

TITLE 24 LIGHTING CONTROLS APPLICATION GUIDE

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BRINGING IDEAS TO LIGHT



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BUILDING ENERGY EFFICIENCY STANDARDS - TITLE 24

"California's energy code is designed to reduce wasteful and unnecessary energy consumption in newly constructed and existing buildings. The California Energy Commission updates the Building Energy Efficiency Standards (Title 24, Parts 6 and 11) every three years by working with stakeholders in a public and transparent process.

The Building Energy Efficiency Standards (Energy Code) apply to newly constructed buildings, additions, and alterations. They are a vital pillar of California's climate action plan. The 2022 Energy Code will produce benefits to support the state's public health, climate, and clean energy goals."

SUCSESSES IN ENERGY EFFICIENCY

The state's Building Energy Efficiency Standards have saved Californians billions of dollars in reduced electricity bills. They conserve nonrenewable resources, such as natural gas, and ensure renewable resources are extended as far as possible so power plants do not need to be built. Learn more in the Energy Almanac about how far we've come-and need to go-on the road toward a more resilient, affordable, equitable, and environmentally sustainable energy system."



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IMPLEMENTATION

- Any projects that apply for permit on or after January 1st, 2023 are subject to the 2022 Code Update Requirements
- 2022 Code Documentation is located at: www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards

MANDATORY

Code that is Mandatory is ALWAYS required, regardless of which method is used to complete the design.

PRESCRIPTIVE

These requirements are in effect when the Prescriptive Approach is utilized.

PERFORMANCE

These requirements are an optional feature when using a Performance based computer modeling.

REORGANIZATION

Major change from 2019 to 2022 are the building type classification structure. High Rise Residential and Low Rise Residential classifications have been removed and, in their place, Single Family Dwelling and Multifamily Building Type were created.

- Single Family Structures, Duplex Structures, and Townhomes are “Residential” dwellings and must comply with Section 150.0 (Residential Dwelling Requirements)
- Multifamily Building Types which are 3 or more family dwellings within the same building must comply with NEW Requirements Section 160.5 (Multifamily Building Requirements)
- Hotel/Motel are still classified as Non-Commercial.

TITLE 24 EASY REFERENCE GUIDE ~ COMMERCIAL APPLICATIONS

SHUT OFF

130.1(a) Manual Area Controls

All luminaires shall be functionally controlled with manual on and off lighting controls.

130.1(c)(1) Timeclock

All areas not shut off by occupancy sensing must be shut off by a time switch control when the space is typically unoccupied.

130.1(c) 5 Auto Full Off Via Occupancy Sensor

Occupant-sensing controls must be used in specific areas to shut off lighting.

130.1(c) 6 & 7 Automatic Partial-Off via Occupancy Sensor

Partial-off occupancy sensing may be used in combination with another form of full automatic shutoff (exception: parking garage areas may use just partial-off sensing).

DIMMING

130.1(b) Multi Level Lighting

Any enclosed area $\geq 100 \text{ ft}^2$ with a lighting power density $> 0.5 \text{ W/ft}^2$, shall provide multi-level lighting control.

130.1(d) Automatic MultiLevel Daylighting Controls

Areas in designated daylight zones with total power $\geq 120 \text{ watts}$ use automatic multi-level daylight controls.

OUTDOOR

130.2(c) 1 Daylight Availability

Lighting shall be controlled by a photo control, astronomical time-switch control or other control to automatically shut off when daylight is available.

130.2(c) 2 Automatic Scheduling Controls

Controls shall be capable of reducing the lighting power by 50-90%, and capable of turning the lighting off, during scheduled unoccupied periods. Scheduling a minimum of two nighttime periods with independent lighting levels is required.

130.2(c) 3 Motion Sensing Controls

Controls shall be capable of reducing the lighting power by 50-90%, and capable of turning the lighting off, during unoccupied periods. Motion sensing controls shall be capable of reducing the lighting to its dim or off state no longer than 15 minutes after the area has been vacated.

OTHER

110.12(c), (e), 130.1(e) Demand Response Controls

Buildings having a total installed lighting power of $\geq 4,000 \text{ W}$ shall be capable of automatically reducing lighting power, including controlled receptacles in response to demand response signals.

130.5 (d) Receptacle / Plug Load Control

Both controlled and uncontrolled 120-volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms.



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SUMMARY OF CHANGES • INDOOR • COMMERCIAL

110.12 Demand Responsive Lighting Capabilities: New Trigger threshold - 4,000 Watts or more of general lighting that is required to be multilevel capable. (Previous threshold was 10,000 sq.ft. or more, project area.)

110.12(e) Receptacles **MUST** be connected to the Demand Response system if the building is required to have Demand Response Controls **AND** Controlled Receptacles. **EXCEPTION:** Spaces where a health or life safety statute, ordinance, or regulation does not permit the receptacles to be automatically controlled

130.1 (a) EXCEPTION to Section 130.1(a)1: Restrooms having two or more stalls, parking areas, stairwells, and corridors, and areas of the building intended for access or use by the public may use a manual control not accessible to unauthorized personnel.

130.1 (c) Occupancy Controls for Offices less than 250 sqft have been moved to **MANDATORY**

130.1 (d) Daylighting Control is now **MANDATORY** in SECONDARY DAYLIGHT ZONES When the Performance Method is Used for Compliance Calculations. Daylight responsive fixtures were already mandatory for all other methods of calculation.

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TITLE 24 CODE REQUIREMENTS FOR TYPICAL BUILDING SPACES

KEY DEFINITIONS

OFFICE AREA

Any room or area in a building of CBC Group B Occupancy in which business, clerical, or professional activities are conducted, regardless of its assigned room name.

BATHROOM

A residential room or area containing a sink use for personal hygiene, toilet, shower, or tub.

RESTROOM

A non-residential room or area providing personal facilities such as toilets and washbasins.

DAYLIGHT TRANSITION ZONE (Parking Garage)

The interior path of travel needed to transition from exterior daylighting levels to interior light levels. Excludes adjacent parking areas.

DEDICATED RAMPS

Parking garage ramps that do not have adjacent parking.

This chart is an overview of the code requirements for typical building spaces. Please use this information as a guide. For specific code requirements, please refer to the California Code of Regulations, Title 24, Part 6.

	Control Requirement ¹	Code Provision	Code Summary ¹	Space Type											
				Office < 250 sq. ft.	Open Office > 250 sq. ft.	Conference, Meeting Room	Classroom, Lecture Hall, Training Room	Lobby	Corridor	Restroom	Stairwell	Gymnasium	Warehouse	Parking Garage	Site Lighting/Facade/Parking Garage Roof
Shut-Off Control	Area Control ²	130.1(a)	All luminaires shall be functionally controlled with manual on and off lighting controls.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Timedclock	130.1(c) 1	All areas not shut off by occupancy sensing must be shut off by a time switch control when the space is typically unoccupied.		✓			✓	✓	✓	✓				
	Automatic Full-Off via Occupancy Sensor ³	130.1(c) 5	Occupant-sensing controls must be used in specific areas to shut off lighting.	✓	(or) ✓ _s	✓	✓	(or) ✓	(or) ✓	(or) ✓	(or) ✓	✓			
	Automatic Partial-Off via Occupancy Sensor ³	130.1(c) 6 & 7	Partial-off occupancy sensing may be used in combination with another form of full automatic shutoff (exception: parking garage areas may use just partial-off sensing).						✓		✓		✓	✓	
Light Level Control	Multi-Level Lighting Controls	130.1(b)	Any enclosed area ≥ 100 ft² with a lighting power density > 0.5 W/ft², shall provide multi-level lighting control.	✓	✓	✓	✓	✓		✓		✓	✓	✓	
	Automatic Multi-Level Daylight Controls	130.1(d)	Areas in designated daylight zones with total power ≥ 120 watts use automatic multi-level daylight controls.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Additional Controls	Demand Response	110.12(c), (e) 130.1(e)	Buildings having a total installed lighting power of ≥ 4,000W shall be capable of automatically reducing lighting power, including controlled receptacles in response to demand response signals.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Receptacle (i.e., Plug Load) Control ⁴	130.5(d)	Both controlled and uncontrolled 120-volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms.	✓	✓	✓		✓							
Outdoor Lighting Controls	Daylight Availability	130.2(c) 1	Lighting shall be controlled by a photo control, astronomical time-switch control or other control to automatically shut off when daylight is available.												✓
	Automatic Scheduling Controls	130.2(c) 2	Controls shall be capable of reducing the lighting power by 50-90%, and capable of turning the lighting off, during scheduled unoccupied periods. Scheduling a minimum of two nighttime periods with independent lighting levels is required.												✓
	Motion Sensing Controls	130.2(c) 3	Controls shall be capable of reducing the lighting power by 50-90%, and capable of turning the lighting off, during unoccupied periods. Motion sensing controls shall be capable of reducing the lighting to its dim or off state no longer than 15 minutes after the area has been vacated.												✓

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TABLE 140.6-C AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES WATTS/SQ FT QUICK REFERENCE GUIDE

PRIMARY FUNCTION AREA	ALLOWED WATTS/SF	PRIMARY FUNCTION AREA	ALLOWED WATTS/SF
Auditorium	0.70	Parking Garage - Decks	0.10
Auto Repair / Maintenance	0.55	Parking Garage Daylight Adaptation (Auto Entries)	1.00
Audience Seating Area	0.50	Pharmacy	1.00
Beauty Salon	0.70	Retail Sales - Grocery	1.00
Civic Meeting Place	0.90	Retail Merchandise	0.95
Classroom, Lecture, Training, Vocational Area	0.60	Retail - Fitting Rooms	0.60
Commercial / Industrial Storage - Warehouse	0.45	Restaurant Kitchen	0.95
Commercial / Industrial Storage -Shipping & Handling	0.60	Theatre - Motion	0.50
Convention, Conference, Multipurpose, Meeting	0.70	Theatre - Performance	0.80
Copy Room	0.50	Labs	0.90
Corridor Area	0.40	Healthcare Facility & Hospitals - Exam / Treatment	1.15
Dining Area - Bar/ Lounge, Fine Dining	0.45	Healthcare Facility & Hospitals - Imaging Room	0.60
Dining Area - Cafeteria and Fast Food	0.45	Healthcare Facility & Hospitals - Medical Supply	0.55
Dining Area - Family and Leisure	0.40	Healthcare Facility & Hospitals - Nursery	0.95
Electrical, Mechanical, Telephone Rooms	0.40	Healthcare Facility & Hospitals - Nurse Station	0.75
Exercise / Fitness Center and Gyms	0.50	Healthcare Facility & Hospitals - Operating Room	1.90
Hotel Function	0.85	Healthcare Facility & Hospitals - Patient Room	0.70
Museums - Exhibition / Display	0.55	Healthcare Facility & Hospitals - Physical Therapy	0.85
Financial Transaction Area	0.70	Healthcare Facility & Hospitals - Recovery Room	0.90
General / Commercial & Industrial Work - Low Bay	0.60	Laundry Area	0.45
General / Commercial & Industrial Work - High Bay	0.65	Religious Worship	0.95
General / Commercial & Industrial Work - Precision	0.85	Restrooms	0.65
Library - Reading Area	0.80	Transportation - Baggage Area	0.40
Library - Stacks Area	1.00	Transportation - Ticketing Area	0.45
Lobby - Main Area	0.70	Sports Arena Playing Area - Class I	2.25
Locker Room	0.45	Sports Arena Playing Area - Class II	1.45
Lounge, Breakroom / Waiting Area	0.55	Sports Arena Playing Area - Class III	1.10
Concourse & Atria Area	0.60	Sports Arena Playing Area - Class IV	0.75
Office > 250 sf	0.60	Stairwell	0.60
Office < 250 sf	0.65	All Other	0.40

* Refer to the 2022 Title 24 Standards Section 140.6-C for further wattage allowances

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TITLE 24 2022 TABLE 160.5-B MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS

LUMINAIRE TYPE	MINIMUM REQUIRED CONTROL STEPS (PERCENT OF FULL RATED POWER)	UNIFORM LEVEL OF ILLUMINANCE SHALL BE ACHIEVED BY:
LED luminaires and LED light source systems	Continuous dimming 10-100%	Continuous dimming 10-100%
Line-voltage sockets except GU-24	Continuous dimming 10-100%	Continuous dimming 10-100%
Low-voltage incandescent systems	Continuous dimming 10-100%	Continuous dimming 10-100%
Fluorescent luminaires	Continuous dimming 20-100%	Continuous dimming 20-100%
GU-24 sockets rated for fluorescent ≤ 20 watts; Pin-based compact fluorescent ≤ 20 watts; Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step between 30-70%	Continuous dimming; OR Stepped dimming; OR Switching alternate lamps in a luminaire, OR Separately switching circuits in multi-circuit track with a minimum of two circuits.
Track Lighting	Minimum one step between 30-70%	Continuous dimming; OR Stepped dimming; OR Switching alternate lamps in a luminaire, OR Separately switching circuits in multi-circuit track with a minimum of two circuits.
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range: 20-40% 50-70% 75-85% 100%	Continuous dimming; OR Stepped dimming; OR Switching alternate lamps in a luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
Other light sources, including HID and induction	Minimum one step between 50-70%	Continuous dimming; OR Stepped dimming; OR Switching alternate lamps in a luminaire, having a minimum of 2 lamps per luminaire illuminating the same area and in the same manner

INDOOR LIGHTING SYSTEM ALTERATIONS SECTIONS 140.0 (B) 21

An Alteration Applies if 10% or More Luminaires in Space are altered or modified. Alterations are less than total building modernizations.

OPTION I

- Comply with Lighting Power Allowance - Section 140.6
- Meet Control Requirements Table 141.0F

OPTION II

- Do not exceed 80% of Lighting Power Allowance - Section 140.6
- Meet Control Requirements Table 141.0F

OPTION III

- One for one luminaire alteration (more than 50 luminaires) within space of 5,000 sq ft or less
- Lower total altered luminaire wattage by at least 40% compared to total pre-altered wattage
- Meet control requirements Table 141.0F

Notes

1. Alteration to indoor lighting system does not prevent the operation of existing, unaltered controls and not alter controls to remove functions in Section 130.1
2. Alterations to lighting wiring are considered alterations to the lighting system.

Exceptions

1. Alteration with less than 10% of luminaires on enclosed space
2. Alteration of portable luminaires, luminaires affixed to moveable partitions or lighting excluded per Section 140.6(a)3
3. Any enclosed space with 1 luminaire
4. Any alteration that would cause the disturbance of asbestos, unless it is made in conjunction with asbestos abatement
5. Acceptance testing requirements are not required for alteration where lighting controls are added to control 20 luminaires or less
6. Any alteration limited to adding lighting controls or replacing lamps, ballast or drivers
7. One for one luminaire of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum

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SUMMARY OF CHANGES • OUTDOOR • COMMERCIAL

TABLE 140.7-A CEC 2022 TITLE 24 - OUTDOOR WATTAGE ALLOWANCES					
POWER ALLOWANCES	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance (AWA)	No Allowance	0.016 W/sf	0.019 W/sf	0.021 W/sf	0.024 W/ sf
Linear Wattage Allowance (LWA)		0.13 W/Lf	0.15 W/Lf	0.20 W/Lf	0.29 W/Lf
Initial Wattage Allowance (IWA)		150 W	200 W	250 W	320 W

TABLE 10-114 -A EXCERPT

Zone	Ambient Illumination	State-Wide Default Location
LZ0	VERY LOW	UNDEVELOPED AREAS
LZ1	LOW	RURAL AREAS
LZ2	MODERATE.	URBAN CLUSTERS
LZ3	MODERATELY HIGH	URBAN AREAS
LZ4	HIGH	NONE

LIGHTING ZONE DESIGNATIONS

Updates to Table 10-114-A

New Examples per category

"Urban" now has two Zones

Updates to Table 140.7-B

Security Cameras Added

0.018 W/sqft in LZ2, LZ3, LZ4

Lighting Power Allowance has revised wattage allowances.

Asphalt and concrete are no longer differentiated on the table.



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COMMERCIAL OUTDOOR APPLICATIONS SECTION 130.2 REFERENCE GUIDE

Luminaire Cut Off Requirements

- 1.All outdoor luminaire of 6,200 initial luminaire lumens or greater shall comply with BUG requirements. Maximum zonal lumens for BUG in accordance with Title 24, Part 11 Section 5.106.8.
- 2.Except signs; lighting for building façade, public monuments, statues, vertical surface of bridge; lighting not permitted to be shut off for health and life safety regulations; temporary outdoor lighting; lighting for public roadways, sidewalks;

Listed Special Applications Section 140.7a

- 1.Temporary outdoor lighting.
- 2.Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
- 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, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
- 6.Lighting of public monuments.
- 7.Lighting of signs complying with the requirements of Sections 130.3 and 140.8
- 8.Lighting of stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, 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 that these lighting systems are additions to area lighting systems and are controlled by a multi-scene or theatrical cross-fade control station accessible only to authorized operators.
- 12.Outdoor lighting systems for qualified historic buildings, as defined in the California Historic Building Code (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic
- 13.buildings shall comply with Section 140.7.

COMMERCIAL OUTDOOR LIGHTING QUICK PICKS



RADEAN POST TOP P1, P2, P3



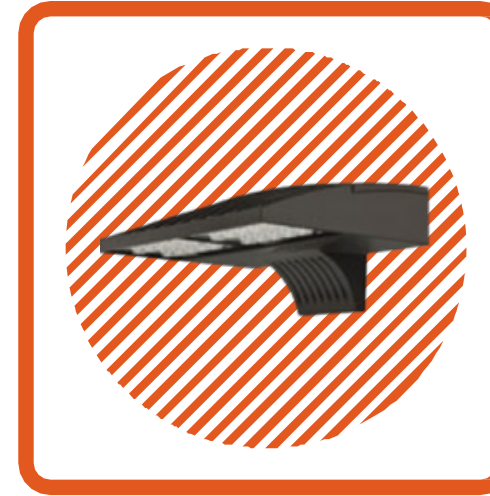
RADEAN ARM MOUNT P1, P2, P3



KAD LED ARM MOUNT 20C



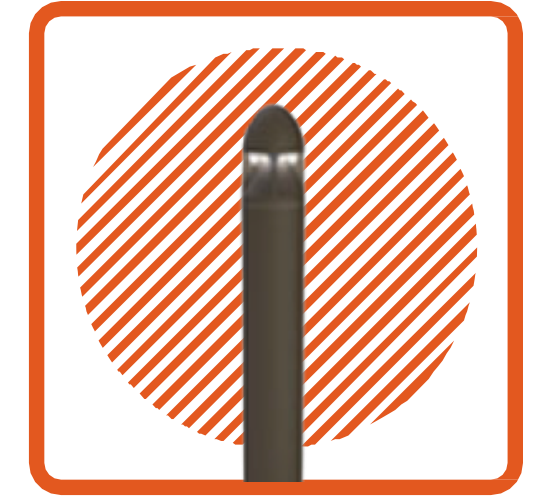
D SERIES DSX0 ARM MOUNT P1



LITHONIA WALL PACKS



LITHONIA WALL PACKS



LITHONIA BOLLARDS

In order to take exception to the exterior lighting motion sensor requirements, the luminaire must be less than 40 watts.

To take exception to the BUG rating requirement, the fixture must be less than 6200 Lumens.

Here are some QUICK PICKS that meet these requirements for easy reference!



OPTION • APPROACH

NO MOTION SENSOR REQUIREMENT • LESS THAN 40 WATTS

NO BUG RATING REQUIREMENT • LESS THAN 6200 LUMENS



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SUMMARY OF CHANGES • INDOOR • RESIDENTIAL

160 .5 New Requirements Section for Multifamily Buildings (3 or more family dwellings).

Common areas and private dwellings have different requirements for compliance

160.5 (b), 170.2 (e)1-4 These sections dictate the Multi Family Common Area Requirements and closely resemble the Indoor Lighting Requirements and Power Allowances of the Non-Residential Building Type Section 130.0

160.5 Section dictate the Multi Family Dwelling Units Requirements and closely resemble Residential Requirements in Section 150.0.

160.6 Where Demand Response controls are required for indoor lighting, controlled receptacles are also required.

SEE SECTIONS 160 .5 (A), 160 .5 (B), 160 .6 , 170 .2 (E)1 -4



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RESIDENTIAL APPLICATIONS JA8 QUICK REFERENCE CHART

LIGHTING TYPE

HIGH EFFICACY	JA8 REQUIRED*
All Ceiling Recessed Downlights	YES
Screw-Base Lamps/Sources	YES
Fluorescent—Pin-Based Linear or CFL Using Electronic Ballasts	NO
Pulse-Start Metal Halide	NO
High-Pressure Sodium	NO
GU-24 Sockets (Non-LED)	NO
GU-24 Sockets (LED)	YES
Induction Lamps w/ High Frequency Generator	NO
Inseparable SSL (e.g. LED) Luminaires w/ Colored Light Sources	NO
Inseparable SLL (e.g. LED) Luminaires Installed Outdoors	NO
Other Lighting Not Listed Above	YES
NON-HIGH-EFFICACY: NOT PERMITTED ANYWHERE	



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SUMMARY OF CHANGES • OUTDOOR • RESIDENTIAL

SINGLE FAMILY Lighting attached to residence or other buildings on the same lot must be high efficacy and one of these controls. Manual ON/OFF Switch WITH:

- a. PHOTOCELL AND MOTION SENSOR OR
- b. PHOTOCELL AND AUTO TIME SWITCH OR
- c. ASTRONOMICAL TIME CLOCK

MULTI FAMILY

Must have the option of complying with the lighting standards for the following: A)

Private Patios B) Entrances C) Balconies D) Porches

Must comply using outdoor Lighting Zone 2 (LZ 2) on Table 10 - 114 -A

Calculation Method is similar to non- resi buildings but there is No Linear Wattage Allowance

and there are Separate Allowance Tables for Multi Family

SEE SECTIONS 160.5 (C) & 170.2(E)6

REFERENCES

- nLight Title 24 2022 Applications Guide
 - <https://nlight.acuitybrands.com/resources/app-guides>
- nLight Solution Typical IC Layout Drawings
 - www.acuitybrands.com/resources/customer-tools/typicals
- California Energy Commission 2022 Energy Standards
 - www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency
- California Lighting Technology Center
 - <https://cltc.ucdavis.edu>
- Energy Code Ace
 - <https://energycodeace.com>
- Use the Following Sections of the Title 24 Code as Reference:
 - **Section 100.1** – Definitions and rules of construction
 - **Section 130.0** – Lighting controls and equipment - general
 - **Section 130.1** – Indoor lighting controls that shall be installed
 - **Section 130.2** – Outdoor lighting controls and equipment
 - **Section 130.4** – Lighting control acceptance and installation certificate requirements
 - **Section 130.5** – Electrical power distribution systems
 - **Section 140.3** – Prescriptive requirements for building envelopes
 - **Section 140.6** – Prescriptive requirements for indoor lighting





TITLE 24 LIGHTING CONTROLS APPLICATION GUIDE

LET US SUPPORT YOU! 16500 SUPPORTS YOUR LIGHTING AND LIGHTING CONTROL NEEDS!

- Lighting Control Applications Engineering
 - Product/system selection and technical support
 - Wiring diagrams
 - CAD Assistance
 - System Layouts
 - Quotations
 - Submittals
 - Fixture-integrated controls coordination
- Lighting Applications Engineering
 - Product selection and technical support
 - Productspecificlightingilluminance & powerdensitycalculations
 - Lighting layouts
 - Quotations
 - Submittals

MANDATORY REQUIREMENTS T24 PART 6 SECTION 130

This guide is intended to assist in your selection of lighting control products and equipment for commercial type projects based on the mandatory requirements set forth in California's Title 24 2022 Section 130.



PERFORMANCE APPROACH T24 PART 6 SECTION 140.1

OR

PRESCRIPTIVE APPROACH T24 PART 6 SECTION 140.2

In addition to the mandatory requirements, either a Performance or Prescriptive approach must be used to determine full compliance for lighting and control systems. Using either approach may result in changes to the required control products and equipment based on project specific lighting selections.

16500 offers this guide in a partnership effort with you, our clients and customers who participate in our electrical lighting and controls specifications, construction, and property ownership/management communities. We invite you to use the Lighting Control Application Guide as a tool that will assist with product and equipment selection.



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