-to-warm <sup>10</sup>	0.1
	Physical Therapy Room	Tunable white or dim-to-warm <sup>10</sup>	0.1
Recovery Room	Tunable white or dim-to-warm <sup>10</sup>	0.1	
Laundry Area	0.45	—	—
Religious Worship Area	0.95	Ornamental	0.3

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft <sup>2</sup> )	Additional Lighting Power	
		Qualified Lighting Systems	Additional Allowance (W/ft <sup>2</sup> , unless noted otherwise)
Restrooms	0.65	Accent, display and feature <sup>3</sup>	0.2
		Decorative <sup>4</sup>	0.15
Transportation Function	Baggage Area	0.4	—
	Ticketing Area	0.45	Accent, display and feature <sup>3</sup>
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>	1.1	—
	Class IV Facility <sup>13</sup>	0.75	—
Stairwell	0.5	Accent, display and feature <sup>3</sup>	0.2
		Decorative <sup>4</sup>	0.15
Videoconferencing Studio	0.9	Videoconferencing	1.0
All other	0.4	—	—
Aging Eye or Low-vision <sup>11</sup>	Main Entry Lobby	0.85	Ornamental
		0.85	Transition lighting OFF at night <sup>12</sup>
	Stairwell	0.8	—
	Corridor Area	0.8	Decorative <sup>4</sup>
	Lounge or Waiting Area	0.75	Ornamental
	Multipurpose Room	0.95	Ornamental
	Religious Worship Area	1.0	Ornamental
	Dining	0.8	Ornamental
	Restroom	0.8	Accent, display and feature <sup>3</sup>

Footnotes for this table are listed below:

- Whiteboard or chalkboard — directional lighting dedicated to a whiteboard or chalkboard.
- Daylight Adaptation Zones shall be no longer than 66 feet from the entrance to the parking garage.
- Accent, display and feature lighting — luminaires shall be adjustable or directional.
- Decorative lighting — primary function shall be decorative and not to provide general lighting.
- Illuminated mirrors — lighting shall be dedicated to the mirror.
- 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.
- Detailed task work — lighting provides high level of visual acuity required for activities with close attention to small elements or extreme close up work.
- Specialized task work — lighting provides for small-scale, cognitive or fast performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical or laboratorial activities.
- 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.
- Tunable white luminaires capable of color change greater than or equal to 2,000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allow color changing of the luminaires.
- Aging Eye and 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 people with special visual needs.
- 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 daylight zones.
- Class I Facility is used for competition play for 5,000 or more spectators. Class II Facility is used for competition play for up to 5,000 spectators. Class III Facility is used for competition play for up to 2,000 spectators. Class IV Facility is normally used for recreational play and there is limited or no provision for spectators.

Reference: Table 140.6-D

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 and Special Effect Lighting Power Density (W/ft <sup>2</sup> )
Auditorium Area	300	3.00	0.2	0.4
Convention, Conference, Multipurpose and Meeting Center Areas	300	2.00	0.35	0.4
Dining Areas	200	1.25	0.5	0.4
Exhibit and Museum Areas	150	11.5	0.8	0.4
Hotel Area				
Ballroom and Events	400	1.8	0.12	0.4
Lobby	200	3.5	0.2	0.4
Main Entry Lobby	200	3.5	0.2	0.4
Religious Worship Area	300	1.30	0.4	0.4
Retail Sales				
Grocery	600	6.8	0.7	0.4
Merchandise Sales and Showroom Area	500	11.8	0.8	0.4
Theater Area				
Motion Picture	200	2.00	0.2	0.4
Performance Arts	200	7.5	0.2	0.4

Tailored Wall and Floor Display Mounting Height Adjustment Factors

Reference: Table 140.6-D

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"	0.7

**INTERIOR SPACES**

	Minimum Required Control Type					Page Reference
	A	B	C	D	E	
	Manually Switched ON/OFF	Luminaire Dimming	Vacancy Sensor, Occupancy Sensor, Automatic Time Switch, Countdown Timer or Remote Signal	Daylighting Control	Receptacle Control	
Office - Small	1	4, 6	<=250sf; 14	21, 24, 25, 27	26	14
Office - Medium or Large	1	4	>250sf; 7, 9, 12	21, 24, 25, 27	26	15
Corridor, Hall and Stairwell	1	4	9,15	21, 24, 25, 27		16
Conference Room	1	4	14	21, 24, 25, 27	26	17
Entry, Waiting and Lobby	1	4, 6	7, 9, 12	21, 24, 25, 27	26	18
Restaurant and Dining	1	4	7, 9, 12, 16	21, 24, 25, 27		19
Restroom - Single Stall	1	4, 6	4 or <70sf; 10	21, 24, 25, 27		20
Restroom - Multi-Stall	1, 2	4	4	21, 24, 25, 27		21
Parking Garage	1	4	17, 18	22, 23, 24, 25		22
Cafeteria, Multipurpose and Gym	1	4	Multipurpose Rooms <1,000sf; 14 Cafeteria and Gym <1,000sf; 7, 9, 12, 16	21, 24, 25, 27		23
Classroom	1	5	14	21, 24, 25, 27		24
Electrical or Mechanical Room	1	4	(<70sf; 10) or 4 or (Elect. Regulated by 110.23(D))	21, 24, 25, 27		25
Library Stacks	1	4	15	21, 24, 25, 27		26
Library Open Area	1	4	7, 9, 12	21, 24, 25, 27		27
Warehouse Racks	3	4	8, 13, 15, 16	21, 24, 25, 27		29
Loading Docks	3	4	8, 9, 13, 17, 18	21, 24, 25, 27		35
Server Aisle	1	4	7, 9, 11	21, 24, 25, 27		

**ALTERATIONS AND MODIFICATIONS-IN-PLACE** (see Section 141.0, and Tables 141.0-E and 141.0-F)

Luminaire Alterations (per space)		Reference: 141.0 (b)ii			
<10% of Existing Luminaires	existing provisions permitted				
≥10% of Existing Luminaires					
≤85% Lighting Power per 140.6 Area Method	A	B	C		
>85% Lighting Power per 140.6 Area Method	A	B	C	Daylighting is required for luminaires "altered" >10,000sf	
Luminaires Modified-in-Place		Reference: 141.0 (b)liii			
<40 Luminaires /Year	existing provisions permitted				
≥40 Luminaires /Year					
Power ≤85%	A	B (one step between 30-70% and modified)	C		
Power >85%	A	B (multi-level for those modified)	C	D (for luminaires modified)	

A,B,C,D: Controls required per column as shown in above INTERIOR Area Type Guide matrix. Refer to Controls Summary Table 130.1-A

**INTERIOR REFERENCE KEY**

- MANDATORY: Luminaires must be manual switched ON/OFF for each area enclosed by ceiling-height partitions and independently controlled, readily accessible, and operated in the same room with the luminaires controlled. Ref: Section 130.1(a)
- OPTION. May use manual switch not accessible to unauthorized personnel. Ref: Section 130.1(a)1
- MANDATORY. Switch shall be located so that the person using the lighting control can see the lights or area operated by the switch. Ref: Section 130.1(a)
- MANDATORY. Enclosed spaces 100sf or greater with connected load greater than 0.5W/sf. Each luminaire must be controlled by one of five control methods; manual dimmer, lumen maintenance, tuning, daylighting, or demand response. Ref: Section 130.1(b), Table 130.1-A.
- MANDATORY. General lighting load of 0.7W/sf or less requires one control step between 30-70%. Ref: Section 130.1(b)
- EXCEPTION. Enclosed area with one luminaire having 2 or less lamps. LED luminaires are not part of the exception. Ref: Section 130.1(b)
- MANDATORY. Each 5,000 sf or less enclosed area requires vacancy, occupancy, automatic time-switch, or signal controls capable of turning off the lighting when unoccupied. Ref: Section 130.1(c)
- MANDATORY. Each 20,000 sf or less enclosed area requires vacancy, occupancy, automatic time-switch, or signal controls capable of turning off the lighting when unoccupied for these larger spaces. Ref: Section 130.1(c)
- EXCEPTION. Lighting used for 24/7 operation. Ref: Section 130.1(c)
- OPTION: Countdown timer allowed when less than 70sf with a 10 minute setting. Ref: Section 130.1(c)
- OPTION: Countdown timer allowed with a 30 minute setting. Ref: Section 130.1(c)
- MANDATORY: Automatic time-switch with a 2 hour setting. Automatic time-switch required to have a "holiday shut-OFF" feature to turn off all loads for at least 24hr, and then resume to normal schedule. Ref: Section 130.1(c)
- OPTION: Countdown timer greater than a 2 hour setting allowed when automatic time-switch control used where captive-key override is utilized. Ref: Section 130.1(c)
- MANDATORY. Vacancy or occupancy sensing control required to shut OFF ALL lighting when the room is unoccupied. This includes any classroom, any conference room, multipurpose rooms less than 1,000sf, and offices 250sf or less. Ref: Section 130.1(c)
- MANDATORY. Partial ON/OFF vacancy or occupancy sensing control is required to reduce lighting power when unoccupied. Warehouse aisle ways and open warehouses shall reduce lighting power by at least 50%; Library book stacks 10 ft or longer accessible from one end and 20 ft or longer accessible from both ends shall reduce lighting power by 50% and done so in each library book stack aisle; General corridors and general stairwells shall reduce lighting power by at least 50% when each space is unoccupied and FULL ON at each designed path of egress; Common area corridors and common area stairwells providing access to dwelling units in buildings including high-rise, hotel/motel, and multi-family apartments shall reduce lighting power by at least 50% when each space is unoccupied and FULL ON at each designed path of egress. Ref: Section 130.1(c)
- EXCEPTION: Installed lighting power is 80% or less of the allowed value for the areas and then at least 40% of the lighting power shall be reduced or when HID technology is deployed at least 40% of the lighting power shall be reduced. Ref: Section 130.1(c)
- MANDATORY. Vacancy or occupancy sensing control shall have at least one control step between 20-50% of lighting power, no more than 500W controlled together as a single zone, and turn the lights FULLY ON in each controlled space activated from designed paths of egress. Areas include parking garages, parking areas, and loading/unloading docks. Ref: Section 130.1(c)
- EXCEPTION. Metal halide luminaires with system efficacy of 75lpw shall have at least one control step between 20-60% of lighting power. Ref: Section 130.1(c)
- MANDATORY. Hotel/motel guest rooms require captive card key, vacancy or occupancy sensing, or automatic control that allows the lighting power and controlled receptacles to remain on no longer than 30 min once the room is vacated. Ref: Section 130.1(c)
- EXCEPTION. One "High Efficacy" luminaire located within 6 feet of entry door. Ref: Section 130.1(c)
- MANDATORY. The indoor, non-parking garage daylighting zones shall be controlled separately. These zones are Skylit, Primary Sidelit, and Secondary Sidelit. Sidelit zones apply when a space has at least 24 sf of glazing. Luminaires that fall in both Skylit and Primary Sidelit are to be controlled as part of the Skylit zone. Luminaires that are at least 50% within the zone are considered part of the designated zone. The luminaires in the daylighting zones must meet the multilevel lighting and uniformity requirements. Illuminance of daylight controlled lighting shall not be less than the space not controlled. When illuminance exceeds 150% of the designed illuminance, the general lighting in the daylighting zones shall be reduce by a minimum of 65%. Ref: Section 130.1(d) and Table 130.1-A
- MANDATORY. The parking garage daylighting zones shall be controlled separately. These zones are Primary Sidelit, and Secondary Sidelit. Sidelit zones apply when a space has at least 36 sf of glazing and when the Primary Skylit zone has lighting loads greater than 60W. Luminaires that are at least 50% within the zone are considered part of the designated zone. The luminaires in the daylighting zones must meet the multilevel lighting and uniformity requirements OR ON/OFF. Illuminance of daylight controlled lighting shall not be less than the space not controlled. When illuminance exceeds 150% of the designed illuminance, the general lighting in the daylighting zones shall be reduce to zero. Ref: Section 130.1(d) and Table 130.1-A
- EXCEPTION. Luminaires located in the daylight transition zone and for only dedicated ramps do not require daylight control. Ref: Section 130.1(d)
- MANDATORY. Photosensors and their calibration adjustment shall be only accessible to authorized personnel. Ref: Section 130.1(d)
- EXCEPTION. Daylit controlled lighting having a lighting power density of less than 0.3W/sf do not require multilevel lighting control. ON/OFF control is sufficient. Ref: Section 130.1(d)
- MANDATORY. 120V receptacle control required for each within each 6 ft of uncontrolled receptacles and the controlled receptacle shall be marked. Hotel/motel guest rooms require that ½ of the receptacles to be controlled. Ref: Section 130.5(d)
- EXCEPTION. When the combined total wattage of Skylit and Primary Sidelit zones is less than 120W, daylighting is not required.

EXTERIOR SPACES

	BUG / Zonal Lumen Control	1500W Controlled Together	Photocontrol or Astronomical Time-Switch	Occupancy Sensor	Multi-Level Dimming	Part-Night Control
Incandescent Luminaires	B	F	D	A		
Public Right of Way (roadways, sidewalks, bikeways)	C		E			
Roadway Tunnels	C		E			
Building Facades	C, N		D	L, N or	G	K, M or
Ornamental Hardscapes	B, N		D	L, N or	G	K, M or
Outdoor Dining	B, N		D	L, N or	G	K, M or
Outdoor Sales (Frontage, Lots, and Canopies)	B		D	L, N or	G	K or M
General Parking Lots (Hardscapes pole mounted >24ft)	B		D			
General Parking Lots (Hardscapes pole mounted <= 24ft)	B	F	D	F, H	G, H, J	
General Wall Mounted (non-pole mounted >24ft)	B		D			
General Wall Mounted (non-pole mounted <=24ft)	B	F	D	F, I	G, I, J	
<b>EXTERIOR ALTERATIONS</b>						
Increases in Lighting Load, All Luminaires must meet the requirements; More than 50% of Luminaires Replaced, All Luminaires must meet the requirements; 10% or More of the Luminaires Replaced, the Altered Luminaires must meet the requirements.						
Incandescent Luminaires	B	F	D	A		
Public Right of Way (roadways, sidewalks, bikeways)	C		E			
Roadway Tunnels	C		E			
Building Facades	C, N		D	L, N	G	K, M
Ornamental Hardscapes	B, O, N		D	L, N	G	K, M
Outdoor Dining	B		D	L, N	G	K, M
Outdoor Sales (Frontage, Lots, and Canopies)	B, O		D	L	G	K
General Parking Lots (Hardscapes pole mounted >24ft)	B, O		D			
General Parking Lots (Hardscapes pole mounted <= 24ft)	B, O	F	D	F, H, J	G, H, J	
General Wall Mounted (non-pole mounted >24ft)	B		D			
General Wall Mounted (non-pole mounted <=24ft)	B	F	D	F, I, J	G, I, J	

EXTERIOR REFERENCE KEY

- A. MANDATORY. Incandescent luminaire rated over 100W must be controlled by a motion sensor to turn-on when occupied. Ref: Section 130.2(a)
- B. MANDATORY. Luminaire must meet the cutoff requirements when the lamp wattage is greater than 150W complying with BUG requirements in accordance with the appropriate lighting zone. Ref: Section 130.2(b), Table 130.2-A, Table 130.2-B
- C. EXCEPTION. Lighting is not required to meet the cutoff requirements for building facades, public monuments, vertical surfaces of bridges, health or life-safety regulations, public right of way for publicly maintained areas (roadways, sidewalks, bikeways) and temporary lighting. Also replacement of existing pole mounted luminaires in hardscape areas with all the following conditions: existing luminaires do not meet BUG rating, spacing between existing poles is greater than 6 times mounting height of the existing luminaires, new wiring is not being installed, and connected load is not increased. Ref: Section 130.2(b)
- D. MANDATORY. Outdoor controls shall be controlled by a photosensor OR outdoor astronomical time-switch that turns OFF the outdoor lighting when daylight is available. The outdoor lighting must be circuited and independently controlled from other electrical loads. Ref: Section 130.2(c)
- E. EXCEPTION. Controls are not required to turn OFF outdoor lighting for health or life-safety regulations applications and in tunnels illuminated 24/7. Ref: Section 130.2(c)
- F. MANDATORY. Luminaires installed 24 feet or less above the ground shall be controlled. No more than 1500W can be controlled together. Motion or other controls shall automatically reduce the power of each luminaire when vacant and turn to full-ON when area becomes occupied. Ref: Section 130.2(c)
- G. MANDATORY. When controlled, the luminaires must reduce power between 40-80% which allows for both stepped and continuous dimming. Ref: Section 130.2(c)
- H. EXCEPTION. Pole mounted luminaires 75W or less do not require controls that automatically reduce power when vacant. Ref: Section 130.2(c)
- I. EXCEPTION. Non-pole mounted luminaires 30W or less do not require controls that automatically reduce power when vacant. Ref: Section 130.2(c)
- J. EXCEPTION. Linear lighting 4W per linear foot or less do not require controls that automatically reduce power when vacant. Ref: Section 130.2(c)
- K. MANDATORY. Part-night outdoor lighting control. Ref: Section 130.2(c)
- L. MANDATORY. Motion sensors of automatically reducing lighting power with auto-ON functionality. Ref: Section 130.2(c)
- M. MANDATORY. Centralized time-based zone lighting automatically reducing lighting by a minimum of 50%. Ref: Section 130.2(c)
- N. MANDATORY. Wall mounted luminaires ("wallpacks") must provide a bilaterally symmetric distribution. Ref: Section 130.2(c) 5 D
- O. Replacement of existing pole mounted luminaires do not need to meet the requirements whereby spacing is greater than 6x mounting height of existing luminaires, no poles added, no new wiring and connected power is not increasing.

GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Reference: Table 140.7-A

Type of Power Allowance	Lighting Zone 0 <sup>3</sup>		Lighting Zone 1 <sup>3</sup>	Lighting Zone 2 <sup>3</sup>		Lighting Zone 3 <sup>3</sup>		Lighting Zone 4 <sup>3</sup>
	Asphalt	Concrete	Asphalt / Concrete	Asphalt	Concrete	Asphalt	Concrete	Asphalt / Concrete
Area Wattage Allowance (AWA)	No allowance		0.018 W/ft <sup>2</sup>	0.023 W/ft <sup>2</sup>	0.025 W/ft <sup>2</sup>	0.025 W/ft <sup>2</sup>	0.03 W/ft <sup>2</sup>	0.03 W/ft <sup>2</sup>
Linear Wattage Allowance (LWA)			0.15 W/lf	0.17 W/lf	0.4 W/lf	0.25 W/lf	0.4 W/lf	0.35 W/lf
Initial Wattage Allowance (IWA)			180 W	250 W	250 W	350 W	350 W	400W

<sup>1</sup>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 Section 130.2(b).

<sup>2</sup>Where greater than 50% of the paved surface of a parking lot is finished with concrete. This does not extend beyond the parking lot, and does not include any other General Hardscape areas.

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





ASHRAE 90.1 (2016), IECC (2018), NECB (2011) & Title 24 (2019)

	ASHRAE 90.1 2016	IECC 2018	T24 2019	Atrium	Banking	Classroom / Training / Lecture	Conference / Meeting room			Copy / Print room	Corridor	Courtroom	Dining area	Food preparation	Library	Office	Restroom	Sales area	Stairwell
Local Control	9.4.1(a)	C405.2.5	130.1(a), (b)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Manual ON	9.4.1(b)	C405.2.5	130.1(a), (b)	○	○	○	○			○		○	○	○	○	○	○	○	○
Partial Automatic ON	9.4.1(c)	C405.2.1.1.2	130.1(b)	○	○	○	○			○		○	○	○	○	○	○	○	○
Bi-level Lighting	9.4.1(d)					●	●			●	●	●	●	●	●	●		●	●
Daylighting Side lighting	9.4.1(e)	C405.2.3.2	130.1(d)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Daylighting Top lighting	9.4.1(f)	C405.2.3.3	130.1(d)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Automatic Partial OFF	9.4.1(g)	C405.2.1.3	130.1(c).6																●
Automatic Full OFF	9.4.1(h)	C405.2.1.1.1	130.1(c).5	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Scheduled Shutoff	9.4.1(i)	C405.2.2	130.1(c)	●	●	●	●			●	●	●	●	●	●		●	●	●
Receptacle Control	8.4.2	C405.2.4	130.5(d)		●	●	●			●			●		●	●	●	●	
Energy Monitoring	8.4.3.2		130.5(b)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Parking Garage Lighting Control	9.4.2	C405.2.6	130.1(a), (b)																
Functional Testing	9.4.3	C408.3	130.1(a), (b)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Demand Response			130.1(a), (b)	●	●	●	●			●	●	●	●	●	●	●	●	●	●
Enhanced Digital Lighting Controls		C406.4		●	●	●	●			●	●	●	●	●	●	●	●	●	●

Reference: WaveLinx Design and Application Guide Title 24 - 2019 Standards

Required
  Choose one
  Choose one
  Choose one
  Required
  Choose one
  Choose one
  Choose one

ASHRAE 90.1 (2016), IECC (2018),NECB (2011), Title 24 (2019)

	IECC 2018	ASHRAE 90.1 2016	Title 24 2019	WaveLinx
<b>AUTOMATIC CONTROLS</b>				
<b>Occupancy Sensors</b>	C405.2.1	9.4.1.1(h)	130.1(c)	●
<b>Partial Off</b>	C405.2.1.2 (warehouse) C405.2.1.3 (open office)	9.4.1.1(g)	130.1(c)	●
<b>Full Off</b>	C405.2.1.1.1 (20min)			●
<b>Scheduled Off</b>	C405.2.2	9.4.1.1(h)	130.1(c) - (warehouse, corridor, stairwell, library stacks)	●
<b>Plug Load Off</b>	N/A	8.4.2	130.1(d)	●
<b>Manual On/Partial On</b>	C405.2.1.1.2	9.4.1.1(b) - (manual ON) 9.4.1.1(c) - (partial ON)	130.1(c) - (office <250ft <sup>2</sup> , classrooms, conference rm)	●
<b>MANUAL CONTROLS</b>				
<b>Manual On/Partial On</b>	C405.2.1.1.2	9.4.1.1(b) - (manual ON) 9.4.1.1(c) - (partial ON)	130.1(c) - (office <250ft <sup>2</sup> , classrooms, conference rm)	●
<b>Manual Light Reduction</b>	C405.2.2.2			●
<b>Area/Local Controls</b>	C405.2.5	9.4.1.1(a)	130.1(b)-(multi-level controls)	●
<b>DAYLIGHTING</b>				
<b>Daylight Responsive Control</b>	C405.2.3	9.4.1.1(e) - (>150W sidelighting) 9.4.1.1(e) - (>150W toplighting)	130.1(d) - (>120W with <.5W/ft <sup>2</sup> dimming optional) 130.1(d) - (>120W with >.5W/ft <sup>2</sup> dimming required)	●
<b>EXTERIOR CONTROLS</b>				
<b>Parking Garage Lighting</b>		9.4.1.2		●
<b>Exterior Lighting</b>	C405.2.5	9.4.1.4		●
<b>Special Items</b>				
<b>Specific Application Controls</b>	C405.2.4			●
<b>Additional Efficiency Packages</b>	C406.1			●
<b>Guest Room or Sleeping Units</b>	C405.2.4.3	9.4.1.3(b)		●
<b>Functional Testing</b>	C408.3	9.4.3	130.4	●
<b>Metering</b>			130.5(a)	●
<b>Demand Responsive Controls</b>			130.1(e) - (>10K ft <sup>2</sup> reduce by 15%)	●

<b>NEW CONSTRUCTION: LIGHTING CONTROLS AND EQUIPMENT</b>	<b>130.</b>	<b>140.6(a)2 and 140.6(d)</b>	<b>—</b>
Manual Area Controls	130.1(a)	—	—
Multi-level Controls	110.9(b)3 and 130.1(b)	—	—
Automatic Shut-Off Controls: Time Switches and Occupant Sensing Controls	110.9, 130.1(c)	140.6(a)2	140.6(a)2
Automatic Daylighting Controls	110.9, § 130.1(d)	140.6(a)2H, 140.6(d) and 140.6(a)2L	140.6(a)2H, 140.6(d) and 140.6(a)2L
Automated Demand Response	110.12(a), 110.12(c) and 130.1(e)	140.6(a)2	140.6(a)2
Control Interactions	130.1(f)	—	—
Institutional Tuning Controls	—	140.6(a)2	140.6(a)2
Lighting Controls Acceptance Tests	130.4(a), 130.4(c) NA 7.6, NA 7.7.5.2 and NA 7.8	—	—
<b>OUTDOOR LIGHTING</b>			
<b>DAYLIGHTING/GLAZING REQUIREMENTS</b>	<b>130.</b>	<b>140.</b>	<b>—</b>
	<b>110.6 and 130.1(d)</b>	<b>140.3, 140.3(d)</b>	<b>—</b>
Fenestration: Minimum U-factor, Solar Heat Gain Coefficient (SHGC), Visible Transmittance	110.6(a)2 through 110.6(a)6 110.6(b)	140.3(a)	—
Skylights: Maximum skylight to gross roof area, minimum SHGC, Visible Transmittance	—	140.3(a)	—
Minimum Daylight Requirements, spaces > 5,000 ft2 with ceiling heights > 15 ft	130.1(d)	140.3(c)	—
<b>CONTROLS DEVICES AND SYSTEMS, BALLASTS AND LUMINAIRES</b>			
Time-Switch Lighting Controls	110.9(b)	—	—
Daylighting Controls	110.9(b)	—	—
Dimmers	110.9(b)	—	—
Occupant Sensing Controls	110.9(b)4 and 110.9(b)	—	—
Track Lighting Integral Current Limiter	110.9(c)	—	—
Track Lighting Supplementary Overcurrent Protection Panel	110.9(d)	—	—
<b>SIGN LIGHTING</b>			
<b>ADDITIONS, ALTERATIONS AND REPAIRS</b>	<b>130.</b>	<b>140.</b>	<b>—</b>
	<b>—</b>	<b>—</b>	<b>—</b>
Additions	130.0 through 130.5 as applicable	141.0(a)	141.0(a)
Alterations	130.0 through 130.5 as applicable	141.0(b)	141.0(b) Table 141.0-E
Altered Indoor Lighting Systems	130.1, as applicable per Table 141.0-F	141.0(b)2 Table 141.0-F	—
Electrical Power Distribution Systems	—	141.0(b)2	—
Outdoor Lighting	—	141.0(b)2	—
Altered Sign Lighting	—	141.0(b)2	—
Repairs	141.0(c)	—	—

**MANDATORY MEASURES**

**HIGH-EFFICACY LIGHTING**

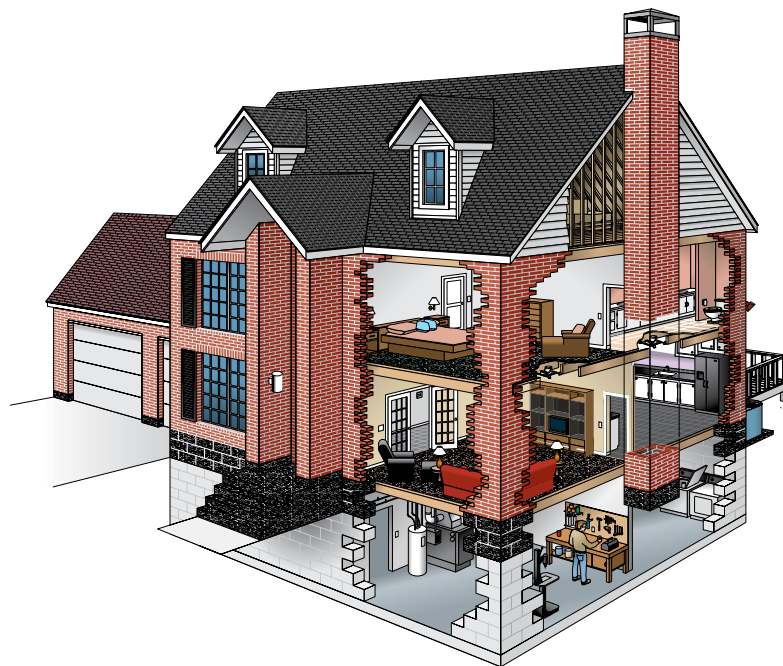
Mandatory Measures require that lighting in permitted projects, such as New Construction, Additions or Alterations, be high efficacy. Some light sources are automatically considered high efficacy. Others must be certified to the Energy Commission as high efficacy per Joint Appendix JA8 (Title 20) requirements.

Luminaires which are subject to JA8’s requirements must include elements of efficiency and lighting quality. The high-efficacy definition is applicable to all lighting technology types and automatically includes linear fluorescent, pin-based compact fluorescent with electronic ballasts, pulse-start metal halide, HID and induction light sources.

Any luminaire can qualify as high efficacy as long as it meets the requirements of Title 24, Section 150.0(k) and, if applicable, JA8 (Title 20).

**DEFINING STATE (CALIFORNIA) REGULATED LED LAMPS**

The Appliance Efficiency Regulations define state-regulated LED lamps as products that emit 2,600 lumens or less; have a CCT between 2,200K and 7,000K; have a Duv between -0.012 and 0.012 in the 1976 color space; and be equipped with an E12, E17, E26 or GU-24 base. Requirements do not apply to lamps that are less than 150 lumens with an E12 base, or to lamps that are less than 200 lumens with an E17, E26 or GU-24



**Products Regulated Under the Appliance Efficiency Regulations**

- Lamps (including General Service Lamps (GSLs) and Small Diameter Directional Lamps(SDDLs))
- Ballasts
- Torchieres
- Metal-halide luminaires
- Portable luminaires
- Undercabinet luminaires
- Luminaires with GU-24 socket and base configurations and GU-24adaptors.

**Product Requirements Provided Under the Energy Code**

- JA8 high-efficacy light sources
- Track lighting current limiters and overcurrent protection devices
- Time-switch lighting controls
- Daylighting controls
- Dimmers
- Occupant sensing controls

**HIGH-EFFICACY LIGHT SOURCES**

Light sources shall comply with one of the columns below:  
Table 150.0-A: Classification of High-Efficacy Light Sources

Light sources in this column other than those installed in ceiling recessed downlight luminaires are classified as high efficacy and are not required to comply with Reference Joint Appendix JA8.	Light sources in this column are only considered to be high efficacy if they are certified to the Commission as High-Efficacy Light Sources in accordance with Reference Joint Appendix JA8 and marked, as required by JA8.
<ol style="list-style-type: none"> <li>1. Pin-based linear fluorescent or compact fluorescent light sources using electronic ballasts.</li> <li>2. Pulse-start metal halide light sources.</li> <li>3. High pressure sodium light sources.</li> <li>4. Luminaires with hardwired high frequency generator and induction lamp.</li> <li>5. LED light sources installed outdoors.</li> <li>6. Inseparable SSL luminaires containing colored light sources that are installed to provide decorative lighting.</li> </ol>	<ol style="list-style-type: none"> <li>7. All light sources installed in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw bases regardless of lamp type, as described in Section 150.0(k)1C.</li> <li>8. Any light source not otherwise listed in this table.</li> </ol>

**Qualification Requirements for TITLE-20 High-Efficacy Light Sources Listed in CEC Appendix JA8:**

Specification	Requirement
<b>Initial Efficacy</b>	≥ 80 lm/W for state regulated LED lamps <sup>1</sup> , or ≥ 45 lm/W for all other light source types
<b>Power factor at Full Rated Power</b>	≥ 0.90
<b>Correlated Color Temperature (CCT)</b>	≤ 4,000 Kelvin
<b>Color Rendering Index (CRI)</b>	≥ 82 for state regulated LED lamps <sup>1</sup> , or ≥ 90 for all else
<b>R1–R8, R9</b>	R1–R8 ≥ 72 for state regulated LED lamps, or R9 ≥ 50 for all else
<b>Rated Life</b>	≥ 15,000 hours
<b>Minimum Dimming Level</b>	≤ 10% light output
<b>Flicker</b>	< 30% for frequencies of 200 Hz or below, at 100% and 20% light output

Small diameter directional lamps may have an initial effect of at least 80 lm/W or a minimum compliance score of at least 165 for products with a minimum efficacy of 70 lm/W, where compliance is determined by the equation: Compliance Score = Efficacy + CRI

Permanent Luminaires

Mandatory Measure	Screw-Base Luminaire	Pin-Base <sup>1</sup> Luminaire	Recessed Downlight	Inseparable <sup>4</sup> SSL Luminaire (LED)	Night Lights, Path Lights, Step Lights, Lights in Drawers, Cabinets and Linen Closets	All Other
High Efficacy (required)	Yes—All	Yes—All	Yes—All	Yes—All	All, except those that are 5 watts or less and emit 150 lumens or less	Yes— All
High-Efficacy Qualification via JA8 lamps and luminaires <sup>2</sup>	All, excluding hardwired ballasted HID	Recessed downlight applications	All types, and certified compliant for elevated temperatures	All, except colored-decorative	Yes	Yes— All
Automatic Qualification as High Efficacy: Listed in Table 150.0-A, Column 1 (JA8 Compliance not required)	Hardwired, ballasted HID only	Linear fluorescent and compact fluorescent light sources using electronic ballasts only	—	Colored-decorative	No	—
Dimmer, Sensor or EMCS <sup>3</sup>	Yes—All	Yes, if installed to meet §150.0(k)2I requirements <sup>5</sup> or if a JA8 light source and not controlled by a vacancy/ occupancy sensor	Yes—All	All, except colored-decorative	All, except those that use 5 watts or less and emit 150 lumens or less	Yes— All
Other Requirements	Cannot be a recessed downlight	Fluorescent lamps must use an electronic ballast	Airtight, IC-rated and maintenance per §150(k)1C	—	—	—

1. Excludes recessed downlights.
2. Enclosed luminaires must use JA8 lamps certified for use at elevated temperatures.
3. Excludes luminaires in closets less than 70 ft<sup>2</sup> and hallways.
4. Solid-state lighting such as LED where the LED source is permanently attached to the luminaire.
5. Per Section 150.0(k)2I: In bathrooms, garages, laundry rooms and utility rooms, at least one luminaire in each of these spaces shall be controlled by an occupant or vacancy sensor providing automatic-OFF functionality.

Spaces and Lighting Controls

Type of Lighting Control	Hallways and Closets <sup>2,3</sup>	Kitchens	Bathrooms	Laundry Rooms or Utility Rooms	Garage	All Other
Manual ON / OFF Controls	Required for all spaces					
Sensor or Dimmer <sup>1</sup>	Not required	Based on installed luminaire or lamp type <sup>4</sup>	At least one luminaire controlled by an occupancy or vacancy sensor that provides manual-ON/auto- OFF functionality, and all other based on installed lamp or luminaire type <sup>5</sup>			Based on luminaire type <sup>4</sup>
Separate Switching: Exhaust Fans	Exhaust fans must be switched separate from lighting or utilize a device where lighting can be turned OFF while the fan is running. Excludes kitchen exhaust hoods.					
Separate Switching: Undercabinet Lighting	Undercabinet lighting must be switched separately from ceiling-mounted lighting.					
Auto-Shut Off: Drawers, Cabinets and Linen Closets	Lighting in drawers, cabinets and linen closets less than 5 watts and 150 lumens must be equipped with controls that automatically turn off when the drawer, cabinet or linen closet is closed.					
Blank Electrical Boxes	Blank electrical boxes must be connected to a dimmer, vacancy sensor or fan speed control.					

1. May be achieved with an EMCS or programmable scene controller with required functionality.
2. Closets less than 70 ft<sup>2</sup>. For all other closets, requirements based on installed lamp or luminaire type.
3. Light sources in linen closets must be high efficacy and be controlled by vacancy sensors if they use more than 5 watts, emit more than 150 lumens and are not equipped to automatically turn the light off when the light closes.
4. See '2019 Indoor Residential Lighting Requirements: Luminaires' table (above) for a list of requirements by lamp and luminaire type.
5. No sensor is required if the light source is automatically classified as high efficacy, according to Table 150.0-A.

ICONOGRAPHY SYSTEM

These icons symbolize specific language found in the code requirements. They represent product and space characteristics. Icons not only represent the requirements of Title 24, but attributes Cooper Lighting products provide. This simplifies educating one on the code, how to apply the code for a given space, and select the products that will deliver a Title 24 compliant project.

LUMINAIRES / CONTROLS				
<b>Luminaire Dimming</b>	<b>Fluorescent Luminaire w/ Ballast</b>	<b>LED Luminaire</b>	<b>Metal Halide Luminaire</b>	<b>Exit Luminaire</b>
<b>Residential Recessed Luminaires w/ Ballast</b>	<b>Emergency Back-up (For Egress)</b>	<b>High Efficacy</b>		
FUNCTIONAL REQUIREMENTS				
<b>Daylighting Control</b>	<b>Vacancy Sensor Manual On/Auto Off</b>	<b>Occupancy Sensor</b>	<b>Demand Response</b>	<b>Manually Switched ON/OFF</b>
<b>Manual Dimmer</b>	<b>Lumen Maintenance Control</b>	<b>Tuning Control</b>	<b>Automatic Time Switch (Indoor)</b>	<b>Astronomical Time Switch (Outdoor)</b>
<b>Photocontrol</b>	<b>Remote Signal Control</b>	<b>Captive Key-Card Control</b>	<b>Combined HVAC &amp; Lighting Control</b>	<b>Part-night Outdoor Lighting Control</b>
<b>Receptacle Control</b>	<b>Reporting</b>	<b>Monitoring</b>	<b>Automatic Countdown Timer Switch</b>	
CONSTRAINTS				
<b>Square Footage Range</b>	<b>Maximum Wattage Controlled Together</b>	<b>Daylight Opening</b>	<b>BUG / Zonal Lumen Requirements</b>	<b>LPD Lighting Power Density</b>
<b>Height of Luminaire for Outdoor</b>	<b>24/7 Operation</b>			

## Lighting Product Lines

Ametrix  
AtLite  
Corelite  
Ephesus  
Fail-Safe  
Halo  
Halo Commercial  
Invue  
io  
Iris  
Lumark  
Lumière  
McGraw-Edison  
Metalux  
MWS  
Neo-Ray  
Portfolio  
RSA  
Shaper  
Streetworks  
Sure-Lites

## Controls Product Lines

Fifth Light Technology  
Greengate  
iLight (International Only)  
iLumin  
Zero 88

## Connected Lighting Systems

HALO Home  
WaveLinX  
Trellix



This product guide contains information taken from publications of California Energy Commission (CEC) and California Lighting Technology Center, UC Davis (CLTC).

Energy Code Ace website provided by the California Statewide Codes & Standards Program contains useful information on Title 24 at:

<https://energycodeace.com/>

CEC Title 24 Nonresidential & Residential code info found at:

<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency>

Guides to meeting or exceeding Title 24 code requirements are found at:

<https://cltc.ucdavis.edu/>

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