

2022 California
Title 24, Part 6: Building Energy Efficiency Standards

legrand

2022!
~~2019~~
~~2016~~

BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS

FOR THE 2016 BUILDING ENERGY EFFICIENCY STANDARDS

TITLE 24, PART 6, AND ASSOCIATED REGULATORY REQUIREMENTS IN PART 7

U.S. GREEN BUILDING COUNCIL MEMBER
ENERGY STAR PARTNER
CONTINUING EDUCATION

STATE OF CALIFORNIA ENERGY COMMISSION SINCE 1975

Provider # 1657
• AIA Course # BCS213-1

V1.01

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TODAYS SPEAKER

CHARLES KNUFFKE
Systems VP and Evangelist for Wattstopper Product Line, Legrand

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Nonresidential Learning Objectives

- 1 Cover the Drivers for the Title 24 Energy Code
- 2 Review the Mandatory Lighting and Power Control requirements (§130.0 - .5)
- 3 Overview changes in the Interior and Exterior Lighting Power Sections (§140.6 - .7)
- 4 Discuss changes in the Lighting Alteration/Addition Section (§141.0)
- 5 Mention New MultiFamily Requirements (§160.0, 170.0, and 180.0)

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Slide Formats

Title 24 Section (§) Info

§130.1(b): Multi-Level Controls

General Lighting Multi-Level Controls

- General Lighting in any Area $\geq 100 \text{ ft}^2$ AND $> 0.5 \text{ W/ft}^2$
 - Controls must allow General Lighting to be adjusted up and down.
 - Meet control step and uniformity criteria (in T130.1-A)
- Exceptions
 - Public restrooms have at least one step between 30-70% full-rated power
 - Healthcare Facilities
 - Areas with a single 1- or 2-lamp luminaire
- Following spaces are exempted per Table 130.1A:
 - While "Areas required to be Full or Partial Off 130.1(c)6 and 7" was deleted, these spaces (library stack aisles, warehouse aisles and open areas, Corridors, Stairwells, Garage Areas, etc...) are exempted but required to have one control step of 20-60%
 - Classrooms with a connected general lighting load $\leq 0.7 \text{ W/ft}^2$ with control step of 30-70%

Changes from 2019 code are in red

"General Lighting is installed electric lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting, and also known as ambient lighting."



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5-minute T24 2022 summary

1. § 110.12 Demand Response

1. T24 now uses 4,000W of General Lighting instead of 10,000 ft² to determine if required. Spaces not meeting Multilevel requirements don't count in calculation
2. DR communication must be bi-directional protocol - not contact closure
3. If Plug Loads are required on a project that requires a DR Lighting system, plug loads also must be DR capable.

2. § 130.1(c) Occupancy Sensors in Open Office

1. Title 24 copying language from IECC 2018 - when an open office is greater than 250 ft², that office's GENERAL lighting needs to be controlled by occupancy sensors. Open office areas with occupancy sensors must be zones of no more than 600 ft².
2. Lights can turn on to any level, and unoccupied zones in the open office can go to a low level of light (< 20%) rather than complete off when other zones are occupied.
3. **Opinion** - This will drive the use of Individually Controllable Fixtures, what the industry refers to as Luminaire Level Lighting Controls (LLLC), in an enormous move forward.

3. § 120.5 Occupancy Sensors for HVAC

1. Code has clarified the use of occupancy sensors for HVAC system in certain spaces – 5-minute grace time between sensor off and HVAC change.

4. **New!!!** § 140.10 New Prescriptive Requirement for Photovoltaic and Battery Storage Systems

1. Mandates the installation of Photovoltaics for many commercial buildings
2. Mandates the installation of Battery Storage Systems
3. Using CA Climate Zones refer to Tables 140.10 - A, and 140.10 - B.

5. **New!!!** Multifamily Sections

1. CEC decided to create entirely new sections for Multifamily dwellings. These Sections add 130+ pages to the code, and basically repeats language used in the non-Residential AND Residential sections of the code.
2. Intent is to allow Multifamily buildings to implement new regulations in the future apart from the other building types.

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Where Is The Code?

The screenshot shows the California Energy Commission website. The main heading is "2022 Building Energy Efficiency Standards". Below this, there are several dockets listed: "2022 Energy Code Part 6 Rulemaking Docket # 21-BSTD-01", "2022 Energy Code Environmental Impact Report Docket # 21-BSTD-02", "2022 Energy Code Parts 2-5 and 11 Rulemaking Docket # 21-BSTD-03", and "2022 Energy Code Compliance Manuals and Forms Docket # 21-BSTD-04". There is a section for "BUILDING ENERGY EFFICIENCY STANDARDS - TITLE 24" with sub-sections for "2022 Building Energy Efficiency Standards", "2019 Building Energy Efficiency Standards", "2016 Building Energy Efficiency Standards", "2013 Building Energy Efficiency Standards", "Online Resource Center", "Solar Assessment Tools", and "Part 6 Building Energy Efficiency Standards". At the bottom, there is a "PUBLIC COMMENTS" section. A red arrow points to the "Expand All" button.

Expand Here →

<https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency>

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When?

- **2022 Building Energy Standards** will go into effect starting **January 1, 2023**, for sites submitting for a permit on or after that date.



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Overview of New T24 Part 6 Sections

Section 10	Regulations
Section 100	All Occupancies – General (& Definitions)
Section 110	Systems and Equipment
Section 120	Mechanical
Section 130	Lighting and Controls
Section 140	Performance/Prescriptive Methods
Section 141	Additions/Alterations
Section 150	Residential
Section 160	Multifamily Mandatory
Section 170	Multifamily Performance/Prescriptive
Section 180	Multifamily Alterations

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§ 100.1: Definitions & Rules of Construction

46 Pages

Review The Definitions

- “Shall” is mandatory, “May” is permissive
- Highlights:
 - “Lighting” includes definitions for all types – General, Permanently Installed, Portable – many updated
 - “Light” redefined as radiant energy that “excites the retina”
 - All Lighting Control Devices are now listed here
 - “Nonresidential Building Occupancy Types”, “Nonresidential Function Areas”, and “Outdoor Areas” are headers for long lists...
- **New/Updated**
 - **Controlled Environment Horticulture (CEH) Space**
 - **Indoor Growing** is a CEH with < 50% Skylight Roof Ratio
 - **Energy Storage System (ESS), and ESS Ready Panelboard**
 - **Multifamily Building** is any of the following:
 - A building of Occupancy Group R-2, other than a hotel/motel building or timeshare property,
 - A building of Occupancy Group R-3 that is a nontransient congregate residence, other than boarding houses of more than 6 guests and alcohol or drug abuse recovery homes of more than 6 guests, or
 - A building of Occupancy Group R-4.
 - **Single-Family Building** is any of the following:
 - A residential building of Occupancy Group R-3 with two or less dwelling units,
 - A building that is of Occupancy Group R-3, other than a multifamily building or hotel/motel building,
 - A townhouse,
 - A building of Occupancy Group R-3.1, or
 - A building of Occupancy Group U when located on a residential site.

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§ 100.1: Definitions

46 Pages

Lighting Definitions

- **Luminaire Alteration** is adding luminaires, removing and reinstalling luminaires, or combined replacement of lamps and ballasts or drivers. Luminaire alterations do not include repairs, such as replacing lamps only, ballasts or drivers only, diffusers, shades, or luminaire covers.
- **Decorative** (Lighting/Luminaires) is lighting or luminaires installed only for aesthetic purposes and that does not serve as display lighting or general lighting. **Decorative luminaires are chandeliers, sconces, lanterns, neon or cold cathode, light emitting diodes, theatrical projectors, moving lights, and light color panels, not providing general lighting or task lighting.**
- **Ornamental** (Lighting/Luminaires) is lighting or luminaires installed outdoor which are rated for ~~30 watts~~ **50 watts or less** that are post-top luminaires, lanterns, pendant luminaires, chandeliers, and marquee lighting, not providing general lighting or task lighting.
- **LED Driver** is a device composed of a power source and light emitting diode (LED) control circuitry designed to operate an LED package (component), an LED array (module), or an LED lamp. **The output may be in the near ultraviolet, the visible or in the infrared regions of the spectrum.** LED Driver is a power source that adjusts the voltage or current to LEDs, ranging in complexity from a resistor to a constant voltage or constant current power supply. LED Driver is also known and referred to as Lamp Control Gear.





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Solar Readiness Requirements

- Mandates a minimum “Solar Zone” for:
 - Single Family (**without Photovoltaics**)
 - Low-rise Multifamily (**without Photovoltaics**)
 - Hotel/Motel Occupancies and High-rise Multifamily
 - All other Nonresidential Buildings 3 stories or less **except healthcare facilities I-2 and I-2.1 buildings, which do not have a photovoltaic system installed**
- Includes Shading and Design Load on Contract Documents. Details on interconnection Pathways, Documentation, and Main Service Panel requirements
- All sections on steep-sloped roofs shall have Azimuth Range of 90° - 300° of true north.



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What Buildings follow the Energy Code?

- Occupancy Group A, B, E, F, H, I, M, R, S, or U (Per T24 §100.0)
 - Exempts I-3 and I-4*
 - I-1: Not Used?
 - I-2: Hospitals, Child Care, Detox facilities, Nursing Homes
 - I-3: Prisons, Jails, Correction Centers, Detention Centers
 - I-4: Adult Care and Child Care facilities
 - Not Listed: L (Laboratories)
 - Exempts Qualified historic buildings. Bldg. departments may exempt temporary structures.
 - See Definition in §100.1 for Healthcare Facilities
- Nonresidential, high-rise residential, motel/hotel, and outdoor lighting (§130.0 - §130.5)
- Dwelling space of **High-rise residential units**, Fire Stations, **Dorms, Senior Housing** and Hotel/Motel guest rooms follow §150.0(k)
 - Outdoor lighting attached to **hotel building**, but separately controlled from the inside of a **high-rise unit or** guest room, also complies with §150.0(k)
 - In addition, Hotel/Motel guest rooms follow §130.1(c)8 & 130.5(d)4



* See <https://www.cityofsacramento.org/-/media/Corporate/Files/Fire/Guidebooks/Occupancy-Classifications.pdf>

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Line Voltage Luminaires

- §130.0(c)2 Wattage for luminaires with line voltage lamp holders and no **drivers**, transformers, or ballasts:
 - Is max relamping wattage labeled **per 130.0(c)1**
 - ~~Recessed with medium screw base shall not be less than 50W, or JAS-compliant lamps~~

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Commercial / Industrial Mandatory Requirements §130.1



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Manual Area Controls

- Each area enclosed by ceiling height partition shall have controls that allow the lighting in the area to be manually turned on and off.

- Manual Area Control Exception allows continuous ~~.1~~ **.2** W/ft²
- Must be a means of egress per CA Building Code §1008.
- Show on plans/specifications provided to AHJ
- Controls for egress lighting not accessible to unauthorized personnel.



- Manual Lighting Controls must be both:

- **Readily accessible**

- **Exceptions:** **Public** Restrooms with 2 or more stalls, stairwells, corridors, **areas of the building intended for access or use by the public**, and parking areas can use a device not accessible to unauthorized personnel

- **Located in the same area with the lighting it controls**

- **Exceptions:** In Malls and atria, **main entry lobbies**, Auditoriums, **dining areas**, Retail Sales Areas, Wholesale Showrooms, Commercial & Industrial storage areas, general Commercial & Industrial work areas, Conv/Arenas, psychiatric & secure healthcare areas, and areas where a manual control is a health or safety hazard, manual control device can be located so you can see controlled lights or visually display their status (pilot light)
- Note that for single occupant restrooms and bathing rooms, lighting control can be outside adjacent to door.

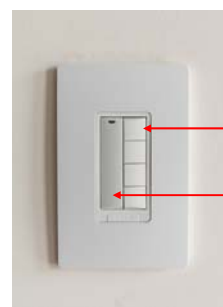
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Manual Area Controls

- Requires separate control (i.e., can be turned on/off by itself):

- General lighting, Floor Display, Wall Display, Window Display, Case Display, Ornamental, and Special Effects Lighting
- **Scene controllers may be used if at least one scene turns on general lighting only, and the control provides a means to manually turn off all lighting.**



OK if:
General Lighting Only

All Lighting Off

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General Lighting Multi-Level Controls




- General Lighting in any Area $\geq 100 \text{ ft}^2$ AND $> 0.5 \text{ W/ft}^2$
 - Shall provide multilevel lighting controls that allow the General Lighting to be adjusted up and down.
 - Meet control steps and uniformity criteria in Table 130.1-A
 - Classrooms with a connected general lighting load $\leq 0.7 \text{ W/ft}^2$ ~~0.6 W/ft²~~ need only one control step of 30-70% regardless of luminaire type
- Exceptions
 - Restrooms
 - Healthcare Facilities
 - Areas with a single 1- or 2-lamp, or one inseparable SSL, luminaire
- ~~Spaces exempted in Table 130.1-A: Minimum Control Steps:~~
 - ~~While "Areas required to be Full or Partial Off 130.1(c)6 and 7" was deleted, these spaces (library stack aisles, warehouse aisles and open areas, Corridors, Stairwells, Garage Areas, etc...) only require one control step of 20-60%~~

"General Lighting is installed electric lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting, and also known as ambient lighting."



Table 130.1-A: Multi-Level Lighting Controls & Uniformity

General Lighting Multi-Level Controls

	General Lighting Luminaire Type	Minimum Steps (% full power)	Uniform illuminance
	LED lamps and systems (& GU-24) Line Voltage sockets except GU-24, Low Voltage Incandescent,	Continuous dimming 10 – 100%	Continuous dimming 10-100% 
Unsure	Fluorescent luminaires	Continuous dimming 20-100%	Continuous dimming 20-100% 
Unsure	Linear/U-bent FL lamps > 13W	1. Full Power 2. High (75-85%) 3. Medium (50-70%) 4. Low (20-40%)	Continuous dimming Stepped dimming, Switching alternate lamps in a luminaire (min 4) 
	CF pin based > 20W GU-24 FL based > 20W	Continuous dimming 20 – 100% of full power	Continuous dimming
Unsure	Linear/U-bent FL lamps $\leq 13 \text{ W}$ Pin based CF $\leq 20 \text{ W}$ GU-24 FL $\leq 20 \text{ W}$ Track Lighting	One step 30-70%	Stepped dimming, Continuous dimming, Switching alternate lamps Track can use multi-circuit switching
	HID > 20 W Induction >25 W and others	One step 50-70%	Stepped dimming, Continuous dimming, Alternate (min 2) lamps in a luminaire

~~Exemptions: Classrooms $\leq 0.7 \text{ W/ft}^2$: 30-70% step-OK~~ Dimming = "Enabling Technology"
~~Library stack aisles, warehouse aisles and open areas, parking garages and areas, loading and unloading areas, stairwells, and corridors: 20-60% step required~~

Shut-Off Requirements

- All interior lighting, except in healthcare facilities, shall include controls to reduce power automatically when space typically unoccupied, by using:
 - Occupancy sensor
 - Automatic time switch
 - Other control device capable of turning off all lighting when space typ. unoccupied
- Separate Controls per floor (except Stairwells)
- Separate Controls per 5,000 ft²
 - 20,000 ft² for Malls, auditoriums, single tenant retail, industrial, convention, arenas
- ~~• Separate Controls for General, Display, Ornamental, and Display Case lighting~~
- ~~• Automatic time switch may include manual on mode~~
- Exceptions:
 - 24/7/365 operational areas
 - Areas that require Occupancy Sensors, or Partial Off Sensors
 - 0.1 W/ft² for means of egress areas. **Lighting providing egress illumination shall be configured to provide no less than what CA Building Code requires while in the Partial Off mode.**
 - Electrical Equipment Rooms - 110.26(d)
 - Illumination by emergency lighting equipment, powered by emergency power source or battery, that is ON only when normal power is absent.



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Countdown Timers and Time Clocks

- Countdown timer switches can only be used in:
 - Closets < 70 ft², set for ≤10 minutes
 - Server Aisles, set for ≤ 30 minutes
- Timeclock Override switching device
 - Meets Area Control requirements
 - Include manual on override ≤ 2 hours
 - Malls, single tenant retail, auditoriums, industrials, **laboratories** and arenas allowed longer via captive key switches
- Most sites require automatic holiday shutoff
 - Not needed in churches, retailers and malls, restaurants or theatres.



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Mandatory Use of Occupancy Sensors

- Occupant Sensing Controls must be installed in the following areas to shut off the lighting:
 - Offices ≤ 250 ft²
 - Multipurpose rooms ≤ 1000 ft²
 - Classrooms any size
 - Conference rooms any size
 - Restrooms of any size
- When multilevel lighting is required per §130.1(b), OS must be:
 - Partial On of between 50-70% lighting power
 - Vacancy Sensor (Manual ON) for All Lighting
- When multilevel lighting IS NOT required per §130.1(b), OS must be:
 - Occupancy Sensor
 - Partial On Occupancy Sensor
 - Vacancy Sensor (Manual On) for All Lighting
- Controls must allow the lights to be manually shut off in compliance with §130.1(a) regardless of the sensor's status



§110.9 Occupant Sensing Controls shall turn OFF all or part of the lighting ≤ 20 minutes after vacancy

Full OFF or Partial OFF Sensor WITH Auto Off

Space	Requirements
Warehouse Aisles & Open Areas 	<ul style="list-style-type: none"> • Sensor required for Hi/Lo $\geq 50\%$ reduction during the day, turn off when vacant • If LPD $\leq 80\%$ area LPD, $\geq 40\%$ reduction • If metal halide, $\geq 40\%$ reduction • Independent zones for each aisle
Library Stack Aisles one end ≥ 10 ft, and both ends ≥ 20 ft 	<ul style="list-style-type: none"> • Sensor required for Hi/Lo $\geq 50\%$ during the day, turn off when vacant • Independent zones for each aisle
Corridors & Stairwells 	<ul style="list-style-type: none"> • Sensor required for Hi/Lo (at least 50%) during the day in each separate space and shall be automatically activated from all designed paths of egress

Reminder: These spaces meet multilevel with single 20-60% control step



Meet MOSILO*: Multiple Occupancy Sensors In Large Offices

- Brings code language from IECC 2018 to Title 24
- Will make Luminaire Level Lighting Controls (LLLC) more attractive in CA



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*MOSILO anagram courtesy of Matt Schulz of ALR, Bay Area

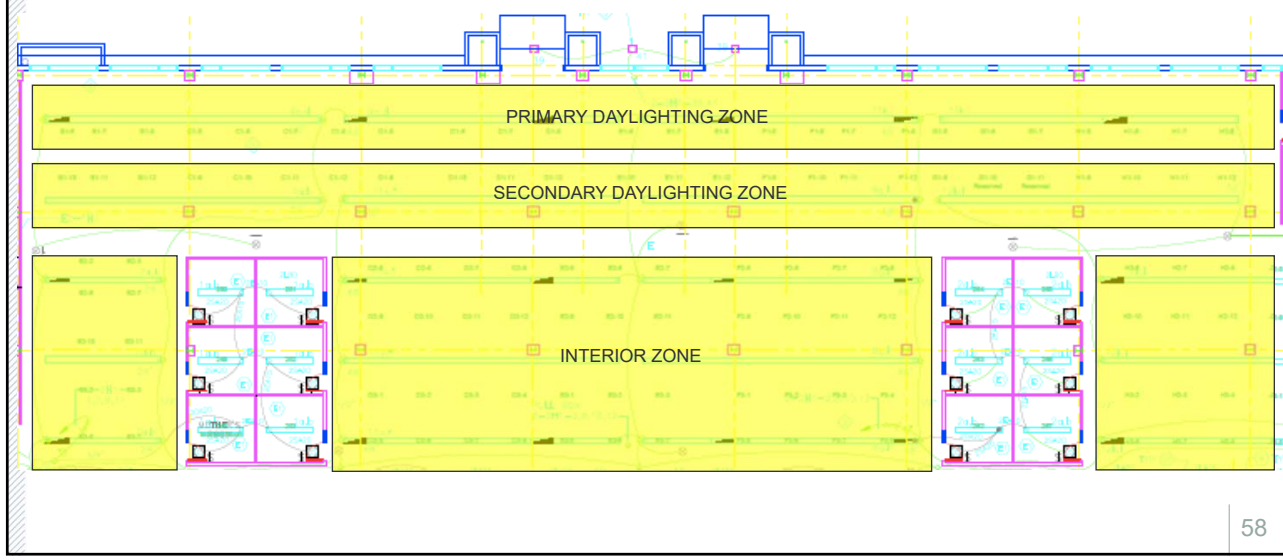


MOSILO Full OFF or Partial OFF Sensor WITH Auto Off

- In office spaces > 250 ft², **General Lighting** shall be controlled with occupant sensors
 - Lighting separated in control zones ≤ 600 ft²
 - Luminaires with embedded sensors can be considered their own control zone
 - Sensors can turn their control zone lighting **on to any level** upon occupancy
 - When a control zone becomes unoccupied, sensors shall uniformly reduce their lighting to ≤ 20% of full power (could be completely off)
 - When occupancy is detected in any control zone in the space, the lighting in other control zones that are unoccupied shall operate at no more than 20 percent of full power.
 - When the entire office space becomes unoccupied, sensors shall turn off all lighting in the space
- EXCEPTION for under-shelf or furniture-mounted task lighting controlled by a local switch and either a time switch or an occupancy sensor.

§ 130.1(c)6D: Indoor Lighting Controls

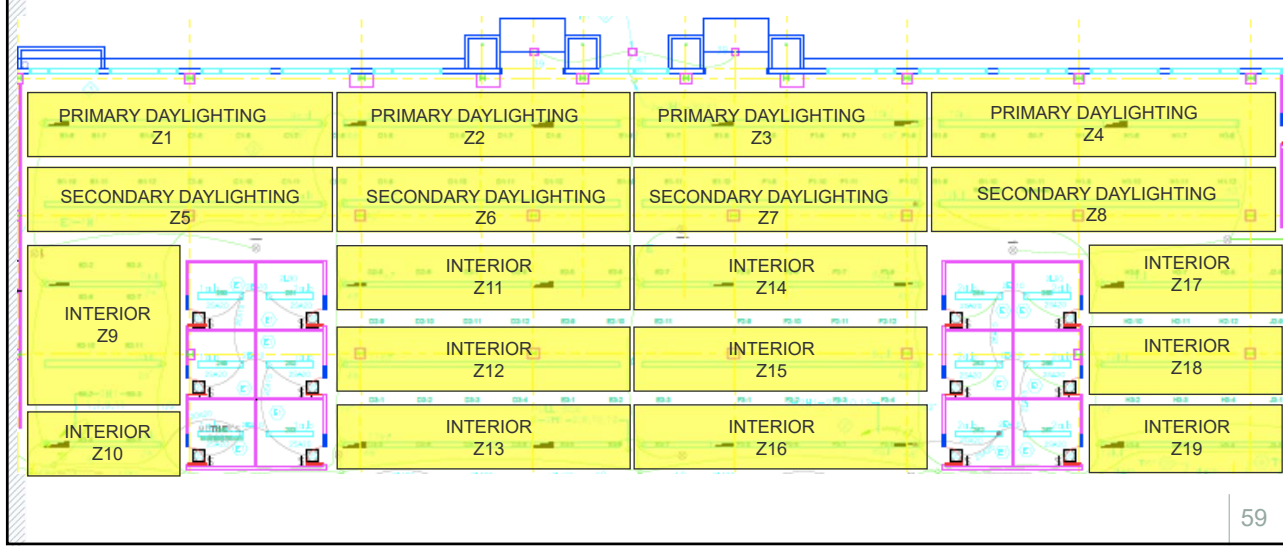
Pre-MOSILO Code Requirements = 3 Zones, any control



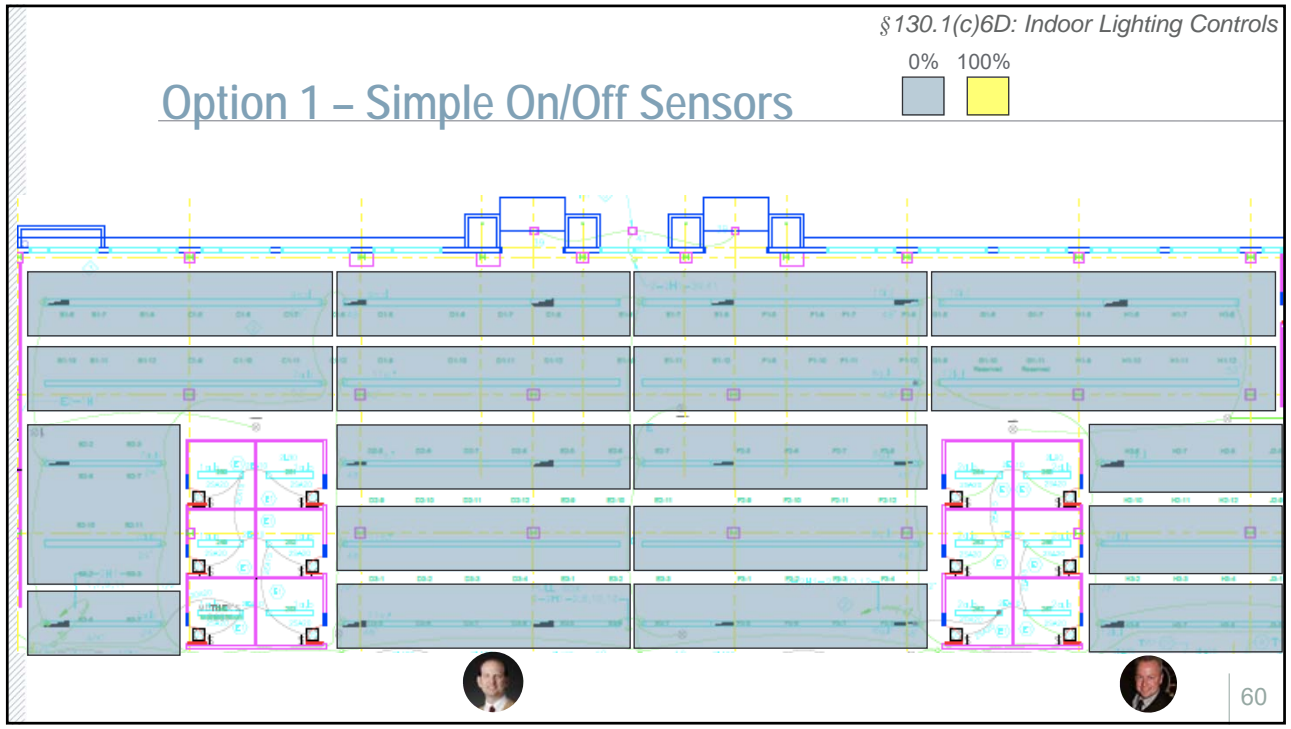
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§ 130.1(c)6D: Indoor Lighting Controls

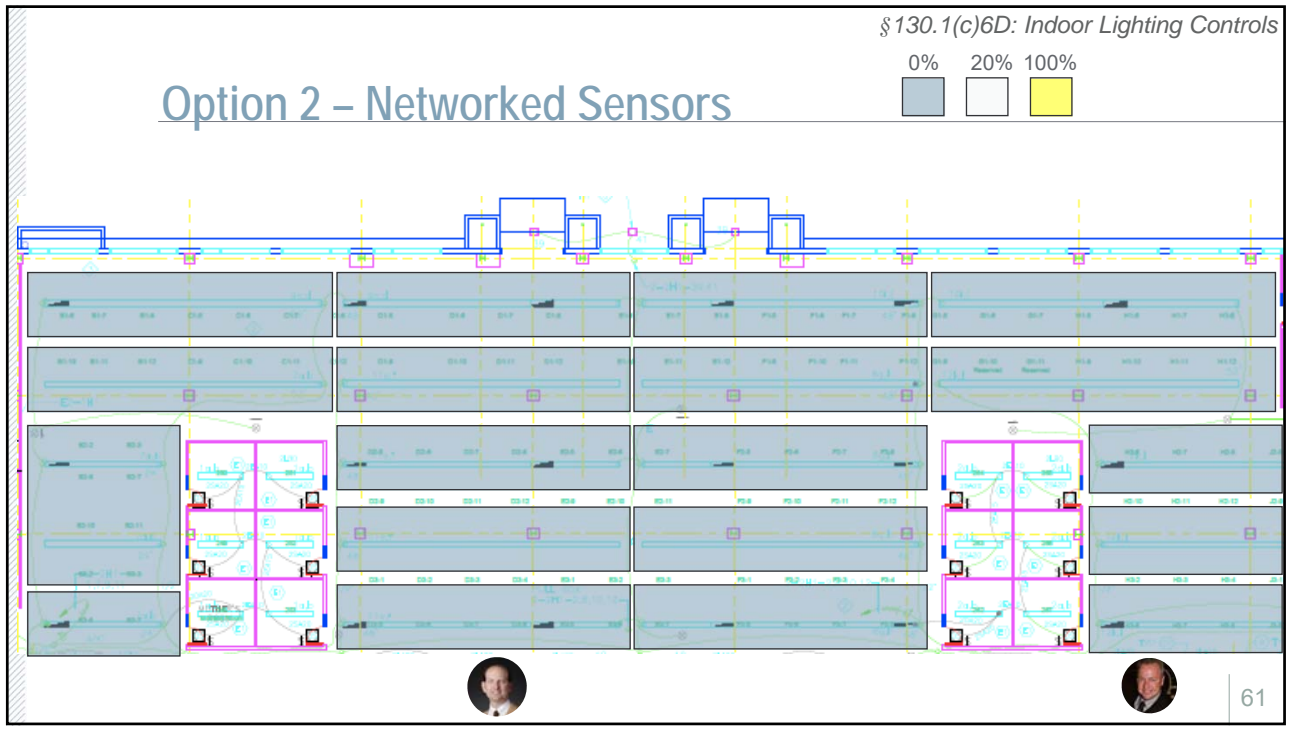
New MOSILO Requirement after Jan 1, 2023



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Thoughts and Takeaways on MOSILO

- Fortunately, applies only to General Lighting
 - Other lighting types can be controlled via Timeclock (or OS) up to 5,000ft²
- Who owns responsibility for determining the 600 ft² zones? Assuming designers will show zones on RCP
- No requirements / suggestions provided on manual area control devices in these spaces
- Can be done with non-intelligent individual fixture sensors that turn general lighting completely off, but that method likely not acceptable to many users.
- Doesn't require Wireless Communication, but that is an obvious way to simplify installation
- This, along with Demand Response, will be another key *entre* for Networked Lighting Controls, since some manufacturer's Wireless products may be easily networked.



§ 130.1(c)7: Indoor Lighting Controls

Partial Off Sensor WITHOUT Auto Off

Space	Requirements
Common Area Stairwells & Corridors in <ul style="list-style-type: none"> • Hotels/Motels • High-rise Resi 	<ul style="list-style-type: none"> • Hi/Lo (at least 50%) during the day in each separate space and shall be automatically activated from all designed paths of egress. • If LPD is ≤ 80% area method, ≥ 40% reduction
Parking garages (Interior) Parking areas Loading and unloading areas 	<ul style="list-style-type: none"> • Reduce <u>general lighting</u> watts to 20-50% • One sensor per 500 Watts max. • Meet uniformity levels in 131-A • Control each separate space and shall be automatically activated from all designed paths of egress. • If HID efficacy > 75 lumens/W, 20 - 60%

This was going to be just General Lighting - don't know why it was changed.

~~Reminder: These spaces meet multilevel with single 20-60% control stop~~

Guestrooms

- Ensure hotel and motel guest room lights are off within 20 minutes of space being vacated using:
 - Occupancy Sensors,
 - Automatic Controls, or
 - Captive Card Key
- Exemption for 1 high efficacy luminaire separately switched and within 6' of the door.



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Daylighting Definitions

- Three different Daylight Zones
- DO NOT double count overlapping areas
 - Skylit Daylight Area
 - Primary Sidelit Daylight Area
 - Secondary Sidelit Daylight Area
- All area measurements moved to definitions

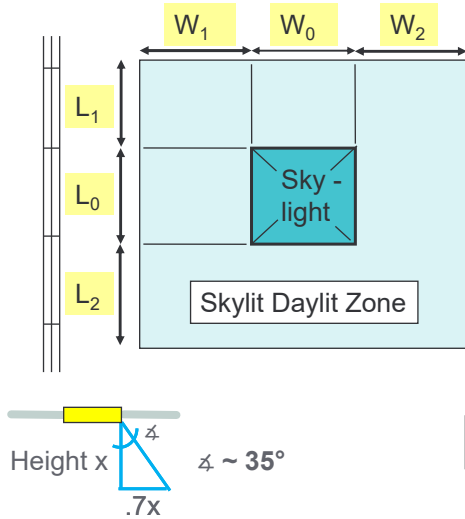
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§ 100.1: "Skylit Daylit Zone"

Skylit Area

Control luminaires in or partially in the daylit area



- L1, L2, W1, W2 = smallest of:
 - 70% of ceiling height of skylight or well, or
 - Distance to permanent obstruction
 - Obstruction if > 50% floor to skylight bottom
- Floor shape matches skylight

$$\text{Daylit area} = L \times W = (L_1 + L_0 + L_2) \times (W_1 + W_0 + W_2)$$

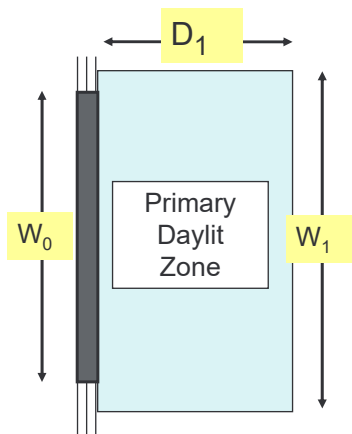
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§ 100.1: "Sidelit Daylit Zone, Primary"

Primary Sidelit Area

Control luminaires in the Primary Sidelit area



D1 = Window Head Height, or

- Distance to closest 60" high permanent obstruction*

W1 = Window Width (W0) + (on each side)

- .5 x Window Head Height, or
- Distance to closest 60" high permanent obstruction

$$\text{Primary Sidelit area} = (D_1) \times (W_1)$$

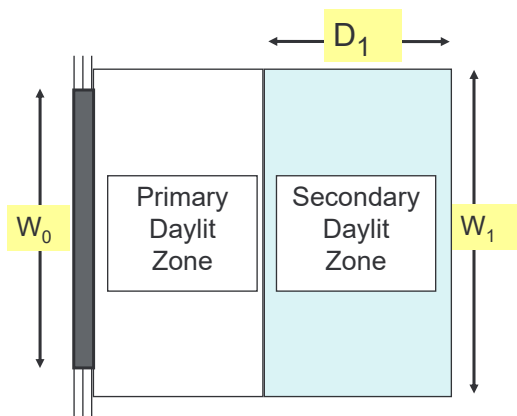
* Per Code, Cubical Walls ARE NOT Permanent

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§ 100.1: "Sidelit Daylit Zone, Secondary"

Secondary Sidelit Area



D_1 = Window Head Height, or

- Distance to closest 60" high permanent obstruction*

W_1 = Window Width (W_0) + (on each side):

- .5 x Window Head Height or
- Distance to closest 60" high permanent obstruction

$$\text{Secondary Sidelit area} = (D_1) \times (W_1)$$

* Per Code, Cubical Walls ARE NOT Permanent

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§ 130.1(d): Daylight

Daylight Areas

- General Lighting luminaires in* the **Skylit, Primary Sidelit, and Secondary Sidelit** daylight** zone, shall have automatic daylighting controls.
 - Control luminaires in each zone separately.
 - **Linear LED and similar SSL devices may be treated as linear lamps in 4' increments or smaller and controlled separately based on its zone.**

* in = at least 50% per p.5-14 of Non-Resi Compliance Manual

** Secondary Sidelit was required in §140.6(d), now called out in §130.1(d)

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Automatic Daylighting Control Device

- Install Automatic Daylighting Controls:
 - ~~At least one~~ Photosensors in a zone should not be accessible to unauthorized people, and calibrations are accessible to only authorized people (may be in locked case or under cover that requires a tool to open)
 - Daylighting controls provide continuous dim or # steps per multi-level controls in §130.1(b)
- Exceptions
 - When skylights blocked from sunlight > 1,500 Hours/Year, from 8am - 4pm
 - Areas next to vertical glazing entirely below overhangs where overhang projection/rise ratio is 1 (North) or 1.5 (S,E,W)
 - Example: If Projection of overhang = 12' & Rise (windowsill to overhang) = 10', therefore ratio = 1.2

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Automatic Daylighting (outside of garages)

- Show Skylit, Primary Sidelit, **and Secondary Sidelit** zones on the plans
- Automatic Daylighting Controls rules:
 - Combined illuminance from controlled lighting and daylight shall not be less than controlled lighting with no daylight.
 - When daylight illuminance >150% of design electric level **when no daylighting is available at full power**, the general lighting power in that zone shall be reduced by minimum **90% 65%** **i.e. DOES NOT mandate full off, but lower than before**
- Exceptions
 - When glazing in room is < 24 ft²
 - **Rooms where the combined total installed wattage of the general lighting in the skylit and primary sidelit zones is < 120W are not required to have daylighting controls for those zones.**
 - **Rooms where the total installed wattage of the general lighting in the secondary sidelit zones is < 120W are not required to have daylighting controls for that zone.**
 - Sidelit Daylit zones in retail merchandise sales & wholesale showrooms

Difficult language

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Automatic Daylighting (in parking garages)

- In Parking Garages, luminaires in the combined **Primary and Secondary Sidelit** daylit zone shall be controlled by automatic daylighting controls.
 - Show combined Primary and Secondary Sidelit zone on plans
 - Combined illuminance from controlled lighting and daylight shall not be less than controlled lighting with no daylight.
 - When illuminance > 150% of controlled lighting at the darkest point, the general lighting in that zone shall be at 0% power
 - ie DOES mandate full off
- Exceptions:
 - Total **Primary + Secondary Sidelit zone** < 60W
 - When < 36 ft² of windows or openings
 - Lighting in garage adaptation zones and dedicated ramps
 - (Note rooftop garages are considered exterior spaces)



<http://www.everastlight.com/>

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Demand Responsive Controls

- Moved from §130.1(e) to §110.12
- Buildings, other than healthcare facilities, shall comply with below:
 - All demand responsive controls shall be either
 1. A certified OpenADR 2.0a or 2.0b Virtual End Node (VEN), per OpenADR 2.0 Specification; or
 2. Certified by the manufacturer as being capable of responding to a DR signal from a certified OpenADR 2.0b VEN
 - DR Controls shall communicate **with the VEN** via **a wired or wireless bi-directional communication pathway** **Wi-Fi, ZigBee, BACnet, Ethernet, or hard wiring**
 - Still operate when DR signal disabled/unavailable
 - Demand responsive control thermostats shall comply with JA5
 - DR for Zonal HVAC Controls and Electronic Message Centers



CEC DR Website:

<https://www.energy.ca.gov/rules-and-regulations/building-energy-efficiency/manufacture-certification-building-equipment-3>

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110.12(a)1.B: Self Certified Communication with a VEN

Hardwired Solution for Demand Response

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§ 110.12(c): Demand Responsive Lighting

Demand Responsive Lighting

- Buildings having total installed lighting power of $\geq 4,000W$ ~~$> 10,000$~~ -ft² **subject to §130.1(b)** shall be capable of automatically reducing power by DR.
- DR controls shall control the general lighting subject to requirements of §130.1(b), and may control additional lighting
- For Compliance Testing, show Total Lighting Power reduction by at least 15% as described in NA7.6.3
- Reduce per uniformity in TABLE 130.1-A.
- Exceptions
 - ~~Spaces $\leq 0.5W/ft^2$ LPD, or~~
 - Spaces where health or life safety statute, ordinance, or regulation do not permit general lighting to be reduced don't required DR controls and don't count toward the ~~4,000W~~ ~~10,000-ft²~~
 - Alterations & Additions exempt $\leq 4,000W$ ~~10,000-ft²~~
- **Notes:**
 - The new phrase "**subject to §130.1(b)**" is as subtle as it is important as it does the following...
 - Eliminates any **non-General Lighting** from requirement (strongly believe this is new)
 - As before, **lighting in rooms $\leq .5W/ft^2$ LPD is exempt**
 - **Now Eliminates any room $< 100ft^2$**
 - **Now Eliminates any room with a single 1- or 2-lamp, or one inseparable SSL, luminaire**
 - **Now Eliminates any Restroom**
 - 50% minimum level in Acceptance Testing forms was eliminated

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§110.12(e): Demand Responsive Lighting

Demand Responsive Example



Courtesy
ALR

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§110.12(e): Demand Responsive Lighting

Demand Responsive Example



- 2022 Exemptions:
- All non-General Lts
 - General Lts ≤ 0.5 W/ft²
 - Spaces < 100 ft²
 - Spaces with 1 SSL
 - Restrooms

e.g. Many open offices,
small offices, corridors,
and storage exempt

Courtesy
ALR

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Demand Responsive Controlled Receptacles

- Controlled receptacles in buildings shall be capable of automatically turning off all loads connected to the receptacle in response to a demand response signal.
- Exceptions
 - Buildings not required to have demand responsive lighting controls.
 - Spaces where a health or life safety statute, ordinance, or regulation does not permit the receptacles to be automatically controlled.

DR for Lighting?	Plug Load?	Plug Load on DR?
Required on Project	Required	Yes
	Not Required	No
Not Required on Project	Required	No
	Not Required	No

Notes:

- Can ignore when Controlled Receptacles are not required by code for that project or that space. See Power Alterations §141.0(b)2P.
- While DR may not be required for lighting in small offices, it's possible DR for controlled receptacles may be required in those same small offices

Controlled Receptacle Spaces

- Office Areas
- Lobbies
- Conference rooms
- Copy rooms
- Kitchen Areas (in office spaces)

Control Interactions

Lighting controls per §130.1 must permit / incorporate functions of the controls in other sections.

- For general lighting, the **manual area control** shall permit the level or amount of light provided while the lighting is on to be set or adjusted **by the controls specified in §130.1(b), (c), (d), and (e)**.
- The **manual area control** shall permit the **shutoff control** to turn the lighting down or off.
- The **multi-level lighting control** shall permit the **automatic daylighting control** to adjust the electric lighting as daylight changes
- The **multi-level lighting control** shall permit the **demand responsive control** to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.
- The **shutoff control** shall permit the **manual area control** to turn the lighting on. An on request during timeclock's off time should be treated as override request
- The **automatic daylighting control** permits **multi-level lighting control to adjust** the level of lighting.
- For lighting controlled by **multi-level lighting controls** and **by occupant sensing controls that provide an automatic-on function**, the controls shall provide a partial-on function that is capable of automatically activating between 50-70% lighting power. **NOTE: This is incorrect based on §130.1(c)6D:**
- Reserved
- For **space conditioning system zones** serving only spaces that are required to have occupant sensing controls as specified in Section 130.1(c)5, 6 and 7, and where Table 120.1-A allows the ventilation air to be reduced to zero when the space is in occupied-standby mode, the space conditioning system shall be controlled by occupancy sensing controls as specified in Section 120.2(e)3.**



Outdoor Lighting Fixtures & Controls §130.2



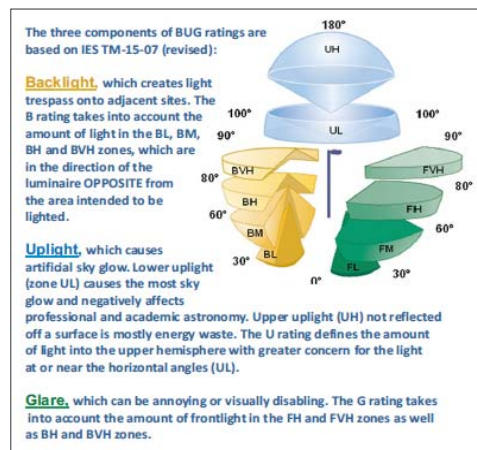
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§130.2(a)-(b): Outdoor Lighting Controls and Equipment

Exterior Lighting and Cutoff

- Outdoor luminaires > 6,200 lumens follow Backlight, Uplight, and Glare (BUG) requirements per T24 Part 11 §5.106.8
- Exceptions:
 - Signs, façade lighting (not wallpacks), **public art**, statues, bridges, health or life safety lighting to be cutoff, temporary...
 - When replacing some existing Pole Luminaires (see code)
 - Luminaires that illuminate public right of way roads, sidewalks, and bikeways.
 - Outdoor lighting attached to **high-rise resi-or** motel/hotel building and controlled separately from **dwelling-unit-or** guest room



From IDA-IES Model Lighting Ordinance

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Outdoor Controls – General Requirements

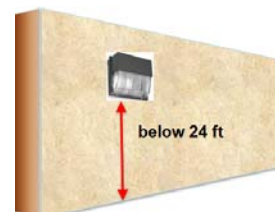
- All installed outdoor lighting shall be controlled separately from other electrical loads
 - Exceptions:
 - Lights that health and life safety regulations say cannot be turned off, and
 - 24/7 Tunnel Lighting
- Be Auto-OFF by a photo control, astronomical time switch, or other control when daylight is available.

Outdoor Controls - Scheduling

- Outdoor Automatic scheduling controls shall:
 - Be installed for all outdoor lighting (& with motion sensing or other controls)
 - Be capable of reducing outdoor lighting power by 50-90%, and separately capable of turning the lighting OFF during scheduled unoccupied periods.
 - Allow scheduling of at least two nighttime periods with independent lighting levels
 - May include a 2 hours override function.

Outdoor Controls – Motion Sensing Controls

- Install Motion sensing controls for the following luminaires (may be installed for other outdoor lighting and in combination with other outdoor lighting controls):
 - Outdoor luminaires where the bottom of luminaire is mounted 24 feet or less above grade;
 - (Except for **Building Façade, Ornamental Hardscape, Outdoor Dining, or Outdoor Sales Frontage lighting**)
 - Outdoor wall mounted luminaires installed for Building Façade, Ornamental Hardscape or Outdoor Dining lighting with a bilaterally symmetric distribution (ie “wall packs”) mounted 24 feet above grade or lower.
- Outdoor Motion Sensing controls shall be capable of:
 - Reducing each luminaire's lighting power by 50-90%, and separately capable of turning the lighting OFF during scheduled unoccupied periods.
 - Reducing the lighting to its dim or OFF state within 15 minutes of vacancy and returning the lighting to its ON state when the area becomes occupied.
- A single sensor **or single zone** should control $\leq 1,500\text{W}$ of lighting power
- Motion Sensor Control Exemptions
 - Luminaires with max rated wattage $\leq 40\text{W}$ each
 - Applications listed in §140.7
 - When Health or Life Safety ordinances/regulations require > 15 min time-out period, or $> 50\%$ min dimming level to comply



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Exterior Lighting Exempted in §140.7(a)

When more than 50 percent of the light from a luminaire falls within one or more of the following applications

1. Temporary outdoor lighting.
2. FAA and Coast Guard required and regulated lighting.
3. **Lighting for public streets, roadways, highways, and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.**
4. Lighting for sports and athletic fields, and children's playgrounds.
5. Lighting for industrial sites, ie: rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting specifically for ATMs.
7. Lighting of signs complying with the requirements of §130.3 and 140.8.
8. **ADA Lighting of tunnels, bridges, stairs, wheelchair elevator lifts, and ramps that are other than parking garage ramps.**
9. **Landscape lighting.**
10. In theme parks: outdoor lighting only for themes and special effects.
11. Lighting for outdoor theatrical and other outdoor live performances (provided there is other Area Lighting, and it's controlled by a theatrical system).
12. Some Outdoor lighting systems for qualified historic buildings, if they consist solely of historic lighting components or replicas of historic lighting components. Other lighting components are not exempt.

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Acceptance and Certificate Requirements

- Mandates certification of lighting controls before occupancy permit granted, except for healthcare facilities which have to comply with OSHPD. Compliance with Part 6 requirements for plans, specifications, installation certificates, operating and maintenance info
- Applicable Procedures for Acceptance testing performed by CLCATT on:
 - Daylighting controls: §130.1(d) and Nonresidential Appendix NA7.6.1
 - Shut Off Lighting Controls: §130.1(c) & NA7.6.2
 - Demand Responsive: §130.1(e) & NA7.6.3
 - **Controllable Receptacles**
 - Outdoor Lighting Controls: §130.2(c) & NA7.8
 - Institutional Tuning PAF: §140.6(a)2J & NA7.7.6.2
- Installation Certificate by someone by Div 3. (C-10, Architect, GC) requirements for specific applications
 - Includes Lighting Control Systems: NA7.7.1
 - EMCS NA7.7.2
 - Interlocked systems § 140.6(a)1: NA7.7.5
 - Power Adjustment Factors: NA7.7.6
 - Videoconference Studios : NA7.7.7
- The acceptance testing shall be performed by a Certified Lighting Controls Acceptance Test Technician (CLCATT).

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Electrical Power Distribution Systems §130.5



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Controlled Receptacles

- Provide Controlled Receptacles (CRs) and Uncontrolled Receptacles (UCRs) in the following spaces:
 - **Office Areas**
 - **Lobbies**
 - **Conference rooms**
 - **Copy rooms**
 - **Kitchen Areas (in office spaces)**
- Install automatic shut-off controls so when space is shut off when unoccupied at the receptacle or receptacle circuit
 - If a Time Switch, must have a max 2 hr override Time Delay
 - Can't use Countdown Timer Switches
- Rules
 - At least one CR within 6' foot from each UCR, or a split wired duplex receptacle
 - Where receptacles are installed in modular furniture in open office areas, at least one controlled receptacle shall be installed at each workstation
 - CR shall have a permanent and durable marking to differentiate them from UCR
- Exception for healthcare facilities



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Controlled Receptacles (con't)

- In hotel and motel guest rooms, at least 50% of receptacles shall be controlled off via sensors, captive card key controls or automatic controls so they are off within 30 minutes of vacancy
 - NOTE: A hardwired power strip controlled by an occupant sensing control may be used. Plug-in strips and other plug-in devices shall not be used to comply with the requirements of this Section.
- EXEMPTIONS: Refrigerators & water dispensers in kitchen areas, clock receptacles above 6', copy room machinery (but not PCs), circuits above 20Amp, and marked receptacles connected to a 24/7 UPS.
- Adds language saying to consider Demand Response 110.12



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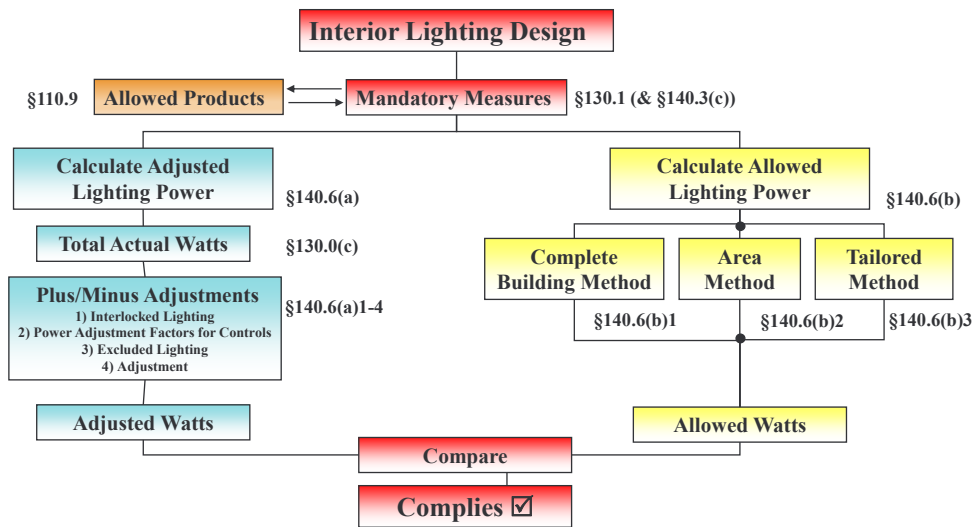
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Compliance Road Choice

Performance vs. Prescriptive

- Regardless of method, nonresidential, highrise resi, and motel/hotel buildings need to meet **§120.0 - §130.5**
- Performance Method based on comparison of TDV energy against energy budget from §140.1 calculated with a CEC approved software.
 - Time Dependant Valuation (TDV) energy is the time varying energy used by the buildings, including space conditioning, water heating, lighting, and mechanical ventilation.
 - TDV varies for each hour of the year, and energy type, by climate zone, and building type.
- Prescriptive is per §140.3 - ~~§140.10~~ **§140.9**

Prescriptive Indoor Lighting Overview



§140.6(a): Prescriptive Requirements for Indoor Lighting

Actual Lighting Power Density (LPD)

- Adjusted must be less than Allowed
- Include Permanent and Portable Lighting
- Calculate Allowed Indoor Lighting Power with one of the following
 - Complete Building
 - Area Category
 - Tailored Method

Don't forget Portable
Lighting Exemption
in the Area Table

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§140.6(a)2: Prescriptive Requirements for Indoor Lighting

Reduction of Wattage through Controls

- Controlled watts of permanently installed General Lighting may be reduced by watts x PAF Table 140.6-A when used with permanently installed nonresidential rated controls
- Specific rules for each power adjustment factor in the table are discussed in §140.6(a)2
 - Only 1 PAF may be used for each qualifying luminaire. PAFs can't be added together unless allowed in Table 140.6-A
 - Rules for PAFs for furniture mounted luminaires (installed, indirect lighting, exempt power, etc.)
 - 50% light output in application area
 - Daylight Dimming with OFF, and institutional Tuning PAFs
 - PAFs for clerestory fenestrations, horizontal slats, or light shelves.



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Table 140.6-A: Lighting Power Adjustment Factors

Lighting Power Adjustment Factors

TABLE 140.6-A—LIGHTING POWER ADJUSTMENT FACTORS (PAF)

TYPE OF CONTROL	TYPE OF AREA	FACTOR
<p>a. To qualify for any of the Power Adjustment Factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2</p> <p>b. Only one PAF may be used for each qualifying luminaire unless combined below.</p> <p>c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF</p>		
1. Daylight Continuous Dimming plus OFF Control	Luminaires in skylit daylight zone or primary sidelit daylight zone or secondary sidelit daylight zone	0.10
2. Occupant Sensing Controls in large Open-Plan Offices Larger than 250 square feet	In open-plan offices > 250 square feet—One sensor controlling an area that is:	No larger than 125 square feet
		From 126 to 250 square feet
		From 251 to 500 square feet
3. Institutional Tuning	Luminaires in non-daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10
4. Demand Responsive Control	Luminaires in daylight areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
	All building types of 10,000 square feet or smaller—General lighting luminaires not in the scope of Section 110.12(c). Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF.	0.05
5. Clerestory Fenestration	Luminaires in daylight areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
6. Horizontal Slats	Luminaires in daylight areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
7. Light Shelves	Luminaires in daylight areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.10

MOSILO Normally

This means no PAF for other lighting (ie: in stores)

Note: Per § 140.6(a)2, only applies to General Lighting. Includes furniture mounted lighting if hardwired and indirect.

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§ 140.6(a)3: Lighting Wattage Excluded

Lighting Power Deductions

- Lighting Watts from many applications are exempted:
 - Lighting for theme and special effects in theme parks
 - Lighting for film, video, and photography studios
 - Theatrical controlled by multiscene or crossfade controller, or makeup, hair and costume lighting controlled by vacancy sensor
 - Pre-installed in walk-in coolers/freezers, vending machine, food prep, and scientific/industrial equipment
 - In office bldgs. with medical/clinic/healthcare spaces, Separately switched medical lighting in addition to general lighting (Exam, Surgical, low-ambient night-lights, and integral to medical equipment).
 - Lighting for plant growth in non-CEH spaces (must have timeclock)
 - Lighting that is for sale
 - Exit Signs if they have maximum lamp power 5W/face
 - Guestrooms in Hotel/Motels, High-rise Resi Living quarters
 - Temporary Lighting Systems
 - Lighting in Elevators per §120.6(f)
 - Lighting connected to Life Safety
 - Horticultural lighting in CEH spaces complying with §120.6(h), or
 - Others... See Complete List!

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§ 140.6(a)4: Lighting Power Adjustment Excluded

Luminaire Power Adjustment

- Determine Luminaire Classification and Power per §130.0(c).
- Small Aperture Tunable-White and Dim-to-Warm LED luminaire power can be reduced by ~~20%~~ **25%** (multiply maximum rated wattage by .80), if all below met:
 1. **Small Aperture:** Luminaires **with aperture length** > 18" must have ≤ 4" wide aperture; luminaires ≤ 18" must be ≤ 8" wide.
 2. **Color Changing:** Tunable-white luminaires shall be capable of a color change ≥ 2000°Kelvin CCT; Dim-to-warm luminaires shall be capable of color change ≥ 500°Kelvin CCT.
 3. **Controls:** Luminaires must be connected to controls that provides CCT change

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§ 140.6(b) : Prescriptive Requirements for Indoor Lighting

Indoor Lighting Power General Rules

- Conditioned and unconditioned spaces must be calculated separately - no trading allowed
- No trading between indoor and outdoor areas
- Some restrictions on power allotments other than General Lighting
- Three possible methods:
 - Complete Building Method
 - Area Category Method (can be combined with Tailored Method)
 - LPD for some tasks/items can't be raised by decreasing others
 - Tailored Method (can be combined with Area)
 - LPD for Wall / Floor / Ornamental / Valuable Case can't be traded

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§ 140.6(c)1 : Prescriptive Requirements for Indoor Lighting

Calc Allowed Indoor Lighting Power Density

Choose between 3 methods

1. Complete Building Method

- Must be listed specifically, and can only apply to one building
 - Exception: If combination parking garage and another type use building, then each portion can be determined separately using complete building method for each.
- Can use for building or tenant space where one type of use accounts at least 90% of the space

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Table 146-E

Complete Bldg. – Lighting Power Density

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Assembly Building	0.700.65
Bank or Financial Institution Building	0.65
Industrial/Manufacturing Facility Building	0.60
Grocery Store Building	0.950.90
Gymnasium Building	0.650.60
Healthcare Facility	0.90
Industrial/Manufacturing Facility Building	0.60
Library Building	0.70
Motion Picture Theater Building	0.60
Museum Building	0.65
Office Building	0.650.60
Parking Garage Building	0.13
Performing Arts Theater Building	0.75
Religious Facility Building	0.70
Restaurant Building	0.700.65
Retail Store Building	0.90
School Building	0.650.60
Sports Arena Building	0.75
Motion Picture Theater Building	0.70
Performing Arts Theater Building	0.80
All others buildings	0.40

$$\% \text{ Diff} = \frac{\text{New} - \text{Old}}{\text{Old}} * 100$$

2022 Code 2019 Code
-7.14%% -50.00%

-7.69% -18.75%

-7.69% -31.58%

Note: 2 New Building Types

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§ 140.6(c)2 : Prescriptive Requirements for Indoor Lighting

Calc Allowed Indoor Lighting Power Density

Choose between 3 methods

2. Area Category Method

- Total allowed lighting power is the sum of the allowed lighting powers for all individual areas
- Multi-tenant areas with an unknown tenant, use 0.4W/ft² 0.6W/ft² for lighting (Unleased Tenant Area)
- Allowance in Table's footnote for specialized tasks, ornamental, precision, accent, display, decorative, video conferencing, white and chalk boards under specific conditions

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Table 140.6-C

Area Method – Lighting Power Density

Primary Function Area	Allowed Lighting Power Density for General Lighting (W/ft ²)	Additional Lighting Power ⁴	
		Qualified Lighting Systems	Additional Allowance (W/ft ² , unless noted otherwise)
Aging Eye/Low-vision ¹¹	Corridor Area	0.70	Decorative/Display 0.30
	Dining	0.80	Decorative/Display 0.30
			Tunable white or dim-to-warm ¹⁰ 0.10
	Lobby, Main Entry	0.85	Decorative/Display 0.30
			Transition Lighting OFF at night ¹² 0.95
			Tunable white or dim-to-warm ¹⁰ 0.10
	Lounge/Waiting Area	0.80	Decorative/Display 0.30
			Tunable white or dim-to-warm ¹⁰ 0.10
	Multipurpose Room	0.85	Decorative/Display 0.30
			Tunable white or dim-to-warm ¹⁰ 0.10
Religious Worship Area	1.00	Decorative/Display 0.30	
		Tunable white or dim-to-warm ¹⁰ 0.10	
Restroom	1.00	Decorative/Display 0.30	
Stairwell	0.80	Decorative/Display 0.30	

Decorative/Display added

Audience Seating Area	0.50	Decorative/Display	0.25
Auditorium Area	0.70	Decorative/Display	0.45
Auto Repair / Maintenance Area	0.55	Detailed Task Work ⁷	0.20
Barber, Beauty Salon, Spa Area	0.60-0.70	Detailed Task Work ⁷	0.20-0.30
		Decorative/Display	0.25
Child Meeting Place Area	0.80	Decorative/Display	0.25
Classroom, Lecture, Training, Vocational Area	0.60	White or Chalk Board ⁸	7 W/ft
Concourse and Atria Area	0.60	Decorative/Display	0.25
Convention, Conference, Multipurpose and Meeting Area	0.250-0.40	Shipping & Handling	0.35
Convention, Conference, Multipurpose and Meeting Area, Convention, Conference, Multipurpose and Meeting Area		Decorative/Display Ornamental	0.250-0.30
Copy Room	0.50	-	-
Corridor Area	0.600-0.40	Decorative/Display	0.25

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Table 140.6-C

Area Method – Lighting Power Density (cont. 2)

Dining Area	Bar/Lounge and Fine Dining	0.45/0.45	Decorative/Display Ornamental	0.40/0.35
	Cafeteria/Fast Food	0.45	Decorative/Display	0.25
	Family and Leisure	0.40	Decorative/Display	0.25
Electrical, Mechanical, Telephone Rooms		0.40	Detailed Task Work ⁷	0.20
Exercise/Fitness Center and Gymnasium Area		0.50	-	-
Financial Transaction Area		0.70	Decorative/Display	0.25
Hotel-Function Area		0.65	Ornamental	0.30
Healthcare Facility and Hospitals	Exam/Treatment Room	1.15	-	-
	Imaging Room	0.60	Decorative/Display	0.20
			Tunable white or dim-to-warm ¹⁰	0.10
	Medical Supply Room	0.55	-	-
	Nursery	0.80	Tunable white or dim-to-warm ¹⁰	0.10
	Nurse's Station	0.85	Tunable white or dim-to-warm ¹⁰	0.10
			Detailed Task Work ⁷	0.20
	Operating Room	1.20	-	-
	Patient Room	0.70	Decorative/Display	0.15
			Tunable white or dim-to-warm ¹⁰	0.10
Physical Therapy Room	0.75	Tunable white or dim-to-warm ¹⁰	0.10	
Recovery Room	0.90	Tunable white or dim-to-warm ¹⁰	0.10	

Hotel Function Area		0.85	Decorative/Display	0.25
Kitchen/Food Preparation Area		0.95	-	-
Laboratory, Scientific		0.90	Specialized Task Work ⁴	0.35
Laundry Area		0.45	-	-
Library	Reading Area	0.80	Decorative/Display	0.25
	Stacks Area	1.00	-	-
Lobby, Main Entry		0.70	Decorative/Display	0.40/0.25
Locker Room		0.45	-	-
Lounge, Breakroom, or Waiting Area		0.55	Decorative/Display	0.25
Manufacturing, Commercial & Industrial Work Area	Low Bay	0.60	Detailed Task Work ⁷	0.20
	High Bay	0.65	Detailed Task Work ⁷	0.20
	Precision	0.85	Precision Specialized Work ⁴	0.70
Museum Area	Exhibition/Display	0.60	Accent, display and feature ⁸ Decorative/Display	0.40/0.45
	Restoration Room	0.25/0.70	Detailed Task Work ⁷	0.20/0.35
	> 250 square feet ≤ 250 square feet Open-plan office	0.40/0.60 0.20/0.65 0.60	Decorative/Display and Portable lighting for office areas ⁹	0.20
Parking Garage Area	Parking Zone and Ramps	0.10	First ATM or Ticket Machine Additional ATM or Ticket Machine	100 W 50 W each
	Daylight Adaptation Zones ⁷	0.40/1.00	-	-

Here's portable lighting @ .2W/sqft

Table 140.6-C

Area Method – Lighting Power Density (cont. 3)

Pharmacy Area		1.40/1.00	Specialized Task Work ⁴	0.35
Retail Sales Area	Grocery Sales	1.05/1.00	Accent, display and feature ⁸	0.20
			Decorative/Display	0.45/0.35
	Retail Merchandise Sales	1.00/0.95	Accent, display and feature ⁸ Decorative/Display/Decorative	0.20 0.45/0.35
	Fitting Room	0.60	External Illuminated Mirror ³ Internal Illuminated Mirror ³	40 W/ea 120 W/ea
Religious Worship Area		0.95	Decorative/Display	0.25
Restrooms		0.65	Decorative/Display	0.35
Sports Arena – Playing Area	Class I Facility ¹¹	2.25	-	-
Sports Arena – Playing Area	Class II Facility ¹¹	1.45	-	-
Sports Arena – Playing Area	Class III Facility ¹¹	1.10	-	-
Sports Arena – Playing Area	Class IV Facility ¹¹	0.75	-	-
Theater Area	Motion picture	0.50	Decorative/Display	0.25
Theater Area	Performance	0.80	Decorative/Display	0.25
Transportation Function	Baggage Area	0.40	-	-
	Ticketing Area	0.45	Decorative/Display	0.20
Videoconferencing Studio		0.90	Videoconferencing ¹⁴	1.00
All other		0.40	-	-

Calc Allowed Indoor Lighting Power Density

- Choose between 3 methods

3. Tailored Method

- Based on Lux
- Use on projects with primary function areas that do not use the Area Category Method
- Voluminous clarifications for most specific applications have been added to the code
 - Wall, Floor, ~~Decorative Ornamental~~/Special Effect, Valuable Case

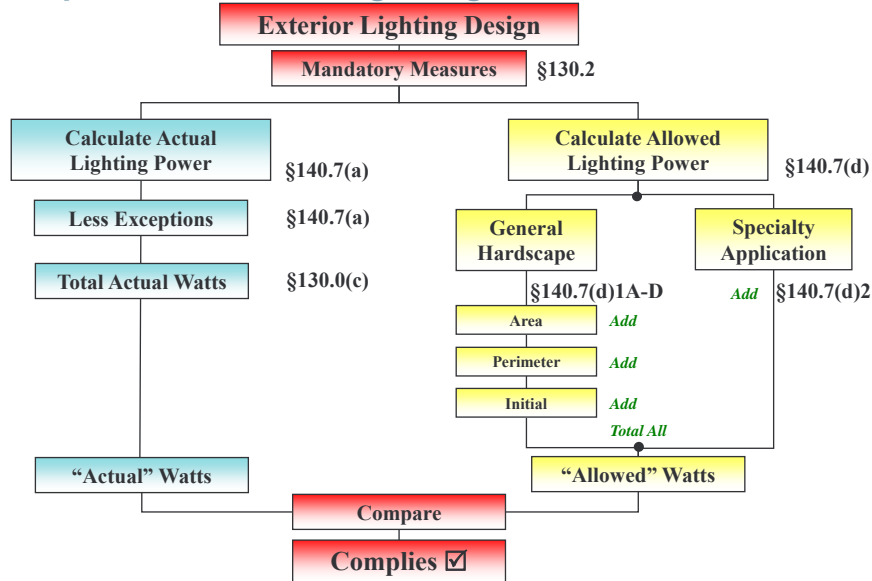


Secondary Sidelit Daylight Areas

- ~~General Lighting luminaires in, or partially in, the Secondary Sidelit daylight area shall be controlled independently from other fixtures by automatic daylighting controls.~~
- ~~Follow applicable §130.1(d) requirements (note parking garages per §130.1(d)3 which combines Primary and Secondary zones)~~
- ~~Show Secondary Sidelit Daylit zones on the plans~~
- ~~Exceptions~~
 - ~~When general lighting power in Secondary Daylit Zone(s) is < 120 W, or when power in Primary and Secondary Daylit Zone(s) is < 240 W.~~
 - ~~Areas next to vertical glazing entirely below overhangs where there is no vertical glazing above the overhang and where overhang projection/rise ratio is 1 (North) or 1.5 (S,E,W)~~
 - ~~Rooms with glazing area < 24 ft², or parking garage areas < 36 ft² of glazing or opening.~~
 - ~~Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.~~

§ 140.7: Prescriptive Requirements for Outdoor Lighting

Prescriptive Outdoor Lighting Overview



§10-114-A: Outdoor Lighting Zones

Determination of Outdoor Lighting Zones

Zone	Ambient Illumination	Statewide Default Location	Moving Up to Higher Zone	Moving Down to Lower Zones
LZ0	Very Low	Undeveloped areas of government designated parks, recreation areas, and wildlife preserves	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.	Not applicable
LZ1	Low	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.	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 a 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.	Not applicable.
LZ2	Moderate	Rural areas, 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.	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 rural mixed-use residential area or city center.	Special districts and government designated parks within a default LZ2 zone may be designated as LZ1 by the local jurisdiction for lower illumination standards, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census. The following building types may occur here: high intensity commercial corridors, entertainment centers, and heavy industrial or manufacturing zone districts.	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.	Special districts and government designated parks within a default LZ3 zone may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None	Not applicable.	Not applicable.



§ 140.7(d): Requirements for Outdoor Lighting

General Hardscape Is A Total Of:

- **Area Based**
 - Total all "Illuminated Areas", which is a Square with sides = 10 x mounting height, centered each luminaire or pole
 - Multiply "Illuminated Area" x Area Allowance in Table 140.7-A
- **Perimeter Based**
 - Perimeter Illuminated Hardscape, less small landscape areas and permanent planters
 - Multiply Illuminated Perimeter x Linear Allowance Table 140.7-A
- **Initial Wattage**
 - One time allowance of power per site per Table 140.7-A

TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 1 ²		Lighting Zone 2 ²		Lighting Zone 3 ³		Lighting Zone 4 ³
	Asphalt/Concrete	Asphalt/Concrete	Asphalt	Concrete ²	Asphalt	Concrete ²	Asphalt/Concrete
Area Wattage Allowance (AWA)	No allowance ¹	0.0180-0.016 W/ft ²	0.0230-0.019 W/ft ²	0.025 W/ft ²	0.0250-0.021 W/ft ²	0.03-W/ft ²	0.030-0.024 W/ft ²
Linear Wattage Allowance (LWA)	No allowance ¹	0.150-13 W/lf	0.170-15 W/lf	0.4-W/lf	0.250-20 W/lf	0.4-W/lf	0.250-29 W/lf
Initial Wattage Allowance (IWA)	No allowance ¹	180-150 W	250-200 W	250-W	250-250 W	250-W	400-320 W

¹Continuous 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).

²Narrow 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.

T24 2019 (Concrete vs. Asphalt LZ 2 & 3) changes have been dropped

Note: Different Values and No Linear Wattage Allowance in Multifamily Table 170.2-R



§ 147(c)2A-D: Allowed Application Specific Outdoor Lighting Power

Specific Application – "Use It or Lose It"

- Similar to Indoor Lighting for Specific Applications, but for Outdoor Applications. Review Table 140.7-B to see if allowed for specific Lighting Zones
- Building Façade Lighting
- Outdoor Sales Frontage Lighting
- Outdoor Ornamental Lighting
- Lighting under Canopies
- Vehicle Service Station
 - Without Canopies
 - Hardscape Areas
- Drive-up Windows
- Guarded Facilities
- Outdoor Dining

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall 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 shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall 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 qualifying for this allowance shall 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 qualifying for this allowance shall be within 2 mounting heights of the dispenser.	Not applicable	55 watts	77 watts	81 watts	135 watts
ATM Machine Lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM machine, 35 watts for each additional ATM machine.			
WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft). May be used for one or two frontage side(s) per site.					
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 qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	W/linear ft	19 W/linear ft	25 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 400-50 watts or less as determined in accordance with Section 130.01(a), and shall 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

§ 147(c)2A-D: Allowed Application Specific Outdoor Lighting Power

Table Changes Only

Specific Application – “Use It or Lose It”

WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.					
	Not applicable	No Allowance	0.100 W/ft²	0.170 W/ft²	0.325 W/ft²
Building Facades. Only areas of building facade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the facade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.					
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 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.	Not applicable	0.060 W/ft²	0.210 W/ft²	0.280 W/ft²	0.485 W/ft²
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.	Not applicable	0.006 W/ft²	0.068 W/ft²	0.138 W/ft²	0.200 W/ft²
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/ft²	0.430 W/ft²	0.580 W/ft²	1.010 W/ft²
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.	Not applicable	No Allowance	0.470 W/ft²	0.622 W/ft²	0.740 W/ft²
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.	Not applicable	0.057 W/ft²	0.137 W/ft²	0.270 W/ft²	0.370 W/ft²
Guard Stations. Allowance 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, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	Not applicable	0.081 W/ft²	0.176 W/ft²	0.325 W/ft²	0.425 W/ft²
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th 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 heights of the student pick-up/drop-off zone.	Not applicable	No Allowance	0.056 W/ft²	0.200 W/ft²	No Allowance
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/ft²	0.030 W/ft²	0.050 W/ft²	0.075 W/ft²
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/ft²	0.005 W/ft²	0.010 W/ft²	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/ft²	0.018 W/ft²	0.018 W/ft²

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§ 140.10(a) Prescriptive Photovoltaic

New Section!

Photovoltaic Requirements

- Newly constructed building types (or mixed occupancy buildings with > 80% area of one or more) in TABLE 140.10-A shall have a newly installed photovoltaic (PV) system meeting JA11.
- The PV size in kWdc shall be greater than the smaller of:
 - PV system size per Equation 140.10-A, or**
 - Total of all available Solar Access Roof Areas (SARA) x 14 W/ft².**
- SARA = Area of the building’s roof space capable of structurally supporting a PV system + Area of all roof space on covered parking areas, carports, and all other newly constructed structures on the site that can support a PV system per Title 24, Part 2, Section 1511.2.
- SARA does NOT include:
 - Any area < 70% annual solar access = total annual solar insolation (accounting for shading obstructions) / total annual solar insolation if the same areas were unshaded by those obstructions. Roof obstructions including those that are external to the building, and obstructions that are part of the building design and elevation features may be considered in annual solar access calcs.
 - Occupied roofs as specified by CBC Section 503.1.4.
 - Roof space otherwise not available due to compliance with other building code requirements (if confirmed by the Executive Director).

EQUATION 140.10-A PHOTOVOLTAIC DIRECT CURRENT SIZE

kW_{PVdc} = (CFA x A)/1000, where

kW_{PVdc} = Size of the PV system in kW

CFA = Conditioned floor area in square feet

A = PV capacity factor in Table 140.10-A for the building type

Note: Per 100.0(e)2C unconditioned non-residential buildings not required to follow §140.10. This happens since if CFA is 0, then kW_{PVdc} will be 0.

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Photovoltaic Requirements

- Building with more than one space type listed in Table 140.10-A shall apply Equation 140.10-A to each listed space types and summing the capacities determined for each.
- Exceptions:
 - No PV system required if:
 - Total SARA is < 3% of the conditioned floor area
 - Required PV system size is < 4 kWdc
 - SARA < 80 contiguous ft².
 - Buildings where enforcement authority determines the PV system (inc. panels, modules, components, supports, and attachments to the roof structure) will not meet ASCE 7-16, Chapter 7, Snow Loads.
 - Multi-tenant buildings in areas where a load serving entity does not provide either a Virtual Net Metering (VNEM) or community solar program.

Table 140.10-A – PV Capacity Factors

Climate Zone	Factor A – Minimum PV Capacity (W/ft ² of conditioned floor area)		
	1, 3, 5, 16	2, 4, 6-14	15
Grocery	2.62	2.91	3.53
Highrise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space			
< 25,000 ft ²	4.04	4.44	5.02
25,000 ft ² - 150,000 ft ²	2.59	3.13	3.80
> 150,000 ft ²	2.16	2.64	3.00
Retail			
< 25,000 ft ²	4.35	4.62	5.17
25,000 ft ² - 150,000 ft ²	2.62	2.91	3.53
> 150,000 ft ²	2.58	2.87	3.39
School			
< 25,000 ft ²	1.44	1.78	2.93
25,000 ft ² - 150,000 ft ²	TBD	TBD	TBD
> 150,000 ft ²	0.39	0.44	0.58
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.85



Battery Storage System Requirements

- Buildings requiring a PV system shall have battery storage system meeting minimum Reference Joint Appendix JA12.
 - Use Equation 140.10-B and –C to determine minimums.
 - Building with more than one space type listed in Table 140.10-A shall apply Equation 140.10-B and 140.10-C to each listed space types and summing the capacities determined for each.
- EXCEPTIONS: No battery storage system required if:
 - The installed PV system size < 15% size determined by Equation 140.10-A.
 - In buildings with battery storage system < 10 kWh rated capacity.
 - For multi-tenant buildings, the energy capacity and power capacity of the battery storage system shall be based on the tenant spaces > 5,000 ft² of conditioned floor area.
 - For single-tenant buildings < 5,000 ft² feet of conditioned floor area, no battery storage system is required.
 - Offices, schools, and warehouses in climate zone 1



Battery Storage System Requirements

EQUATION 140.10-B - BATTERY STORAGE RATED ENERGY CAPACITY

$kWh_{batt} = kW_{PVdc} \times B/D^{0.5}$, where:

kWh_{batt} = Rated Useable Energy Capacity of the battery storage system in kWh

kW_{PVdc} = PV system capacity required by section 140.10(a) in kWdc

B = Battery energy capacity factor specified in Table 140.10-B for the building type

D = Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system

EQUATION 140.10-C - BATTERY STORAGE RATED POWER CAPACITY

$kW_{batt} = kW_{PVdc} \times C$, where:

kW_{batt} = Power capacity of the battery storage system in kWdc

kW_{PVdc} = PV system capacity required by section 140.10(a) in kWdc

C = Battery power capacity factor specified in Table 140.10-B for the building type

Table 140.10-B – Battery Storage Capacity Factors

	Factor B – Energy Capacity	Factor C – Power Capacity
Storage to PV Ratio	Wh/W	W/W
Grocery	1.03	0.26
Highrise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space		
< 25,000 ft ²	1.48	0.37
25,000 ft ² - 150,000 ft ²	1.68	0.42
> 150,000 ft ²	1.73	0.43
Retail		
< 25,000 ft ²	0.93	0.23
25,000 ft ² - 150,000 ft ²	1.03	0.26
> 150,000 ft ²	1.07	0.27
School		
< 25,000 ft ²	1.93	0.48
25,000 ft ² - 150,000 ft ²	1.87	0.46
> 150,000 ft ²	1.81	0.45
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

Altered Indoor Lighting Systems

One § for ALL Luminaire Alterations: T.I.'s, Modifications-in-Place, Component Modifications, & Lighting Wiring Alterations

- Indoor lighting system alterations for **≥ 10% of the luminaires** in an enclosed space to meet one of below, per the requirements specified in Table 141.0-F:
 - 1 • i. The alteration complies with the indoor lighting power requirements specified in §140.6; or
 - 2 • ii. The alteration ≤ 80% of the indoor lighting power requirements specified in §140.6; or
 - 3 • iii. The alteration is a **one-for-one luminaire alteration** within a building or tenant space of ≤ 5,000 ft² or less, the total wattage of the altered luminaires shall be at least 40% lower compared to their total pre-alteration wattage.
- Alterations shall not prevent operation of existing, unaltered controls, nor alter controls to remove functions in §130.1.
- Alterations to lighting wiring are considered alterations to the lighting system. Alterations to indoor lighting systems are not required to separate existing general, floor, wall, display, or decorative ornamental lighting on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of §130.1(a)4 and 130.1(c)1D.
- EXCEPTIONS
 - Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in §140.6(a)3.
 - Any enclosed space with only one luminaire
 - Alterations that would directly cause the disturbance of asbestos, unless the alterations are made in conjunction with asbestos abatement.
 - Acceptance testing requirements of Section 130.4 are not required for alterations where lighting controls are added to control 20 or fewer luminaires.
 - Any alteration limited to adding lighting controls or replacing lamps, ballasts, or drivers.
 - One-for-one luminaire alteration ≤ 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

130.1(a)4 =(a)3? separate manual control of general, floor display, wall display, window display, case display, ornamental, and special effects lighting
 130.1(c)1D = Separate shut off controls for general, display, ornamental, and display case lighting

Table § 141.0-E

Altered Indoor Lighting Systems

Table 141.0-F – Control Requirements for Indoor Lighting System Alterations

Control Specifications		Projects complying with Section 141.0(b)2ii ¹	Projects complying with Sections 141.0(b)2ii and/or 141.0(b)2iii ² ³
Manual Area Controls	130.1(a)1	Required	Required
<u>Manual Area Controls</u>	130.1(a)2	Required	Required
<u>Manual Area Controls</u>	130.1(a)3	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multilevel Controls	130.1(b)	Required	Not Required
Automatic Shut Off Controls	130.1(c)1	Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
<u>Automatic Shut Off Controls</u>	130.1(c)2	Required	Required
<u>Automatic Shut Off Controls</u>	130.1(c)3	Required	Required
<u>Automatic Shut Off Controls</u>	130.1(c)4	Required	Required
<u>Automatic Shut Off Controls</u>	130.1(c)5	Required	Required
<u>Automatic Shut Off Controls</u>	130.1(c)6	Required	Required, except for 130.1(c)6D
<u>Automatic Shut Off Controls</u>	130.1(c)7	Required	Required
<u>Automatic Shut Off Controls</u>	130.1(c)8	Required	Required
Daylighting Controls	130.1(d)	Required	Not Required
Demand Responsive Controls	430-440-110.12(a) and 110.12(c)	Required	Not Required

VEN and Lighting

MOSILO exempted

§ 141.0(b)2P: Electrical Power Alterations

Electrical Power Alterations

- Alterations to electrical power distribution systems shall meet the applicable requirements of Section 130.5 as follows:
 - i. Service Electrical Metering.
New or replacement electrical service equipment shall meet the requirements of §130.5(a) applicable to the electrical power distribution system altered.
 - ii. Separation Of Electrical Circuits For Electrical Energy Monitoring.
For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of §130.5(b).
 - iii. Voltage Drop. Alterations of feeders and branch circuits where the alteration includes addition, modification, or replacement of both feeders and branch circuits, the altered circuits shall meet the requirements of §130.5(c).
 - EXCEPTION: Voltage drop permitted by California Electrical Code §647.4, 695.6 and 695.7.
 - iv. Circuit Controls for 120-Volt Receptacles and Controlled Receptacles.
For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of §130.5(d) and §130.5(e) (ie DR Receptacles).


 Rewritten

HVAC Occupant Sensors

Occupant Sensor (OS) Ventilation Controls are required for space conditioning zones that are **both** permitted to have their ventilation air reduced to zero while in occupied standby mode per Table 120.1-A **and** required to install occupant sensors to comply with Section 130.1(c)5, 6, and 7. OS ventilation controls used to reduce the rate of outdoor airflow when occupants are not present shall comply with:

- Occupant sensors shall have suitable coverage and placement to detect occupants in the entire space ventilated. **In 20 minutes or less after no occupancy is detected by any sensors covering the room, occupant sensing controls shall indicate a room is vacant.**
- When occupant sensors controlling lighting are also used for ventilation, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.
- When a single zone damper or a single zone system serves multiple rooms, there shall be an occupant sensor in each room and the zone shall not be considered vacant until all rooms in the zone are vacant.
- One hour prior to normal scheduled occupancy, the occupant sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(d)2.
- **When the zone is scheduled to be occupied and occupant sensing controls in all rooms and areas served by the zone indicate the spaces are unoccupied, the zone shall be placed in occupied standby mode.**
- **In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall be shut off until the space becomes occupied or until ventilation is needed to provide space heating or conditioning. When mechanical ventilation is shut off to the zone, the ventilation system serving the zone shall reduce the system outside air rate by the amount of outside air required for the zone.**

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 Rewritten

Occupant Sensing Zone Controls

- **Where the system providing space conditioning also provides the ventilation required by Section 120.1 and includes occupant sensor ventilation control as specified in Section 120.1(d)5, the occupant sensing zone controls shall additionally comply with the following:**
- ~~The zone shall be placed in occupied standby mode when all room(s) served by the zone are unoccupied for more than 5 minutes; and~~
- **In 5 minutes or less after entering occupied standby mode as described in §120.1(d):**
 - Automatically setup the operating cooling temperature set point by 2°F or more and setback the operating heating temperature set point by 2°F or more; or
 - For multiple zone systems with Direct Digital Controls (DDC) to the zone level, setup the operating cooling temperature setpoint by 0.5°F or more and setback the operating heating temperature setpoint by 0.5°F or more.
 - ~~During~~ **In 5 minutes or less after entering** occupied-standby mode, **all airflow mechanical ventilation** to the zone shall ~~remain be shut~~ off whenever the space temperature is between the active heating and cooling setpoints.
- EXCEPTION 1 to §120.2(e)1, 2, and 3: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.
- EXCEPTION 2 to §120.2(e)1, 2, and 3: Systems with full load demands ≤ 2 kW, if they have a readily accessible manual shut-off switch.
- EXCEPTION 3 to §120.2(e)1 and 2: Systems for hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

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New Subsection! **3 NEW!** Multifamily Building Code Sections

Residential Code Duplication (Dwelling Areas and Common Use Areas)

Nonresidential Code Duplication (Common Service Areas)

Nonresidential Code Required (Retail)

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HUGE Organizational/Concept Change

- Before we had two categories: Nonresidential and Residential
 - Nonresidential covered commercial building occupancies.
 - Residential covered single & multi-family homes, condos, low-rise, and high-rise apartments where the residential living space followed Residential Code and the common living areas, corridors, stairwells, and exterior lighting might follow Nonresidential Code.

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§100.0

New Code Organization

SINGLE FAMILY RESIDENCE BUILDING is any of the following:

- A residential building of Occupancy Group R-3 with two or less dwelling units,
- A building that is of Occupancy Group R-3, other than a multifamily building or hotel/motel building,
- A townhouse,
- A building of Occupancy Group R-3.1, or
- A building of Occupancy Group U when located on a residential site.



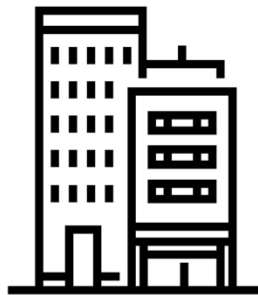
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§100.0

New Code Organization

**NONRESIDENTIAL, HIGH RISE RESIDENTIAL, AND
HOTEL/MOTEL OCCUPANCIES—MANDATORY REQUIREMENTS
FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL
POWER DISTRIBUTION SYSTEMS**



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§100.0

NEW! Code Organization

Multifamily Building is any of the following:

A building of Occupancy Group R-2, other than a hotel/motel building or timeshare property,

A building of Occupancy Group R-3 that is a nontransient congregate residence, other than boarding houses of more than 6 guests and alcohol or drug abuse recovery homes of more than 6 guests, or

A building of Occupancy Group R-4.



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§160.5(b)4

Code Section - Cross Reference

• §160.5(a):	§150.0(k)	Dwelling Unit Lighting (include dormitory & senior housing)
• §160.5(b):	§130.0(a)	Common Services Area Lighting (shared living, eating, cooking, sanitation use a)
• §160.5(b)1:	§130.1(a)	Luminaire classification and power
• §160.5(b)4A:	§130.1(a)	Manual Area Controls
• §160.5(b)4B:	§130.1(b)	Multi-level Lighting Controls
• §160.5(b)4C:	§130.1(c)	Automatic Shut-OFF Controls
• §160.5(b)4D:	§130.1(d)	Automatic Daylighting Controls
• §160.5(b)4E:	§130.1(e)	Demand Responsive Controls See §110.12
• §160.5(b)4F:	§130.1(f)	Control Interactions
• §160.5(c)(1-3):	§130.2(a-c)	Outdoor Lighting
• §160.6(a-d):	§130.5(a-d)	Electrical Power & Receptacles
• §170.0:	§140.0	Performance & Prescriptive Compliance Approaches
• §170.2(e)1:	§140.6	Interior Lighting Power
• §170.2(e)6:	§140.7	Outdoor Lighting Power
• §170.2(f-h)	§140.10	Photovoltaic and Battery Storage
• §180.0:	§141.0	Additions, Alterations & Repairs
• §180.2(b)4:		Dwelling Unit Lighting Alterations
• §180.2(b)4.B.:	§141.0(b)2.I	Common Use Area Lighting, Sign and Power Alterations

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§100.0

MultiFamily Takeaway

- Will be **increasingly** difficult to track differences between earlier code sections and new Multifamily language in future code revisions.
- For non-residential designers/contractors, will be easy to learn the residential requirements. However, residential designers/contractors will have to expend significant effort to learn the non-residential requirements.



Typical 3 flat building in SF. Basement now follows non-residential requirements in Multifamily section.

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Title 24 Resources



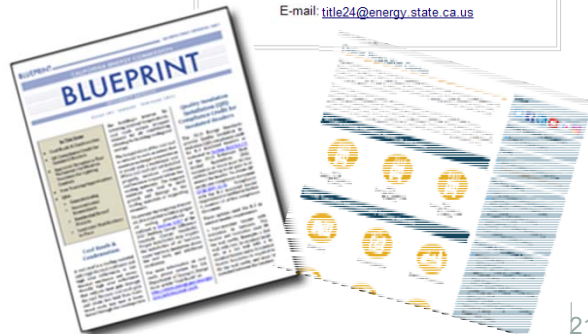
- <http://www.energy.ca.gov/title24>
 - Energy Efficiency Standards
 - Compliance Manual
- Hotline: 800-772-3300
- Blueprint
 - <http://www.energy.ca.gov/efficiency/blueprint/>
- **New! Online Resource Center**
 - <http://www.energy.ca.gov/title24/orc>
- CLTC
 - [Commercial Guide](#)
 - [Resi Guide](#)

California Energy Commission Energy Standards Hotline

(916) 654-5106
or toll free in California
(800) 772-3300

HOURS:
Monday through Friday
8 a.m. to 12 p.m. and 1 p.m. to 4:30 p.m.

E-mail: title24@energy.state.ca.us



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- **Energy Code Ace JetPack™** –A virtual compliance document assistant using “Ace-age” technology to help you complete and verify the appropriate 2016 nonresidential prescriptive certificate of compliance (NRCC) form for your lighting project
- **Forms Ace™** – A web-based tool that aids in determining which compliance forms are applicable to your specific project
- **Installation Ace™** – A “field guide” providing photos and text to assist you in identifying proper installation techniques
- **Reference Ace™** – Helps you navigate the standards using key word search capabilities, hyperlinked tables and related sections – *2019 Code Now Available!*
- **Q&Ace™** – Easily find answers to many of the most-asked questions about Title 24, Part 6 and Title 20
- **Timeline Ace™** – Track events related to the development and implementation of Title 24, Part 6, Title 20 and Federal appliance efficiency standards
- **Navigator Ace™** – Step-by-step guide to the Title 24, Part 6 compliance process

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THANK YOU!

Questions welcomed



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